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Preface

The ear is mainly composed of the temporal bone, and the temporal bone houses the end organs of hearing and equilibrium, the smallest separated bones and its articulates. The brain nerves (such as the facial nerve) and the carotid artery run through the temporal bone, therefore, the temporal bone is one of the most complex bones in the body, to explore the fine anatomy and radiological feature of the temporal bone will have important clinical and scientific significances.

High resolution computed tomography (HRCT) scan was one of the most frequently used radiological methods for the ear diseases, it provided an important reference for the diagnosis, the surgical procedure, and the prognosis judgment of the ear diseases. However, the spatial resolution of clinical conventional HRCT imaging is relatively low, and the appearance of small canals is not always clear and sometimes may be confused with fractures. In addition, HRCT scan also has significant shortcomings in determining the fine structure of the temporal bone (including the stapes, the incudostapedial articulation, and the fundus of internal auditory canal) and the tiny lesions, such as the diseases of stapes, dislocation of incudostapedial articulation, the dehiscence of the facial nerve canal, etc.

Micro-computed tomography (micro-CT) scan has been used to investigate the structure and density of rodent bone since its very beginnings, due to its high spatial resolution and high contrast in imaging mineralized tissues, and high correlations and excellent agreement between conventional histomorphometry and micro-CT data have been demonstrated. What is more, the availability of micro-CT imaging has increased over the last decade and has shown its utility in many preclinical applications. By providing high-quality two-dimensional and three-dimensional reconstruction with extremely high resolution (5–80μm), micro-CT is regarded as an adequate technique for imaging surface topography of the temporal bone and evaluation of its architecture. Comparison with HRCT (maximum resolution $\approx$ 500 μm), micro-CT will be one of the more helpful radiological techniques to observe the fine anatomy of the temporal bone and tiny lesions in it, and the three-dimensional models from micro-CT imaging data sets for educational purposes will also be established in the medical literature.

Recently, micro-CT scan technique has been used in the study for the facial canal and its dehiscences, the anatomical characteristics of facial nerve and cochlea interaction, the complex stapes motions, the variations of the human cochlea, the quantitative analysis of the cochlea, the anatomy of the fundus of the internal acoustic meatus, the cochlear nerve implant, the human embryonic development, and so on. To the best of our knowledge, there is no book in English has been published at present to systematically explore the fine anatomy of the temporal bone and the tiny lesion in it.

In this atlas, we observed the anatomical image of the temporal bone with nearly successive slides on axial view, coronal view, and sagittal view. We believe, by doing this can help us understand the normal fine anatomy and HRCT image of the temporal bone. The three-dimensional reconstruction of the temporal bone based on data from micro-CT scan can clearly and accurately show the spatial relationship of the structures in temporal bone. In addition,

man-made tiny lesions models, such as the fenestration, dislocation and fracture of the stapedial footplate, and dislocation of the incudostapedial joint, were reconstructed on two-dimensional and three-dimensional images with the micro-CT data, which were hardly recognized on HRCT images.

We wish this atlas can become one of the useful tools to understand the fine anatomy of temporal bone, re-recognize HRCT images, and provide a state-of-the-art teaching method for temporal bone.

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June 2021

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Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this atlas.

Acknowledgments

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Abstract

Micro-CT (micro-computed tomography) scan with 3D rendering technique was used in this atlas to reconstruct the two-dimensional, three-dimensional structures of the temporal bone and observe the models of man-made tiny lesion models in the temporal bone with extremely high resolution (≈30μm). The images were precise and accurate. We hope this atlas can become a useful tool for understanding the fine anatomy and the image of high resolution computed tomography(HRCT)of the temporal bone.

This atlas included:

I. Two-dimensional reconstructions of the temporal bone were made via micro-CT scanning on axial, coronal, and sagittal view just as HRCT showed. The detailed annotations were also made simultaneously for each image.

II. Three-dimensional reconstructions of the temporal bone were produced using the mimics and 3-matic software based on micro-CT scan data, it included the following structures: the external auditory canal, the ossicular chain, the tensor tympani muscle, the Eustachian tube, the niche of vestibular window, the cochlea, the vestibule and semicircular canals, the vestibular aqueduct, the cochlear aqueduct, the facial nerve, the internal auditory canal and their adjacent structures (such as the jugular bulb, the internal carotid artery), etc.

III. Man-made tiny lesions (the model of diseases) in the temporal bone were reconstructed via micro-CT scan, such as the dislocation of incudomalleolar and incudostapedial joints, the fenestration or dislocation of stapedial footplate, the fenestration of facial canal and lateral semicircular canal, the fenestration and fracture of cochlea, etc.

IV. The ability was compared between micro-CT and HRCT to display the normal structure and tiny lesion models of the temporal bone.

This atlas is available for all levels of otolaryngology and head and neck surgeons, radiologists, related research and teaching personnel.

Keywords

Micro-CT; Temporal bone; Anatomy; Three-dimensional reconstruction; Tiny lesion

Contents

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Principles and Conditions of Micro-CT Scan

1

Zilong Yu, Luo Zhang, and Demin Han

1.1 Temporal Bone Preparation and High Resolution CT Scan

1.1.1 Location of the Temporal Bone

The temporal bone is formed by the fusion of five distinct osseous portions, including the tympanic, squamous, mastoid, petrous, and the styloid process. It houses the hearing and vestibular organs, numerous nerves and vessels, and fits into the base of the skull between the sphenoid and the occipital bones, and separates the middle cranial fossa from the posterior cranial fossa.

1.1.2 Temporal Bone Preparation

Twelve temporal bones from six corpses were provided by the Beijing Institute of Otolaryngology. In order to reduce the liquid artifact when micro-CT scanning, the corpses were ventilated for some time to let the fixation liquid (the condition of the corpse can be examined by HRCT scan) discharge via the eustachian tube. After taken out from the corpse, only the primary part of the temporal bone including the external auditory canal, middle ear, inner ear, and internal auditory canal was remained so that the block of the temporal bone could be accommodated by the micro-CT scanner. The block is dissected as following:

Superiorly: arcuate eminence of the anterior semicircular canal.
Inferiorly: stylomastoid foramen.
Laterally: bony opening of external auditory canal.
Medially: petrous apex.
Anteriorly: posterior wall of temporomandibular articulation and the foramen lacerum
Posteriorly: sigmoid sinus.

The block of temporal bone is approximately 5 cm × 4 cm × 3 cm (Fig. 1.1).

1.1.3 High Resolution CT Scan

High resolution computed tomography (HRCT) examinations were performed on the above-mentioned corpses with 1 mm contiguous sections before dissection. The equipment utilized was a Philips Brilliance 64 CT scanner (Philips, the Netherlands). The imaging parameters were as follows: voltage 120 Kv, current 200 mA, matrix 512 × 512, reconstructing section thickness 1 mm. The images were reconstructed using a high resolution bone algorithm. A window width of 4000 Hounsfield Units (HU) and a window center of 700 HU were preferred for reading these high resolution images. The final resolution is 0.65 mm.

The protocol was approved by the Institutional Committee of the Beijing Institute of Otolaryngology.

1.2 The Principles and Conditions of Micro-CT Scan

The basic principle of the micro-CT scan is using the microfocus X-ray tube to scan and project the specimen (such as the small animals): the hard tissues and the related soft tissues on different planes with cone beam, the detector accepts the X-ray which transmits these planes, the X-ray is first converted to the visible light, then converted to electric signal by light-electric converter, this signal is converted to digital signal via Analog to Digital Converter later, the projections are captured along the long axis of the specimen and reconstructed using a software (Inveon Research Workstation).

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Fig. 1.1 Temporal bone block (right). (1) External auditory canal. (2) Mastoid. (3) Petrous apex

The bilateral temporal bones were scanned, respectively, with the micro-CT scanner (Siemens, Inveon, Germany) (Fig. 1.2). The long axis of the temporal bone parallels to the scan backplane. Scan parameters were as follows: The X-ray source voltage was set to 80 kV and current to 500 μA, image acquisition time: 20 min, auto-reconstruction time: 30 min, the diameter of X-ray: 50 μm, radioactive source: 30.6 mm × 45.9 mm, exposure time: 2000 ms, detector pixel: 3072 × 2048, image:1024 × 1024 pixel, and the resultant resolution was 29.86 μm.

1.3 The Significance and Methods of Two-Dimensional and Three-Dimensional Reconstruction for Temporal Bone

Micro-CT scan can provide the basic knowledge for scientific study and preclinical research. Because of the excellent spatial resolution, micro-CT can also show the two-dimensional and three-dimensional microstructures of the temporal bone clearly, such as the stapes, incudostapedial articulation, the fundus of internal auditory canal, and so on.

The digital data from micro-CT scan is input the computer, the intrastructures of temporal bone are oriented by rotating the image at different directions over and over again, until a certain structure (such as the lateral semicircular canal) is shown on one plane just as shown on HRCT image, then the two-dimensional images on axial, coronal, and sagittal view are built, respectively, three-dimensional reconstruction is made via software-mimics (Materialise.Mimics. Innovation.Suite.Research.v17.0.x64_p30download.com) (Fig. 1.3), and the semi-transparency is made via 3-matic Research 11.0 (x64).

Fig. 1.2 Micro-CT scanner (Siemens, Inveon, Germany)

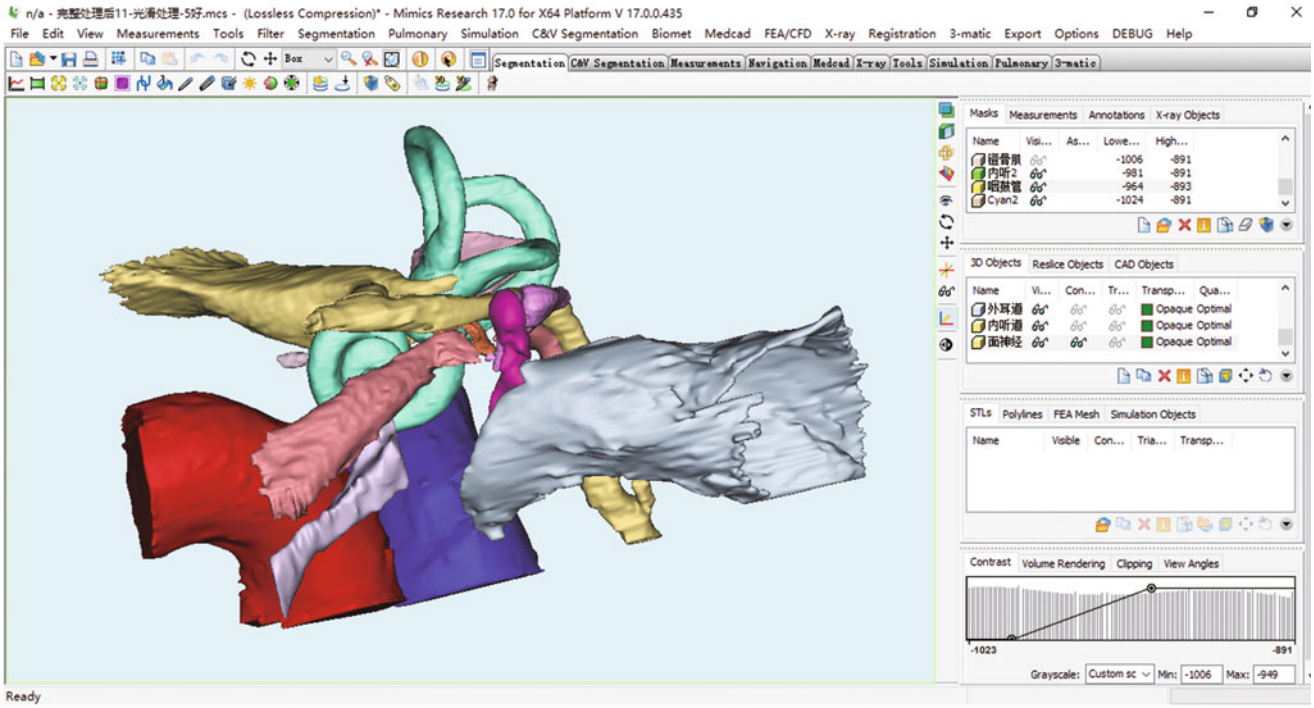

Fig. 1.3 Three-dimension reconstruction interface

1.4 Preparation and Clinical Significance of Man-Made Tiny Lesion Models in Temporal Bone

The diagnosis of the tiny lesions in temporal bone has always bewildered the radiologist and the otologist for a long time because of the insufficient resolution of clinical CT. These diseases, such as the dislocation, fenestration, and fracture of the stapedial footplates, the dislocation of incudostapedial articulation, and the atresia of the vestibular window, were usually identified during the operation at present. In this atlas, we made several tiny lesion models in the temporal bone under the surgical microscope, such as the dislocation, perforation, and fracture of the stapedial footplates et al. (the details see the Chaps. 8 and 9), and observed if these man-made disease models could be shown clearly via micro-CT scanning.

Two-Dimensional Reconstruction of Temporal Bone on Axial View

2

Zilong Yu, Luo Zhang, and Demin Han

2.1 Introduction

Two-dimensional image of the temporal bone is usually reconstructed on the axial, coronal, and sagittal planes. Those three planes own their significant advantages and disadvantages in imaging a certain structure. The structures parallel to the plane of section can be only seen partially or not at all (Valvassori and Mafee 1985). Axial plane can excellently visualize the anterior and posterior walls of the external and internal auditory canals, Eustachian tube, semicanal of tensor tympani muscle, carotid canal, molar tooth configuration formed by the malleus and incus, labyrinthine portion and first genu and tympanic portion of the facial canal, promontory, cochlea, cochlear window(niche), sinus tympani, facial recess, pyramidal eminence, stapedial superstructure, stapedial tendon, lateral semicircular canal, vestibule, fundus of internal auditory canal, vestibular and cochlear aqueducts (Virapongse et al. 1982), but the tegmen tympani, the superior and inferior walls of external and internal auditory canals, the superior and inferior walls of facial canal in tympanic portion, the mastoid portion of facial nerve due to surrounding mastoid air cells (Virapongse et al. 1982) are difficult to identify. Although micro-CT scan owns extremely high resolution, the condition above still exists to some extent.

In this chapter, all the two-dimensional images (Figs. 2.1–2.153) were reconstructed from the left temporal bone, the scanning range was from the arcuate eminence of the anterior semicircular canal to the stylomastoid foramen.

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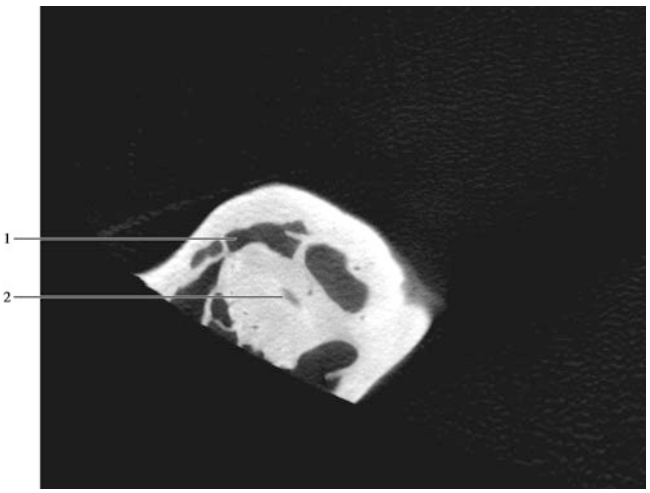

Fig. 2.1 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior semicircular canal arcuate

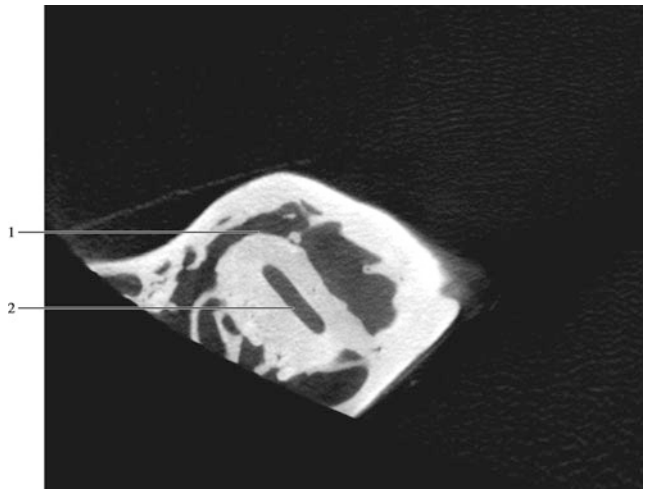

Fig. 2.3 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior semicircular canal arcuate

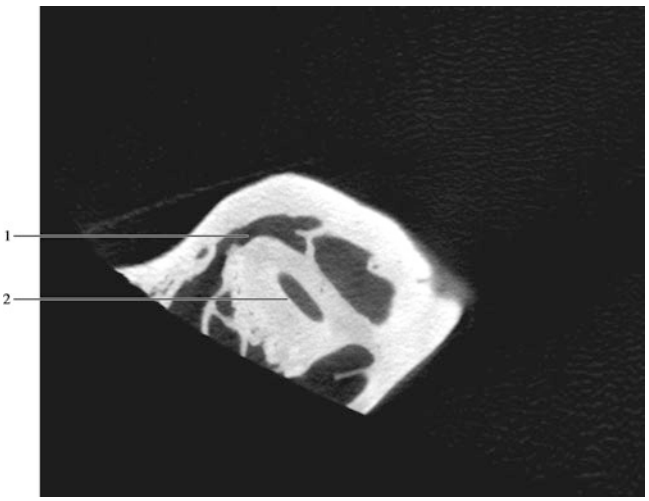

Fig. 2.2 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior semicircular canal arcuate

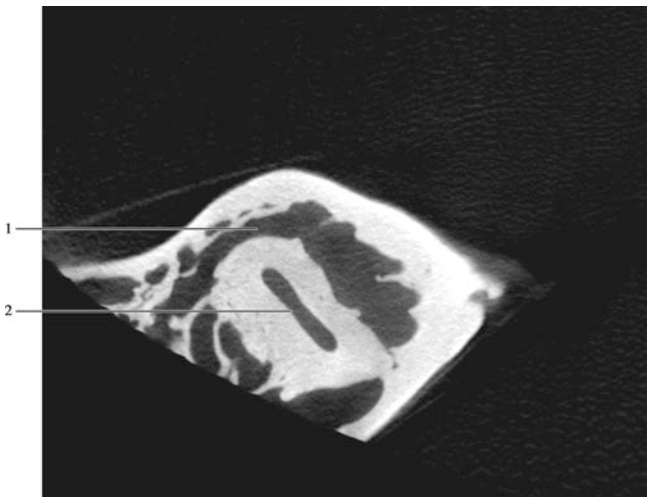

Fig. 2.4 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior semicircular canal arcuate

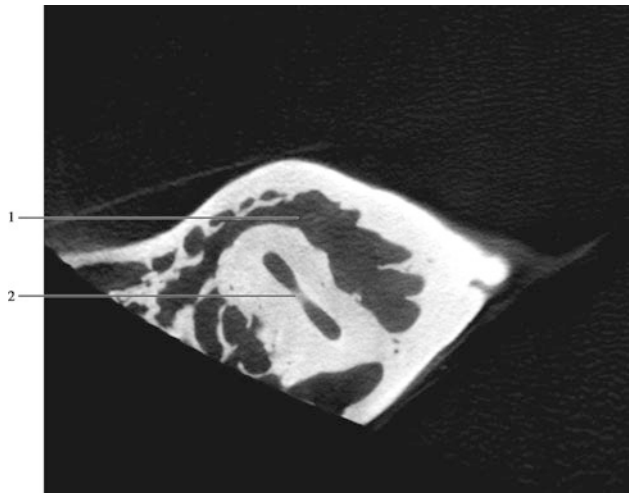

Fig. 2.5 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior semicircular canal arcuate

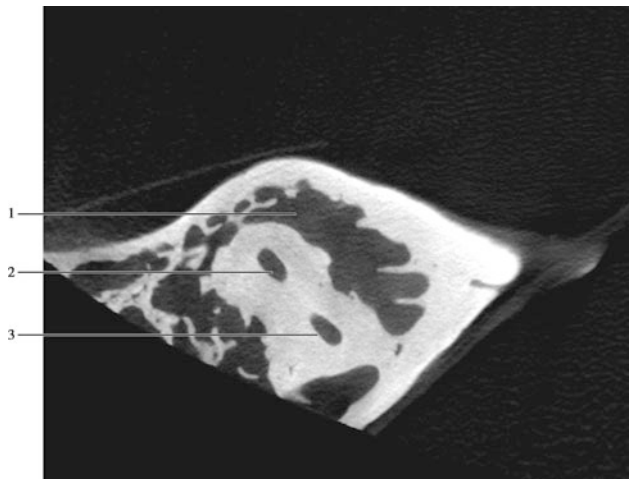

Fig. 2.6 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior crus of anterior semicircular canal. (3) Posterior crus of anterior semicircular canal

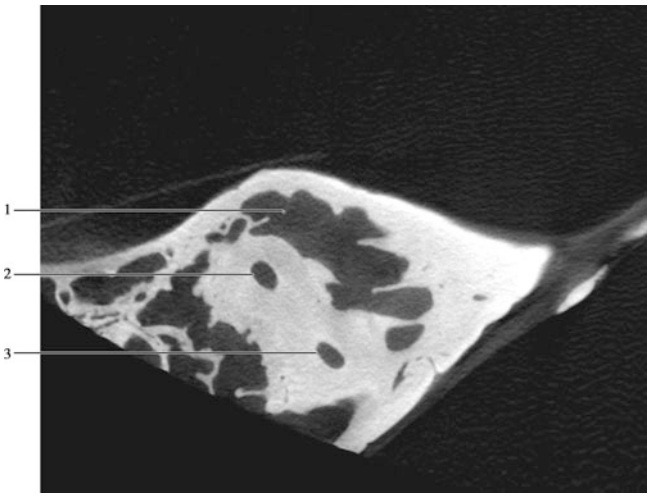

Fig. 2.7 Anterior semicircular canal on axial view. (1) Air cells around the labyrinth. (2) Anterior crus of anterior semicircular canal. (3) Posterior crus of anterior semicircular canal

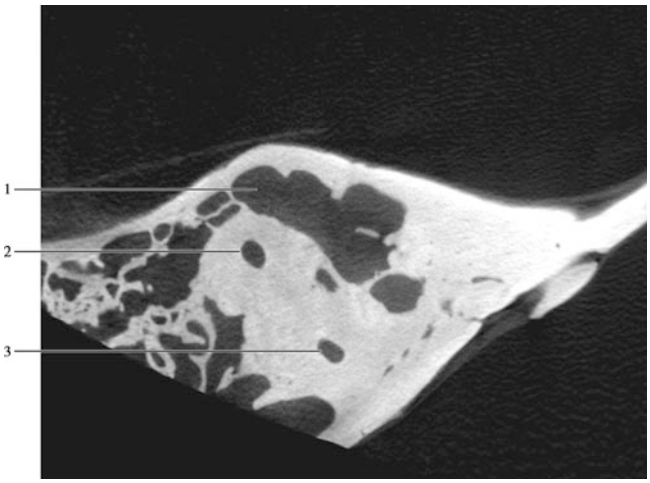

Fig. 2.8 Anterior semicircular canal on axial view. (1) Air cells around the labyrinthine. (2) Anterior crus of anterior semicircular canal. (3) Posterior crus of anterior semicircular canal

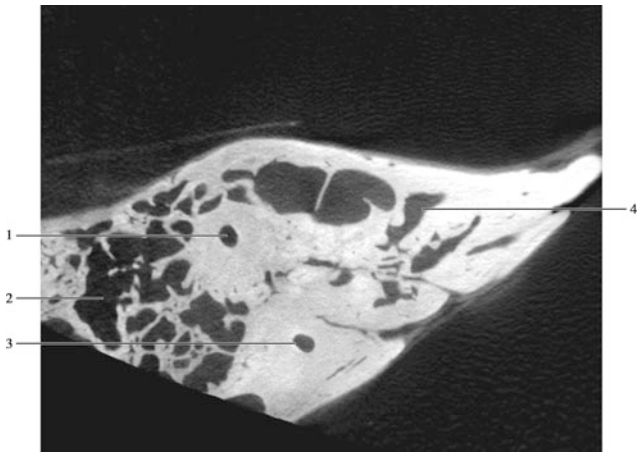

Fig. 2.9 Anterior semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Posterior crus of anterior semicircular canal. (4) Air cells in petrous apex

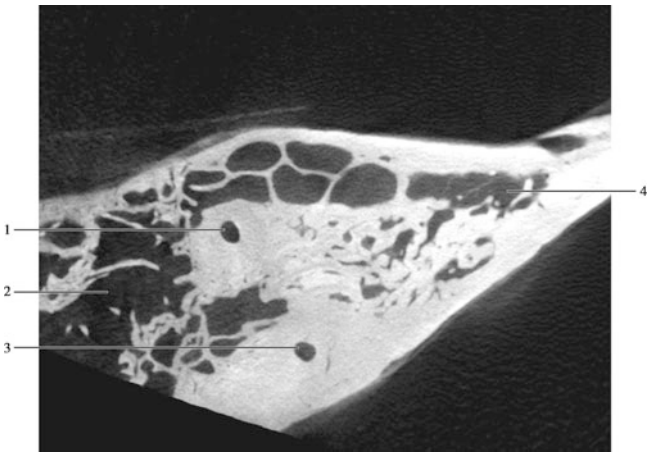

Fig. 2.11 Anterior semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Posterior crus of anterior semicircular canal. (4) Air cells in petrous apex

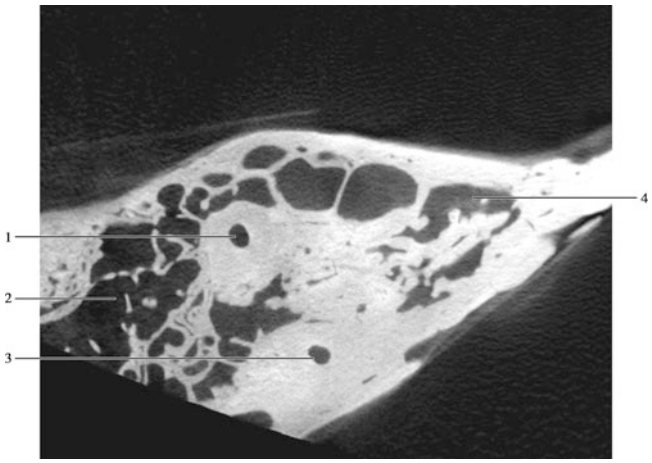

Fig. 2.10 Anterior semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Posterior crus of anterior semicircular canal. (4) Air cells in petrous apex

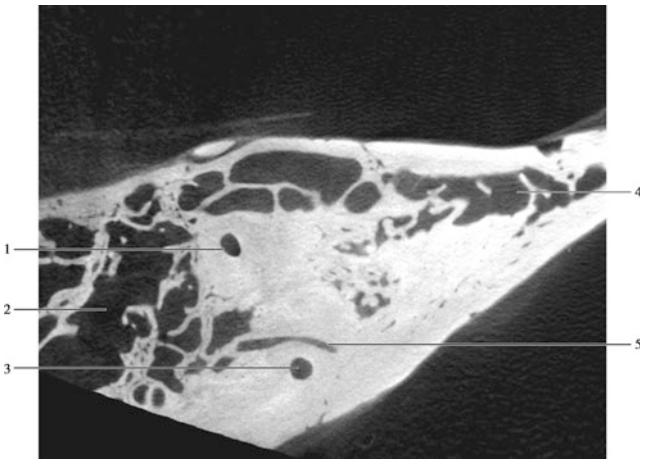

Fig. 2.12 Anterior semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Posterior crus of anterior semicircular canal. (4) Air cells in petrous apex. (5) Petromastoid canal (subarcuate artery)

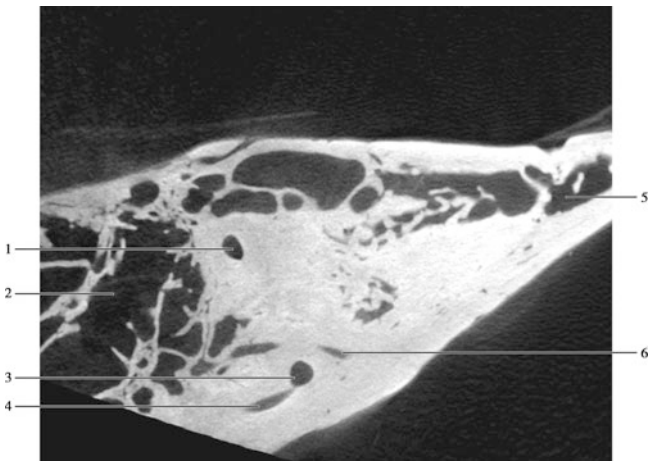

Fig. 2.13 Anterior-posterior semicircular canal and common crus on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Petromastoid canal

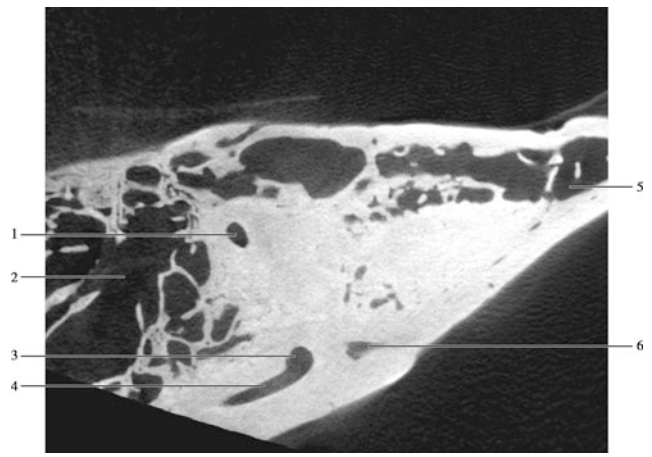

Fig. 2.14 Anterior-posterior semicircular canal and common crus on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Petromastoid canal

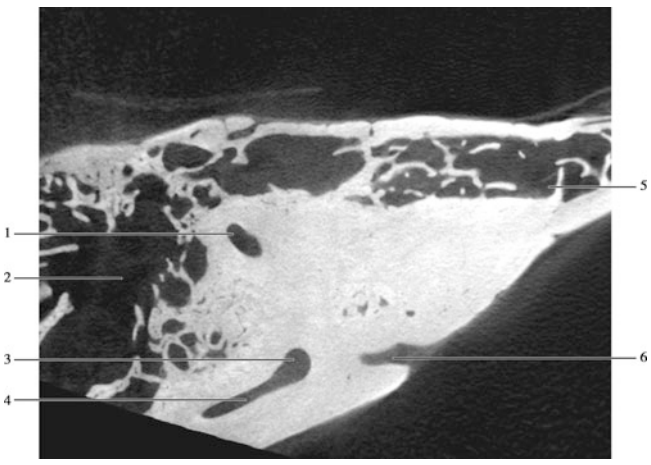

Fig. 2.15 Anterior-posterior semicircular canal and common crus on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Petromastoid canal

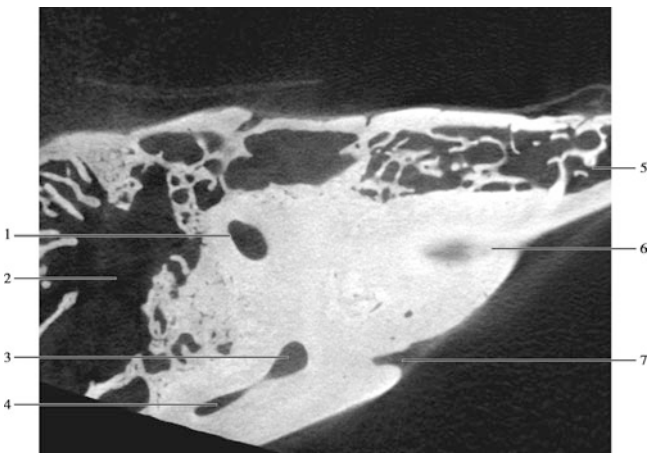

Fig. 2.16 Internal auditory canal and semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Top wall of internal auditory canal. (7) Petromastoid canal

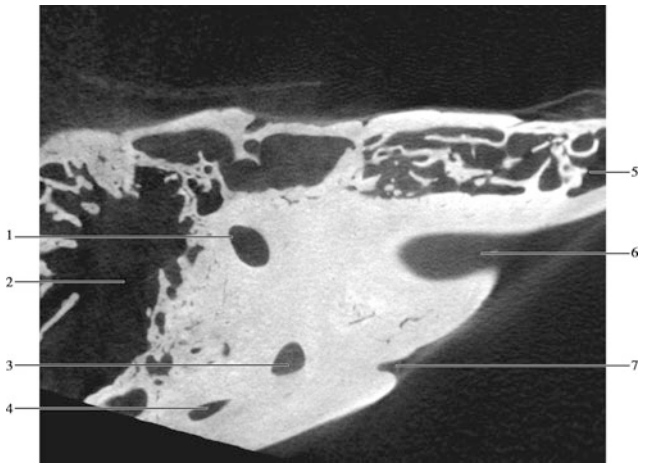

Fig. 2.17 Internal auditory canal and semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Internal auditory canal. (7) Petromastoid canal

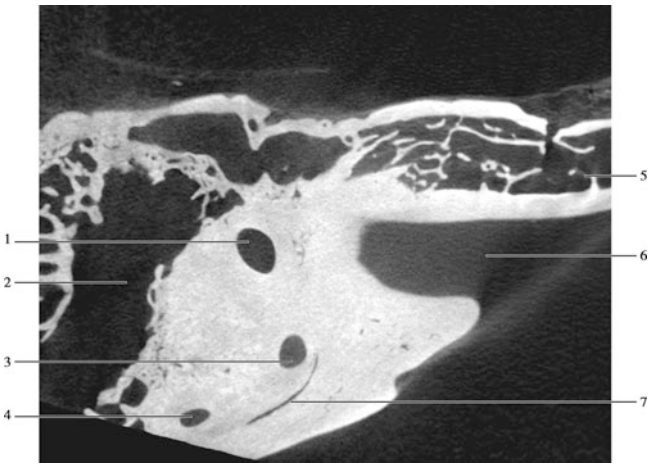

Fig. 2.19 Internal auditory canal-vestibular aqueduct and semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Internal auditory canal. (7) Vestibular aqueduct

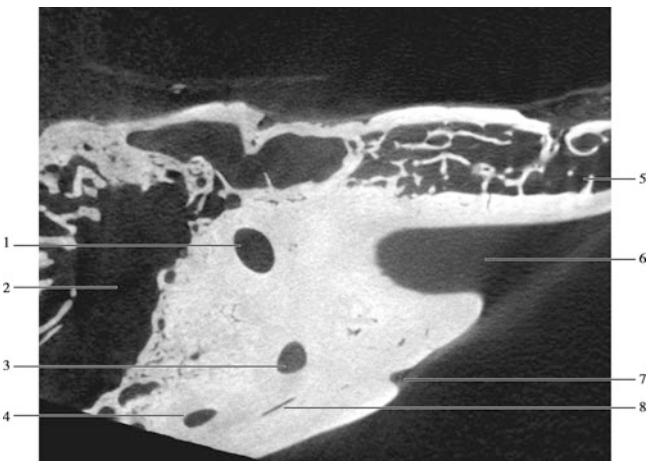

Fig. 2.18 Internal auditory canal-vestibular aqueduct and semicircular canal on axial view. (1) Anterior crus of anterior semicircular canal. (2) Antrum. (3) Common crus. (4) Posterior semicircular canal. (5) Air cells in petrous apex. (6) Internal auditory canal. (7) Petromastoid canal. (8) Vestibular aqueduct

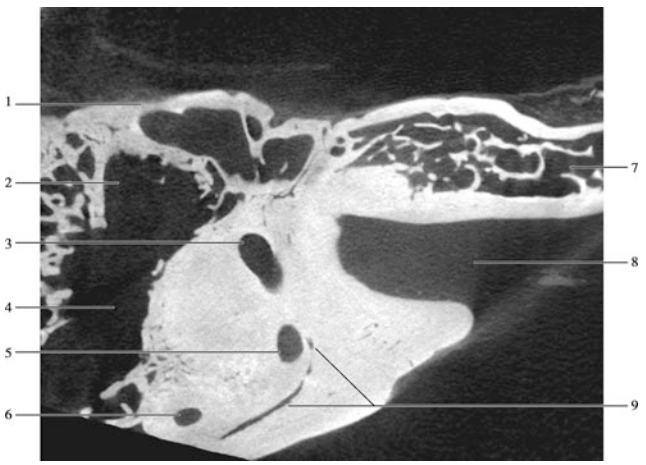

Fig. 2.20 Internal auditory canal-vestibular aqueduct and semicircular canal on axial view. (1) Tympanic tegmen (middle cranial fossa). (2) Attic. (3) Anterior crus of anterior semicircular canal. (4) Antrum. (5) Common crus. (6) Posterior semicircular canal. (7) Air cells in petrous apex. (8) Internal auditory canal. (9) Vestibular aqueduct

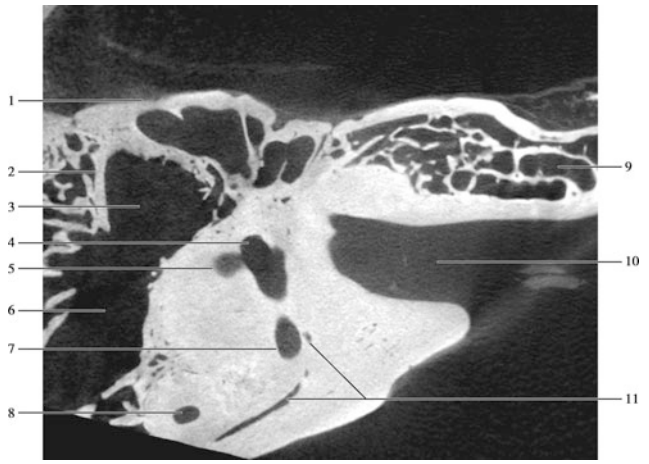

Fig. 2.21 Internal auditory canal-vestibular aqueduct and semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Attic. (4) Ampulla of anterior semicircular canal. (5) Ampulla of lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Air cells in petrous apex. (10) Internal auditory canal. (11) Vestibular aqueduct

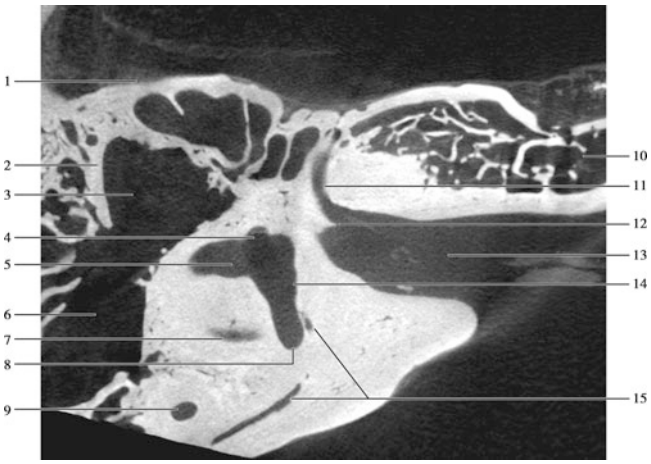

Fig. 2.23 Internal auditory canal-labyrinthine portion of facial nerve on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Attic. (4) Ampulla of anterior semicircular canal. (5) Ampulla of lateral semicircular canal. (6) Antrum. (7) Lateral semicircular canal. (8) Common crus. (9) Posterior semicircular canal. (10) Air cells in petrous apex. (11) Labyrinthine portion of facial nerve. (12) Bill's bar (vertical crest). (13) Internal auditory canal. (14) Vestibule. (15) Vestibular aqueduct

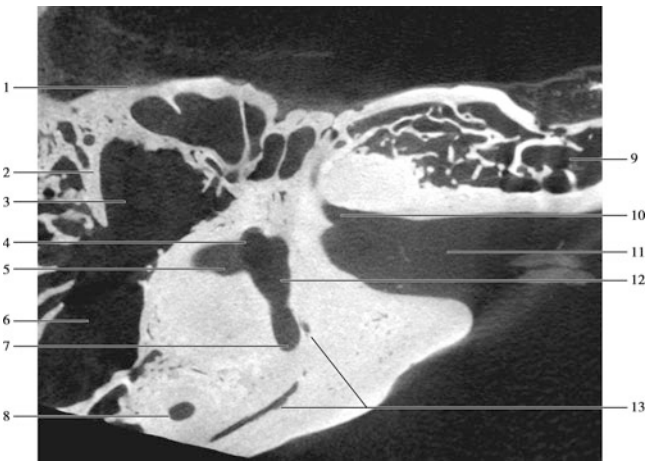

Fig. 2.22 Internal auditory canal-vestibular aqueduct and semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Attic. (4) Ampulla of anterior semicircular canal. (5) Ampulla of lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Air cells in petrous apex. (10) Orifice of facial nerve. (11) Internal auditory canal. (12) Vestibule. (13) Vestibular aqueduct

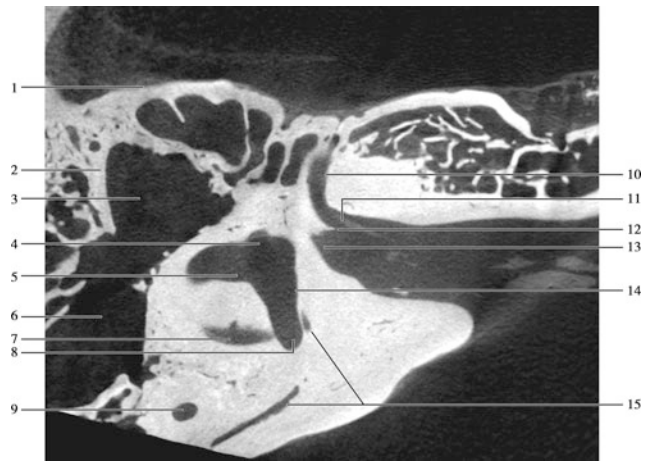

Fig. 2.24 Internal auditory canal-labyrinthine portion of facial nerve on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Attic. (4) Ampulla of anterior semicircular canal. (5) Ampulla of lateral semicircular canal. (6) Antrum. (7) Lateral semicircular canal. (8) Common crus. (9) Posterior semicircular canal. (10) Air cells in petrous apex. (11) Labyrinthine portion of facial nerve. (12) Bill's bar. (13) Internal auditory canal. (14) Vestibule. (15) Vestibular aqueduct

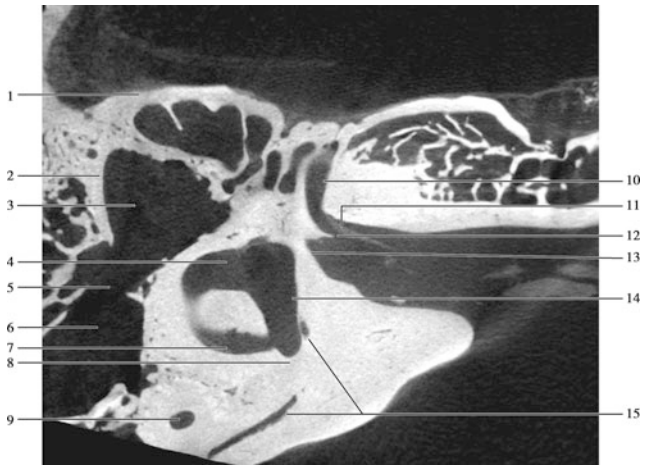

Fig. 2.25 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Attic. (4) Ampulla of lateral semicircular canal. (5) Aditus ad antrum. (6) Antrum. (7) Lateral semicircular canal. (8) Common crus. (9) Posterior semicircular canal. (10) Labyrinthine portion of facial nerve. (11) Orifice of facial canal. (12) Bill's bar. (13) Superior vestibular nerve. (14) Vestibule. (15) Vestibular aqueduct

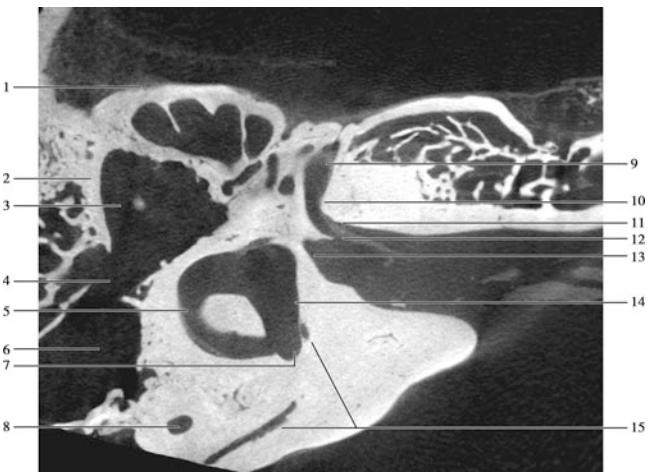

Fig. 2.26 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Attic. (4) Aditus ad antrum. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Geniculate ganglion. (10) Labyrinthine portion of facial nerve. (11) Orifice of facial canal. (12) Bill's bar. (13) Superior vestibular nerve. (14) Vestibule. (15) Vestibular aqueduct

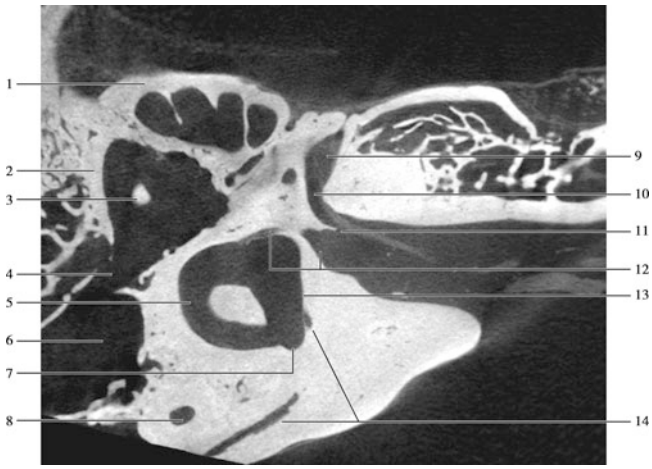

Fig. 2.27 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Body of the incus. (4) Aditus ad antrum. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Geniculate ganglion. (10) Labyrinthine portion of facial nerve. (11) Bill's bar. (12) Superior vestibular nerve. (13) Vestibule. (14) Vestibular aqueduct

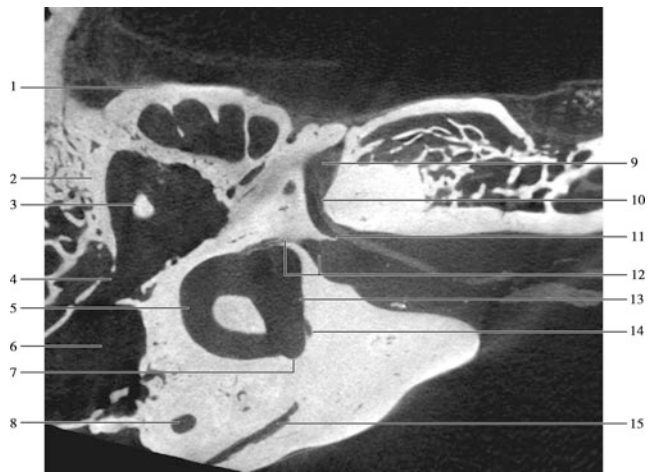

Fig. 2.28 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Body of the incus. (4) Aditus ad antrum. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Geniculate ganglion. (10) Labyrinthine portion of facial nerve. (11) Bill's bar. (12) Superior vestibular nerve. (13) Vestibule. (14) Orifice of vestibular aqueduct. (15) Vestibular aqueduct

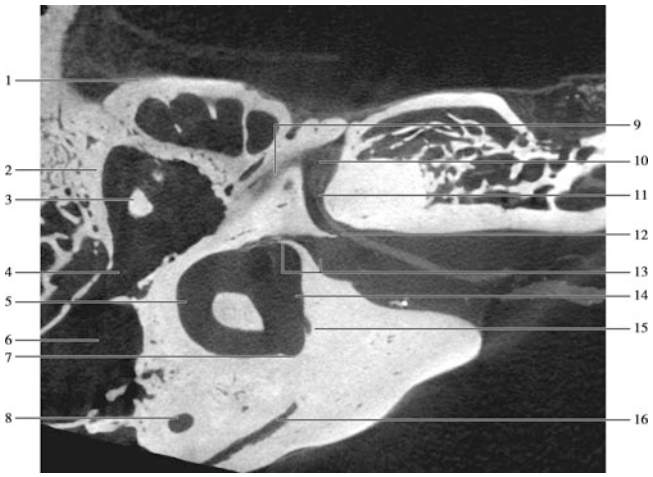

Fig. 2.29 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Scutum. (3) Body of the incus. (4) Aditus ad antrum. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Geniculate ganglion. (11) Labyrinthine portion of facial nerve. (12) Bill's bar. (13) Superior vestibular nerve. (14) Vestibule. (15) Orifice of vestibular aqueduct. (16) Vestibular aqueduct

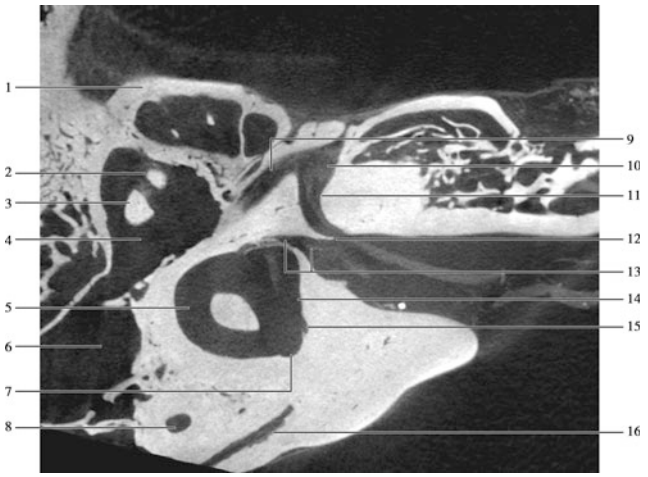

Fig. 2.31 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Head of the malleus. (3) Body of the incus. (4) Attic. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Geniculate ganglion. (11) Labyrinthine portion of facial nerve. (12) Bill's bar. (13) Superior vestibular nerve. (14) Vestibule. (15) Orifice of vestibular aqueduct. (16) Vestibular aqueduct

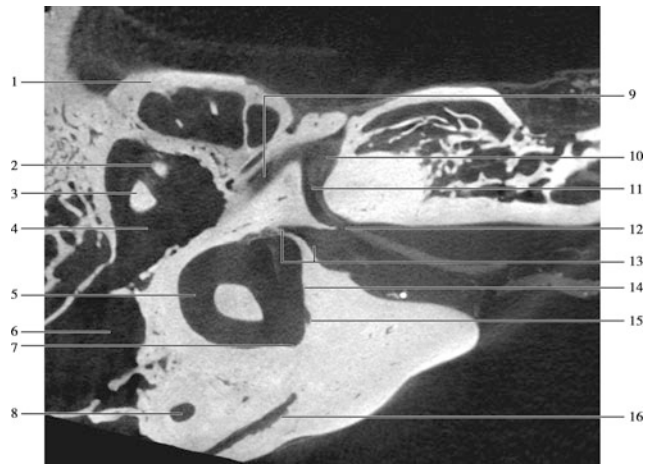

Fig. 2.30 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Head of the malleus. (3) Body of the incus. (4) Attic. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Geniculate ganglion. (11) Labyrinthine portion of facial nerve. (12) Bill's bar. (13) Superior vestibular nerve. (14) Vestibule. (15) Orifice of vestibular aqueduct. (16) Vestibular aqueduct

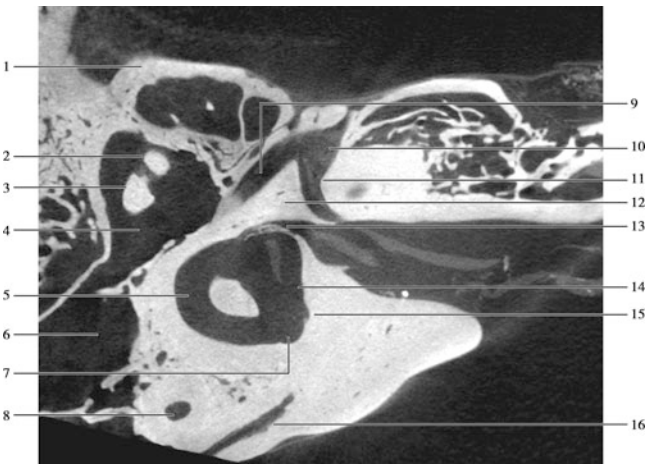

Fig. 2.32 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Head of the malleus. (3) Body of the incus. (4) Attic. (5) Lateral semicircular canal. (6) Antrum. (7) Common crus. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Geniculate ganglion. (11) Labyrinthine portion of facial nerve. (12) Anterior supralabyrinthine region. (13) Superior vestibular nerve. (14) Vestibule. (15) Orifice of vestibular aqueduct. (16) Vestibular aqueduct

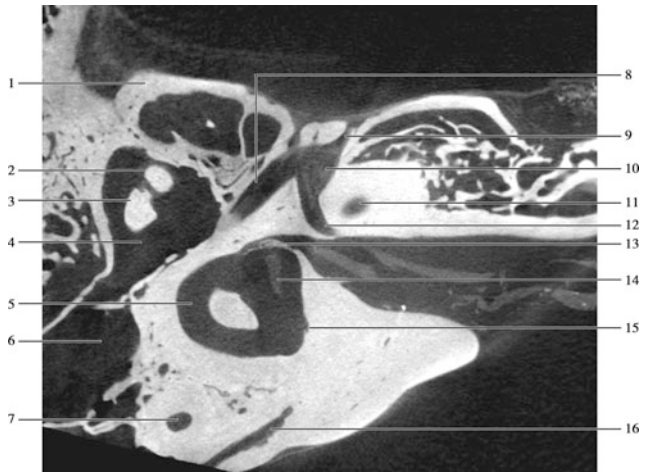

Fig. 2.33 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Tympanic tegmen. (2) Head of the malleus. (3) Body of the incus. (4) Attic. (5) Lateral semicircular canal. (6) Antrum. (7) Posterior semicircular canal. (8) Tympanic portion of facial nerve. (9) Greater superficial petrosal nerve. (10) Geniculate ganglion. (11) Cochlea. (12) Labyrinthine portion of facial nerve. (13) Superior vestibular nerve. (14) Vestibule and otoconia. (15) Orifice of vestibular aqueduct. (16) Vestibular aqueduct

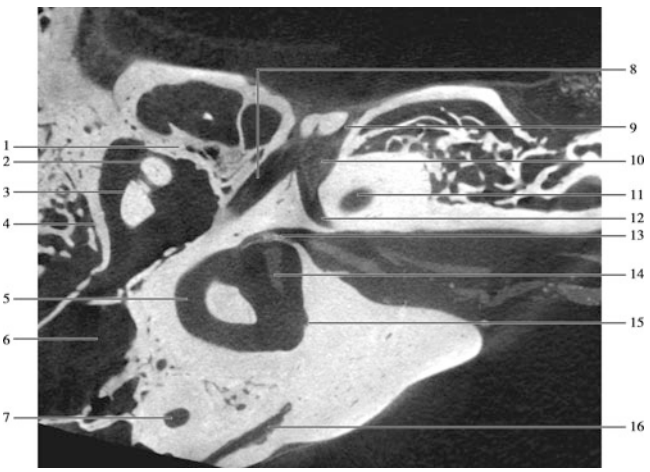

Fig. 2.34 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Cog. (2) Head of the malleus. (3) Body of the incus. (4) Scutum. (5) Lateral semicircular canal. (6) Antrum. (7) Posterior semicircular canal. (8) Tympanic portion of facial nerve. (9) Greater superficial petrosal nerve. (10) Geniculate ganglion. (11) Cochlea. (12) Labyrinthine portion of facial nerve. (13) Superior vestibular nerve. (14) Vestibule and otoconia. (15) Orifice of vestibular aqueduct. (16) Vestibular aqueduct

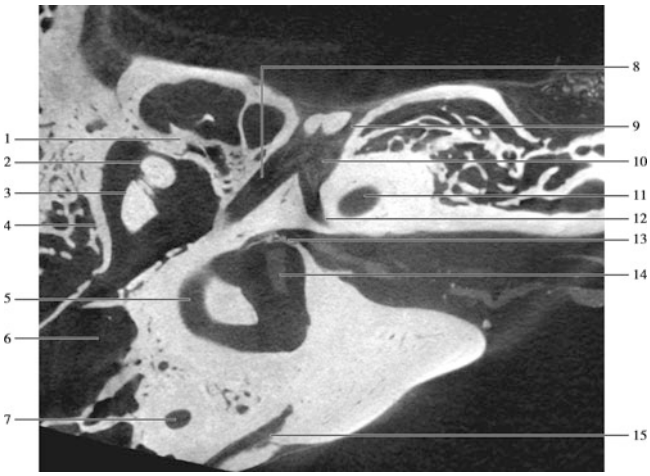

Fig. 2.35 Labyrinthine portion of facial nerve and lateral semicircular canal on axial view. (1) Cog. (2) Head of the malleus. (3) Body of the incus. (4) Scutum. (5) Lateral semicircular canal. (6) Antrum. (7) Posterior semicircular canal. (8) Tympanic portion of facial nerve. (9) Greater superficial petrosal nerve. (10) Geniculate ganglion. (11) Cochlea. (12) Labyrinthine portion of facial nerve. (13) Superior vestibular nerve. (14) Vestibule and otoconia. (15) Endolymphatic sac fissure

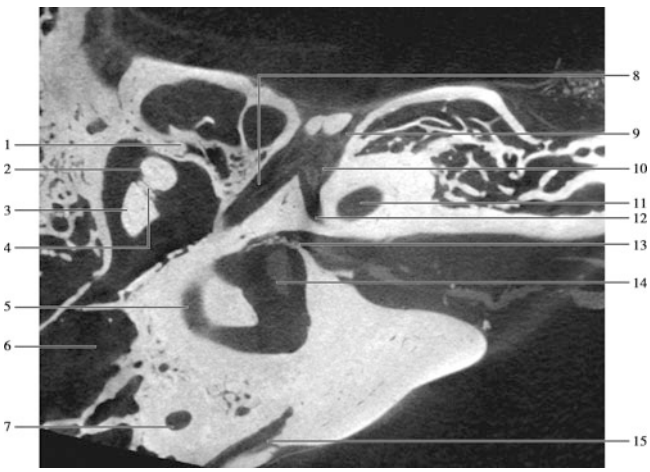

Fig. 2.36 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Cog. (2) Head of the malleus. (3) Body of the incus. (4) Incudomalleolar articulation. (5) Lateral semicircular canal. (6) Antrum. (7) Posterior semicircular canal. (8) Tympanic portion of facial nerve. (9) Greater superficial petrosal nerve. (10) Geniculate ganglion. (11) Cochlea. (12) Labyrinthine portion of facial nerve. (13) Superior vestibular nerve. (14) Vestibule and otoconia. (15) Endolymphatic sac fissure

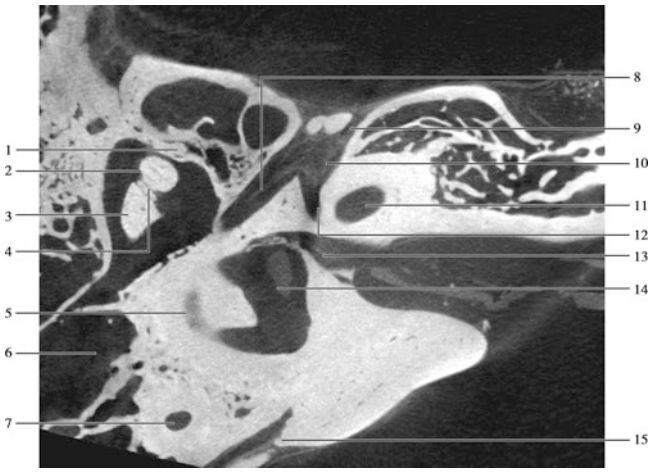

Fig. 2.37 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Cog. (2) Head of the malleus. (3) Body of the incus. (4) Incudomalleolar articulation. (5) Lateral semicircular canal. (6) Antrum. (7) Posterior semicircular canal. (8) Tympanic portion of facial nerve. (9) Greater superficial petrosal nerve. (10) Geniculate ganglion. (11) Cochlea. (12) Labyrinthine portion of facial nerve. (13) Superior vestibular nerve. (14) Vestibule and otoconia. (15) Endolymphatic sac fissure

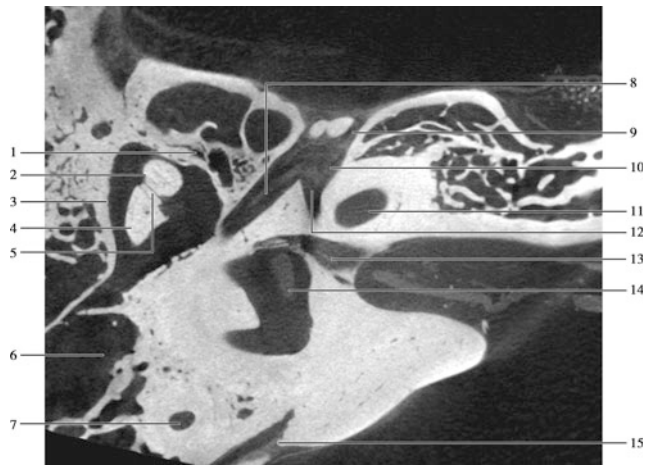

Fig. 2.38 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Cog. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Incudomalleolar articulation. (6) Antrum. (7) Posterior semicircular canal. (8) Tympanic portion of facial nerve. (9) Greater superficial petrosal nerve. (10) Geniculate ganglion. (11) Cochlea. (12) Anterior supralabyrinthine region. (13) Superior vestibular nerve. (14) Vestibule and otoconia. (15) Endolymphatic sac fissure

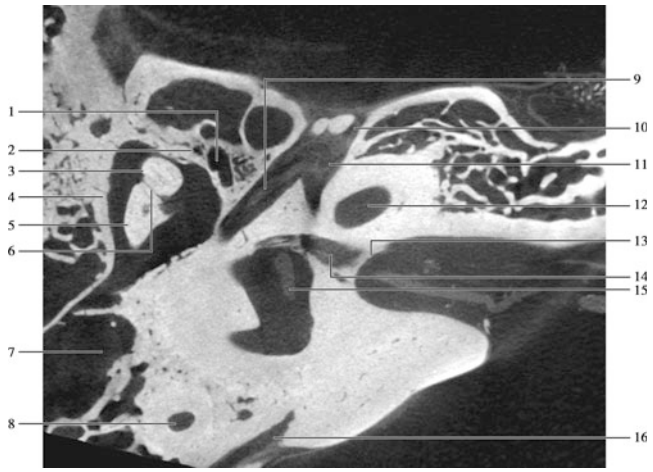

Fig. 2.39 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule and otoconia. (16) Endolymphatic sac

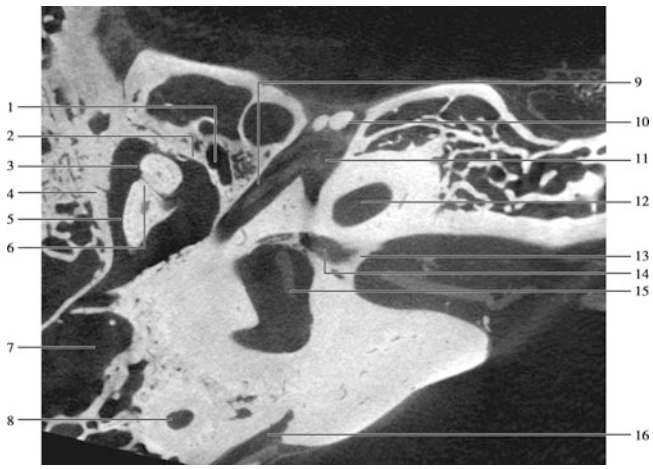

Fig. 2.40 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule and otoconia. (16) Endolymphatic sac

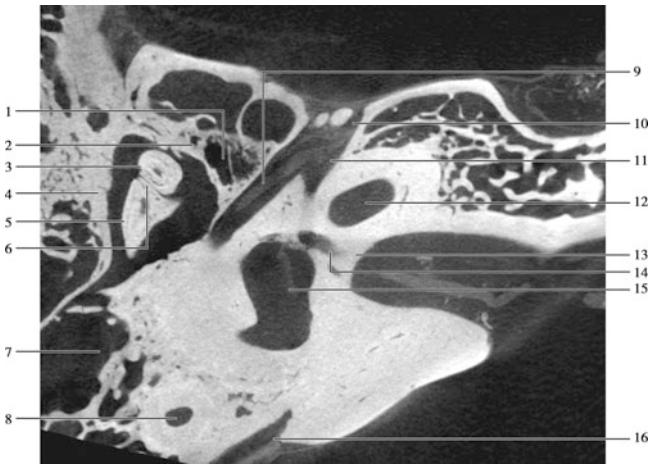

Fig. 2.41 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule and otoconia. (16) Endolymphatic sac

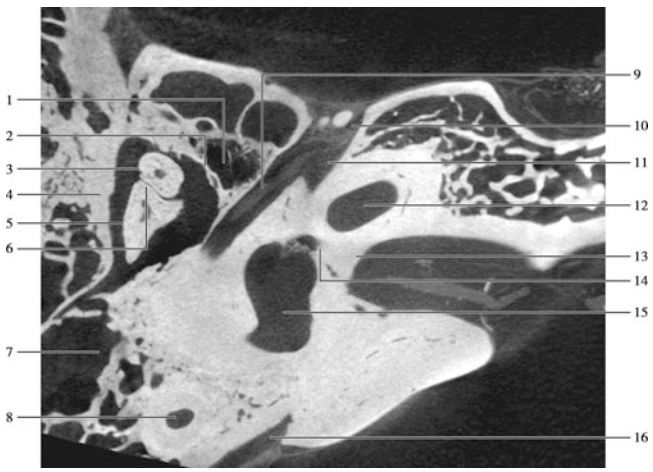

Fig. 2.42 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

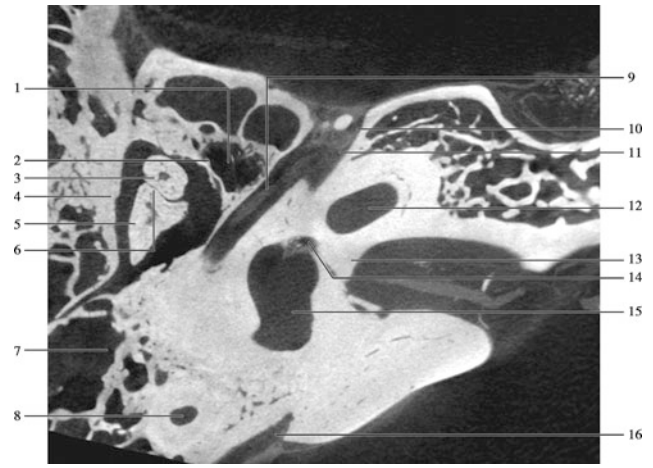

Fig. 2.43 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3)Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

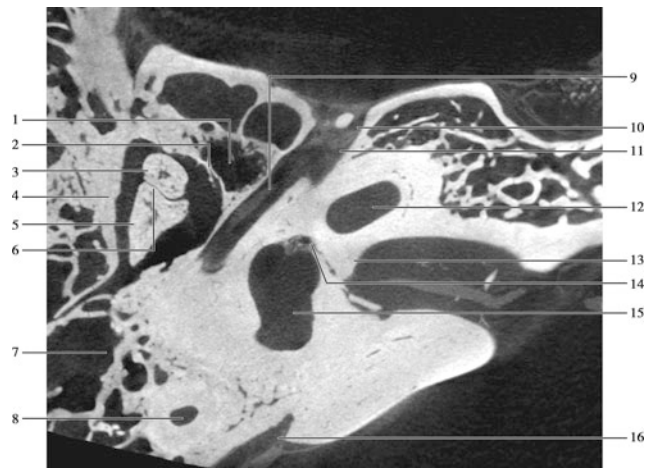

Fig. 2.44 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3)Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

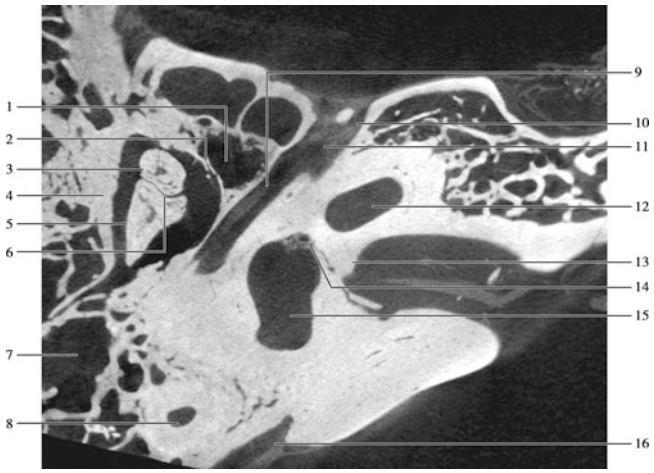

Fig. 2.45 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3)Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Antrum. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Superior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

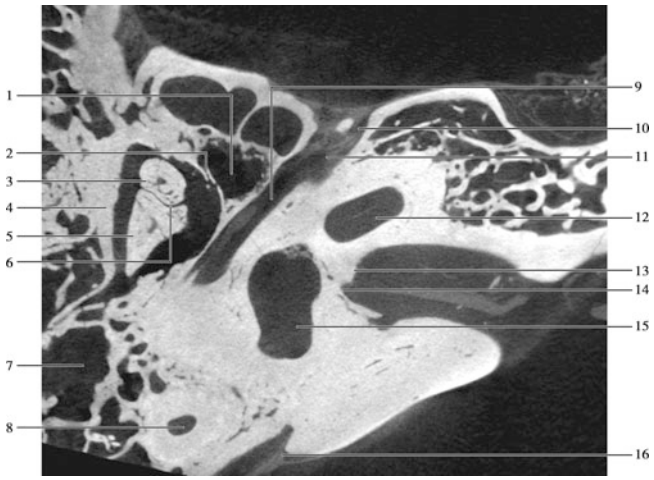

Fig. 2.46 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Inferior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

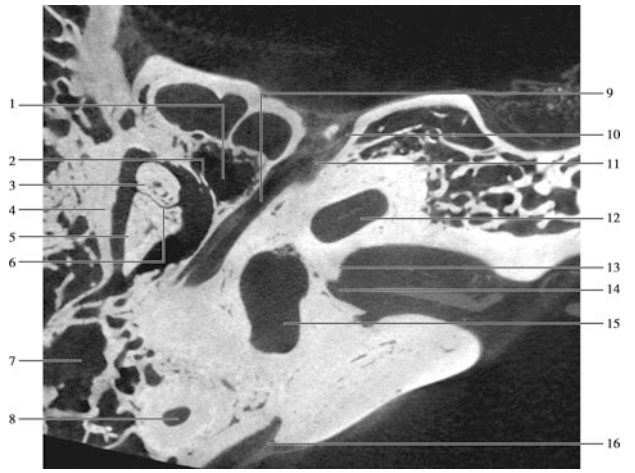

Fig. 2.47 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Inferior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

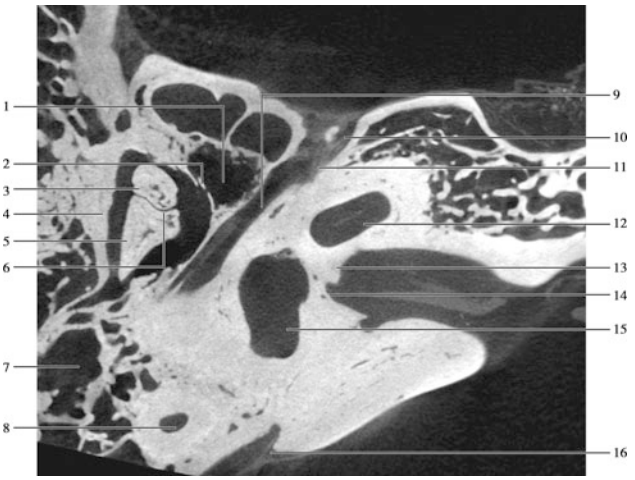

Fig. 2.48 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Geniculate ganglion. (12) Cochlea. (13) Transverse crest. (14) Inferior vestibular nerve. (15) Vestibule. (16) Endolymphatic sac

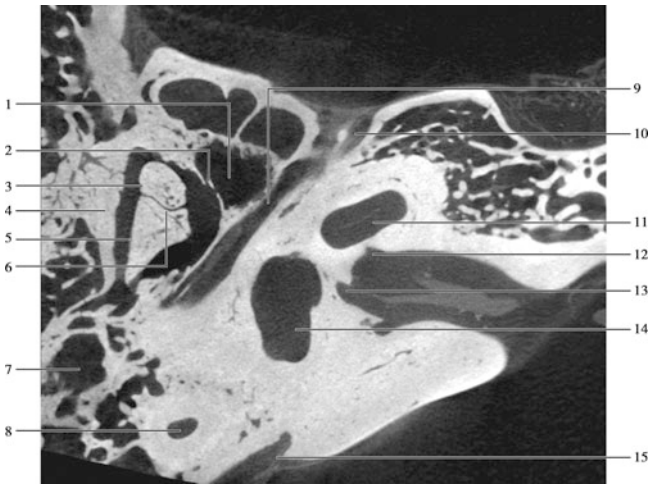

Fig. 2.49 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Cochlea. (12) Cochlear nerve canal. (13) Inferior vestibular nerve. (14) Vestibule. (15) Endolymphatic sac

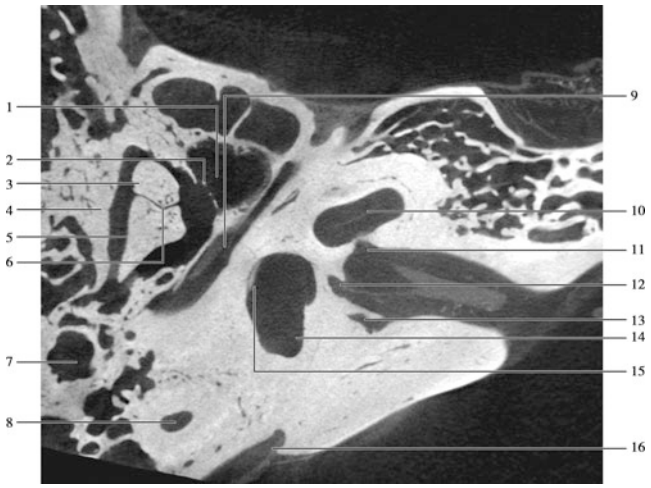

Fig. 2.51 Incudomalleolar articulation and footplate of stapes on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Cochlea. (11) Cochlear nerve canal. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes. (16) Endolymphatic sac

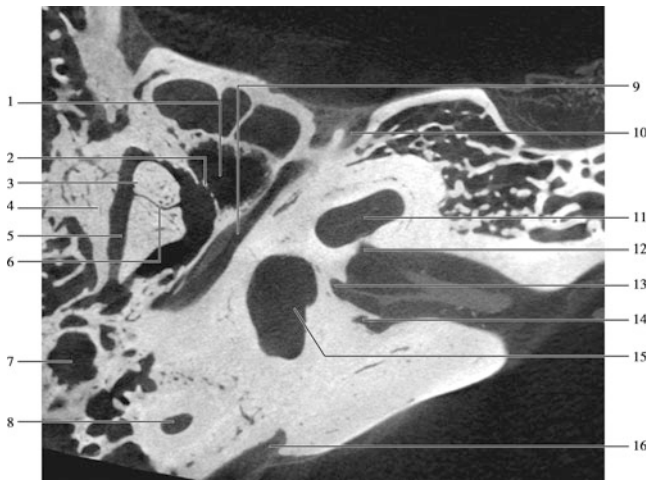

Fig. 2.50 Tympanic portion of facial nerve and incudomalleolar articulation on axial view. (1) Anterior epitympanic recess. (2) Cog. (3) Head of the malleus. (4) Scutum. (5) Body of the incus. (6) Incudomalleolar articulation. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Tympanic portion of facial nerve. (10) Greater superficial petrosal nerve. (11) Cochlea. (12) Cochlear nerve canal. (13) Inferior vestibular nerve. (14) Singular foramen. (15) Vestibule. (16) Endolymphatic sac

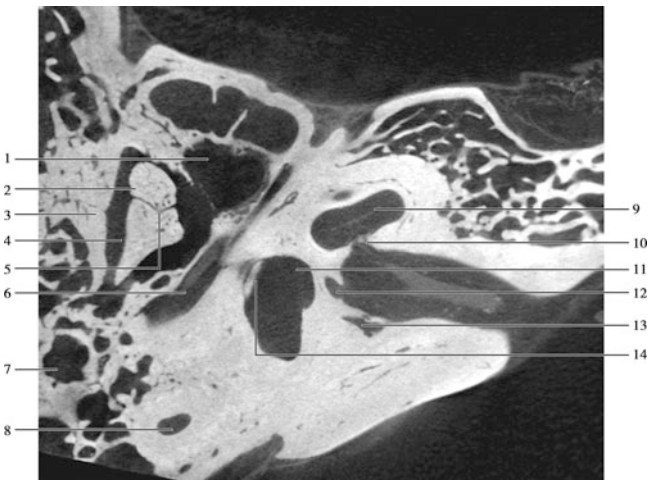

Fig. 2.52 Incudomalleolar articulation and footplate of stapes on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Incudomalleolar articulation. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Cochlea. (10) Cochlear nerve canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes

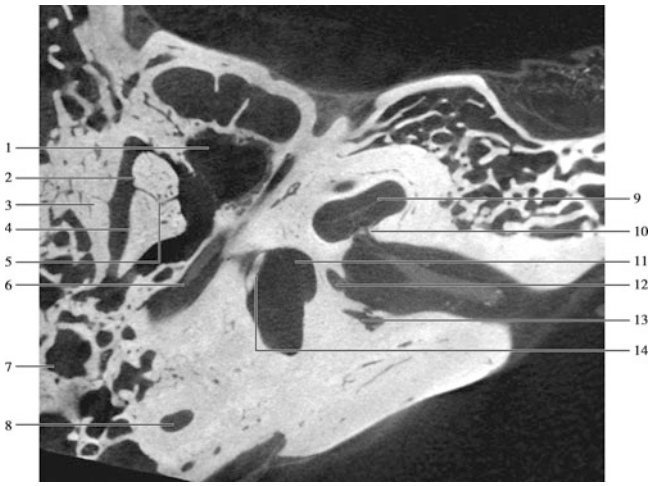

Fig. 2.53 Incudomalleolar articulation and footplate of stapes on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Incudomalleolar articulation. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Cochlea. (10) Cochlear nerve canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes

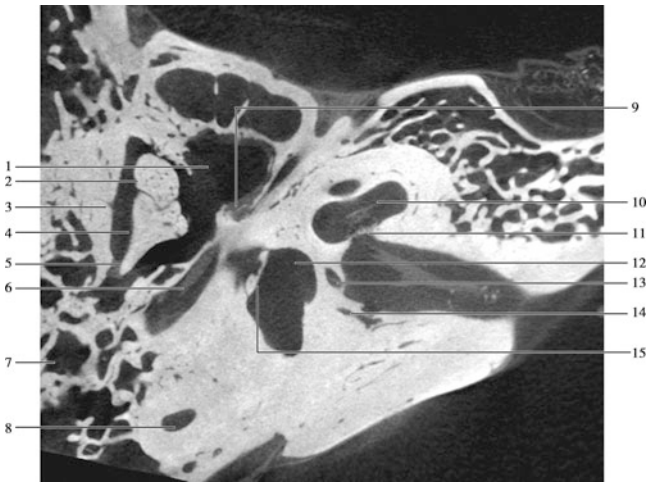

Fig. 2.55 Footplate of stapes and cochlear nerve canal on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Short crus of the incus. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Processus cochleariformis and tensor tympani muscle. (10) Cochlea. (11) Cochlear nerve canal. (12) Vestibule. (13) Inferior vestibular nerve. (14) Singular foramen. (15) Footplate of the stapes

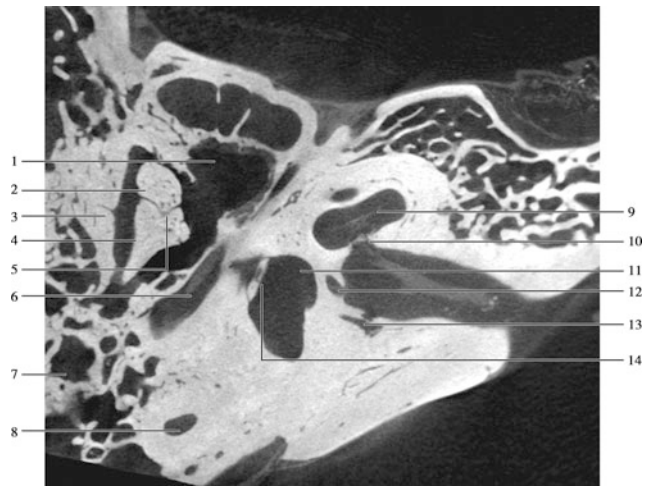

Fig. 2.54 Incudomalleolar articulation and footplate of stapes on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Incudomalleolar articulation. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Cochlea. (10) Cochlear nerve canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes

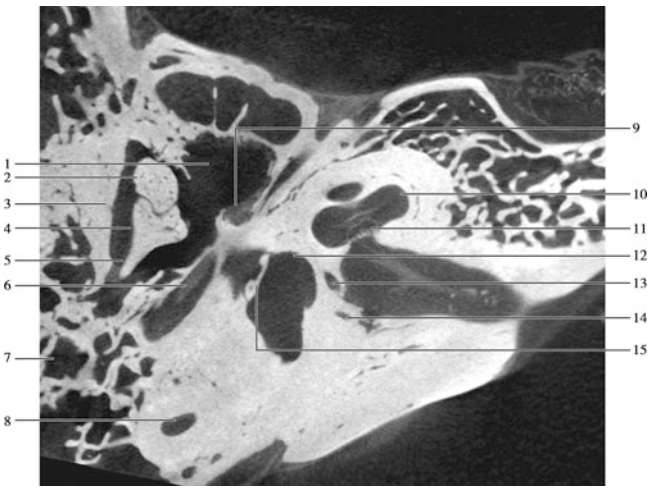

Fig. 2.56 Footplate of stapes and cochlear nerve canal on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Short crus of the incus. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Processus cochleariformis and tensor tympani muscle. (10) Cochlea. (11) Cochlear nerve canal. (12) Vestibule. (13) Inferior vestibular nerve. (14) Singular foramen. (15) Footplate of the stapes

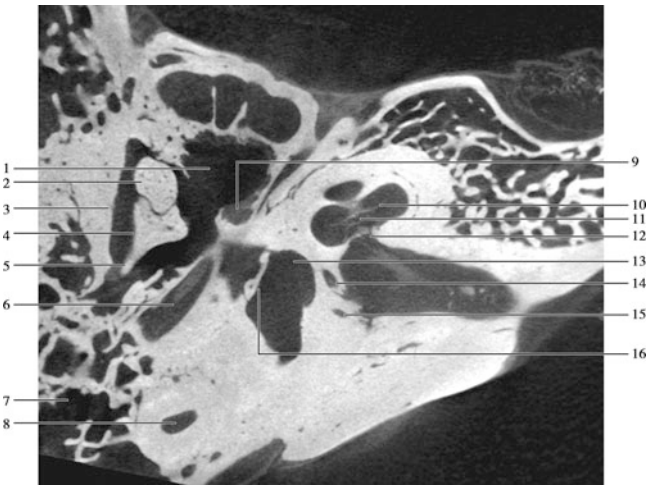

Fig. 2.57 Footplate of stapes and cochlear nerve canal on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Short crus of the incus. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Processus cochleariformis and tensor tympani muscle. (10) Spiral lamina. (11) Modiolus. (12) Cochlear nerve canal. (13) Vestibule. (14) Inferior vestibular nerve. (15) Singular foramen. (16) Footplate of the stapes

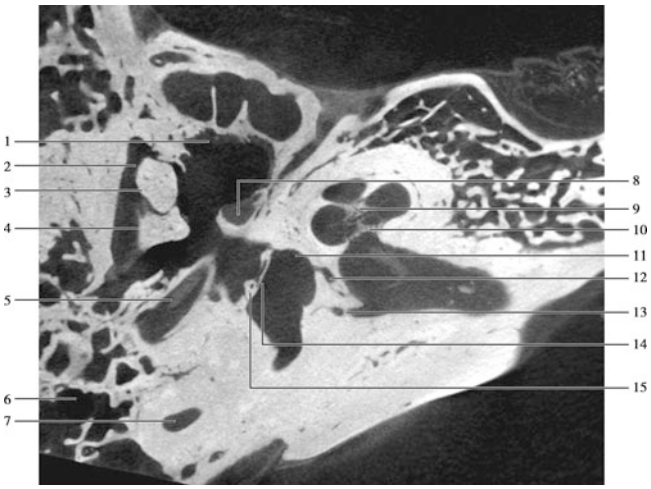

Fig. 2.59 Footplate of stapes and cochlear nerve canal on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Body of the incus. (5) Tympanic portion of facial nerve. (6) Mastoid cavity. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Modiolus. (10) Cochlear nerve canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes. (15) Posterior crus of the stapes

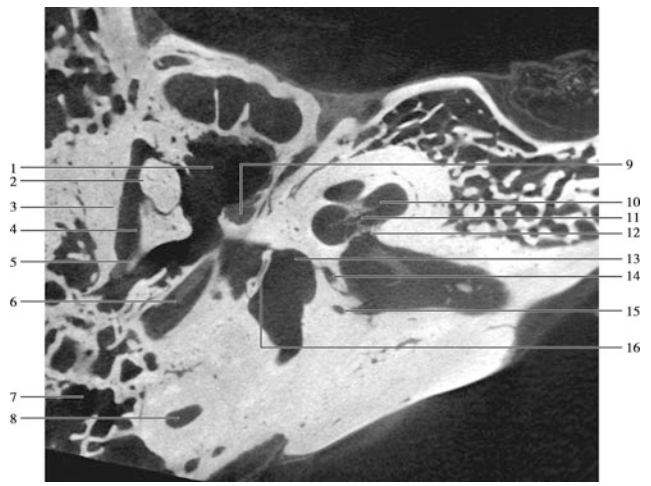

Fig. 2.58 Footplate of stapes and cochlear nerve canal on axial view. (1) Anterior epitympanic recess. (2) Head of the malleus. (3) Scutum. (4) Body of the incus. (5) Short crus of the incus. (6) Tympanic portion of facial nerve. (7) Mastoid cavity. (8) Posterior semicircular canal. (9) Processus cochleariformis and tensor tympani muscle. (10) Spiral lamina. (11) Modiolus. (12) Cochlear nerve canal. (13) Vestibule. (14) Inferior vestibular nerve. (15) Singular foramen. (16) Footplate of the stapes

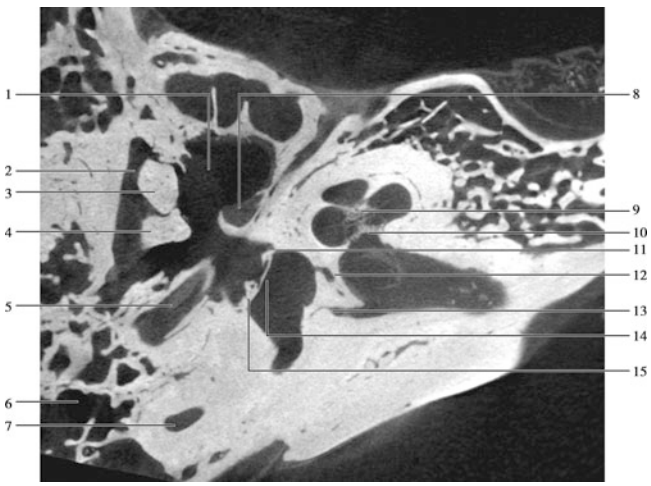

Fig. 2.60 Footplate of stapes and cochlear nerve canal on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Body of the incus. (5) Tympanic portion of facial nerve. (6) Mastoid cavity. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Modiolus. (10) Cochlear nerve canal. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes. (15) Posterior crus of the stapes

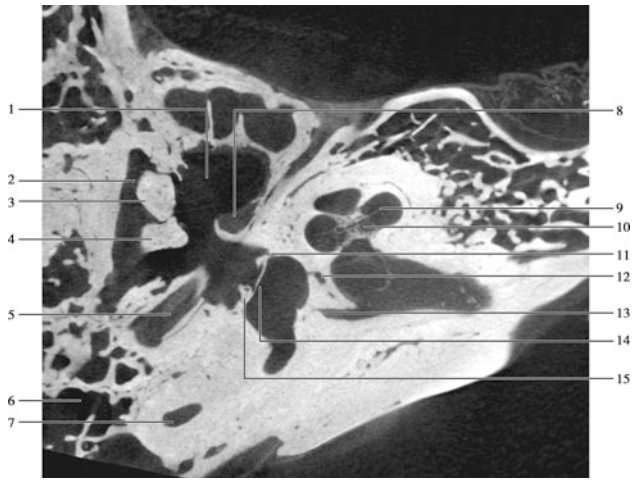

Fig. 2.61 Footplate of stapes and modiolus on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Long crus of the incus. (5) Tympanic portion of facial nerve. (6) Mastoid cavity. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Spiral lamina. (10) Modiolus. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes. (15) Posterior crus of the stapes

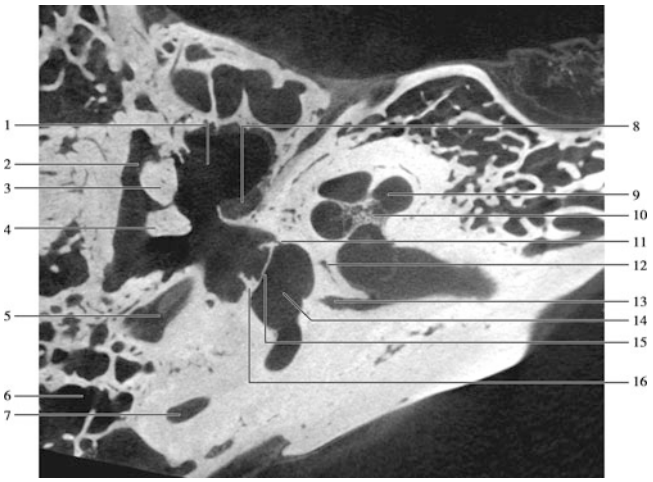

Fig. 2.63 Footplate of stapes and modiolus on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Long crus of the incus. (5) Tympanic portion of facial nerve. (6) Mastoid cavity. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Spiral lamina. (10) Modiolus. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes. (16) Posterior crus of the stapes

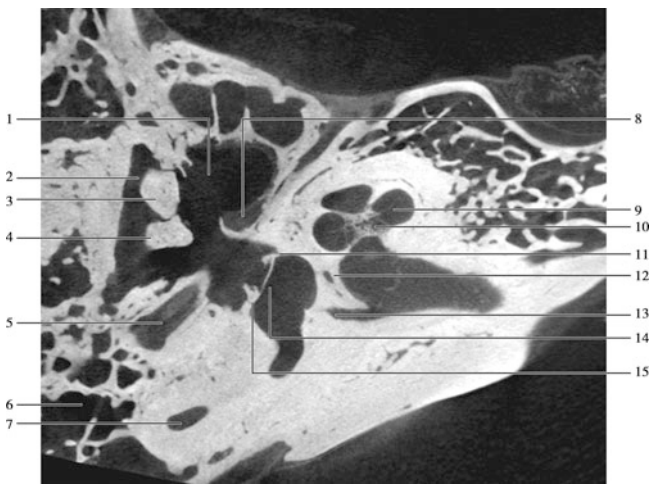

Fig. 2.62 Footplate of stapes and modiolus on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Long crus of the incus. (5) Tympanic portion of facial nerve. (6) Mastoid cavity. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Spiral lamina. (10) Modiolus. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes. (15) Posterior crus of the stapes

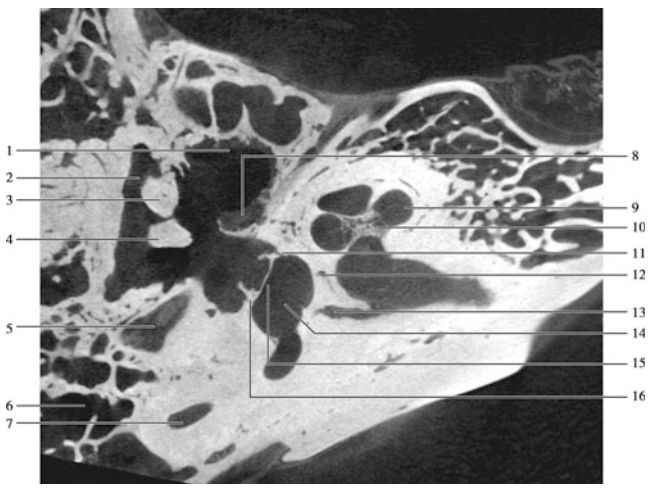

Fig. 2.64 Footplate of stapes and modiolus on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Long crus of the incus. (5) Second genu. (6) Mastoid cavity. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Cochlea. (10) Modiolus. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes. (16) Posterior crus of the stapes

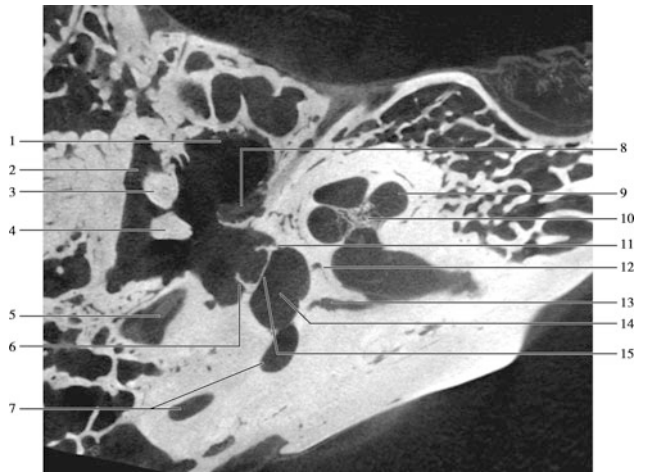

Fig. 2.65 Footplate of stapes and modiolus on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Long crus of the incus. (5) Second genu. (6) Posterior crus of the stapes. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Cochlea. (10) Modiolus. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes

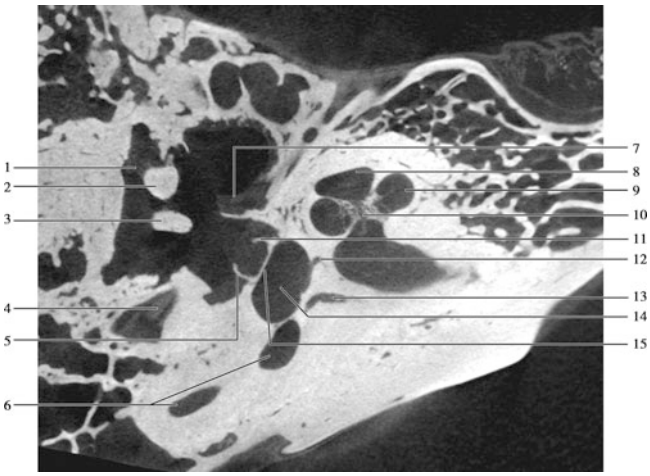

Fig. 2.67 Footplate of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Second genu. (5) Posterior crus of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Anterior crus of the stapes. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes

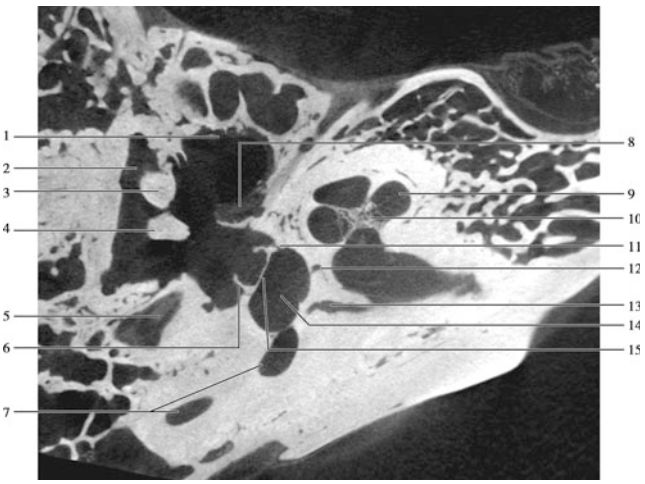

Fig. 2.66 Footplate of stapes and modiolus on axial view. (1) Anterior epitympanic recess. (2) Prussak's space. (3) Neck of the malleus. (4) Long crus of the incus. (5) Second genu. (6) Posterior crus of the stapes. (7) Posterior semicircular canal. (8) Processus cochleariformis and tensor tympani muscle. (9) Cochlea. (10) Modiolus. (11) Annular ligament. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes

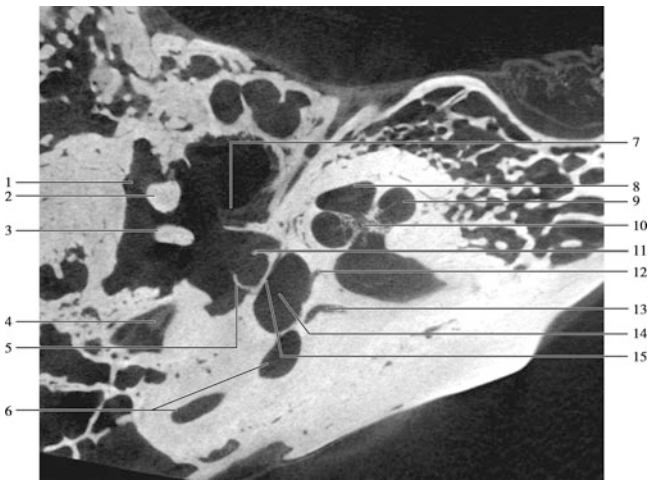

Fig. 2.68 Footplate of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Second genu. (5) Posterior crus of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Anterior crus of the stapes. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule. (15) Footplate of the stapes

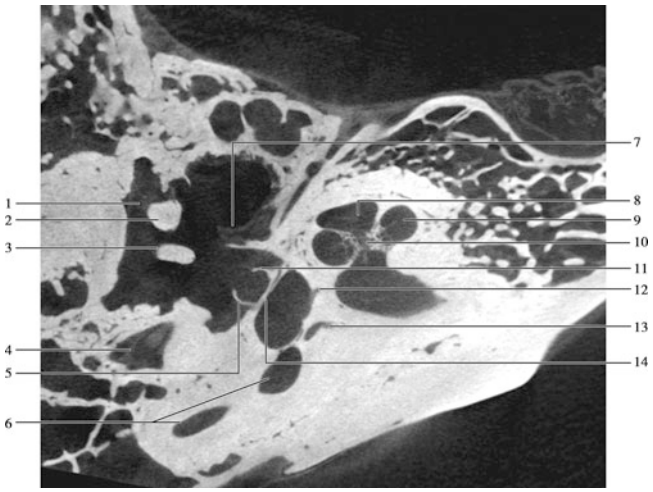

Fig. 2.69 Footplate of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Second genu. (5) Posterior crus of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Anterior crus of the stapes. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Footplate of the stapes

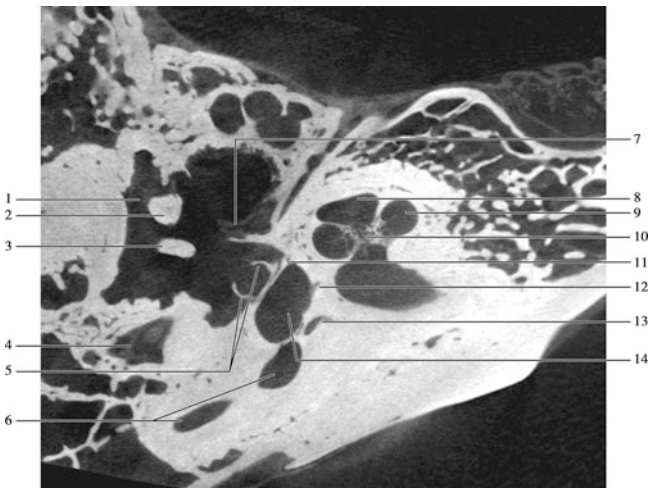

Fig. 2.70 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Second genu. (5) Crura of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Fissula ante fenestram. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Vestibule

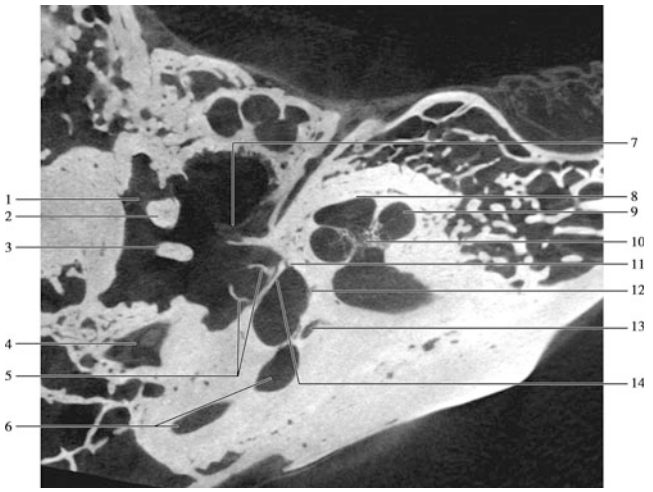

Fig. 2.71 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crura of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Fissula ante fenestram. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Promontory

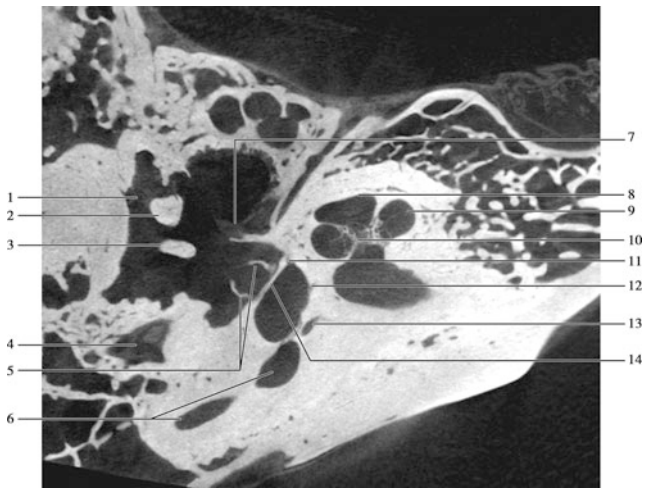

Fig. 2.72 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crura of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Fissula ante fenestram. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Promontory

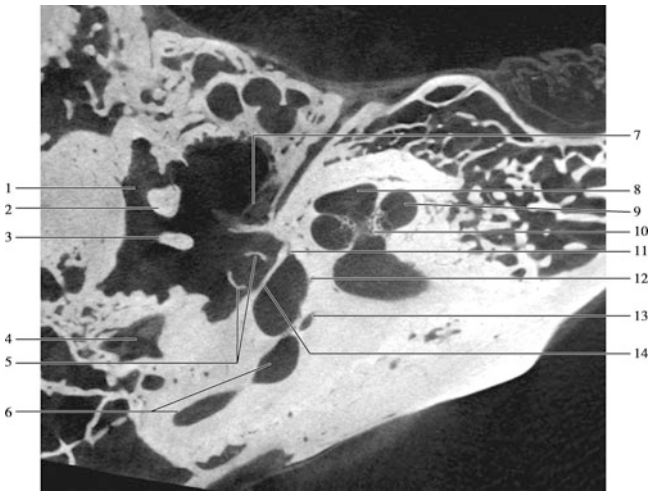

Fig. 2.73 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crura of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Fissula ante fenestram. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Promontory

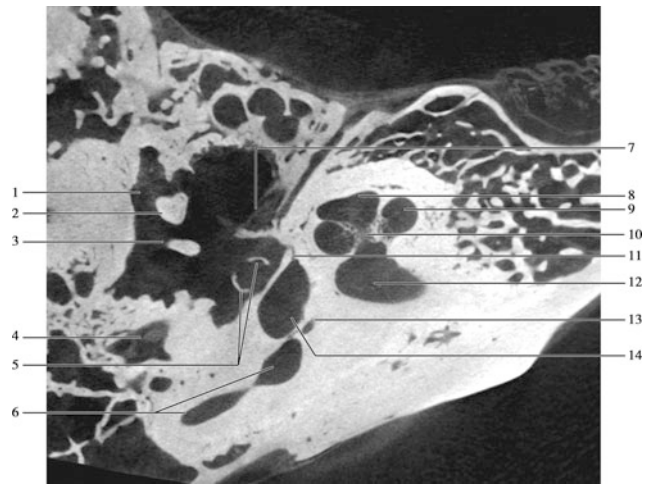

Fig. 2.74 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crura of the stapes. (6) Posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Fissula ante fenestram. (12) Internal auditory canal. (13) Singular foramen. (14) Vestibule

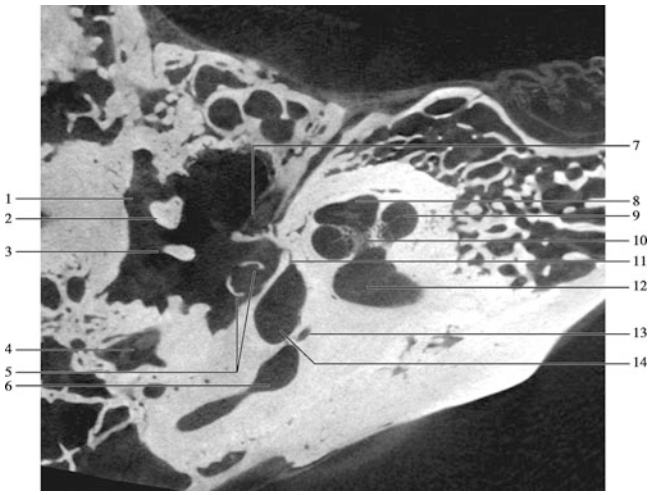

Fig. 2.75 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Neck of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crura of the stapes. (6) Ampulla of posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Fissula ante fenestram. (12) Internal auditory canal. (13) Singular foramen. (14) Vestibule

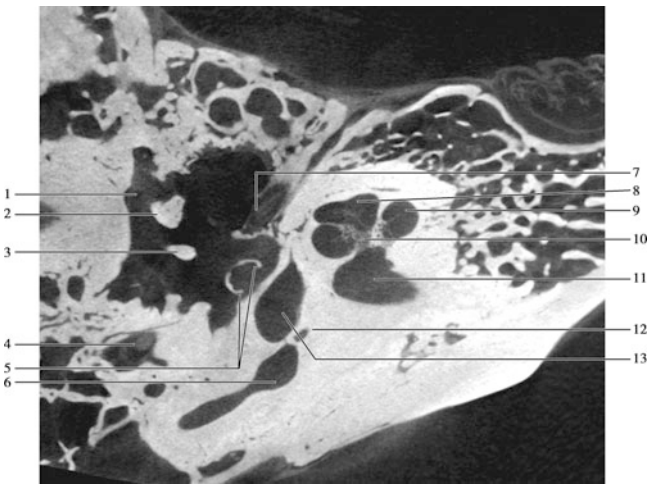

Fig. 2.76 Crura of stapes and modiolus on axial view. (1) Prussak's space. (2) Short process of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crura of the stapes. (6) Ampulla of posterior semicircular canal. (7) Processus cochleariformis and tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Internal auditory canal. (12) Singular foramen. (13) Vestibule

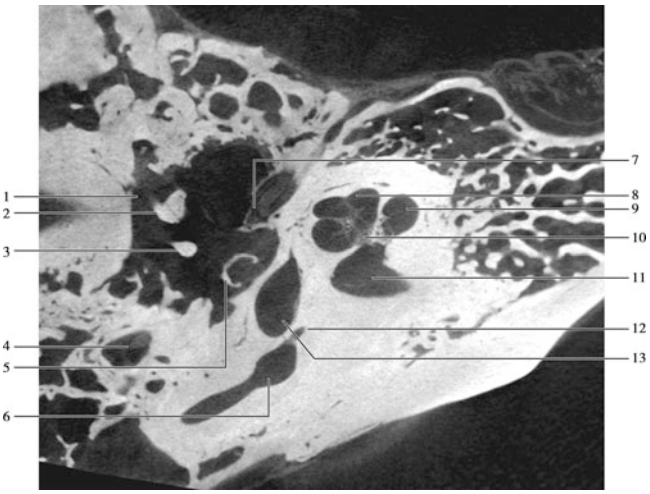

Fig. 2.77 Crus of stapes and modiolus on axial view. (1) Prussak's space. (2) Short process of the malleus. (3) Long crus of the incus. (4) Mastoid portion of facial nerve. (5) Crus of the stapes. (6) Ampulla of posterior semicircular canal. (7) Tensor tympani muscle. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus. (11) Internal auditory canal. (12) Singular foramen. (13) Vestibule

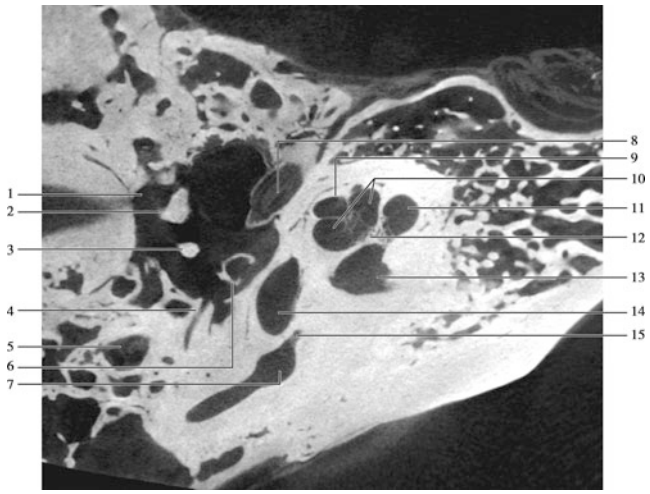

Fig. 2.79 Crus of stapes and modiolus on axial view. (1) Prussak's space. (2) Short process of the malleus. (3) Long crus of the incus. (4) Pyramidal eminence and stapedius muscle. (5) Mastoid portion of facial nerve. (6) Crus of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Modiolus. (13) Internal auditory canal. (14) Vestibule. (15) Singular foramen

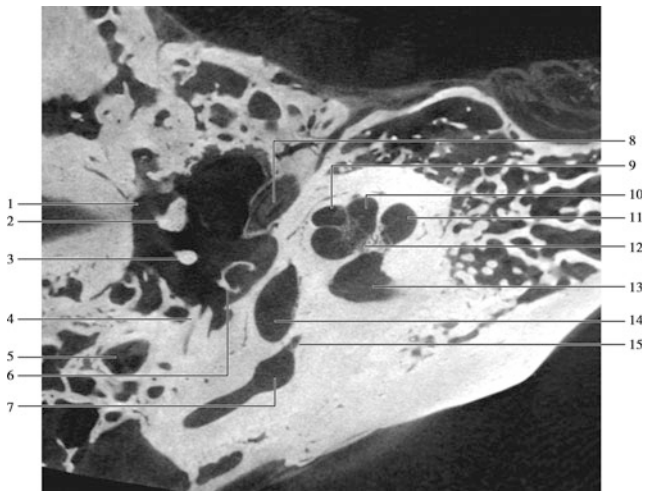

Fig. 2.78 Stapes and modiolus on axial view. (1) Prussak's space. (2) Short process of the malleus. (3) Long crus of the incus. (4) Pyramidal eminence and stapedius muscle. (5) Mastoid portion of facial nerve. (6) Crus of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Modiolus. (13) Internal auditory canal. (14) Vestibule. (15) Singular foramen

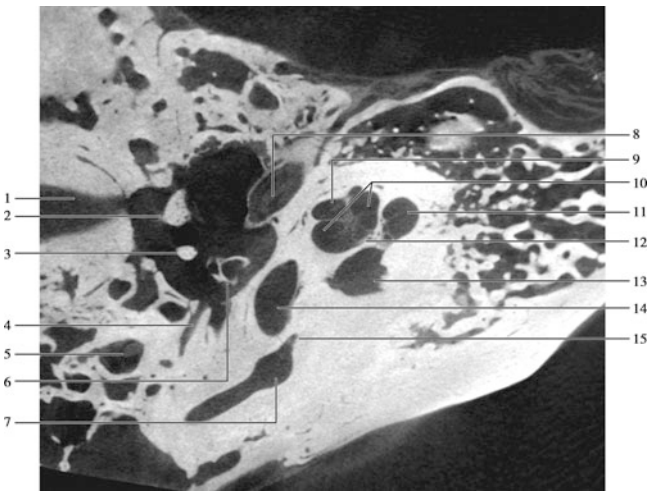

Fig. 2.80 Crus of stapes and modiolus on axial view. (1) External auditory canal. (2) Manubrium. (3) Long crus of the incus. (4) Pyramidal eminence and stapedius muscle. (5) Mastoid portion of facial nerve. (6) Crus of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Modiolus. (13) Internal auditory canal. (14) Vestibule. (15) Singular foramen

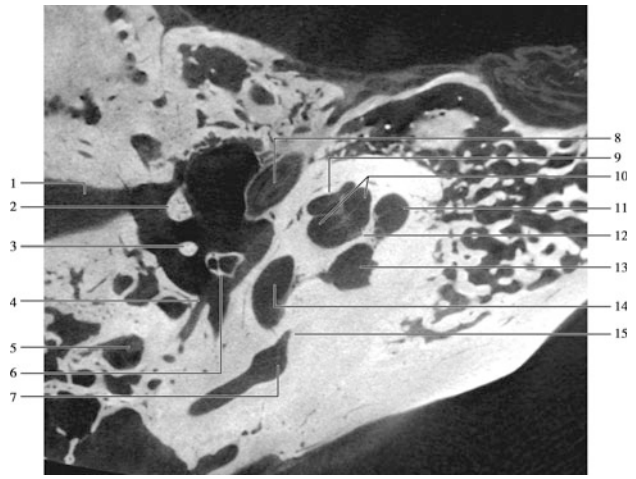

Fig. 2.81 Neck of stapes and pyramidal eminence on axial view. (1) External auditory canal. (2) Manubrium. (3) Long crus of the incus. (4) Pyramidal eminence and stapedius muscle. (5) Mastoid portion of facial nerve. (6) Neck of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Modiolus. (13) Internal auditory canal. (14) Vestibule. (15) Singular foramen

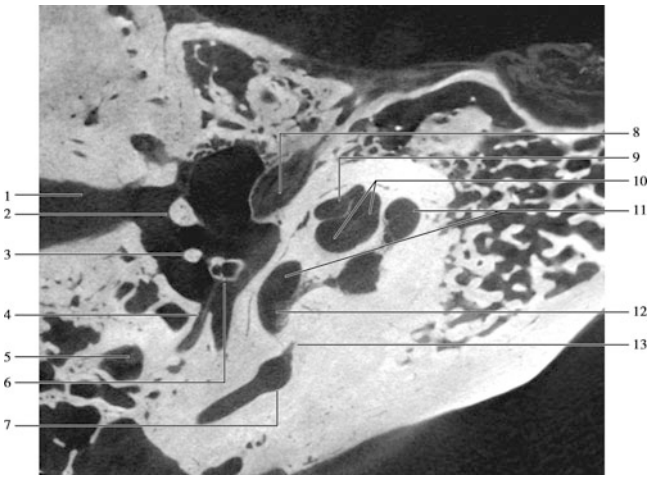

Fig. 2.83 Neck of stapes and pyramidal eminence on axial view. (1) External auditory canal. (2) Manubrium. (3) Long crus of the incus. (4) Pyramidal eminence and stapedius muscle. (5) Mastoid portion of facial nerve. (6) Neck of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Vestibule. (13) Singular foramen

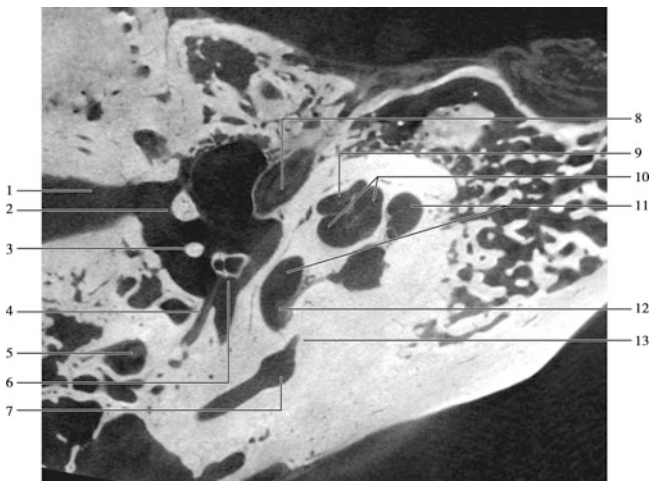

Fig. 2.82 Neck of stapes and pyramidal eminence on axial view. (1) External auditory canal. (2) Manubrium. (3) Long crus of the incus. (4) Pyramidal eminence and stapedius muscle. (5) Mastoid portion of facial nerve. (6) Neck of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Vestibule. (13) Singular foramen

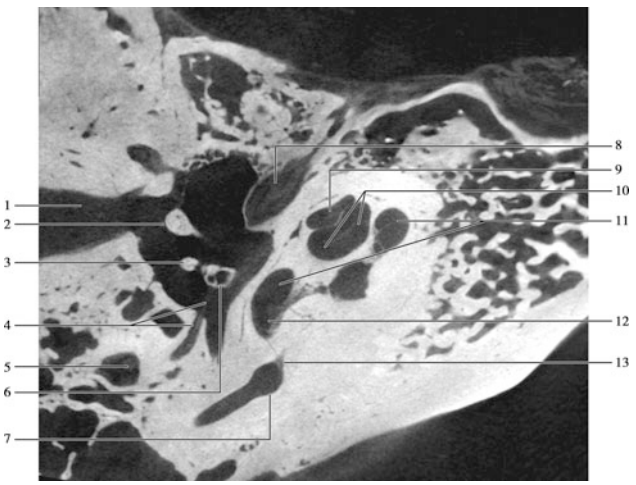

Fig. 2.84 Neck of stapes and pyramidal eminence on axial view. (1) External auditory canal. (2) Manubrium. (3) Long crus of the incus. (4) Pyramidal eminence-stapedius muscle and tendon. (5) Mastoid portion of facial nerve. (6) Neck of the stapes. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Vestibule. (13) Singular foramen

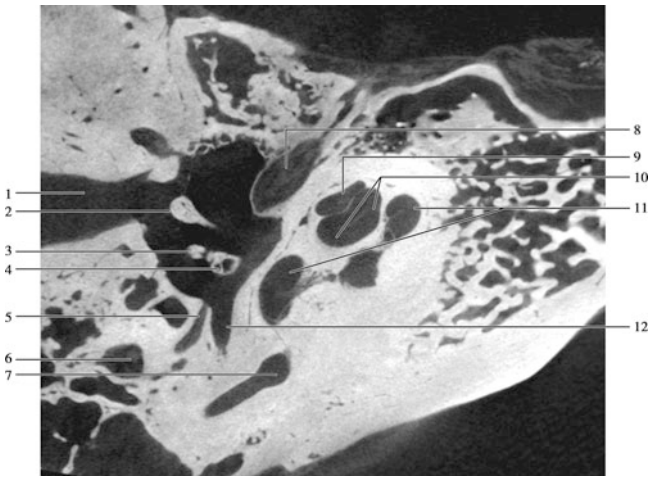

Fig. 2.85 Head of stapes and stapedius muscle on axial view. (1) External auditory canal. (2) Manubrium. (3) Long crus of the incus. (4) Head of the stapes. (5) Pyramidal eminence-stapedius muscle. (6) Mastoid portion of facial nerve. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Tympanic sinus

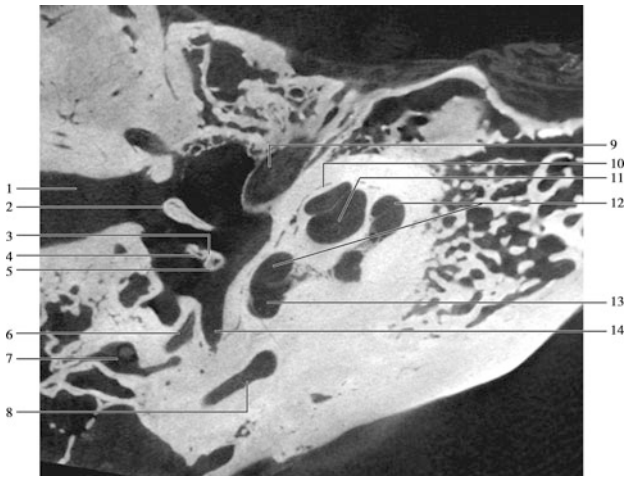

Fig. 2.87 Incudostapedial articulation and cochlear window on axial view. (1) External auditory canal. (2) Manubrium. (3) Incudostapedial articulation. (4) Lenticular process. (5) Neck of the stapes. (6) Stapedius muscle. (7) Mastoid portion of facial nerve. (8) Posterior semicircular canal. (9) Tensor tympani muscle. (10) Apical turn of cochlea. (11) Second turn of cochlea. (12) Basal turn of cochlea. (13) Cochlear window. (14) Tympanic sinus

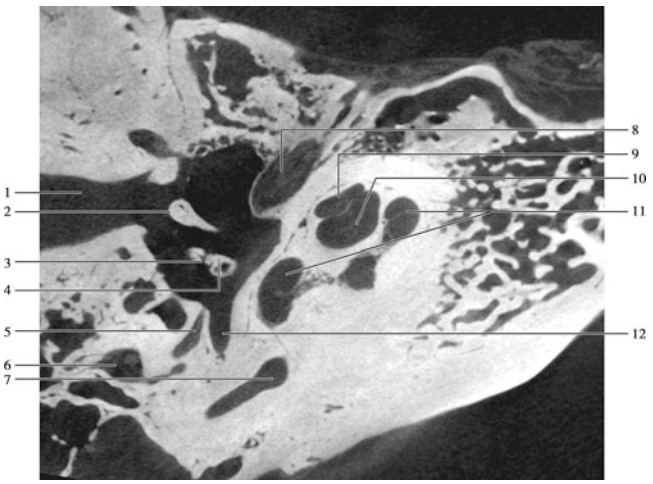

Fig. 2.86 Head of stapes and stapedius muscle on axial view. (1) External auditory canal. (2) Manubrium. (3) Lenticular process. (4) Neck of the stapes. (5) Stapedius muscle. (6) Mastoid portion of facial nerve. (7) Ampulla of posterior semicircular canal. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Tympanic sinus

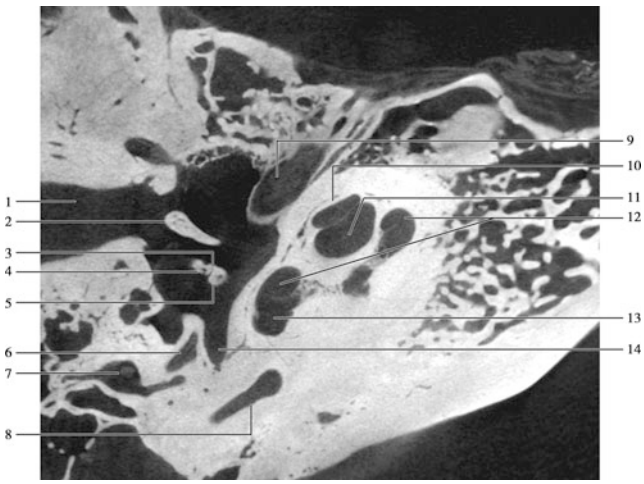

Fig. 2.88 Incudostapedial articulation and cochlear window on axial view. (1) External auditory canal. (2) Manubrium. (3) Incudostapedial articulation. (4) Lenticular process. (5) Neck of the stapes. (6) Stapedius muscle. (7) Mastoid portion of facial nerve. (8) Posterior semicircular canal. (9) Tensor tympani muscle. (10) Apical turn of cochlea. (11) Second turn of cochlea. (12) Basal turn of cochlea. (13) Cochlear window. (14) Tympanic sinus

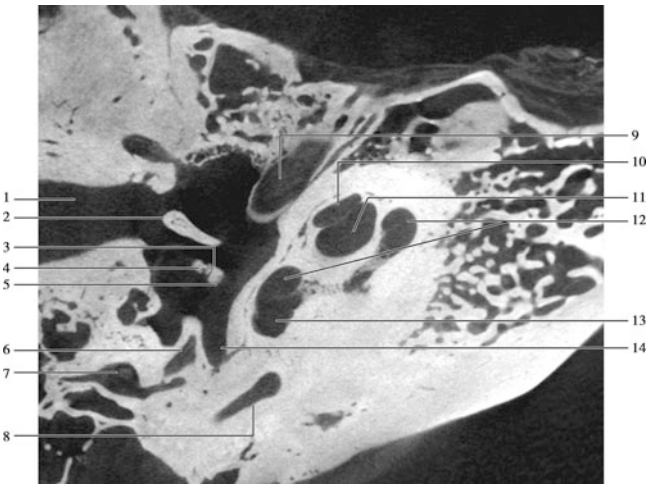

Fig. 2.89 Incudostapedial articulation and cochlear window on axial view. (1) External auditory canal. (2) Manubrium. (3) Incudostapedial articulation. (4) Lenticular process. (5) Neck of the stapes. (6) Stapedius muscle. (7) Mastoid portion of facial nerve. (8) Posterior semicircular canal. (9) Tensor tympani muscle. (10) Apical turn of cochlea. (11) Second turn of cochlea. (12) Basal turn of cochlea. (13) Cochlear window. (14) Tympanic sinus

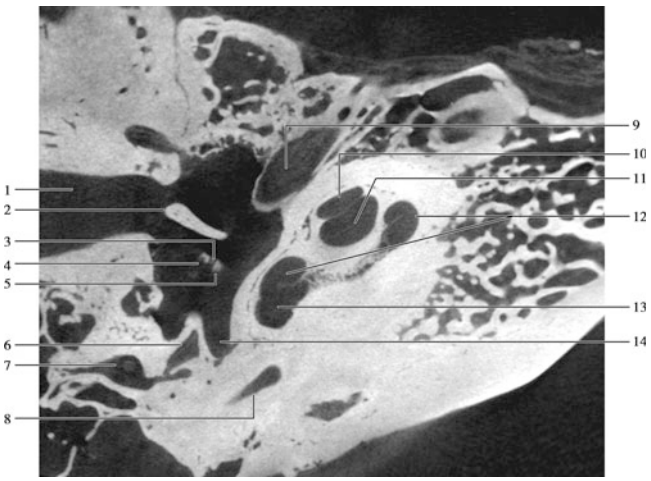

Fig. 2.90 Incudostapedial articulation and cochlear window on axial view. (1) External auditory canal. (2) Manubrium. (3) Incudostapedial articulation. (4) Lenticular process. (5) Neck of the stapes. (6) Stapedius muscle. (7) Mastoid portion of facial nerve. (8) Posterior semicircular canal. (9) Tensor tympani muscle. (10) Apical turn of cochlea. (11) Second turn of cochlea. (12) Basal turn of cochlea. (13) Cochlear window. (14) Tympanic sinus

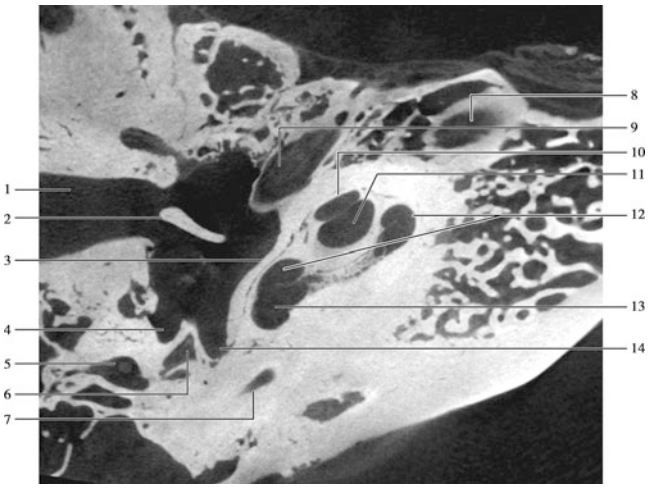

Fig. 2.91 Cochlear window and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Facial recess. (5) Mastoid portion of facial nerve. (6) Stapedius muscle. (7) Posterior semicircular canal. (8) Internal carotid artery (canal). (9) Tensor tympani muscle. (10) Apical turn of cochlea. (11) Second turn of cochlea. (12) Basal turn of cochlea. (13) Cochlear window. (14) Tympanic sinus

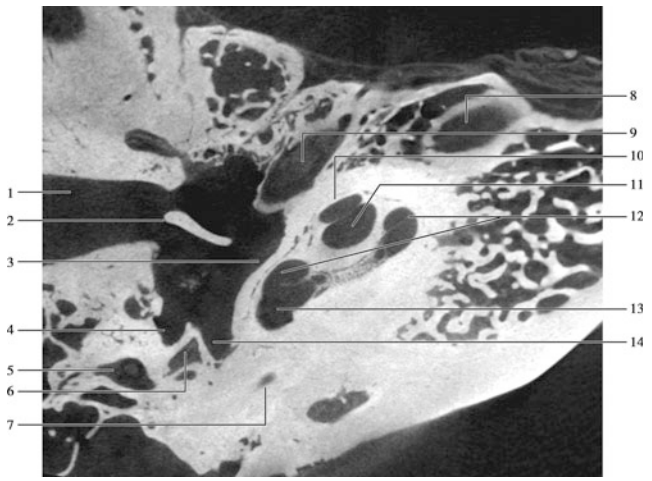

Fig. 2.92 Cochlear window and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Facial recess. (5) Mastoid portion of facial nerve. (6) Stapedius muscle. (7) Posterior semicircular canal. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Apical turn of cochlea. (11) Second turn of cochlea. (12) Basal turn of cochlea. (13) Cochlear window. (14) Tympanic sinus

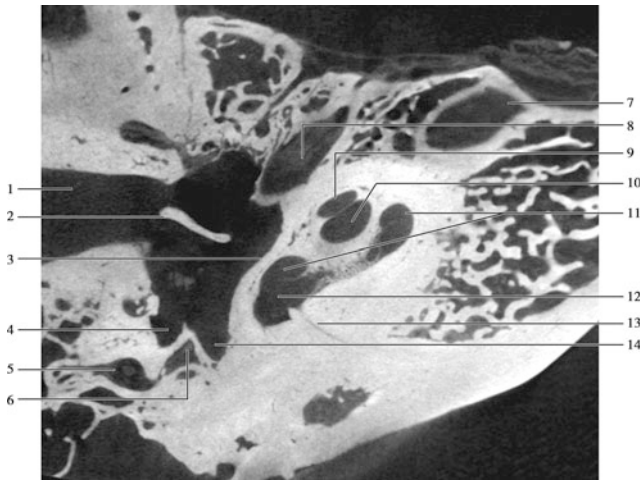

Fig. 2.93 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Facial recess. (5) Mastoid portion of facial nerve. (6) Stapedius muscle. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Cochlear window. (13) Cochlear aqueduct. (14) Tympanic sinus

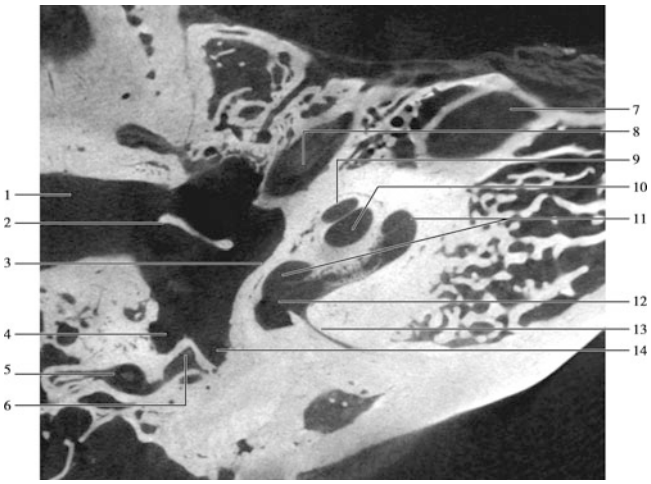

Fig. 2.95 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Facial recess. (5) Mastoid portion of facial nerve. (6) Stapedius muscle. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Cochlear window. (13) Cochlear aqueduct. (14) Tympanic sinus

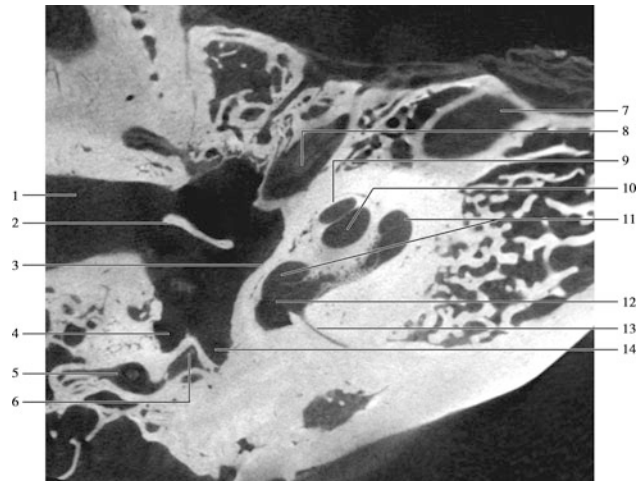

Fig. 2.94 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Facial recess. (5) Mastoid portion of facial nerve. (6) Stapedius muscle. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Apical turn of cochlea. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Cochlear window. (13) Cochlear aqueduct. (14) Tympanic sinus

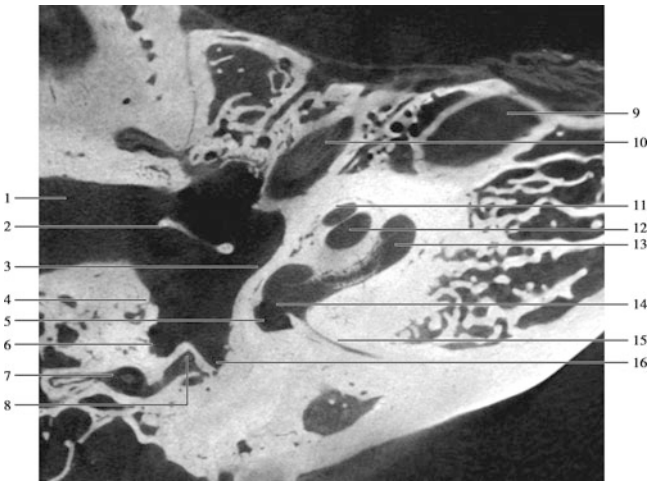

Fig. 2.96 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Chorda tympani nerve. (5) Cochlear window niche. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Stapedius muscle. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Apical turn of cochlea. (12) Second turn of cochlea. (13) Basal turn of cochlea. (14) Cochlear window. (15) Cochlear aqueduct. (16) Tympanic sinus

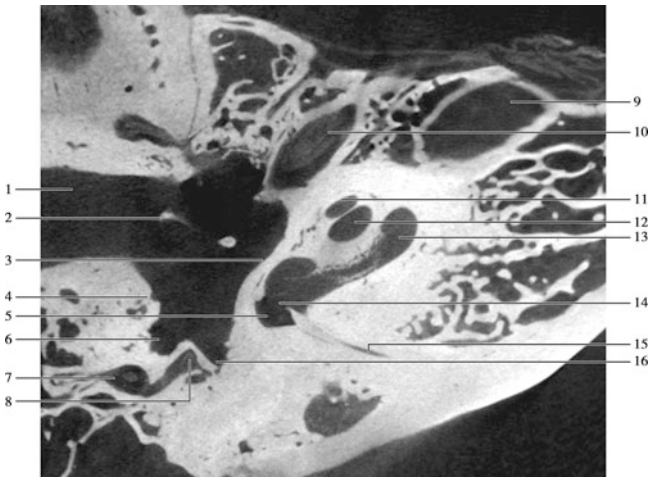

Fig. 2.97 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) External auditory canal. (2) Manubrium. (3) Promontory. (4) Chorda tympani nerve. (5) Cochlear window niche. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Stapedius muscle. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Apical turn of cochlea. (12) Second turn of cochlea. (13) Basal turn of cochlea. (14) Cochlear window. (15) Cochlear aqueduct. (16) Tympanic sinus

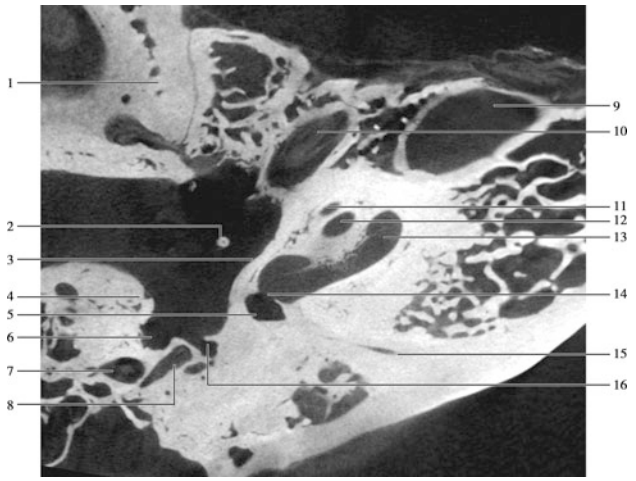

Fig. 2.99 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) Squamous portion. (2) Umbo. (3) Promontory. (4) Chorda tympani nerve. (5) Cochlear window niche. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Stapedius muscle. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Apical turn of cochlea. (12) Second turn of cochlea. (13) Basal turn of cochlea. (14) Cochlear window. (15) Cochlear aqueduct. (16) Tympanic sinus

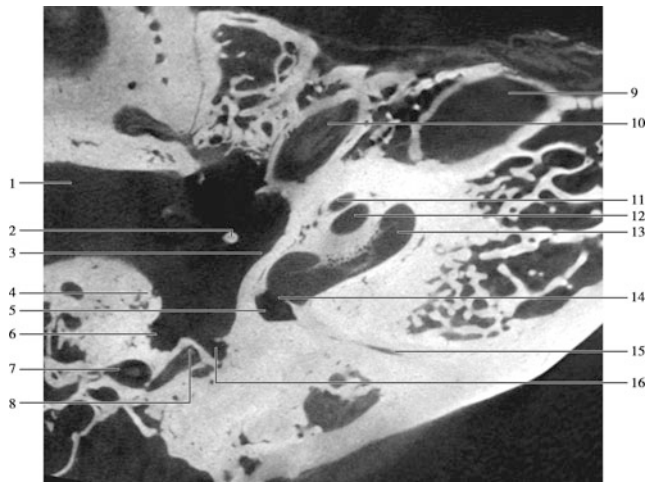

Fig. 2.98 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) External auditory canal. (2) Umbo. (3) Promontory. (4) Chorda tympani nerve. (5) Cochlear window niche. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Stapedius muscle. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Apical turn of cochlea. (12) Second turn of cochlea. (13) Basal turn of cochlea. (14) Cochlear window. (15) Cochlear aqueduct. (16) Tympanic sinus

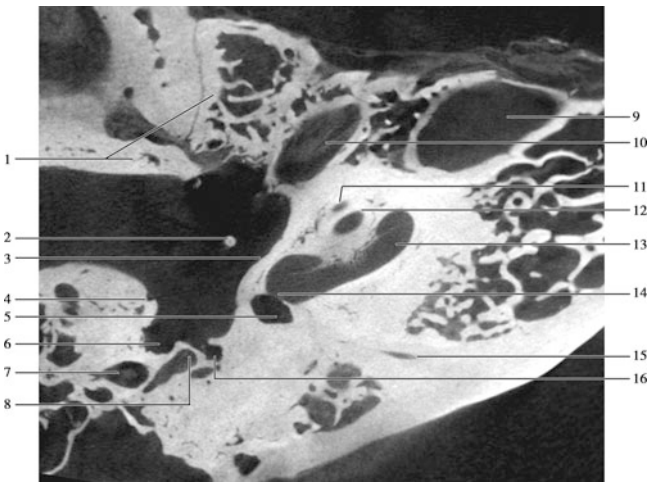

Fig. 2.100 Cochlear window-cochlear aqueduct and facial recess on axial view. (1) Tympanic portion. (2) Umbo. (3) Promontory. (4) Chorda tympani nerve. (5) Cochlear window niche. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Stapedius muscle. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Apical turn of cochlea. (12) Second turn of cochlea. (13) Basal turn of cochlea. (14) Cochlear window. (15) Cochlear aqueduct. (16) Tympanic sinus

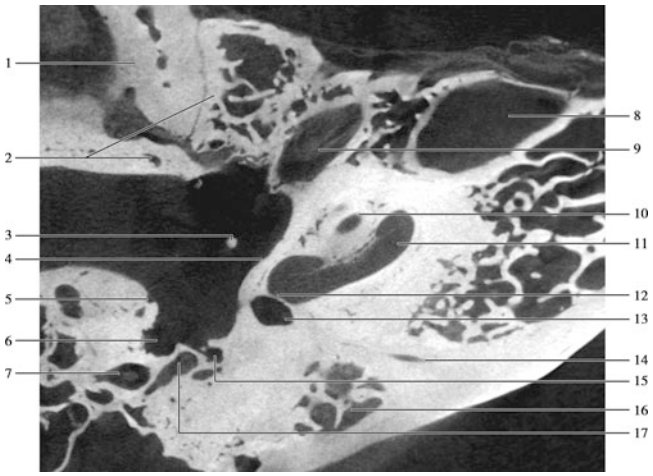

Fig. 2.101 Cochlear window niche and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) Umbo. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Inferior edge of cochlear window. (13) Cochlear window niche. (14) Cochlear aqueduct. (15) Tympanic sinus. (16) Air cells around the jugular bulb. (17) Stapedius muscle

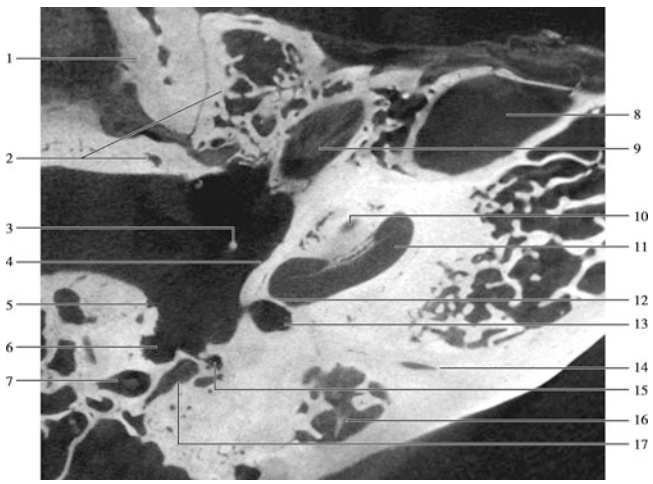

Fig. 2.102 Cochlear window niche and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) Umbo. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Second turn of cochlea. (11) Basal turn of cochlea. (12) Inferior edge of cochlear window. (13) Cochlear window niche. (14) Cochlear aqueduct. (15) Tympanic sinus. (16) Air cells around the jugular bulb. (17) Stapedius muscle

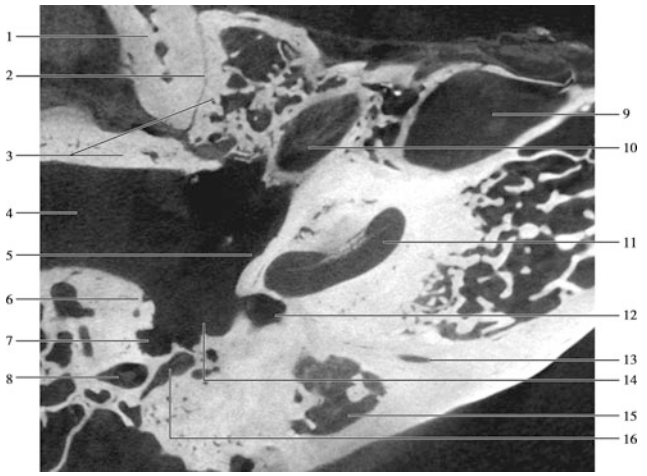

Fig. 2.103 Cochlear window niche-basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanosquamous fissure. (3) Tympanic portion. (4) External auditory canal. (5) Promontory. (6) Chorda tympani nerve. (7) Facial recess. (8) Mastoid portion of facial nerve. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Basal turn of cochlea. (12) Cochlear window niche. (13) Cochlear aqueduct. (14) Posterior tympanum. (15) Air cells around the jugular bulb. (16) Stapedius muscle

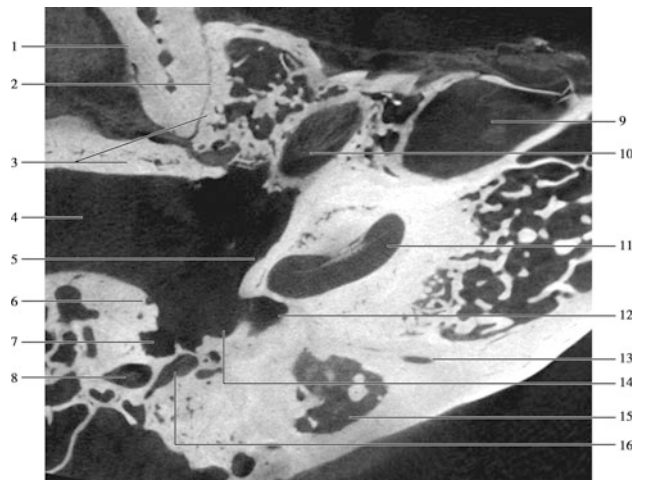

Fig. 2.104 Cochlear window niche-basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanosquamous fissure. (3) Tympanic portion. (4) External auditory canal. (5) Promontory. (6) Chorda tympani nerve. (7) Facial recess. (8) Mastoid portion of facial nerve. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Basal turn of cochlea. (12) Cochlear window niche. (13) Cochlear aqueduct. (14) Posterior tympanum. (15) Air cells around the jugular bulb. (16) Stapedius muscle

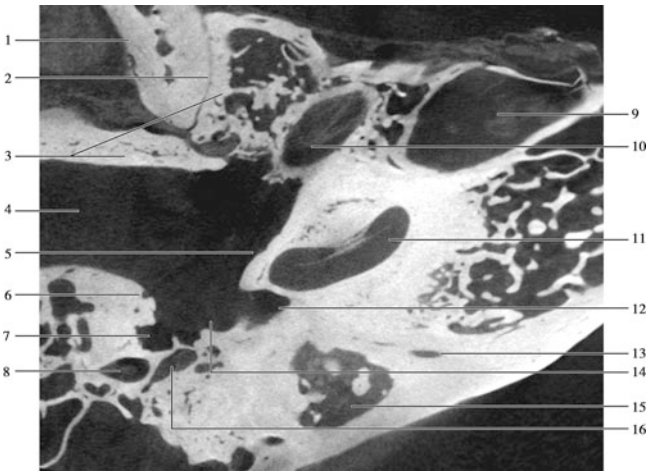

Fig. 2.105 Cochlear window niche-basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanosquamous fissure. (3) Tympanic portion. (4) External auditory canal. (5) Promontory. (6) Chorda tympani nerve. (7) Facial recess. (8) Mastoid portion of facial nerve. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Basal turn of cochlea. (12) Cochlear window niche. (13) Cochlear aqueduct. (14) Posterior tympanum. (15) Air cells around the jugular bulb. (16) Stapedius muscle

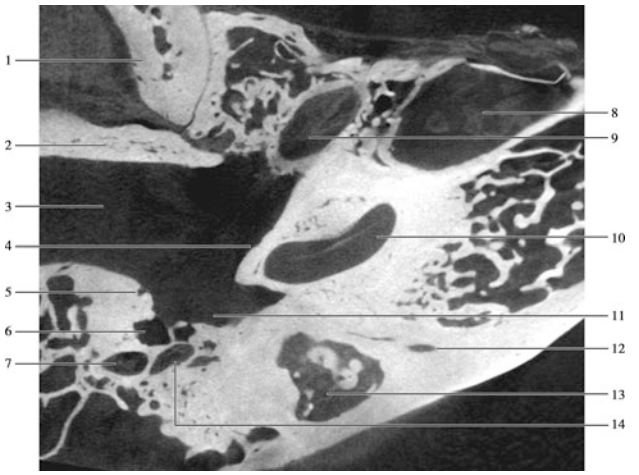

Fig. 2.107 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

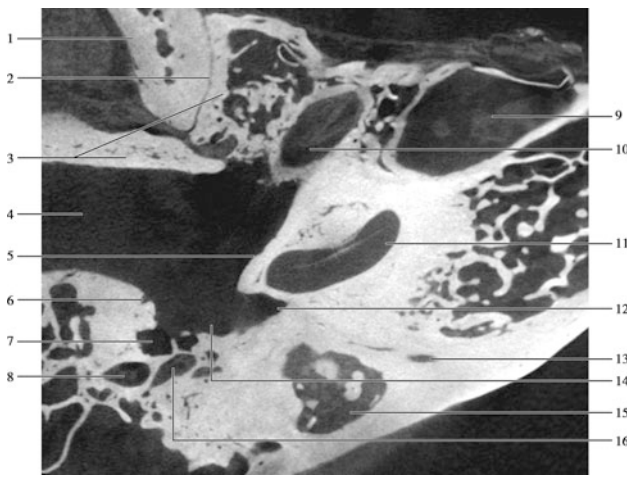

Fig. 2.106 Cochlear window niche -basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanosquamous fissure. (3) Tympanic portion. (4) External auditory canal. (5) Promontory. (6) Chorda tympani nerve. (7) Facial recess. (8) Mastoid portion of facial nerve. (9) Internal carotid artery. (10) Tensor tympani muscle. (11) Basal turn of cochlea. (12) Cochlear window niche. (13) Cochlear aqueduct. (14) Posterior tympanum. (15) Air cells around the jugular bulb. (16) Stapedius muscle

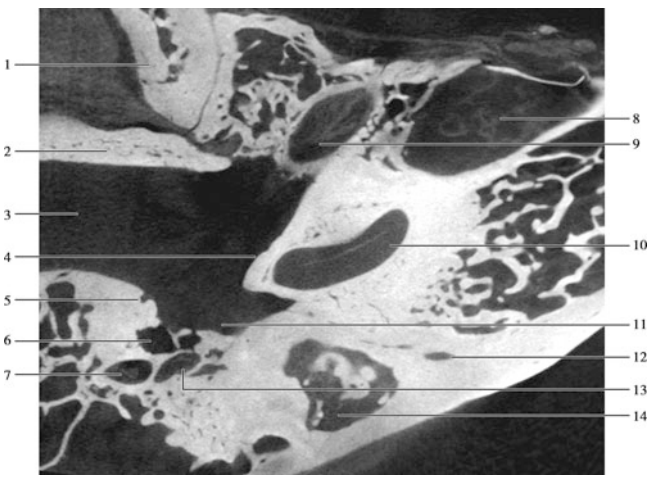

Fig. 2.108 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Stapedius muscle. (14) Air cells around the jugular bulb

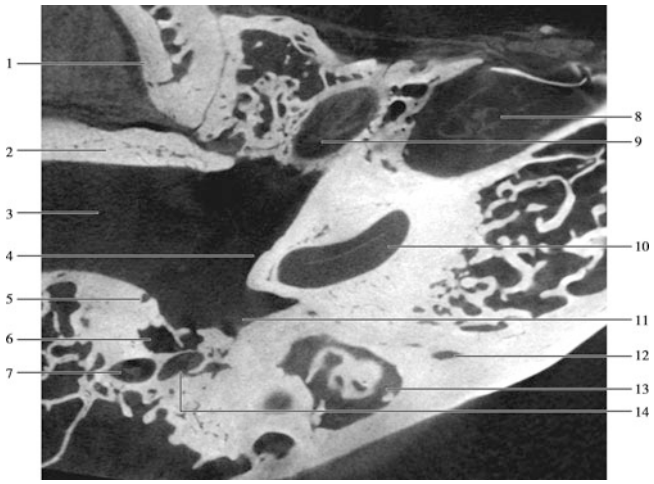

Fig. 2.109 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

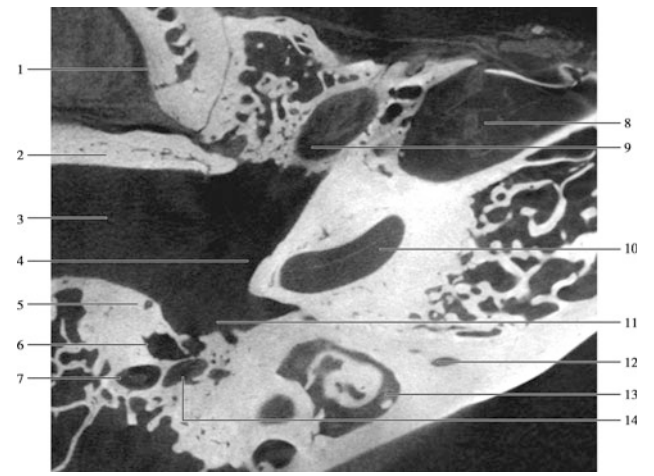

Fig. 2.110 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

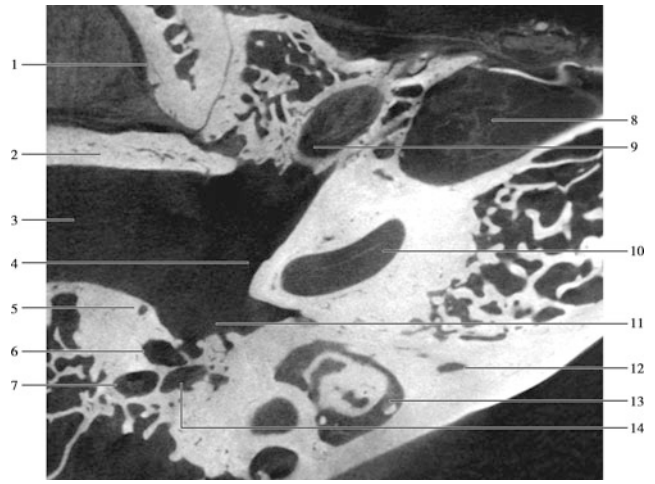

Fig. 2.111 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

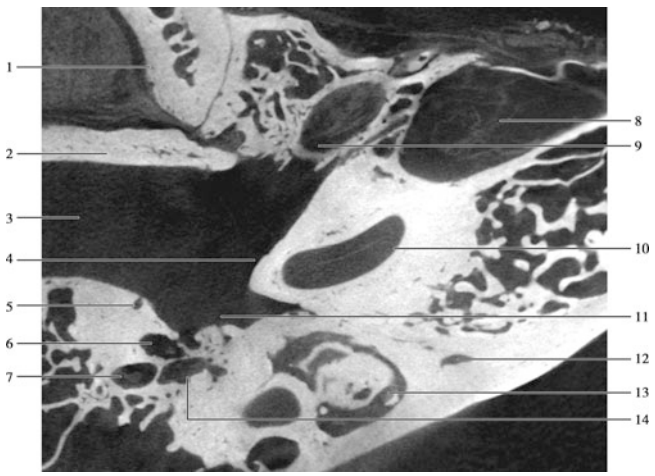

Fig. 2.112 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

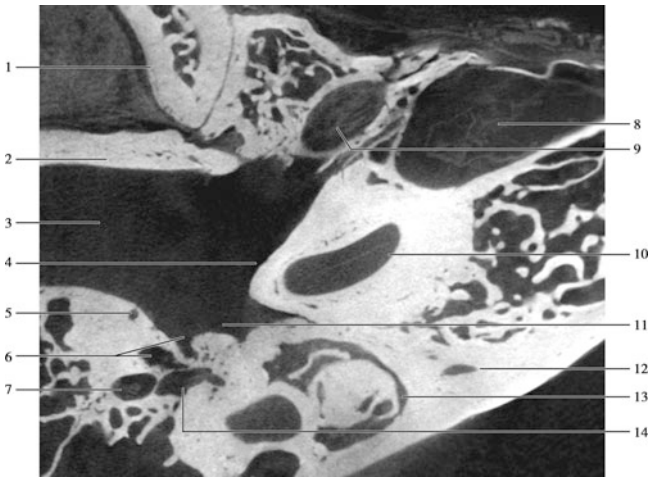

Fig. 2.113 Basal turn of cochlea and facial recess on axial view. (1) Squamous portion. (2) Tympanic portion. (3) External auditory canal. (4) Promontory. (5) Chorda tympani nerve. (6) Facial recess. (7) Mastoid portion of facial nerve. (8) Internal carotid artery. (9) Tensor tympani muscle. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

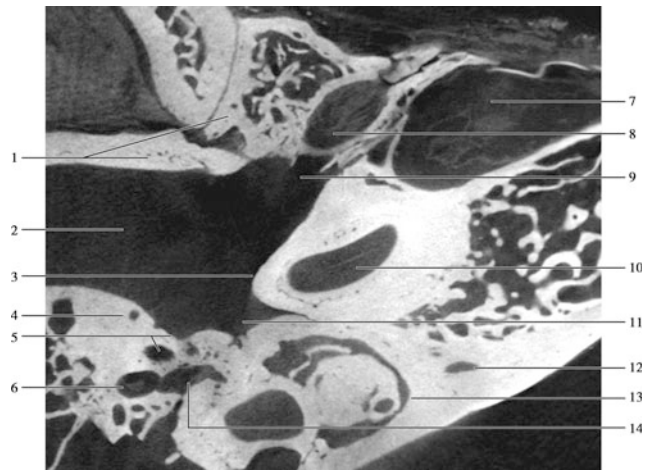

Fig. 2.114 Basal turn of cochlea and facial recess on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Promontory. (4) Chorda tympani nerve. (5) Facial recess. (6) Mastoid portion of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Anterior tympanum. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Air cells around the jugular bulb. (14) Stapedius muscle

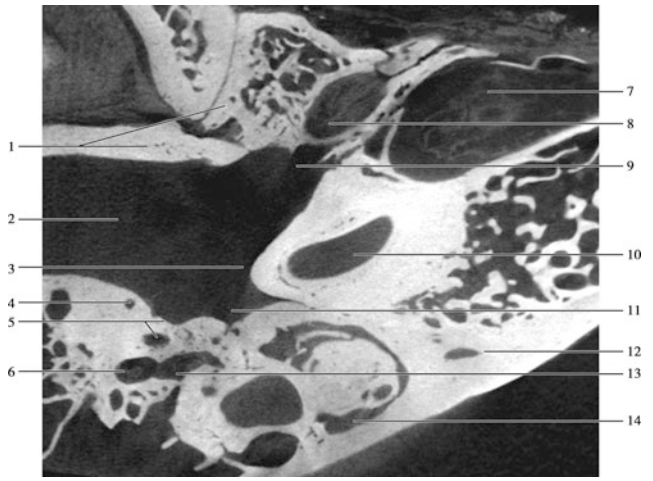

Fig. 2.115 Basal turn of cochlea and facial recess on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Promontory. (4) Chorda tympani nerve. (5) Facial recess. (6) Mastoid portion of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Anterior tympanum. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Stapedius muscle. (14) Air cells around the jugular bulb

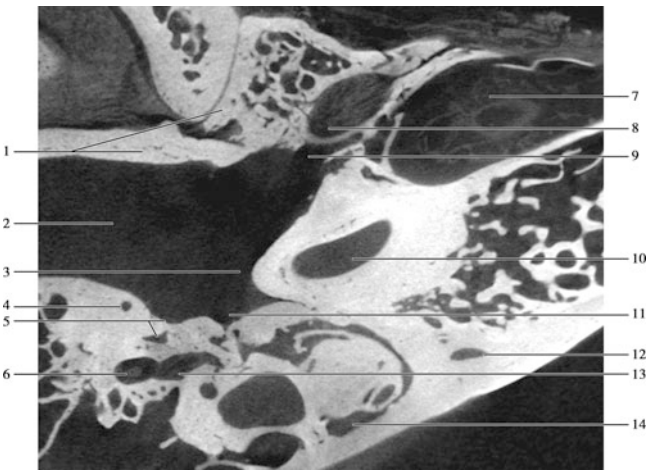

Fig. 2.116 Basal turn of cochlea and facial recess on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Promontory. (4) Chorda tympani nerve. (5) Facial recess. (6) Mastoid portion of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Anterior tympanum and tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Stapedius muscle. (14) Air cells around the jugular bulb

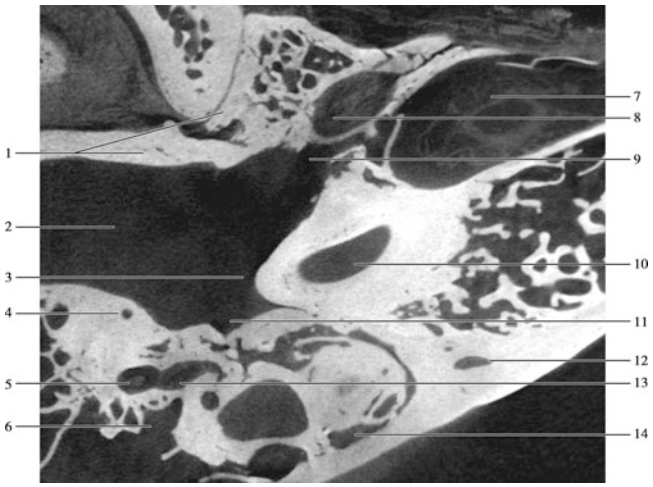

Fig. 2.117 Basal turn of cochlea and facial recess on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Promontory. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Anterior tympanum and tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Stapedius muscle. (14) Air cells around the jugular bulb

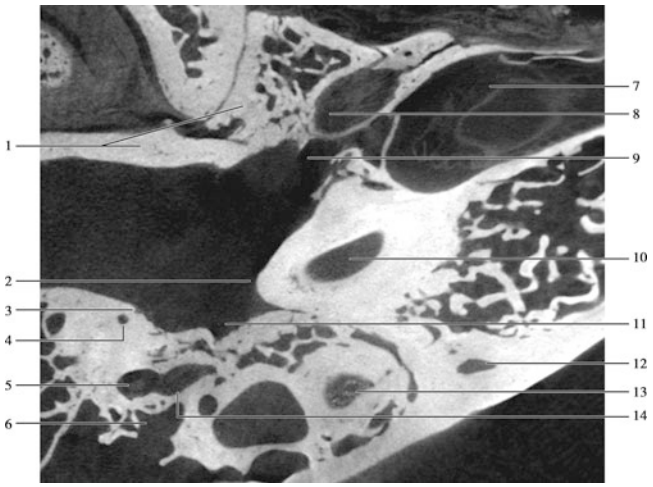

Fig. 2.119 Basal turn of cochlea and tympanic sulcus on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Anterior tympanum and tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Jugular bulb. (14) Stapedius muscle

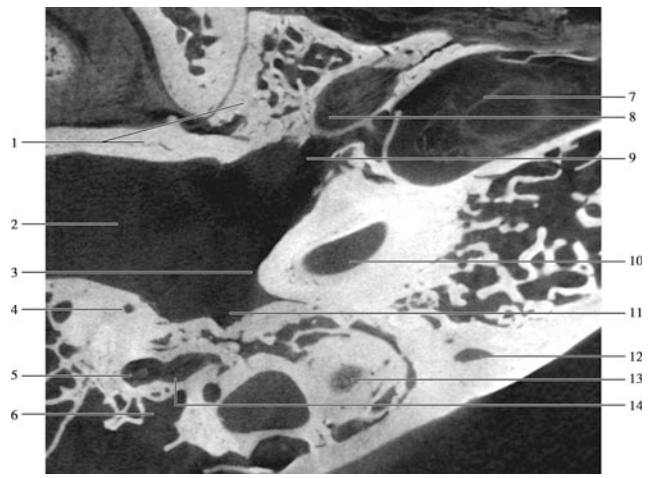

Fig. 2.118 Basal turn of cochlea on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Promontory. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Anterior tympanum and tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Jugular bulb. (14) Stapedius muscle

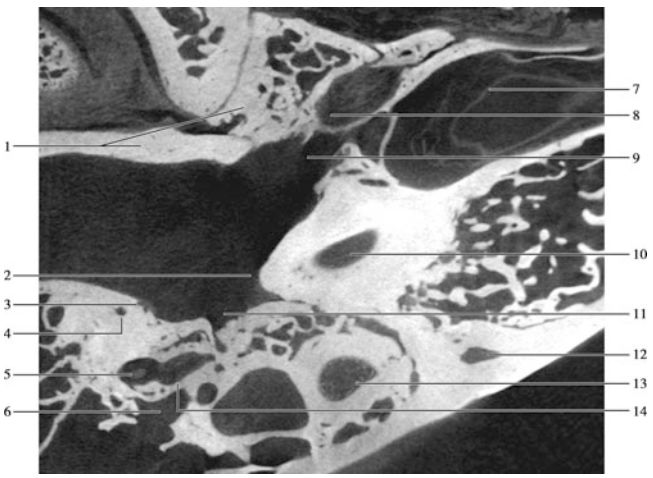

Fig. 2.120 Basal turn of cochlea and tympanic sulcus on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Jugular bulb. (14) Stapedius muscle

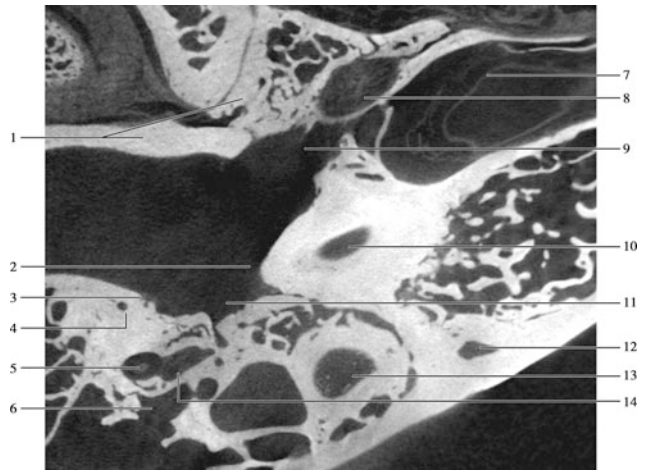

Fig. 2.121 Basal turn of cochlea and tympanic sulcus on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Jugular bulb. (14) Stapedius muscle

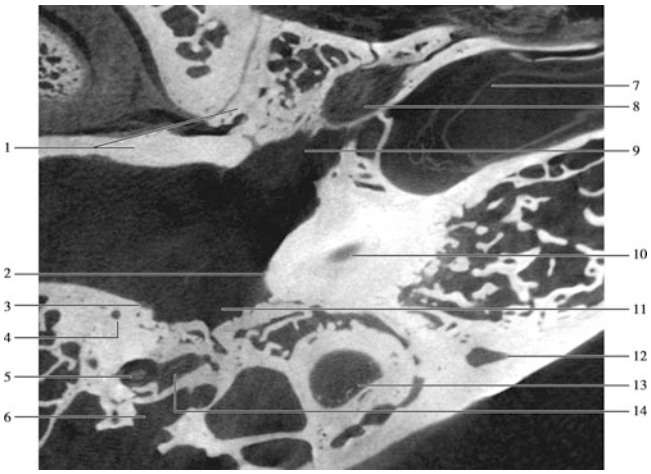

Fig. 2.123 Basal turn of cochlea and tympanic sulcus on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Jugular bulb. (14) Stapedius muscle

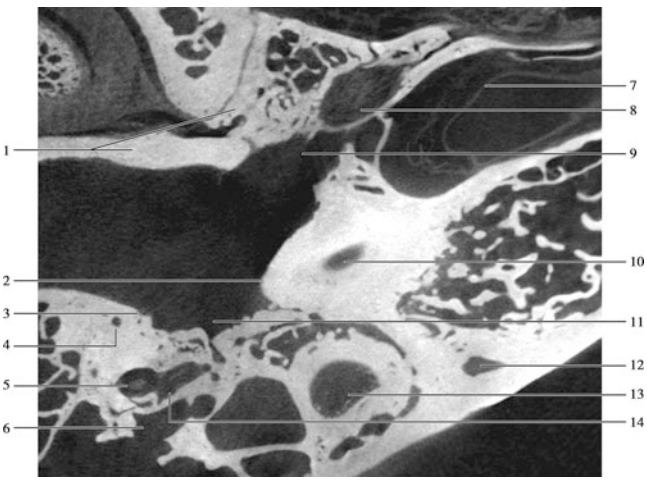

Fig. 2.122 Basal turn of cochlea and tympanic sulcus on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Tympanic orifice of eustachian tube. (10) Basal turn of cochlea. (11) Posterior tympanum. (12) Cochlear aqueduct. (13) Jugular bulb. (14) Stapedius muscle

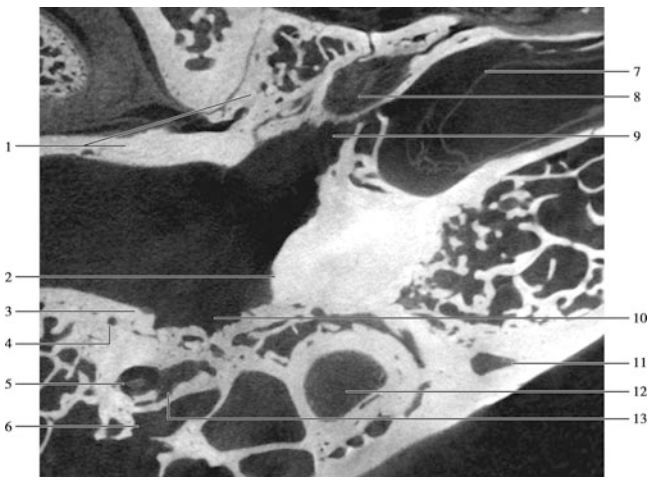

Fig. 2.124 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Eustachian tube. (10) Posterior tympanum. (11) Cochlear aqueduct. (12) Jugular bulb. (13) Stapedius muscle

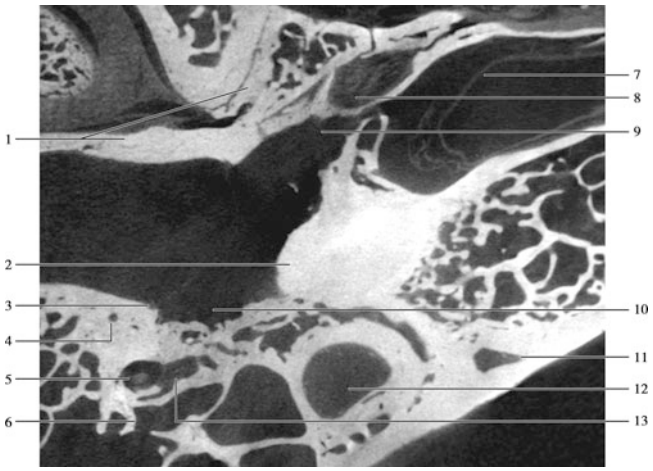

Fig. 2.125 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) Promontory. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Eustachian tube. (10) Posterior tympanum. (11) Cochlear aqueduct. (12) Jugular bulb. (13) Stapedius muscle

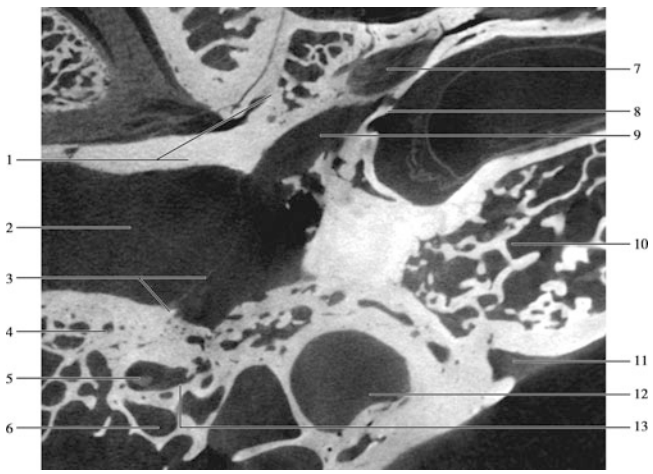

Fig. 2.126 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Outer orifice of cochlear aqueduct. (12) Jugular bulb. (13) Stapedius muscle

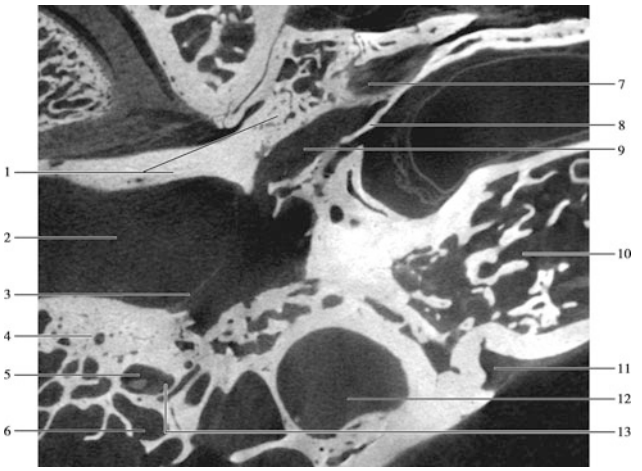

Fig. 2.127 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Outer orifice of cochlear aqueduct. (12) Jugular bulb. (13) Stapedius muscle

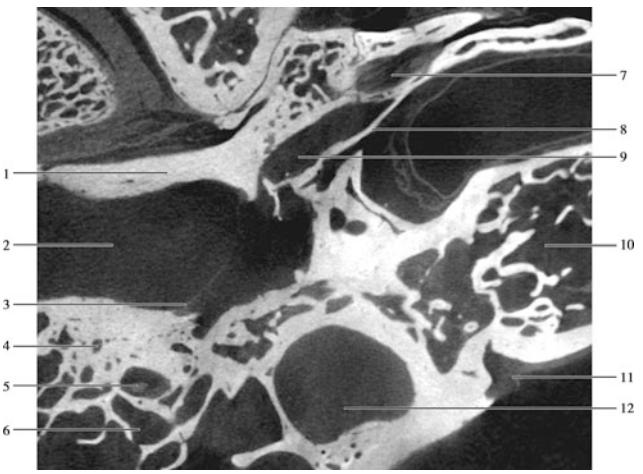

Fig. 2.128 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Outer orifice of cochlear aqueduct. (12) Jugular bulb

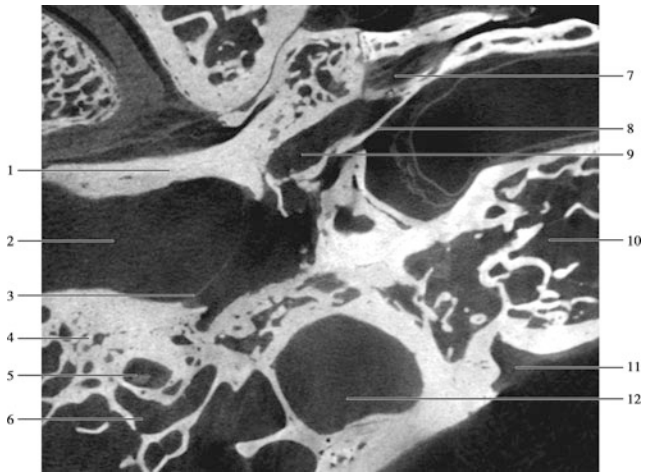

Fig. 2.129 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Outer orifice of cochlear aqueduct. (12) Jugular bulb

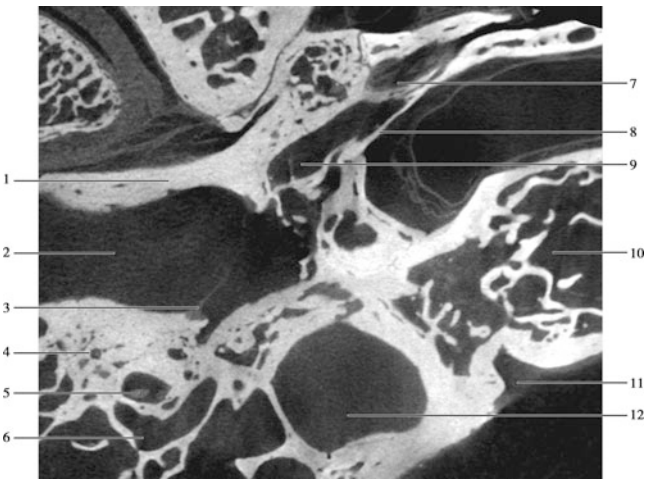

Fig. 2.130 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

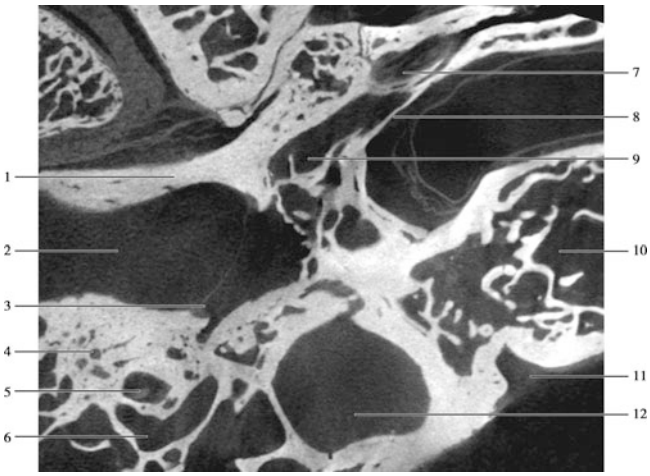

Fig. 2.131 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

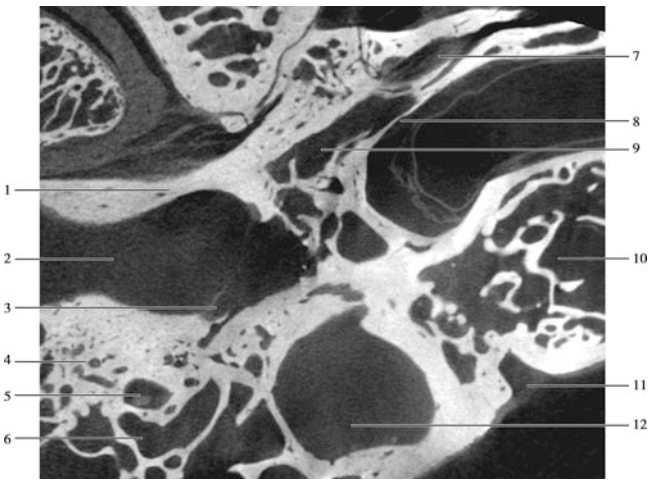

Fig. 2.132 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

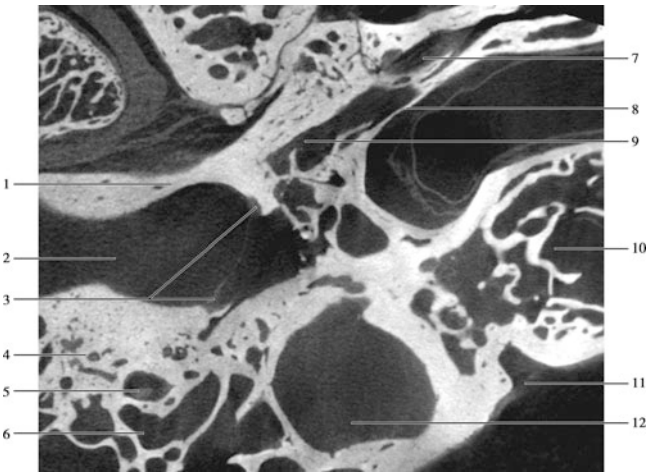

Fig. 2.133 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

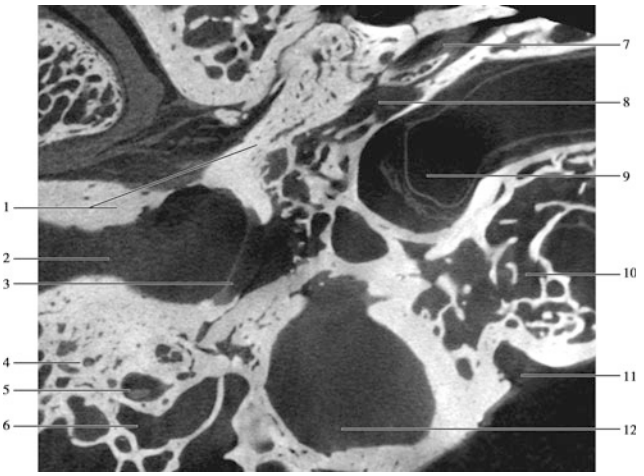

Fig. 2.135 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Eustachian tube. (9) Internal carotid artery. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

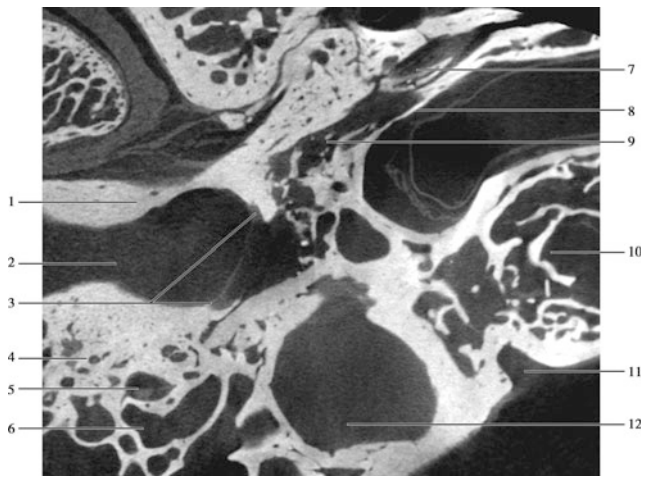

Fig. 2.134 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Lateral wall of carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

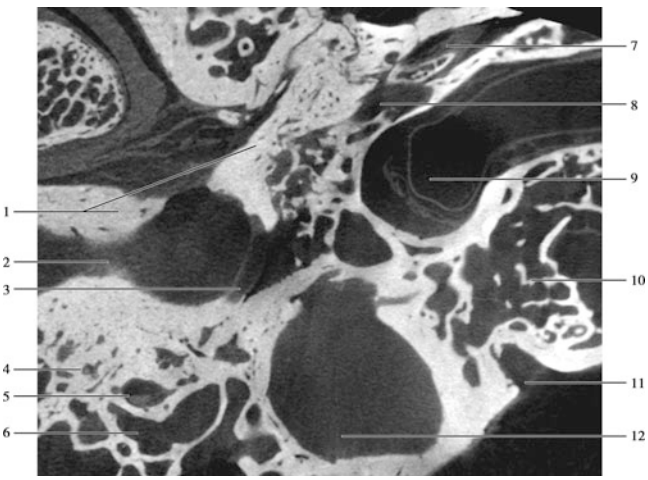

Fig. 2.136 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) External auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery canal. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

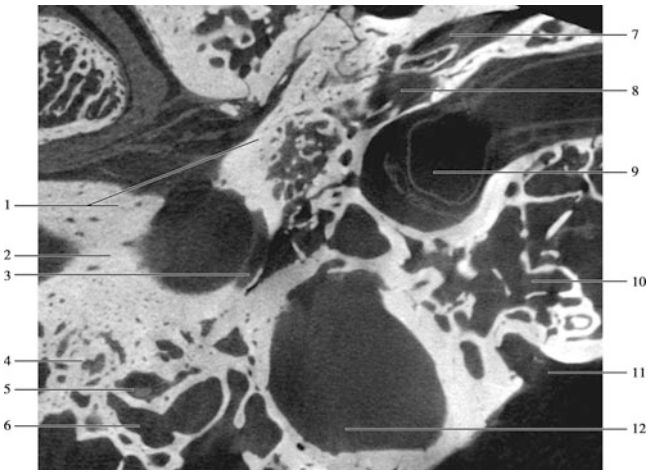

Fig. 2.137 Tympanic sulcus and eustachian tube on axial view. (1) Tympanic portion. (2) Inferior wall of external auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

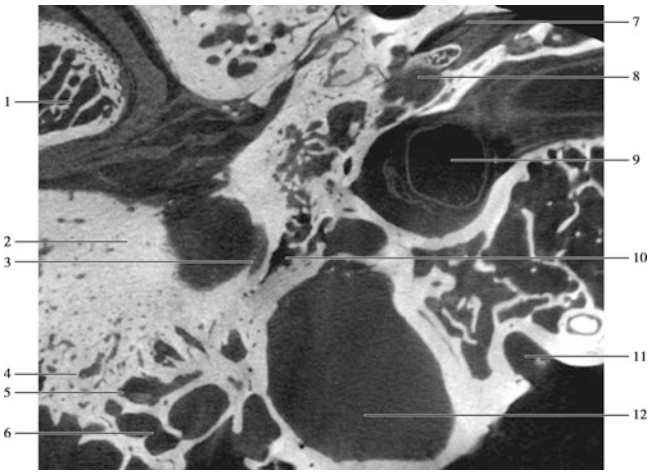

Fig. 2.139 Tympanic sulcus and eustachian tube and inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Inferior wall of external auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery. (9) Eustachian tube. (10) Hypotympanum. (11) Nerve portion of jugular foramen. (12) Jugular bulb

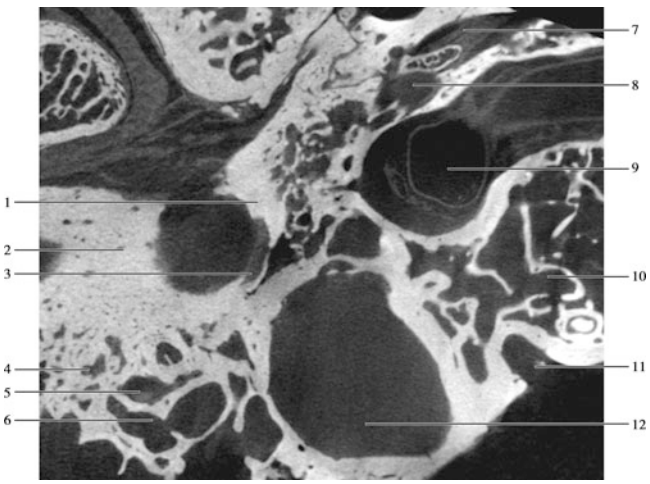

Fig. 2.138 Tympanic sulcus and eustachian tube andinferior wall of external auditory canal on axial view. (1) Tympanic portion. (2) Inferior wall of external auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery. (9) Eustachian tube. (10) Petrous air cells. (11) Nerve portion of jugular foramen. (12) Jugular bulb

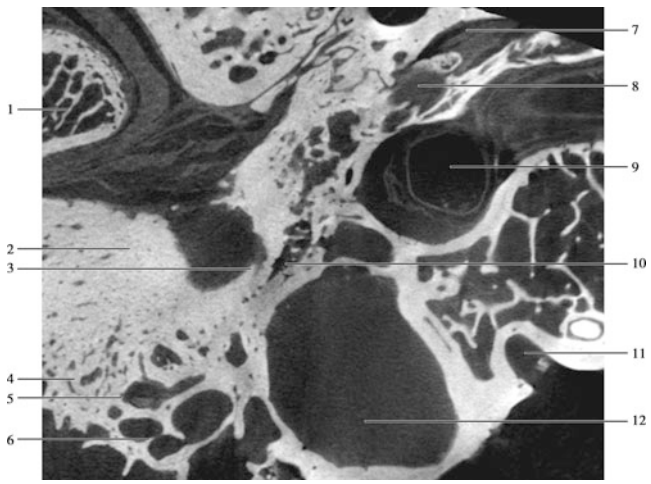

Fig. 2.140 Tympanic sulcus and eustachian tube and inferior wall of external auditory canal on axial view. (1) Mandibular cndyle. (2) Inferior wall of external auditory canal. (3) Tympanic sulcus. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery. (9) Eustachian tube. (10) Hypotympanum. (11) Nerve portion of jugular foramen. (12) Jugular bulb

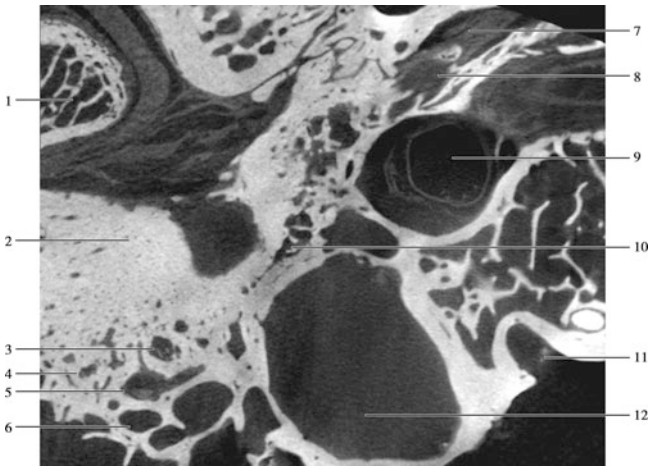

Fig. 2.141 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Inferior wall of external auditory canal. (3) Styloid process. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery. (9) Eustachian tube. (10) Hypotympanum. (11) Nerve portion of jugular foramen. (12) Jugular bulb

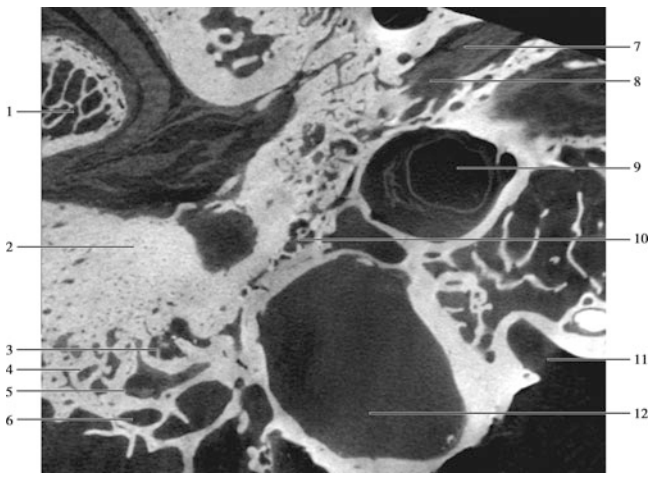

Fig. 2.142 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Inferior wall of external auditory canal. (3) Styloid process. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Posterior air cells of facial nerve. (7) Tensor tympani muscle. (8) Internal carotid artery. (9) Eustachian tube. (10) Hypotympanum. (11) Nerve portion of jugular foramen. (12) Jugular bulb

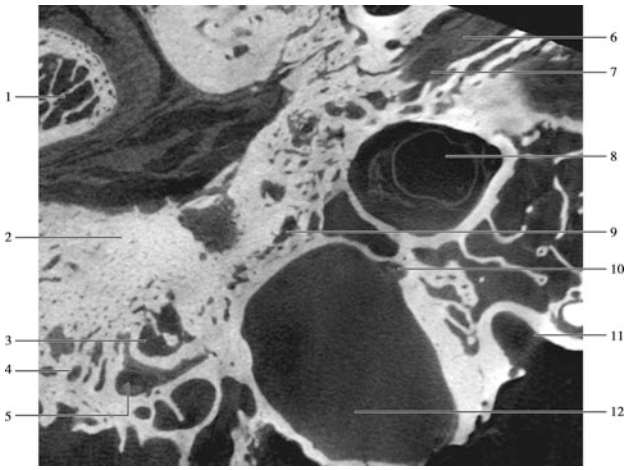

Fig. 2.143 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Inferior wall of external auditory canal. (3) Styloid process. (4) Chorda tympani nerve. (5) Mastoid portion of facial nerve. (6) Tensor tympani muscle. (7) Eustachian tube. (8) Internal carotid artery. (9) Hypotympanum. (10) Tympanic canaliculus1 (Jacobson nerve). (11) Nerve portion of jugular foramen. (12) Vascular portion of jugular foramen

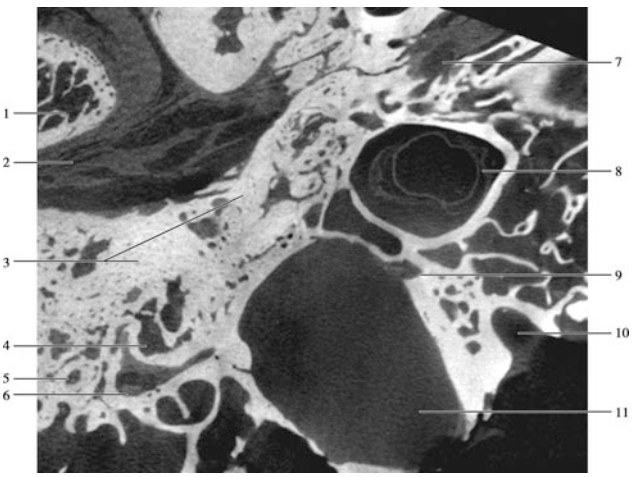

Fig. 2.144 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Eustachian tube. (8) Internal carotid artery. (9) Tympanic canaliculus1 (Jacobson nerve). (10) Nerve portion of jugular foramen. (11) Vascular portion of jugular foramen

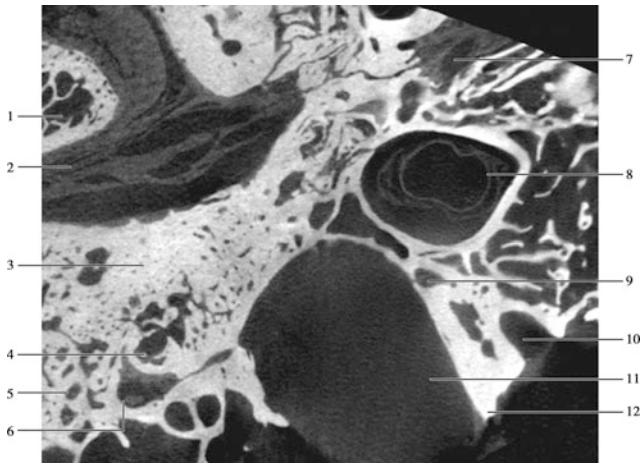

Fig. 2.145 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Eustachian tube. (8) Internal carotid artery. (9) Tympanic canaliculus. (10) Nerve portion of jugular foramen. (11) Vascular portion of jugular foramen. (12) Jugular ridge

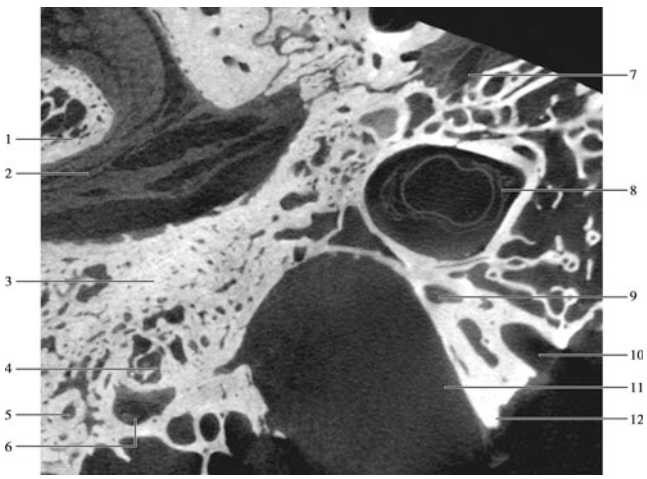

Fig. 2.146 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Eustachian tube. (8) Internal carotid artery. (9) Tympanic canaliculus. (10) Nerve portion of jugular foramen. (11) Vascular portion of jugular foramen. (12) Jugular ridge

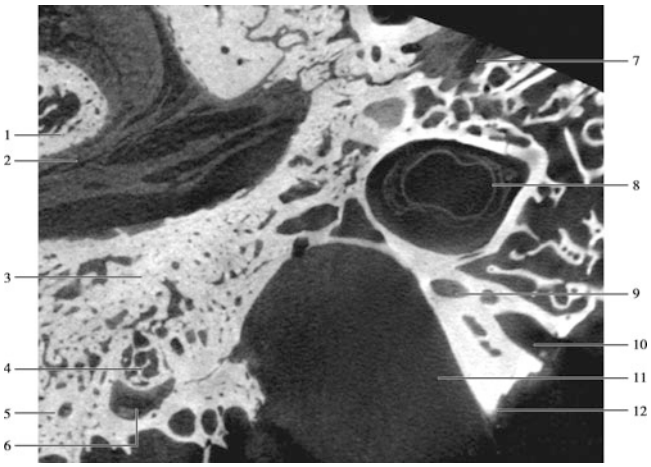

Fig. 2.147 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Eustachian tube. (8) Internal carotid artery. (9) Tympanic canaliculus1. (10) Nerve portion of jugular foramen. (11) Vascular portion of jugular foramen. (12) Jugular ridge

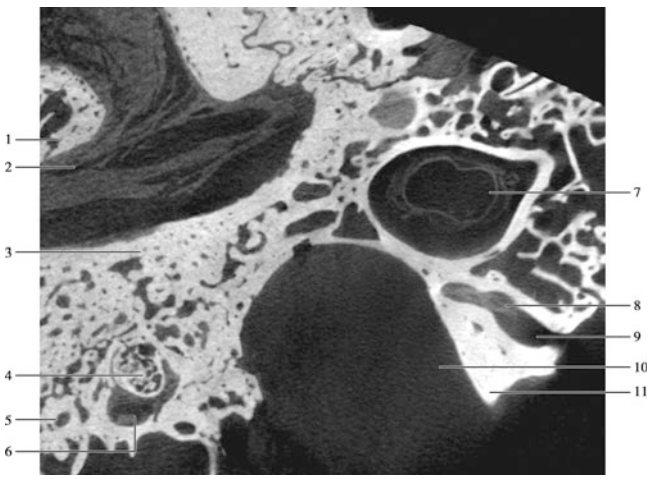

Fig. 2.148 Inferior wall of external auditory canal on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Internal carotid artery. (8) Tympanic canaliculus (9) Nerve portion of jugular foramen. (10) Vascular portion of jugular foramen. (11) Jugular ridge

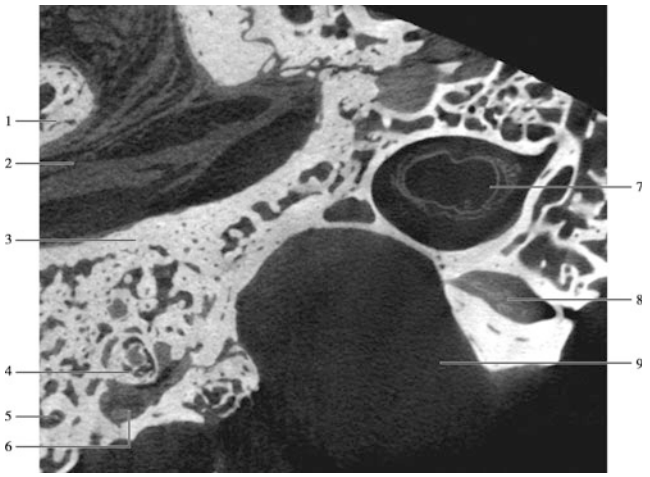

Fig. 2.149 Inferior wall of external auditory canal and stylomastoid foramen on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Stylomastoid foramen. (7) Internal carotid artery. (8) Nerve portion of jugular foramen. (9) Vascular portion of jugular foramen

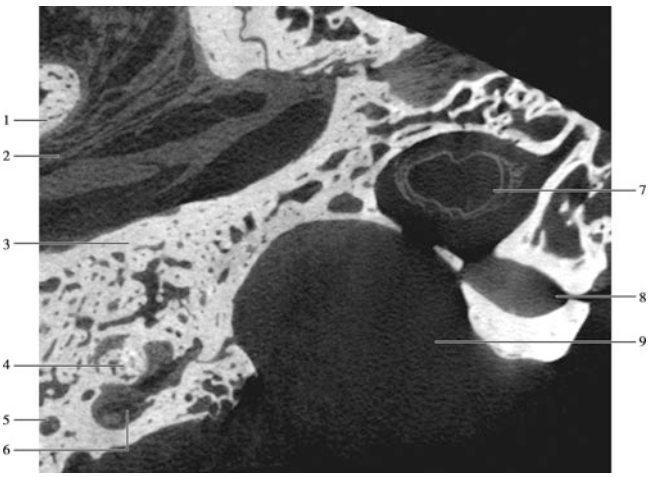

Fig. 2.150 Inferior wall of external auditory canal and stylomastoid foramen on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Stylomastoid foramen. (7) Internal carotid artery. (8) Nerve portion of jugular foramen. (9) Vascular portion of jugular foramen

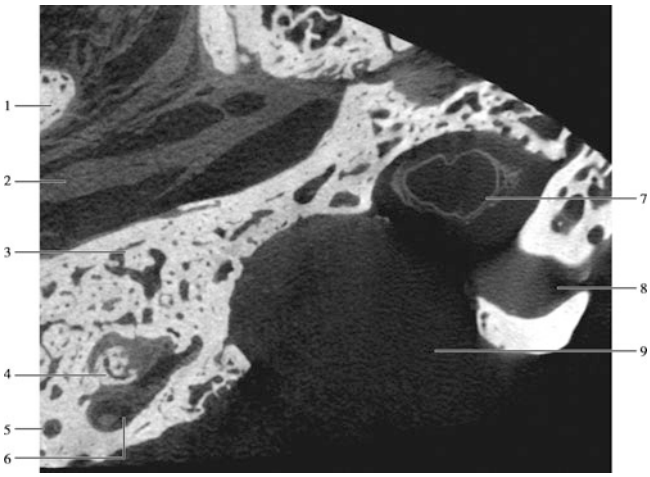

Fig. 2.151 Inferior wall of external auditory canal and stylomastoid foramen on axial view. (1) Mandibular condyle. (2) Temporomandibular joint capsule. (3) Inferior wall of external auditory canal. (4) Styloid process. (5) Chorda tympani nerve. (6) Stylomastoid foramen. (7) Internal carotid artery. (8) Nerve portion of jugular foramen. (9) Vascular portion of jugular foramen

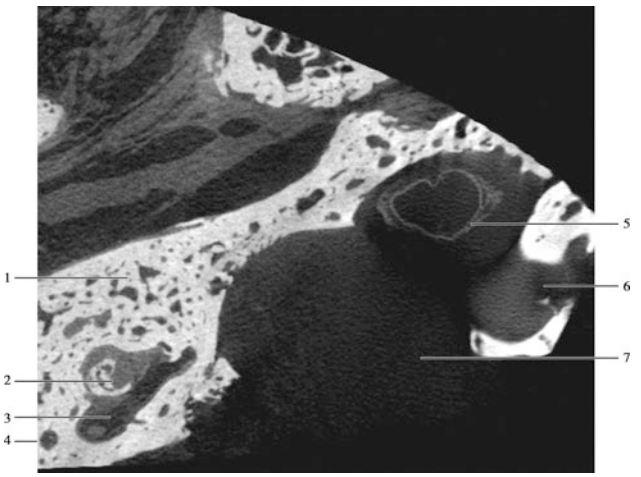

Fig. 2.152 Inferior wall of external auditory canal and stylomastoid foramen on axial view. (1) Inferior wall of external auditory canal. (2) Styloid process. (3) Stylomastoid foramen. (4) Chorda tympani nerve. (5) Internal carotid artery. (6) Nerve portion of jugular foramen. (7) Vascular portion of jugular foramen

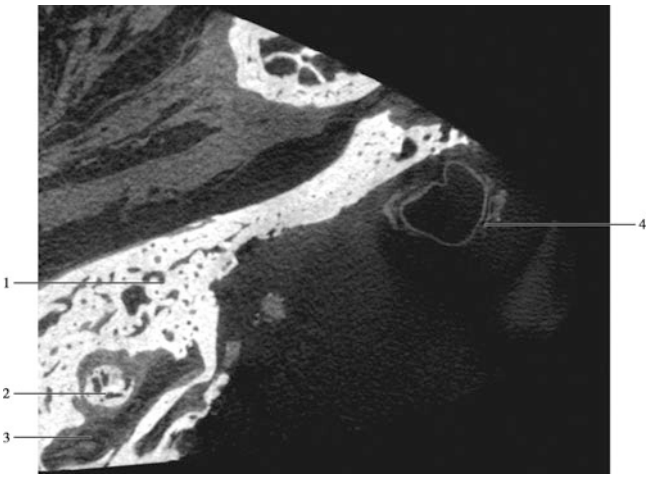

Fig. 2.153 Inferior wall of external auditory canal and stylomastoid foramen on axial view. (1) Inferior wall of external auditory canal. (2) Styloid process. (3) Stylomastoid foramen. (4) Internal carotid artery

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Two-Dimensional Reconstruction of Temporal Bone on Coronal View

3

Zilong Yu, Luo Zhang, and Demin Han

3.1 Introduction

As one of the usual planes of section in temporal bone view, coronal plane has a significant advantage in imaging the tegmen tympani, the superior and inferior wall of external and internal auditory canal, epi-meso-hypotympanum (including the scutum), mastoid portion of facial nerve, incudostapedial articulation, vestibular window, and fundus of internal auditory canal on one section, and it can also provide good visualization of the promontory, cochlea, and incudomalleolar articulation (Virapongse et al. 1982), but the following structures, such as the Eustachian tube (particularly when the petrous bone well aerated), the anterior and posterior walls of tympanum, the anterior and posterior walls of external and internal auditory canal, and so on, are difficult to be shown on one section.

In this chapter, all the two-dimensional images were reconstructed from the left temporal bone, the scanning range was from the cartilage portion of the Eustachian tube to the Sigmoid sinus (Figs. 3.1–3.115).

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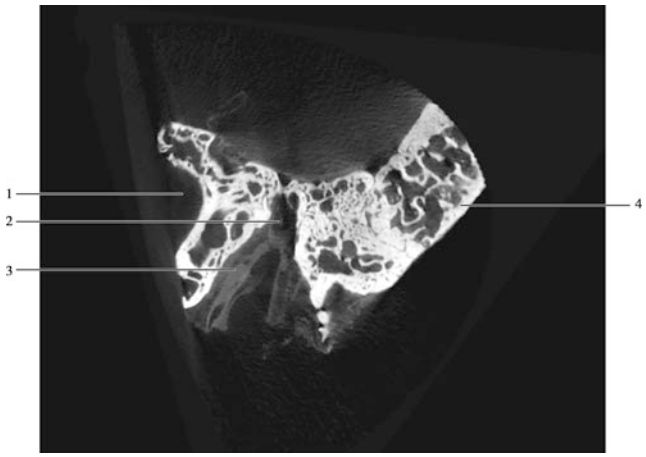

Fig. 3.1 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle (semicanal). (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone

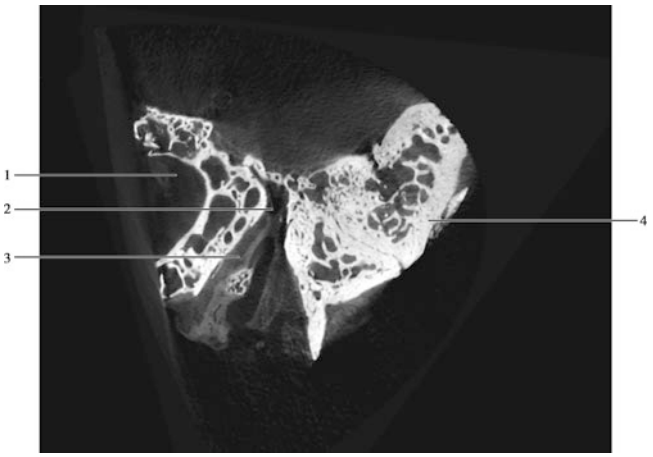

Fig. 3.3 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone

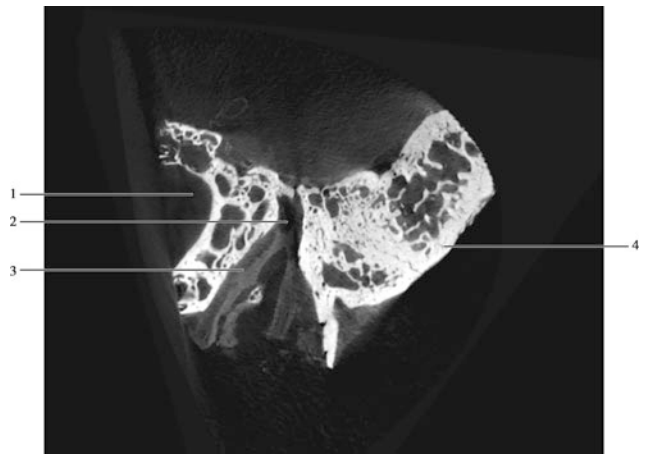

Fig. 3.2 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone

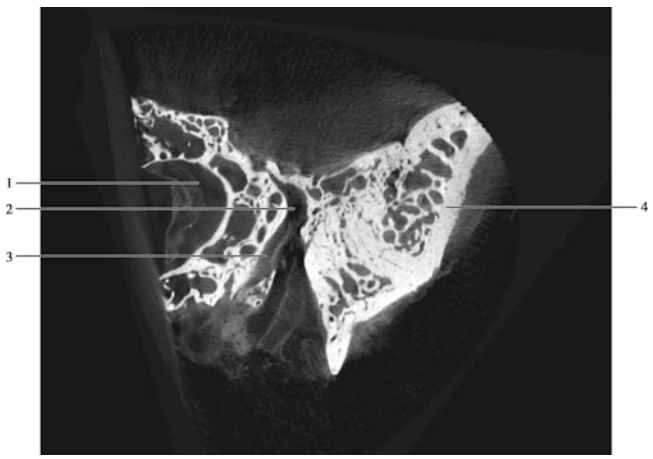

Fig. 3.4 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone

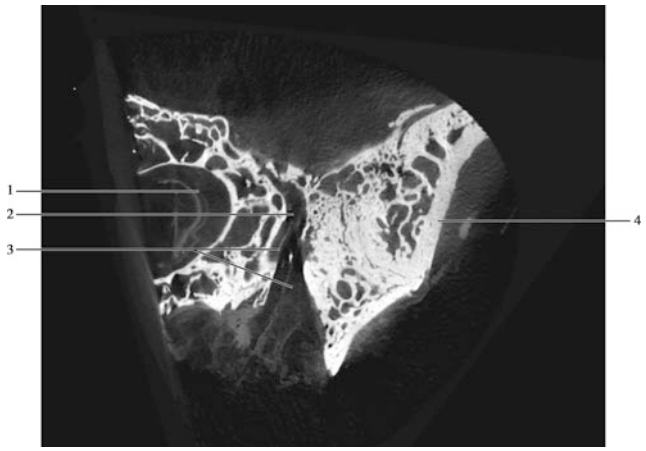

Fig. 3.5 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone

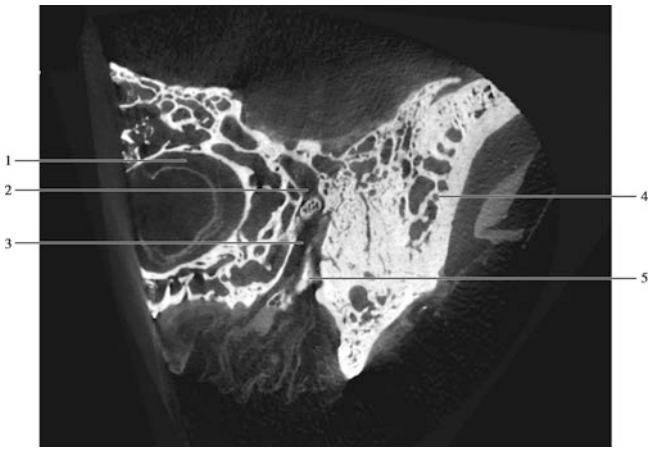

Fig. 3.7 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

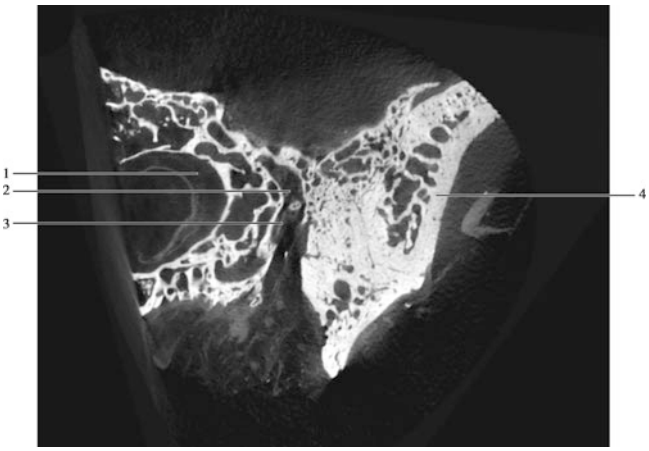

Fig. 3.6 Cartilaginous portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Cartilaginous portion of eustachian tube. (4) Squamous portion of temporal bone

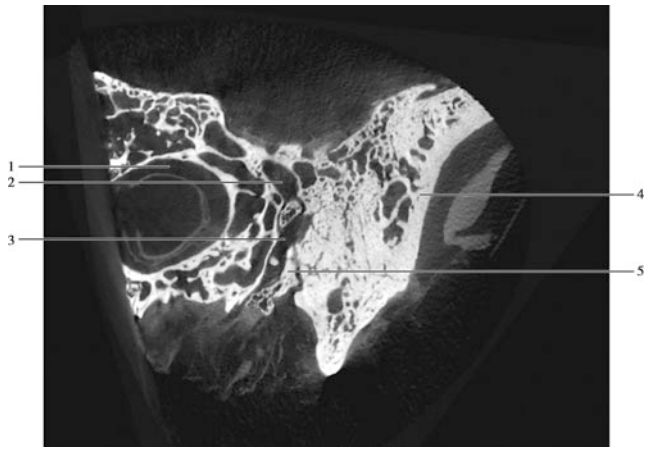

Fig. 3.8 Isthmus portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Isthmus portion of eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

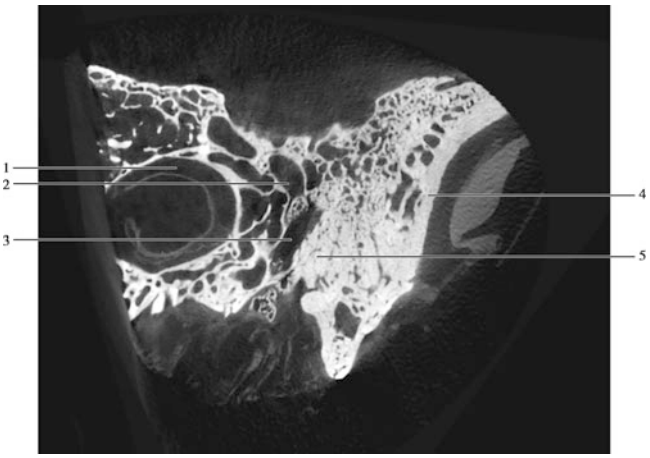

Fig. 3.9 Bony portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Bony portion of eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

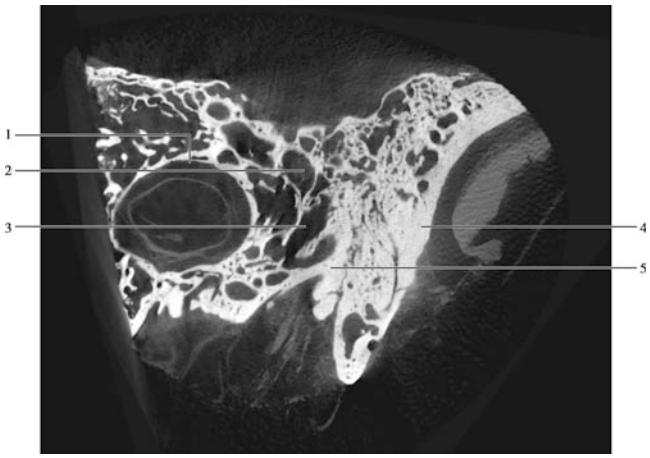

Fig. 3.11 Eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

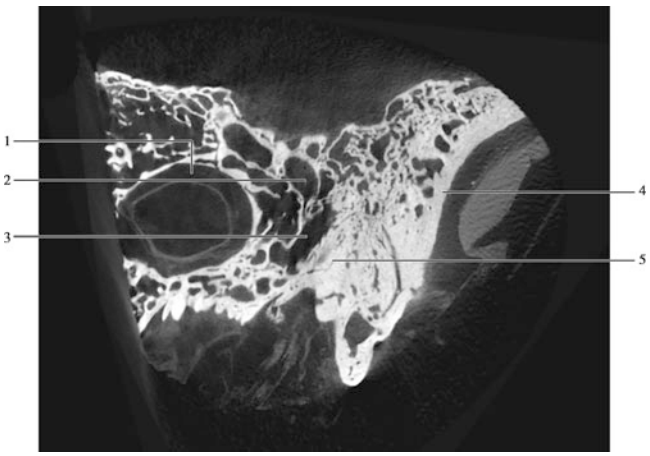

Fig. 3.10 Bony portion of eustachian tube on coronal view. (1) Internal carotid artery. (2) Tensor tympani muscle. (3) Bony portion of eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

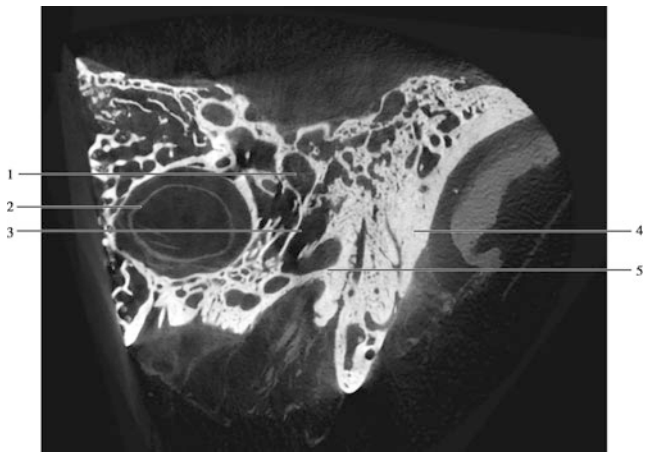

Fig. 3.12 Eustachian tube on coronal view. (1) Tensor tympani muscle. (2) Internal carotid artery(carotid artery canal). (3) Eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

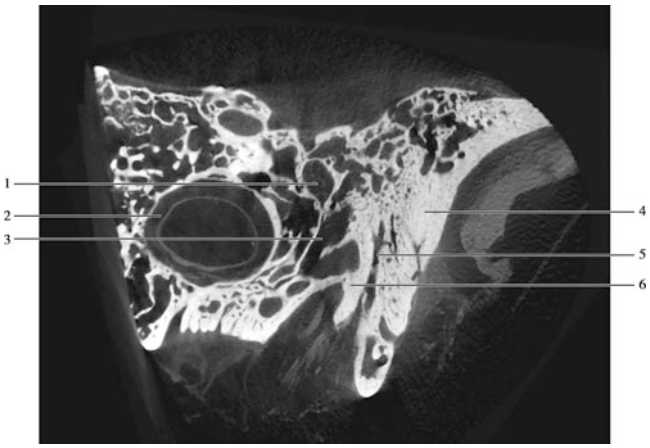

Fig. 3.13 Eustachian tube on coronal view. (1) Tensor tympani muscle. (2) Internal carotid artery(carotid artery canal). (3) Eustachian tube. (4) Squamous portion of temporal bone. (5) Squamotympanic fissure. (6) Tympanic portion of temporal bone

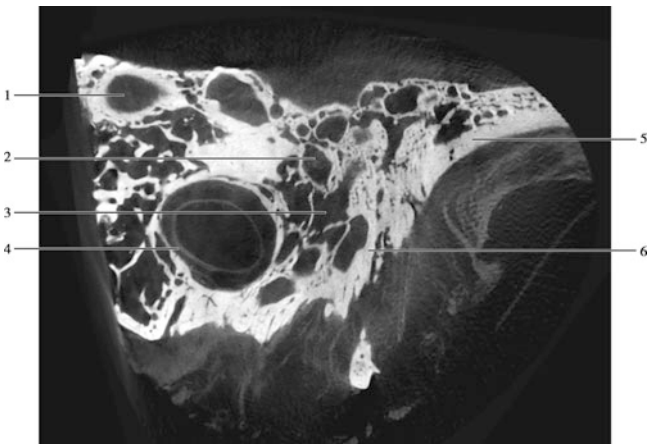

Fig. 3.15 Eustachian tube on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Eustachian tube. (4) Internal carotid artery. (5) Squamous portion of temporal bone. (6) Tympanic portion of temporal bone

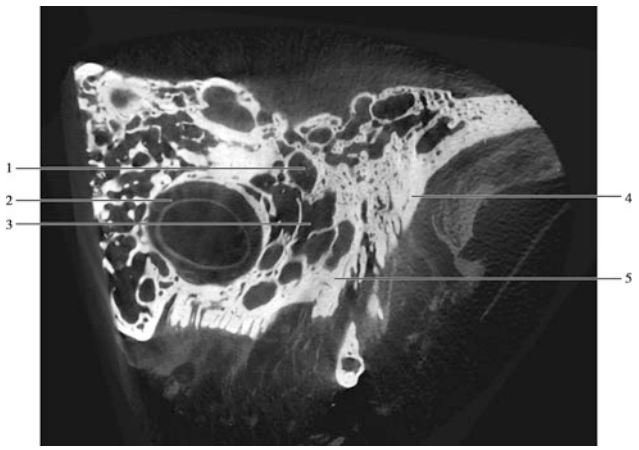

Fig. 3.14 Eustachian tube on coronal view. (1) Tensor tympani muscle. (2) Internal carotid artery (carotid artery canal). (3) Eustachian tube. (4) Squamous portion of temporal bone. (5) Tympanic portion of temporal bone

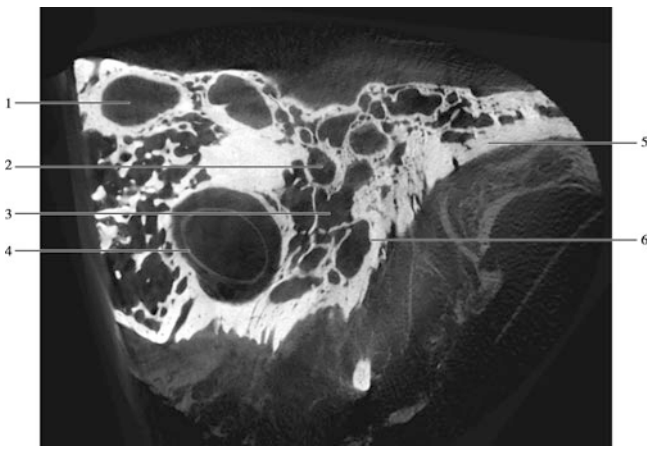

Fig. 3.16 Eustachian tube on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Eustachian tube. (4) Internal carotid artery. (5) Squamous portion of temporal bone. (6) Tympanic portion of temporal bone

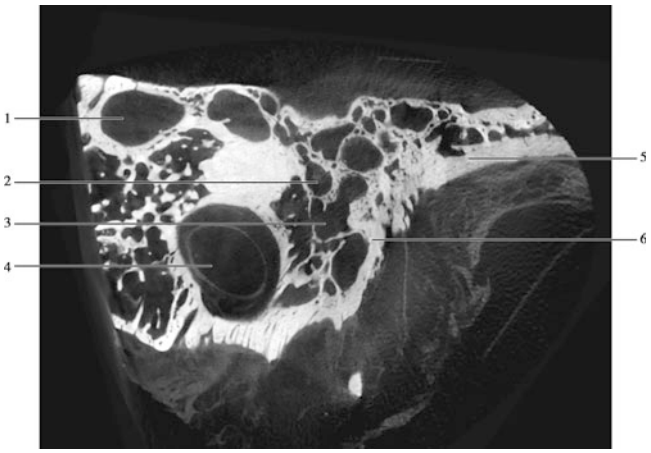

Fig. 3.17 Eustachian tube on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Eustachian tube. (4) Internal carotid artery. (5) Squamous portion of temporal bone. (6) Tympanic portion of temporal bone

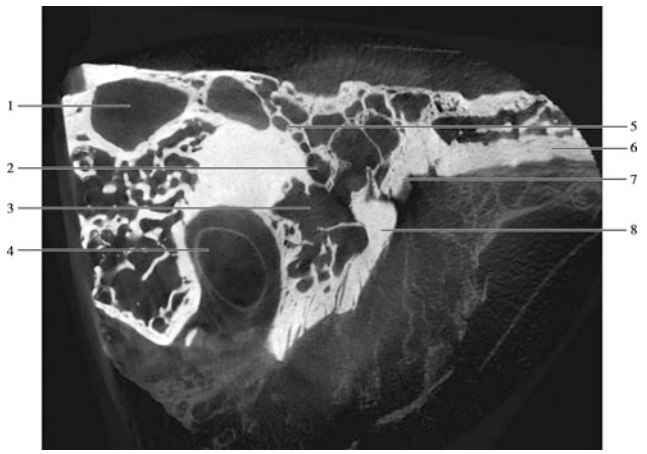

Fig. 3.19 Tympanic orifice of eustachian tube on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Tympanic orifice of eustachian tube. (4) Internal carotid artery. (5) Greater superficial petrosal nerve. (6) Squamous portion (superior wall of temporomandibular joint). (7) Petrous portion of temporal bone. (8) Medial wall of temporomandibular joint

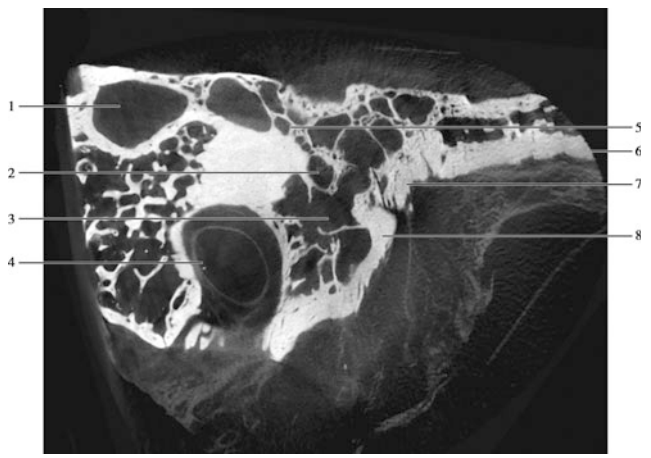

Fig. 3.18 Tympanic orifice of eustachian tube and geniculate ganglion on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Tympanic orifice of eustachian tube. (4) Internal carotid artery. (5) Greater superficial petrosal nerve. (6) Squamous portion of temporal bone. (7) Petrous portion of temporal bone. (8) Medial wall of temporomandibular joint

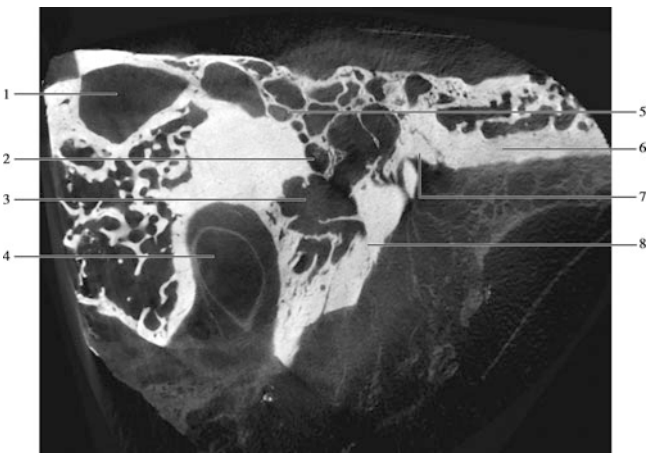

Fig. 3.20 Tympanic orifice of eustachian tube on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Tympanic orifice of eustachian tube. (4) Internal carotid artery. (5) Greater superficial petrosal nerve. (6) Squamous portion (superior wall of temporomandibular joint). (7) Petrous portion of temporal bone. (8) Medial wall of temporomandibular joint

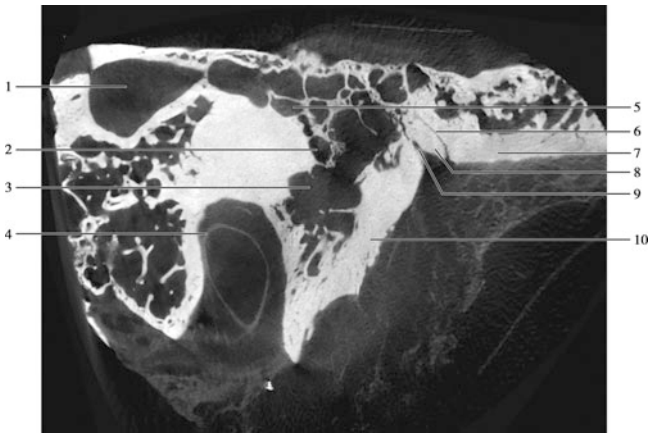

Fig. 3.21 Tympanic orifice of eustachian tube on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Tympanic orifice of eustachian tube. (4) Internal carotid artery. (5) Greater superficial petrosal nerve. (6) Petrosquamous fissure. (7) Squamous portion (superior wall of temporomandibular joint). (8) Petrous portion of temporal bone. (9) Petrotympanic fissure. (10) Medial wall of temporomandibular joint

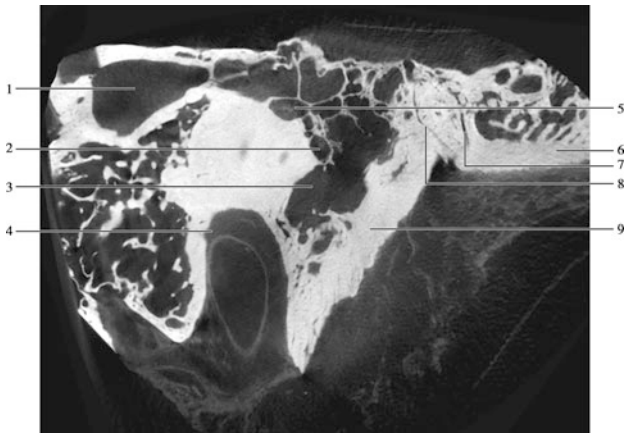

Fig. 3.23 Geniculate ganglion on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Tympanic orifice of eustachian tube. (4) Internal carotid artery. (5) Geniculate ganglion. (6) Squamous portion of temporal bone. (7) Petrosquamous fissure. (8) Petrotympanic fissure. (9) Medial wall of temporomandibular joint

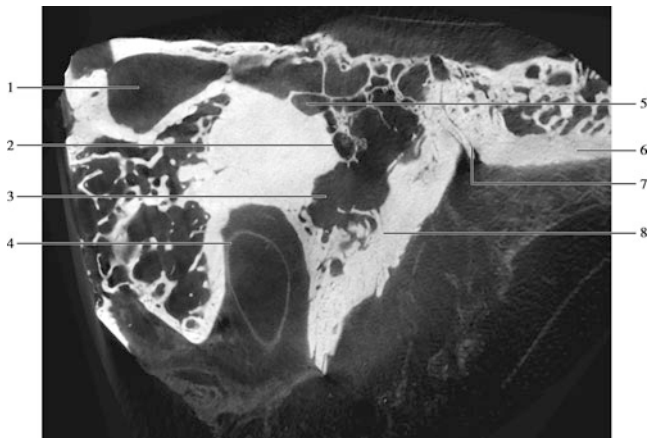

Fig. 3.22 Tympanic orifice of eustachian tube and geniculate ganglion on coronal view. (1) Petrous cell. (2) Tensor tympani muscle. (3) Tympanic orifice of eustachian tube. (4) Internal carotid artery. (5) Geniculate ganglion. (6) Squamous portion of temporal bone. (7) Petrosquamous fissure. (8) Medial wall of temporomandibular joint

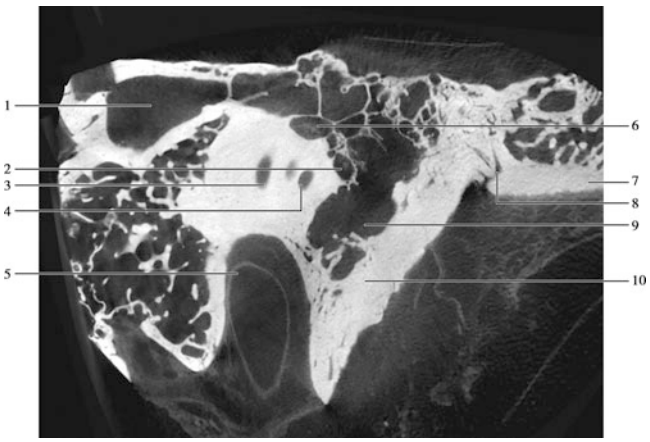

Fig. 3.24 Geniculate ganglion on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Apical turn of cochlea. (5) Internal carotid artery. (6) Geniculate ganglion. (7) Squamous portion of temporal bone. (8) Petrosquamous fissure. (9) Anterior tympanum. (10) Medial wall of temporomandibular joint

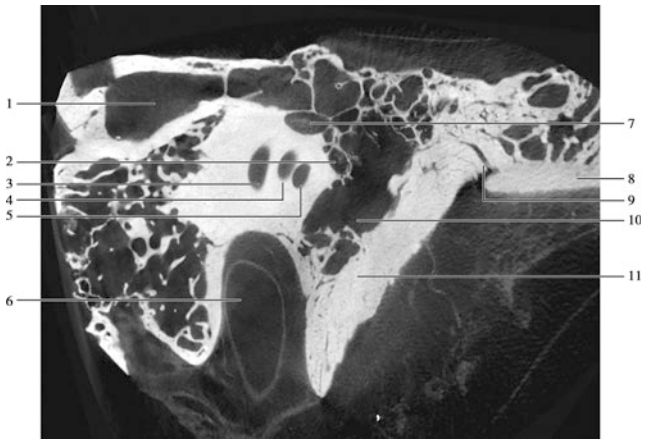

Fig. 3.25 Geniculate ganglion on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Geniculate ganglion. (8) Squamous portion of temporal bone. (9) Petrosquamous fissure. (10) Anterior tympanum. (11) Medial wall of temporomandibular joint

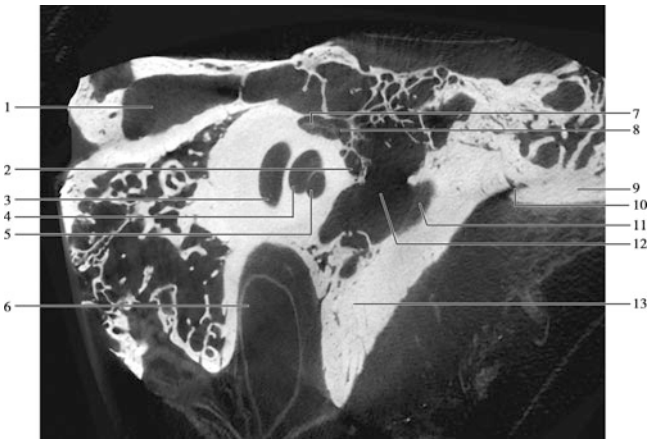

Fig. 3.27 Labyrinthine and tympanic portions of facial nerve on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Labyrinthine portion of facial nerve. (8) Tympanic portion of facial nerve. (9) Squamous portion of temporal bone. (10) Tympanosquamous fissure. (11) External auditory canal. (12) Tympanic cavity. (13) Medial wall of temporomandibular joint

Fig. 3.26 Geniculate ganglion on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Geniculate ganglion. (8) Squamous portion of temporal bone. (9) Petrosquamous fissure. (10) Anterior tympanum. (11) Medial wall of temporomandibular joint

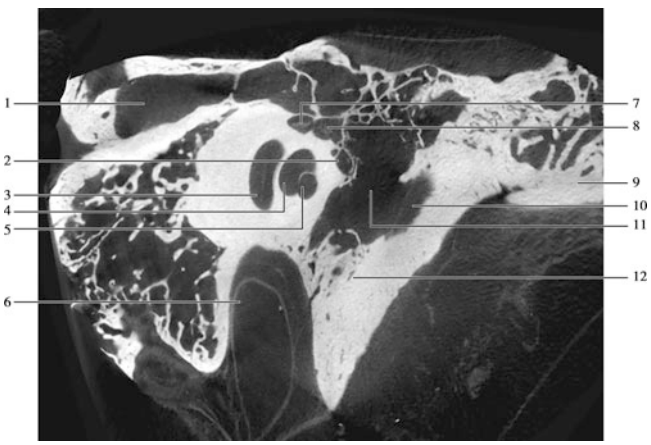

Fig. 3.28 Labyrinthine and tympanic portions of facial nerve on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Labyrinthine portion of facial nerve. (8) Tympanic portion of facial nerve. (9) Squamous portion of temporal bone. (10) External auditory canal. (11) Tympanic cavity. (12) Tympanic portion of temporal bone

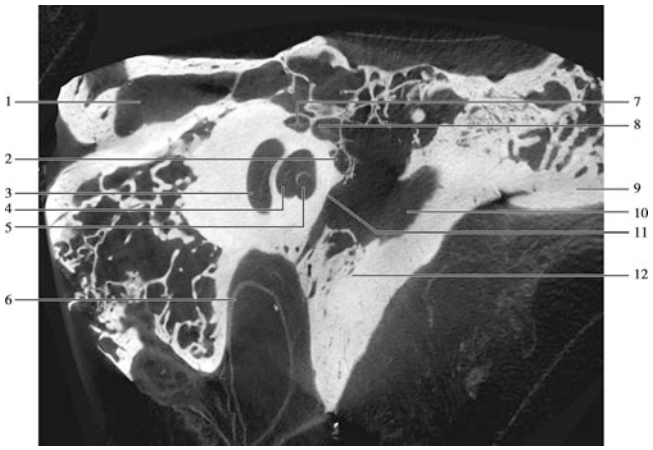

Fig. 3.29 Labyrinthine and tympanic portions of facial nerve on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Labyrinthine portion of facial nerve. (8) Tympanic portion of facial nerve. (9) Squamous portion of temporal bone. (10) External auditory canal. (11) Promontory. (12) Tympanic portion of temporal bone

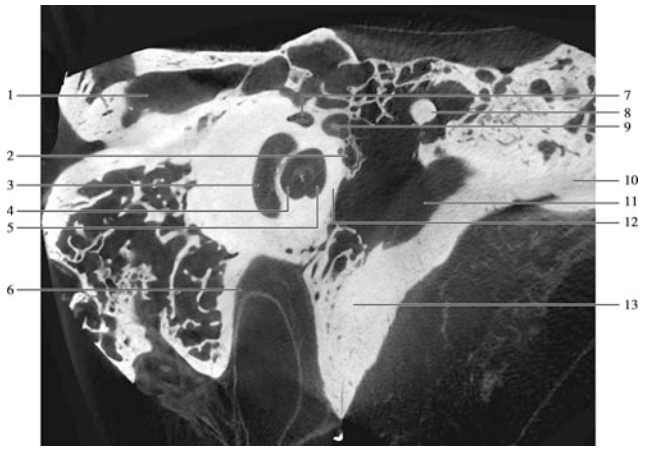

Fig. 3.31 Labyrinthine and tympanic portions of facial nerve and head of malleus on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Labyrinthine portion of facial nerve. (8) Head of the malleus. (9) Tympanic portion of facial nerve. (10) Squamous portion of temporal bone. (11) External auditory canal. (12) Promontory. (13) Medial wall of temporomandibular joint

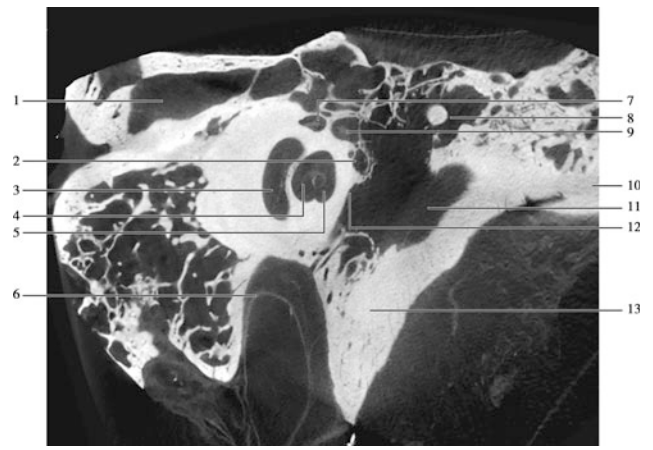

Fig. 3.30 Labyrinthine and tympanic portions of facial nerve and head of malleus on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Labyrinthine portion of facial nerve. (8) Head of the malleus. (9) Tympanic portion of facial nerve. (10) Squamous portion of temporal bone. (11) External auditory canal. (12) Promontory. (13) Medial wall of temporomandibular joint

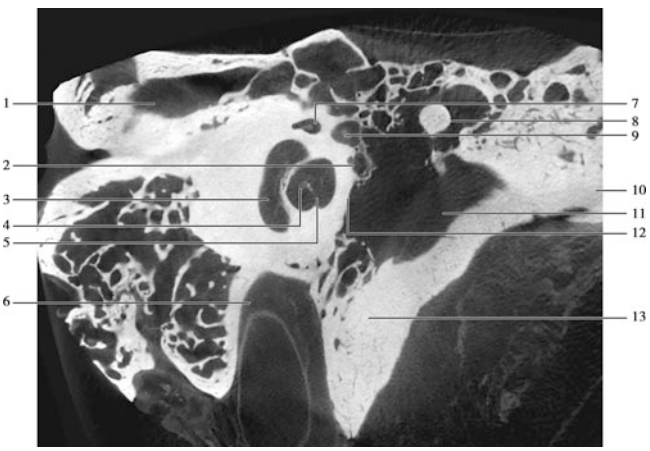

Fig. 3.32 Labyrinthine and tympanic portions of facial nerve and head of malleus on coronal view. (1) Petrous cells. (2) Tensor tympani muscle. (3) Basal turn of cochlea. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Internal carotid artery. (7) Labyrinthine portion of facial nerve. (8) Head of the malleus. (9) Tympanic portion of facial nerve. (10) Squamous portion of temporal bone. (11) External auditory canal. (12) Promontory. (13) Medial wall of temporomandibular joint

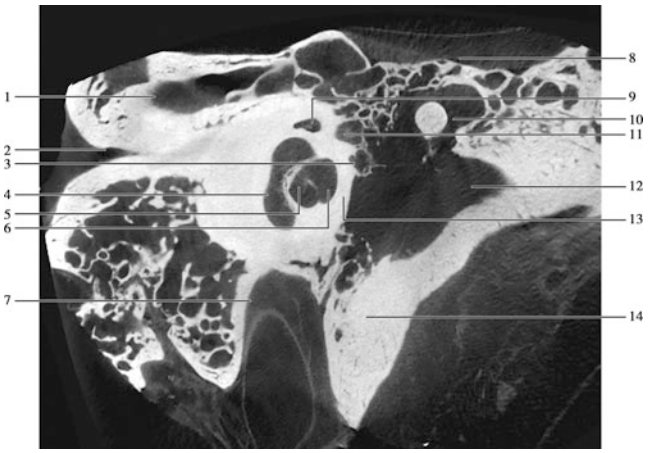

Fig. 3.33 Labyrinthine and tympanic portions of facial nerve and head of malleus on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Internal auditory canal. (3) Processus cochleariformis and tensor tympani muscle. (4) Basal turn of cochlea. (5) Second turn of cochlea. (6) Apical turn of cochlea. (7) Internal carotid artery. (8) Tympanic tegmen. (9) Labyrinthine portion of facial nerve. (10) Head of the malleus. (11) Tympanic portion of facial nerve. (12) External auditory canal. (13) Promontory. (14) Medial wall of temporomandibular joint

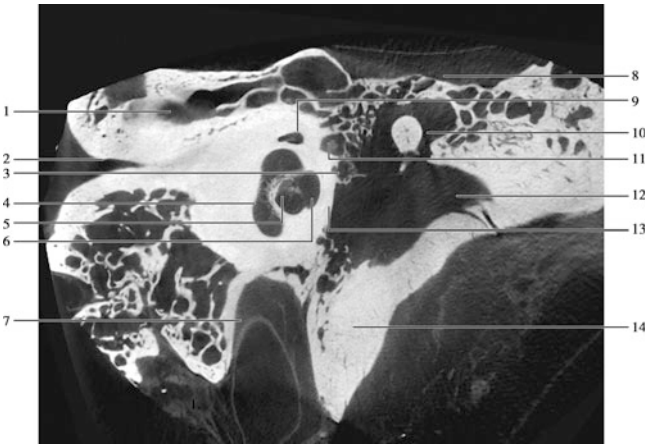

Fig. 3.34 Labyrinthine and tympanic portions of facial nerve and head of malleus on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Internal auditory canal. (3) Processus cochleariformis and tensor tympani muscle. (4) Basal turn of cochlea. (5) Second turn of cochlea. (6) Apical turn of cochlea. (7) Internal carotid artery. (8) Tympanic tegmen. (9) Labyrinthine portion of facial nerve. (10) Head of the malleus. (11) Tympanic portion of facial nerve. (12) External auditory canal. (13) Promontory. (14) Medial wall of temporomandibular joint

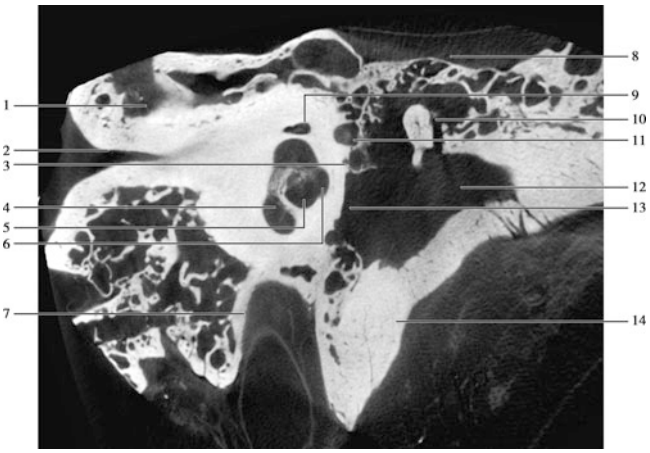

Fig. 3.35 Labyrinthine and tympanic portions of facial nerve and head of malleus on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Internal auditory canal. (3) Processus cochleariformis and tensor tympani muscle. (4) Basal turn of cochlea. (5) Second turn of cochlea. (6) Apical turn of cochlea. (7) Internal carotid artery. (8) Tympanic tegmen. (9) Labyrinthine portion of facial nerve. (10) Head of the malleus. (11) Tympanic portion of facial nerve. (12) External auditory canal. (13) Promontory. (14) Medial wall of temporomandibular joint

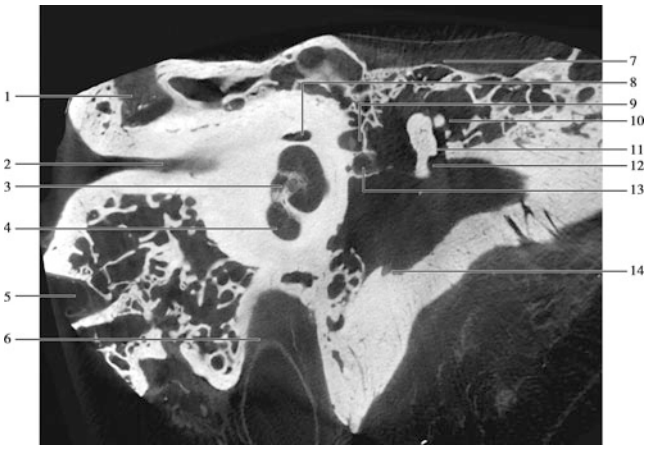

Fig. 3.36 Processus cochleariformis and malleus on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Internal auditory canal. (3) Modiolus. (4) Basal turn of cochlea. (5) Subpetrous sinus. (6) Internal carotid artery. (7) Tympanic tegmen. (8) Labyrinthine portion of facial nerve. (9) Tympanic portion of facial nerve. (10) Incus. (11) Head of the malleus. (12) Neck of the malleus. (13) Processus cochleariformis and tensor tympani muscle. (14) Tympanic sulcus (fibra annulus of tympanic membrane)

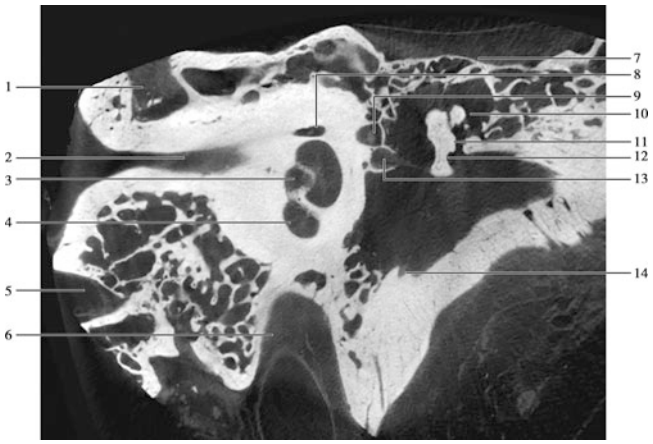

Fig. 3.37 Processus cochleariformis and malleus on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Internal auditory canal. (3) Modiolus. (4) Basal turn of cochlea. (5) Subpetrous sinus. (6) Internal carotid artery. (7) Tympanic tegmen. (8) Labyrinthine portion of facial nerve. (9) Tympanic portion of facial nerve. (10) Incus. (11) Head of the malleus. (12) Neck of the malleus. (13) Processus cochleariformis and tensor tympani muscle. (14) Tympanic sulcus (fibra annulus of tympanic membrane)

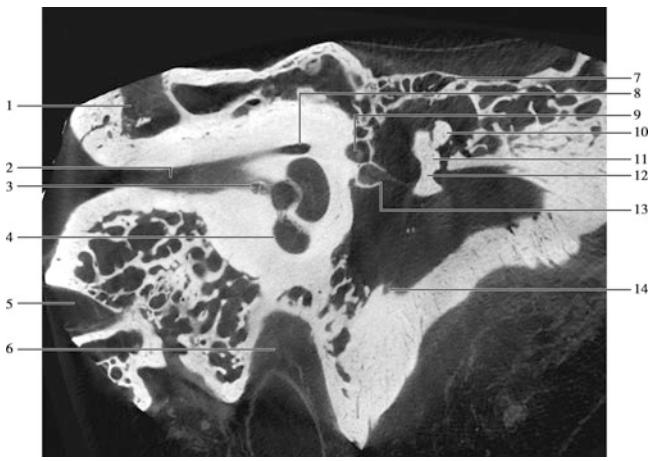

Fig. 3.38 Processus cochleariformis and malleus on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Internal auditory canal. (3) Modiolus. (4) Basal turn of cochlea. (5) Subpetrous sinus. (6) Internal carotid artery. (7) Tympanic tegmen. (8) Labyrinthine portion of facial nerve. (9) Tympanic portion of facial nerve. (10) Incus. (11) Head of the malleus. (12) Neck of the malleus. (13) Processus cochleariformis and tensor tympani muscle. (14) Tympanic sulcus (fibra annulus of tympanic membrane)

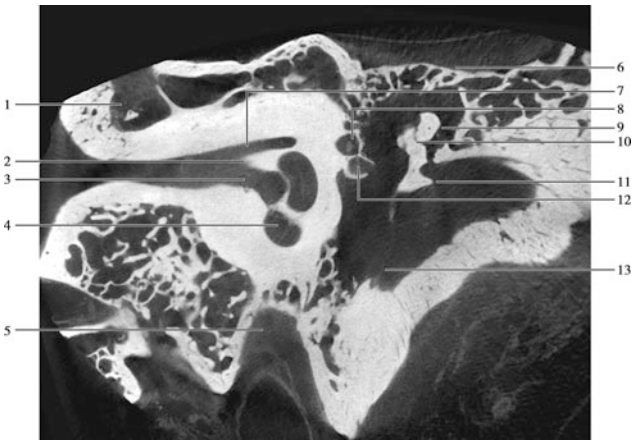

Fig. 3.39 Incudomalleolar articulation on coronal view. (1) Air cells in superior wall of internal auditory canal. (2) Transverse crest. (3) Cochlear nerve canal. (4) Basal turn of cochlea. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Facial nerve in internal auditory canal. (8) Tympanic portion of facial nerve. (9) Body of the Incus. (10) Incudomalleolar articulation. (11) Short process of the malleus. (12) Processus cochleariformis and tensor tympani muscle. (13) Tympanic membrane

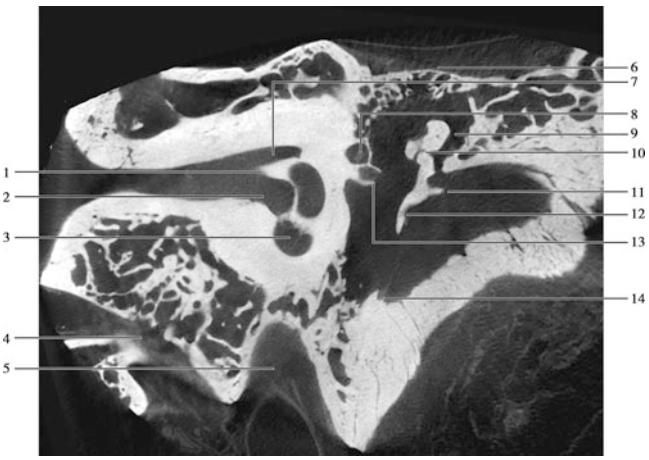

Fig. 3.40 Incudomalleolar articulation on coronal view. (1) Transverse crest. (2) Cochlear nerve canal. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Facial nerve in internal auditory canal. (8) Tympanic portion of facial nerve. (9) Body of the Incus. (10) Incudomalleolar articulation. (11) Short process of the malleus. (12) Manubrium. (13) Processus cochleariformis and tensor tympani muscle. (14) Tympanic sulcus

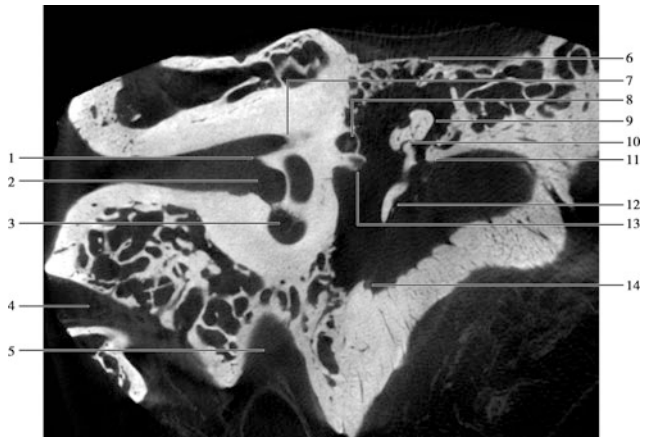

Fig. 3.41 Incudomalleolar articulation on coronal view. (1) Transverse crest. (2) Cochlear nerve canal. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Bill's crest. (8) Tympanic portion of facial nerve. (9) Body of the Incus. (10) Incudomalleolar articulation. (11) Scutum. (12) Manubrium. (13) Processus cochleariformis and tensor tympani muscle. (14) Tympanic sulcus

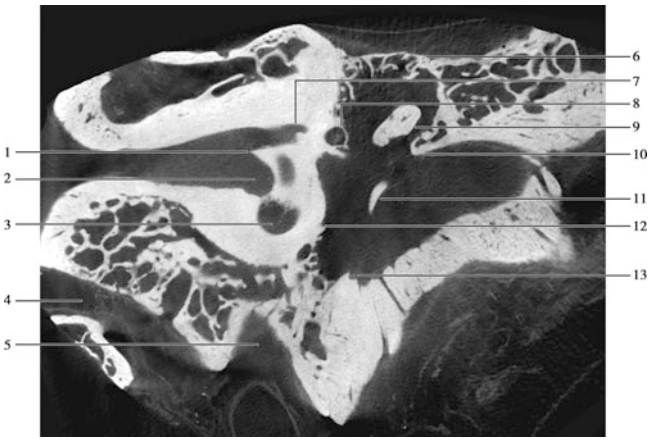

Fig. 3.43 Body of incus and superior vestibular nerve on coronal view. (1) Transverse crest. (2) Cochlear nerve canal. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Superior vestibular nerve. (8) Tympanic portion of facial nerve. (9) Body of the Incus. (10) Scutum. (11) Manubrium. (12) Promontory. (13) Tympanic sulcus

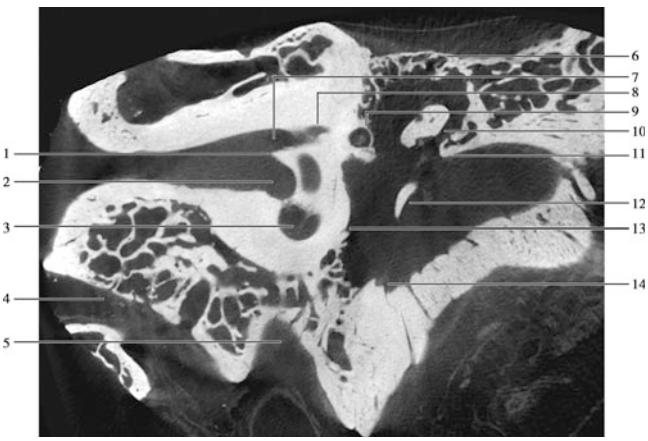

Fig. 3.42 Body of incus and superior vestibular nerve on coronal view. (1) Transverse crest. (2) Cochlear nerve canal. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Internal auditory canal. (8) Superior vestibular nerve. (9) Tympanic portion of facial nerve. (10) Body of the Incus. (11) Scutum. (12) Manubrium. (13) Promontory. (14) Tympanic sulcus

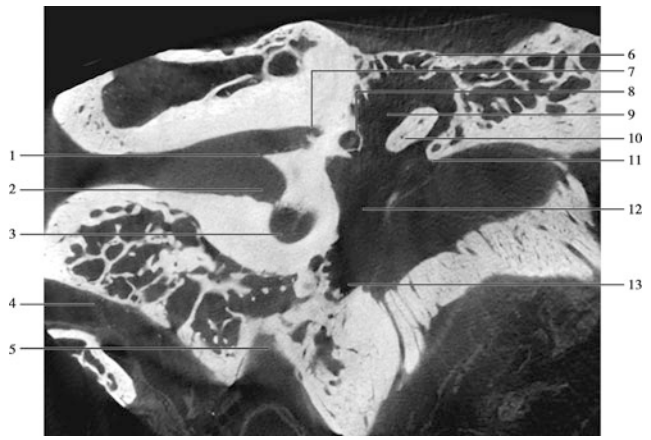

Fig. 3.44 Body of incus and superior vestibular nerve on coronal view. (1) Transverse crest. (2) Cochlear nerve canal. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Superior vestibular nerve. (8) Tympanic portion of facial nerve. (9) Epitympanum. (10) Body of the Incus. (11) Scutum. (12) Mesotympanum. (13) Hypotympanum

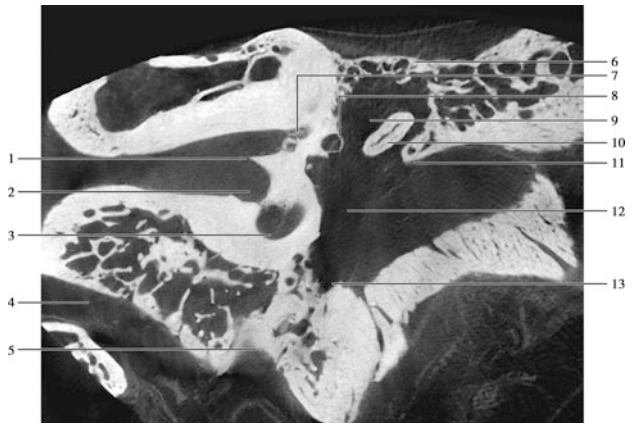

Fig. 3.45 Body of incus and superior vestibular nerve on coronal view. (1) Transverse crest. (2) Cochlear nerve canal. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Superior vestibular nerve. (8) Tympanic portion of facial nerve. (9) Epitympanum. (10) Body of the Incus. (11) Scutum. (12) Mesotympanum. (13) Hypotympanum

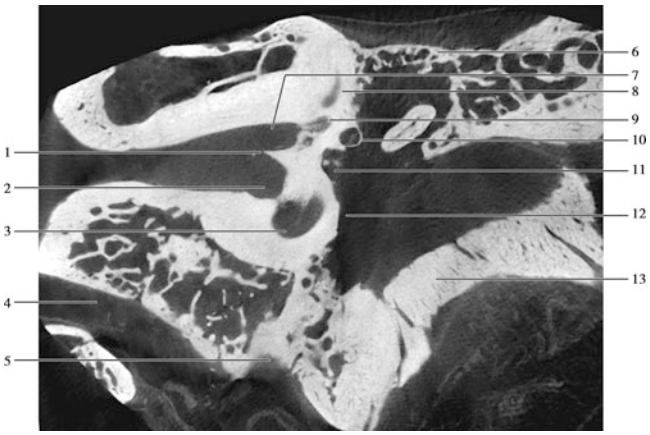

Fig. 3.46 Superior vestibular nerve and vestibular window niche on coronal view. (1) Transverse crest. (2) Inferior part of fundus. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Internal carotid artery. (6) Tympanic tegmen. (7) Superior part of fundus. (8) Anterior semicircular canal. (9) Ampullar branch of superior vestibular nerve. (10) Tympanic portion of facial nerve. (11) Vestibular window niche. (12) Promontory. (13) Tympanic portion of temporal bone (basal wall of external auditory canal)

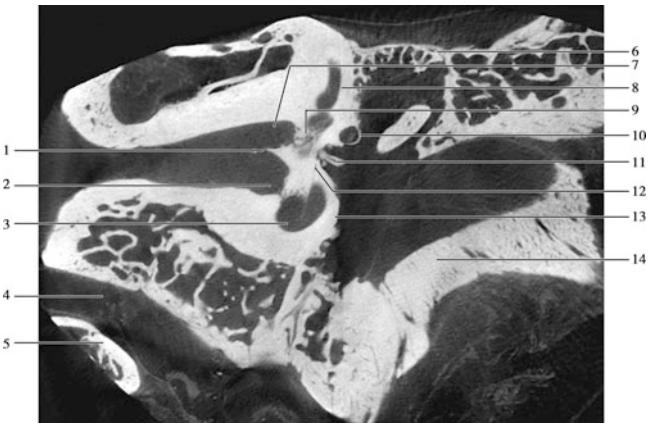

Fig. 3.47 Anterior crus of stapes on coronal view. (1) Transverse crest. (2) Inferior part of fundus. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Occipital bone. (6) Tympanic tegmen. (7) Superior part of fundus. (8) Anterior semicircular canal. (9) Ampullar branch of superior vestibular nerve. (10) Tympanic portion of facial nerve. (11) Anterior crus of stapes. (12) Fissula ante fenestram. (13) Promontory. (14) Tympanic portion of temporal bone (basal wall of external auditory canal)

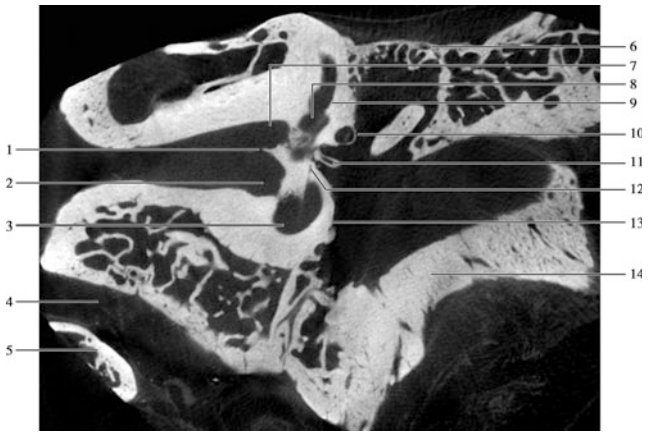

Fig. 3.48 Anterior crus of stapes on coronal view. (1) Transverse crest. (2) Inferior part of fundus. (3) Basal turn of cochlea. (4) Petro-occipital fissure. (5) Occipital bone. (6) Tympanic tegmen. (7) Superior part of fundus. (8) Anterior semicircular canal ampulla. (9) Lateral semicircular canal ampulla. (10) Tympanic portion of facial nerve. (11) Anterior crus of the stapes. (12) Fissula ante fenestram. (13) Promontory. (14) Basal wall of external auditory canal

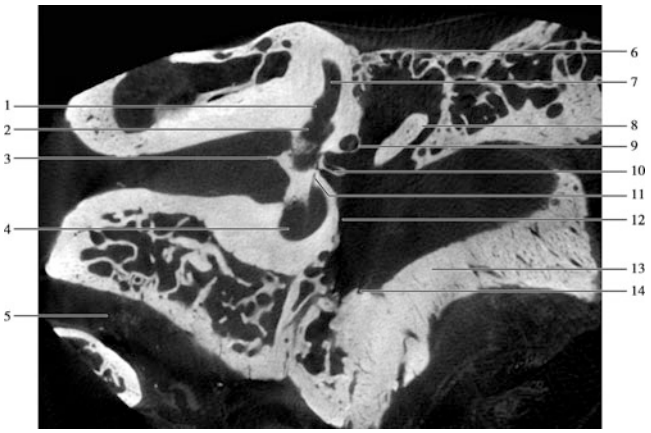

Fig. 3.49 Anterior crus of stapes on coronal view. (1) Anterior semicircular canal ampulla. (2) Lateral semicircular canal ampulla. (3) Transverse crest. (4) Basal turn of cochlea. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Long crus of the incus. (9) Tympanic portion of facial nerve. (10) Anterior crus of the stapes. (11) Fissula ante fenestram. (12) Promontory. (13) Basal wall of external auditory canal. (14) Tympanic sulcus (fibra annulus of tympanic membrane)

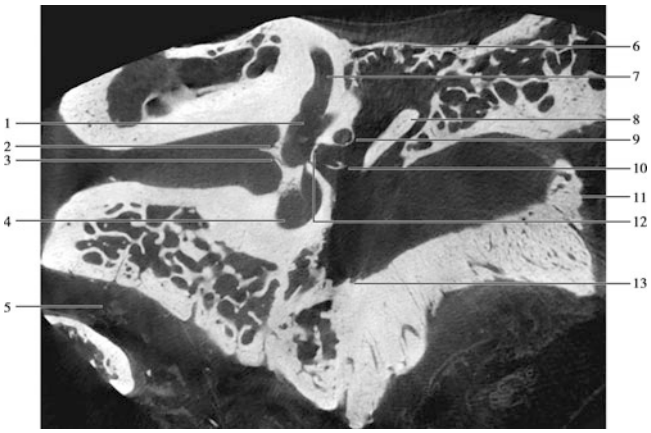

Fig. 3.51 Anterior crus of stapes on coronal view. (1) Lateral semicircular canal ampulla. (2) Superior vestibular nerve. (3) Inferior vestibular nerve. (4) Basal turn of cochlea. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Long crus of the incus. (9) Tympanic portion of facial nerve. (10) Anterior crus of the stapes. (11) Anterosuperior ridge of external auditory canal. (12) Footplate of the stapes. (13) Tympanic sulcus

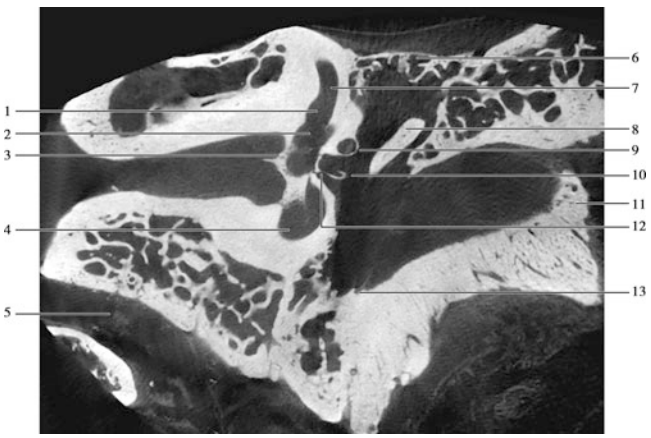

Fig. 3.50 Anterior crus of stapes on coronal view. (1) Anterior semicircular canal ampulla. (2) Lateral semicircular canal ampulla. (3) Anterior vestibular nerve. (4) Basal turn of cochlea. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Long crus of the incus. (9) Tympanic portion of facial nerve. (10) Anterior crus of the stapes. (11) Anterosuperior ridge of external auditory canal. (12) Footplate of the stapes. (13) Tympanic sulcus

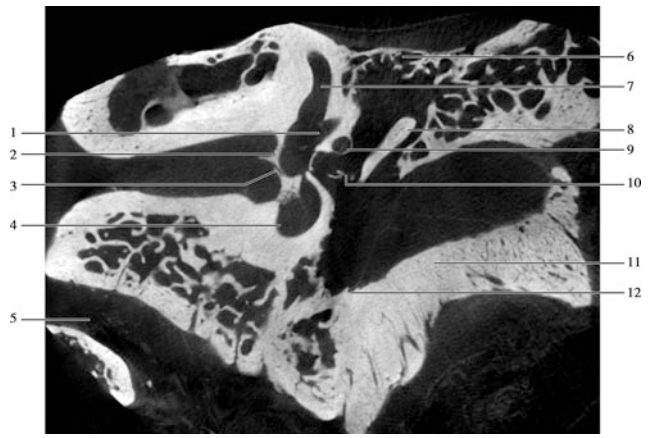

Fig. 3.52 Incudostapedial articulation on coronal view. (1) Lateral semicircular canal. (2) Superior vestibular nerve. (3) Inferior vestibular nerve. (4) Basal turn of cochlea. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Long crus of the incus. (9) Tympanic portion of facial nerve. (10) Incudostapedial articulation. (11) Tympanic portion of temporal bone. (12) Tympanic sulcus

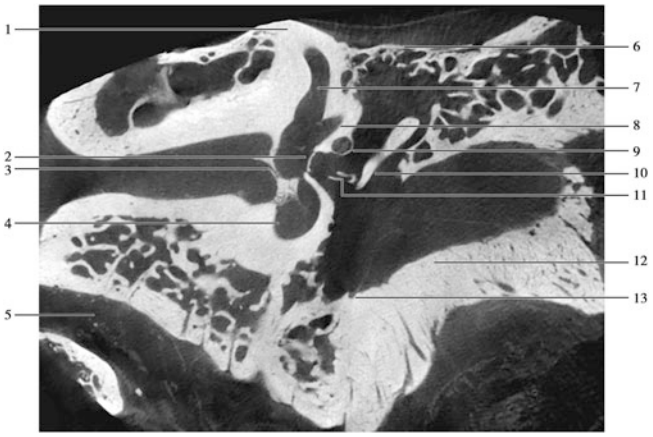

Fig. 3.53 Incudostapedial articulation on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Inferior vestibular nerve. (4) Basal turn of cochlea. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) Long crus of the incus. (11) Incudostapedial articulation. (12) Tympanic portion of temporal bone. (13) Tympanic sulcus

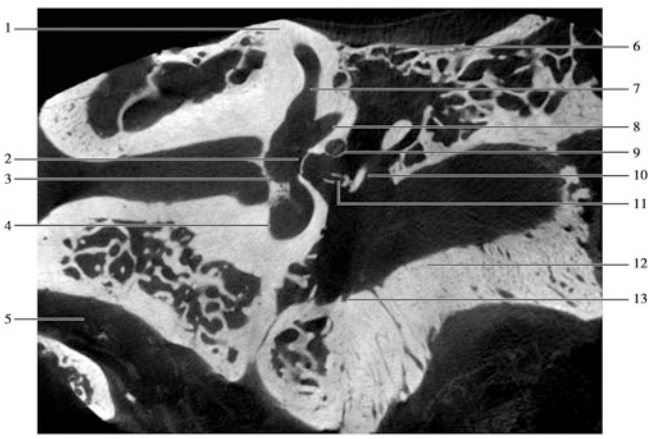

Fig. 3.54 Incudostapedial articulation on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Inferior vestibular nerve. (4) Basal turn of cochlea. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) Long crus of the incus. (11) Incudostapedial articulation. (12) Tympanic portion of temporal bone. (13) Tympanic sulcus

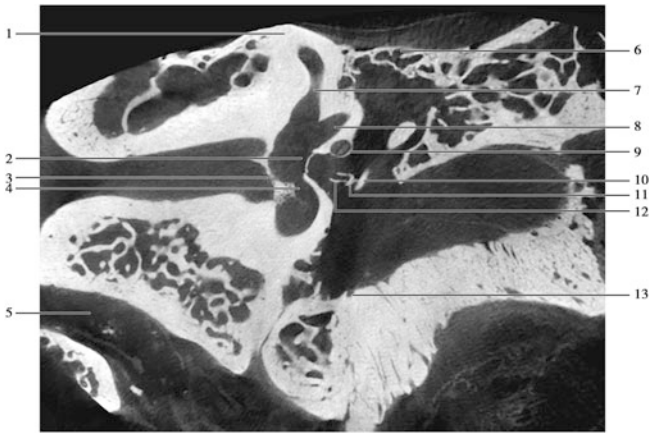

Fig. 3.55 Incudostapedial articulation on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Inferior vestibular nerve. (4) Ductus reuniens. (5) Petro-occipital fissure. (6) Tympanic tegmen. (7) Anterior semicircular canal. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) Long crus of the incus. (11) Lenticular process. (12) Head of the stapes. (13) Tympanic sulcus

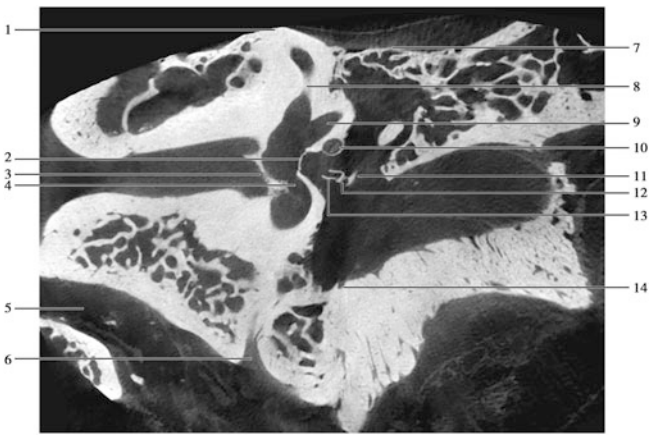

Fig. 3.56 Incudostapedial articulation on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Inferior vestibular nerve. (4) Ductus reuniens. (5) Petro-occipital fissure. (6) Tympanic canaliculus (Jacobson's nerve). (7) Tympanic tegmen. (8) Anterior semicircular canal. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Long crus of the incus. (12) Lenticular process. (13) Head of the stapes. (14) Tympanic sulcus

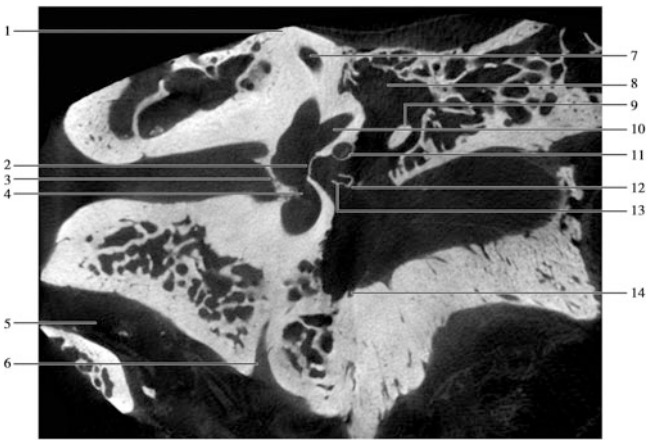

Fig. 3.57 Incudostapedial articulation on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Inferior vestibular nerve. (4) Ductus reuniens. (5) Petro-occipital fissure. (6) Tympanic canaliculus (Jacobson's nerve). (7) Anterior semicircular canal. (8) Aditus ad antrum. (9) Short crus of the incus. (10) Lateral semicircular canal. (11) Tympanic portion of facial nerve. (12) Lenticular process. (13) Head of the stapes. (14) Tympanic sulcus

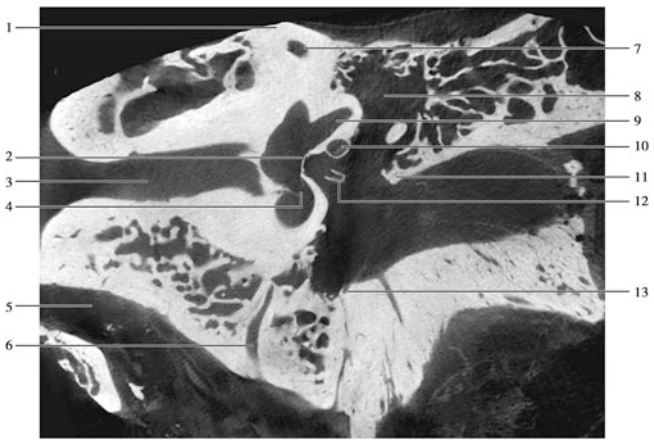

Fig. 3.59 Neck of stapes on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Internal auditory canal. (4) Ductus reuniens. (5) Petro-occipital fissure. (6) Tympanic canaliculus. (7) Anterior semicircular canal. (8) Aditus ad antrum. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Scutum. (12) Neck of the stapes. (13) Tympanic sulcus

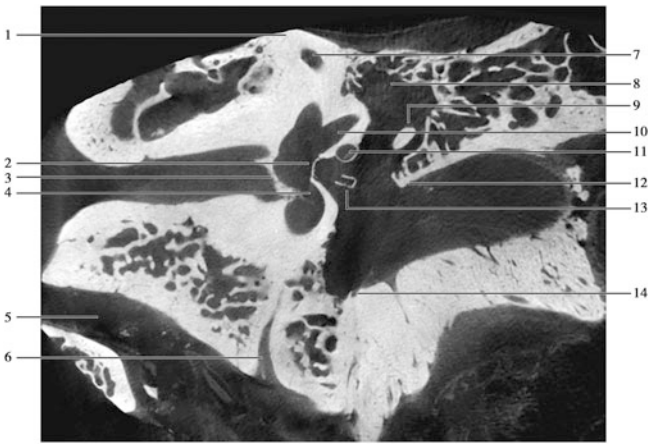

Fig. 3.58 Incudostapedial articulation on coronal view. (1) Arcuate eminence. (2) Footplate. (3) Inferior vestibular nerve. (4) Ductus reuniens. (5) Petro-occipital fissure. (6) Tympanic canaliculus (Jacobson's nerve). (7) Anterior semicircular canal. (8) Aditus ad antrum. (9) Short crus of the incus. (10) Lateral semicircular canal. (11) Tympanic portion of facial nerve. (12) Scutum. (13) Incudostapedial articulation. (14) Tympanic sulcus

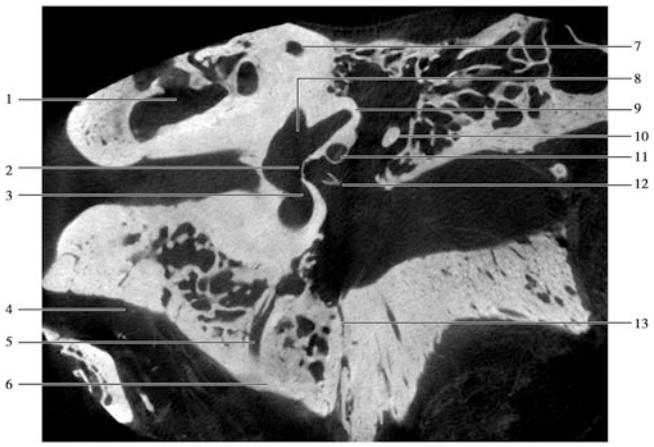

Fig. 3.60 Neck of stapes on coronal view. (1) Superior air cells of internal auditory canal. (2) Footplate. (3) Ductus reuniens. (4) Petro-occipital fissure. (5) Tympanic canaliculus. (6) Ridge between carotid artery canal and jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Short crus of the incus. (11) Tympanic portion of facial nerve. (12) Neck of the stapes. (13) Petrotympanic fissure

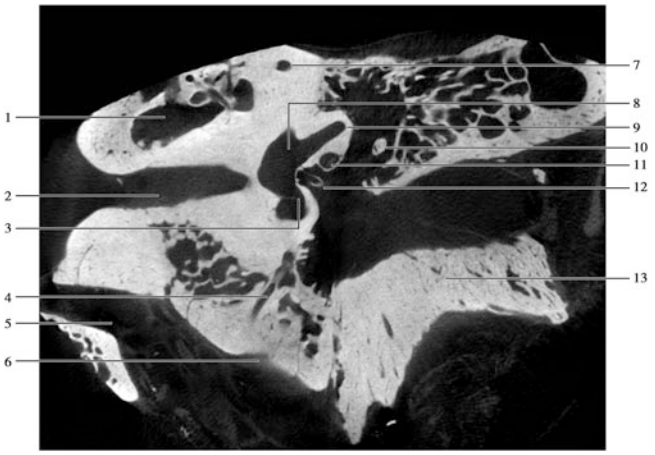

Fig. 3.61 Posterior crus of stapes on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Ductus reuniens (4) Tympanic canaliculus. (5) Petro-occipital fissure. (6) Ridge between carotid artery canal and jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Short crus of the incus. (11) Tympanic portion of facial nerve. (12) Posterior crus of the stapes. (13) Basal wall of external auditory canal

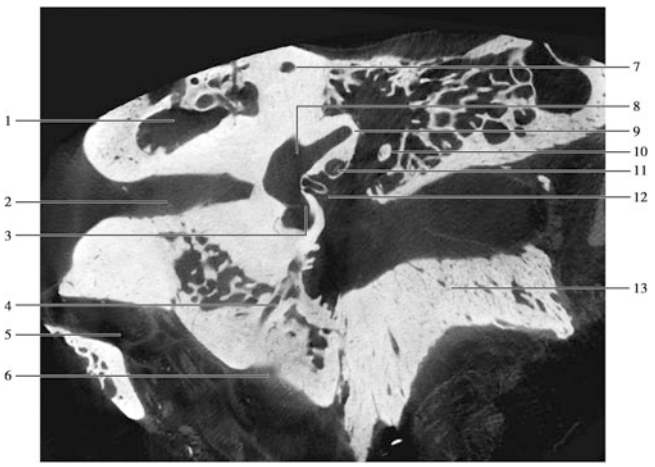

Fig. 3.62 Posterior crus of stapes on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Ductus reuniens. (4) Tympanic canaliculus. (5) Petro-occipital fissure. (6) Ridge between carotid artery canal and jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10 Short crus of the incus. (11) Tympanic portion of facial nerve. (12) Posterior crus of the stapes. (13) Basal wall of external auditory canal

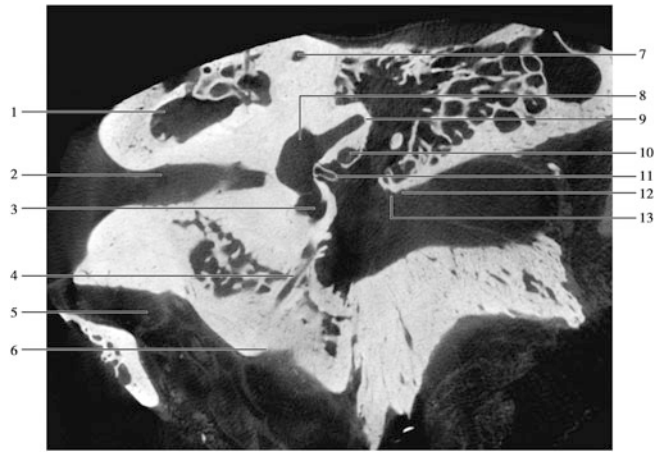

Fig. 3.63 Posterior crus of stapes on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Cochlear window. (4) Tympanic canaliculus. (5) Petro-occipital fissure. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Posterior crus of the stapes. (12) Tympanic sulcus. (13) Chorda tympani nerve

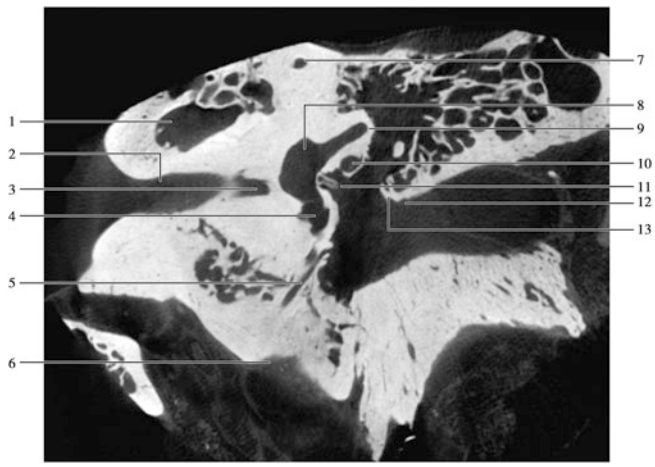

Fig. 3.64 Posterior crus of stapes on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window. (5) Tympanic canaliculus. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Posterior crus of the stapes. (12) Tympanic sulcus. (13) Chorda tympani nerve

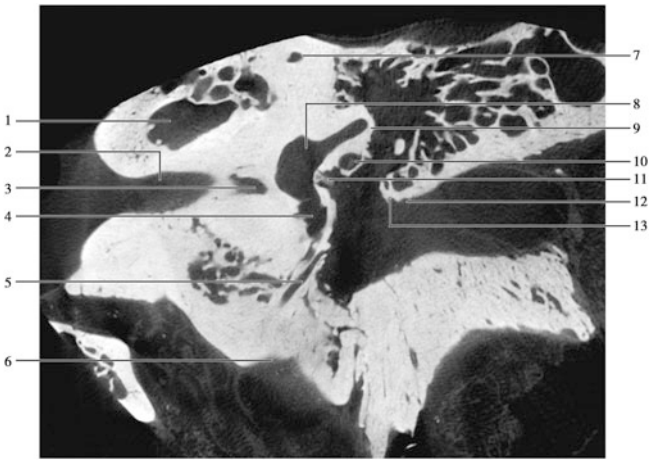

Fig. 3.65 Posterior crus of stapes and cochlear window on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window. (5) Tympanic canaliculus. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Posterior crus of the stapes. (12) Tympanic sulcus. (13) Chorda tympani nerve

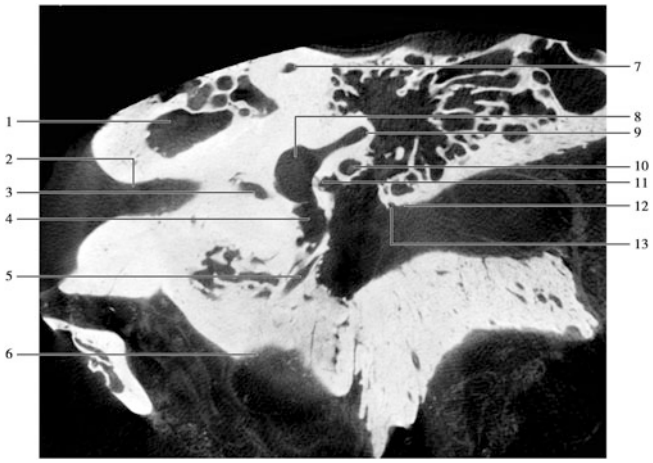

Fig. 3.67 Posterior crus of stapes and cochlear window on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window. (5) Tympanic canaliculus. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Posterior crus of the stapes. (12) Tympanic sulcus. (13) Chorda tympani nerve

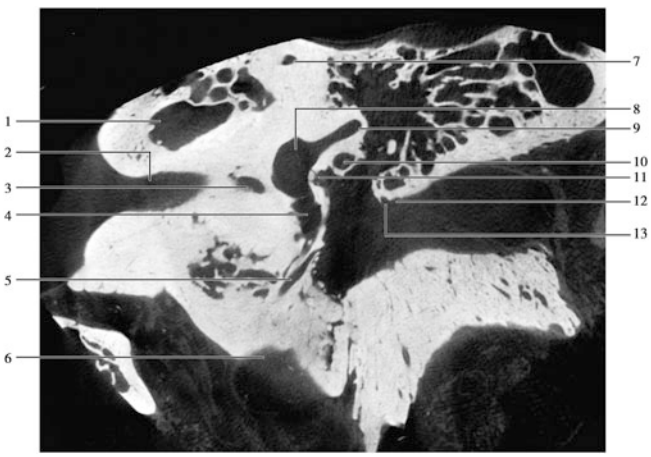

Fig. 3.66 Posterior crus of stapes and cochlear window on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window. (5) Tympanic canaliculus. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Posterior crus of the stapes. (12) Tympanic sulcus. (13) Chorda tympani nerve

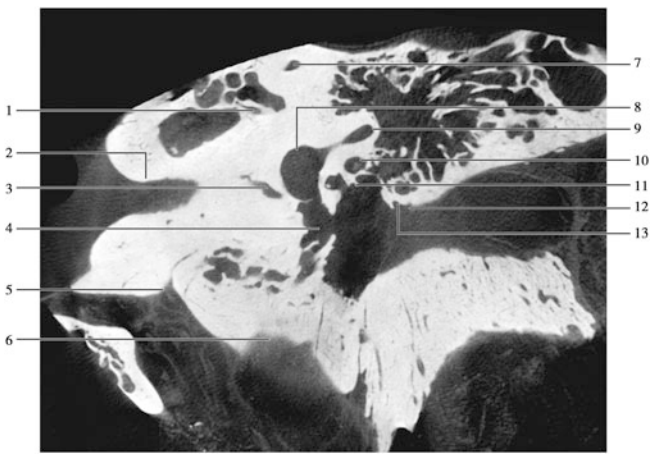

Fig. 3.68 Cochlear window niche on coronal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window niche. (5) Nerve portion of jugular foramen. (6) Vascular portion of jugular foramen (jugular bulb). (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Pyramidal eminence and stapedius muscle. (12) Tympanic sulcus. (13) Chorda tympani nerve

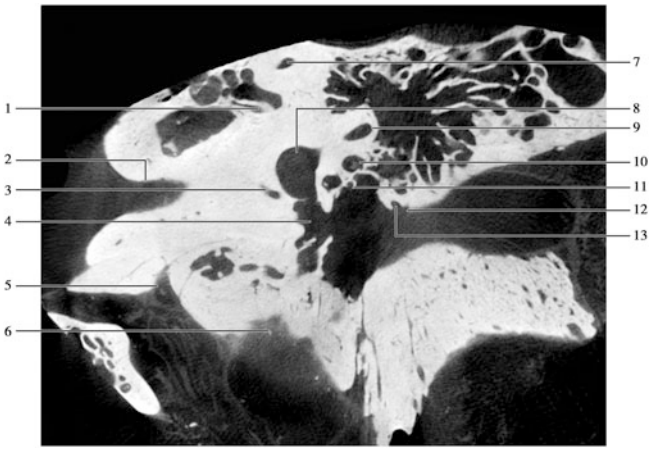

Fig. 3.69 Cochlear window niche on coronal view. (1) Petrosomastoid channel (subarcuate artery). (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window niche. (5) Nerve portion of jugular foramen. (6) Vascular portion of jugular foramen (jugular bulb). (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Tympanic portion of facial nerve. (11) Pyramidal eminence and stapedius muscle. (12) Tympanic sulcus. (13) Chorda tympani nerve

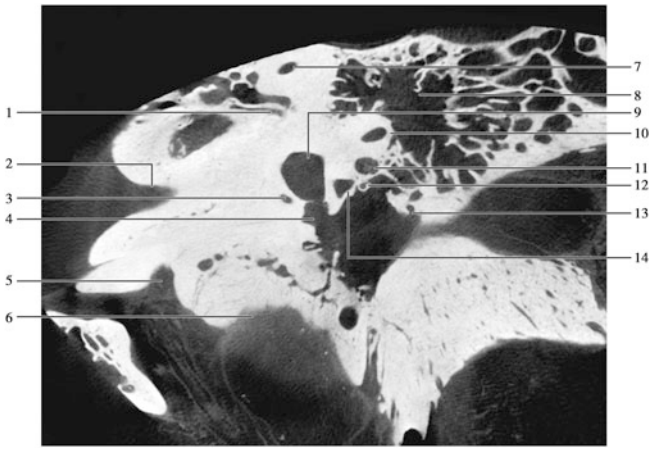

Fig. 3.71 Cochlear window niche on coronal view. (1) Petrosomastoid channel. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window niche. (5) Nerve portion of jugular foramen. (6) Jugular bulb. 7 Anterior semicircular canal. (8) Antrum. (9) Vestibule. (10) Lateral semicircular canal. (11) Tympanic portion of facial nerve. (12) Pyramidal eminence and stapedius muscle. (13) Chorda tympani nerve. (14) Tympanic sinus

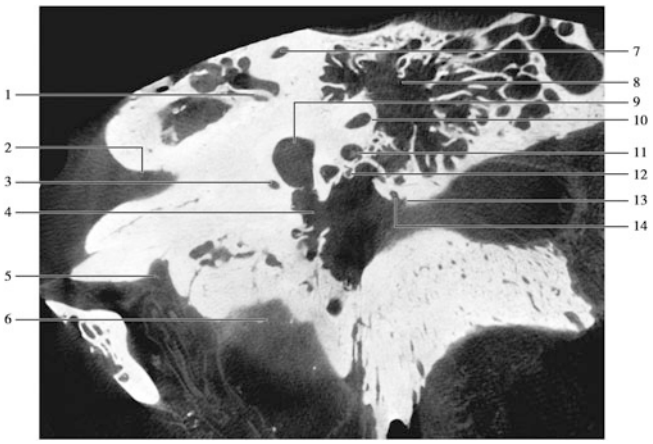

Fig. 3.70 Cochlear window niche on coronal view. (1) Petrosomastoid channel (subarcuate artery). (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window niche. (5) Nerve portion of jugular foramen. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Antrum. (9) Vestibule. (10) Lateral semicircular canal. (11) Tympanic portion of facial nerve. (12) Pyramidal eminence and stapedius muscle. (13) Tympanic sulcus. (14) Chorda tympani nerve

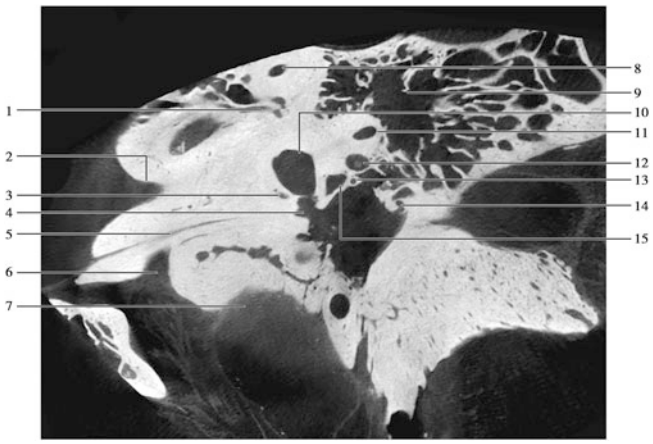

Fig. 3.72 Cochlear window niche on coronal view. (1) Petrosomastoid channel. (2) Internal auditory canal. (3) Singular foramen. (4) Cochlear window niche. (5) Cochlear aqueduct. (6) Nerve portion of jugular foramen. (7) Jugular bulb. (8) Anterior semicircular canal. (9) Antrum. (10) Vestibule. (11) Lateral semicircular canal. (12) Tympanic portion of facial nerve. (13) Pyramidal eminence and stapedius muscle. (14) Chorda tympani nerve. (15) Tympanic sinus

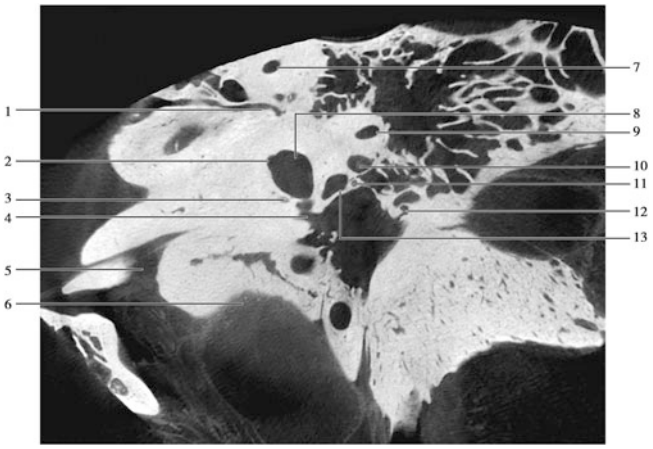

Fig. 3.73 Cochlear window niche and second genu of facial nerve on coronal view. (1) Petrosomastoid channel. (2) Internal orifice of vestibular aqueduct. (3) Singular foramen. (4) Cochlear window niche. (5) Nerve portion of jugular foramen. (6) Jugular bulb. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Second genu of facial nerve. (11) Pyramidal eminence and stapedius muscle. (12) Chorda tympani nerve. (13) Tympanic sinus

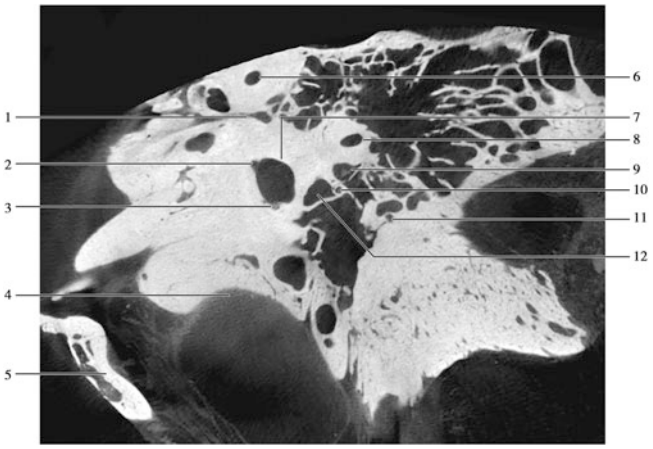

Fig. 3.75 Second genu of facial nerve on coronal view. (1) Petrosomastoid channel. (2) Internal orifice of vestibular aqueduct. (3) Singular foramen. (4) Jugular bulb. (5) Occipital bone. (6) Anterior semicircular canal. (7) Vestibule. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Chorda tympani nerve. (12) Tympanic sinus

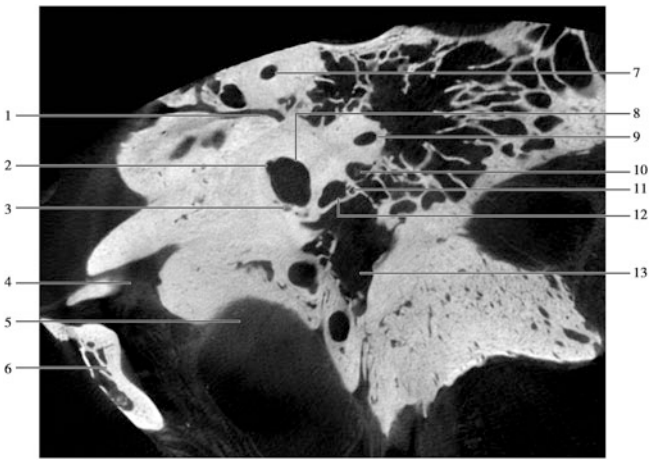

Fig. 3.74 Second genu of facial nerve on coronal view. (1) Petrosomastoid channel. (2) Internal orifice of vestibular aqueduct. (3) Singular foramen. (4) Nerve portion of jugular foramen. (5) Jugular bulb. (6) Occipital bone. (7) Anterior semicircular canal. (8) Vestibule. (9) Lateral semicircular canal. (10) Second genu of facial nerve. (11) Pyramidal eminence and stapedius muscle. (12) Tympanic sinus. (13) Posterior tympanum

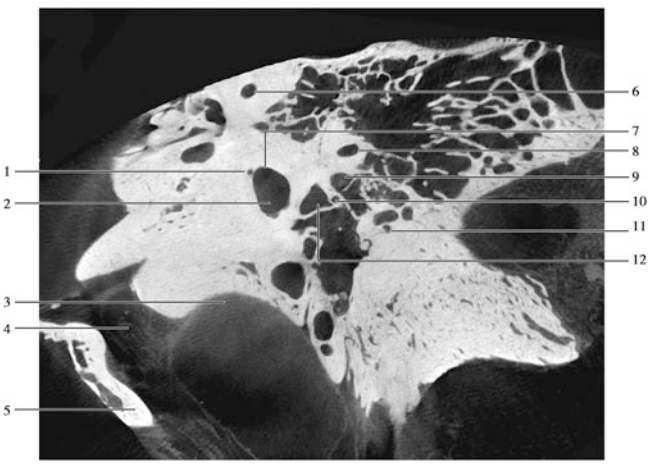

Fig. 3.76 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Vestibule. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Chorda tympani nerve. (12) Tympanic sinus

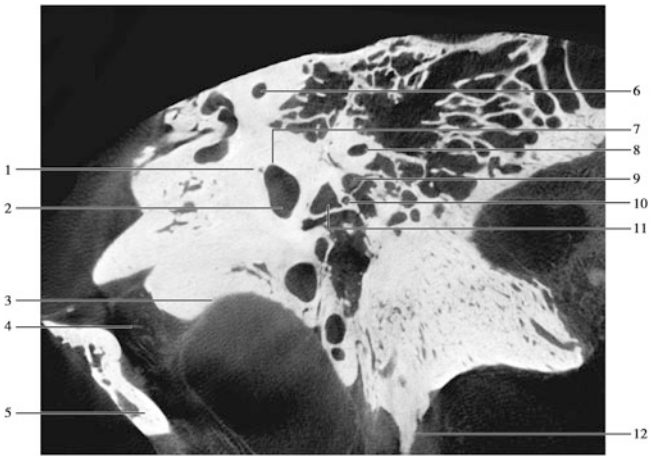

Fig. 3.77 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Tympanic sinus. (12) Styloid process

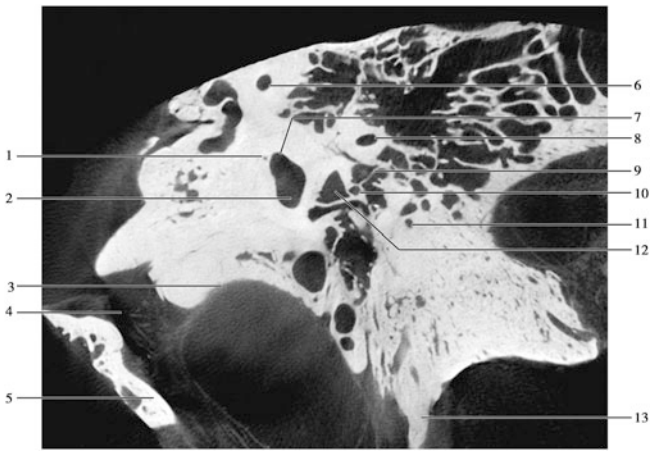

Fig. 3.78 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Chorda tympani nerve. (12) Tympanic sinus. (13) Styloid process

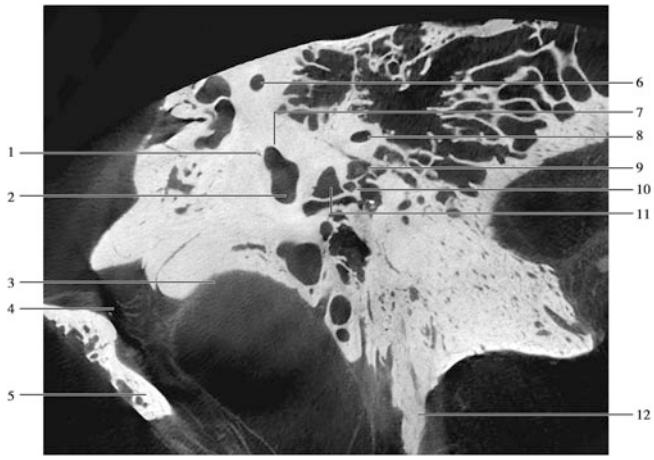

Fig. 3.79 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Tympanic sinus. (12) Styloid process

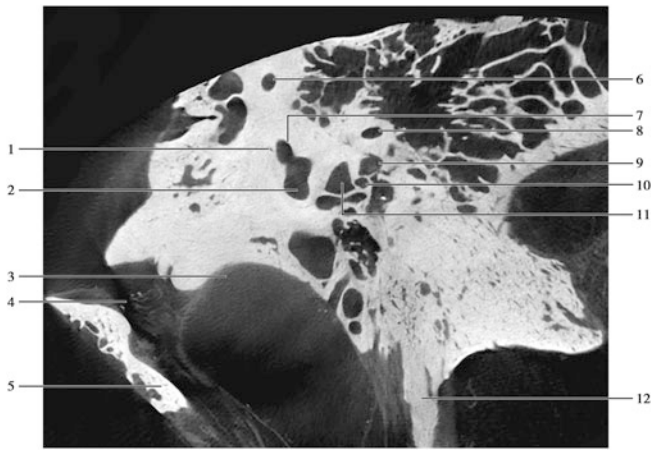

Fig. 3.80 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Tympanic sinus. (12) Styloid process

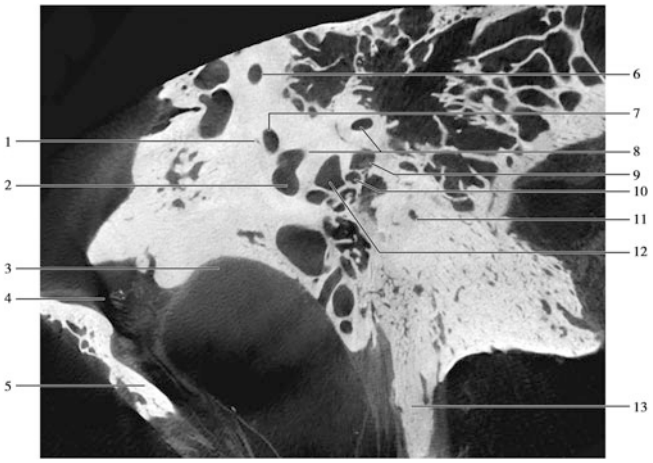

Fig. 3.81 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Chorda tympani nerve. (12) Tympanic sinus. (13) Styloid process

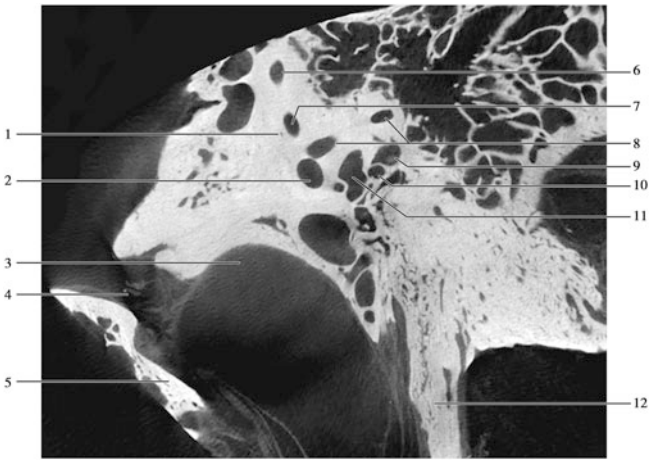

Fig. 3.83 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Stapedius muscle. (11) Tympanic sinus. (12) Styloid process

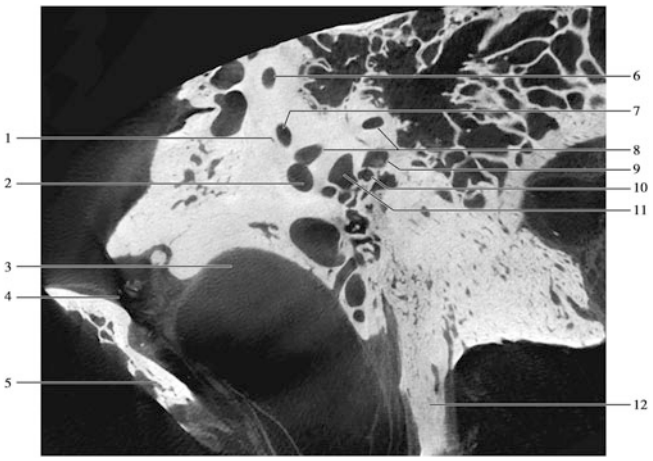

Fig. 3.82 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Ampulla of posterior semicircular canal. (3) Jugular bulb. (4) Petro-occipital fissure. (5) Occipital bone. (6) Anterior semicircular canal. (7) Common crus. (8) Lateral semicircular canal. (9) Second genu of facial nerve. (10) Pyramidal eminence and stapedius muscle. (11) Tympanic sinus. (12) Styloid process

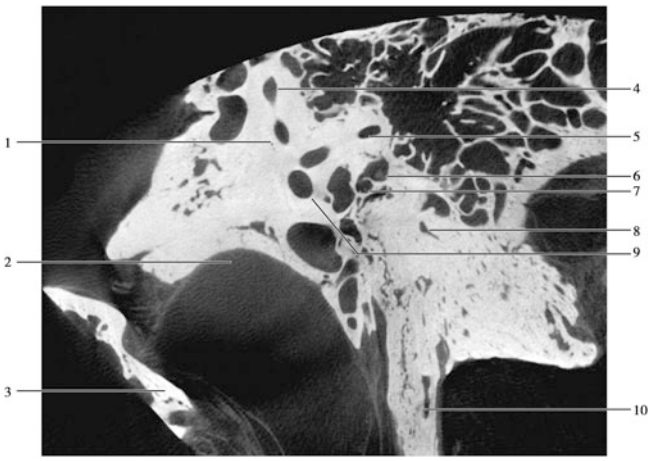

Fig. 3.84 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Second genu of facial nerve. (7) Stapedius muscle. (8) Chorda tympani nerve. (9) Ampulla of posterior semicircular canal. (10) Styloid process

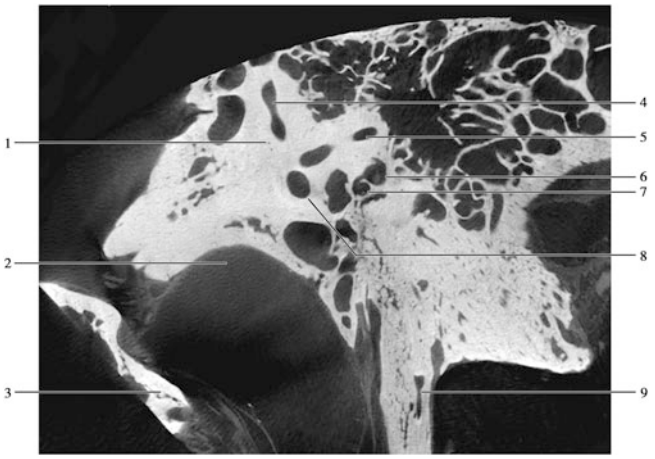

Fig. 3.85 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Second genu of facial nerve. (7) Stapedius muscle. (8) Ampulla of posterior semicircular canal. (9) Styloid process

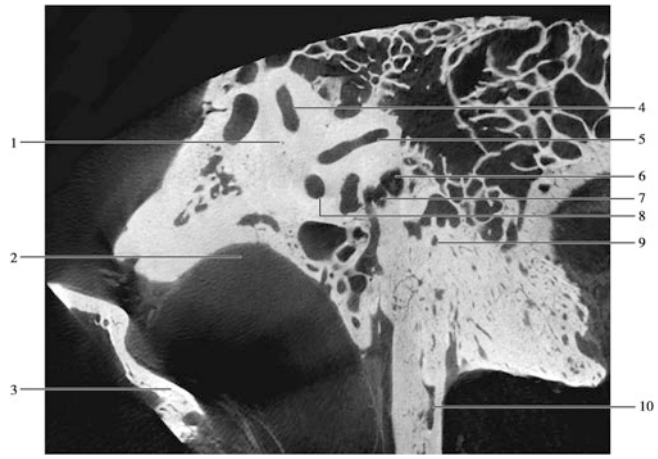

Fig. 3.87 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Second genu of facial nerve. (7) Stapedius muscle. (8) Ampulla of posterior semicircular canal. (9) Chorda tympani nerve. (10) Styloid process

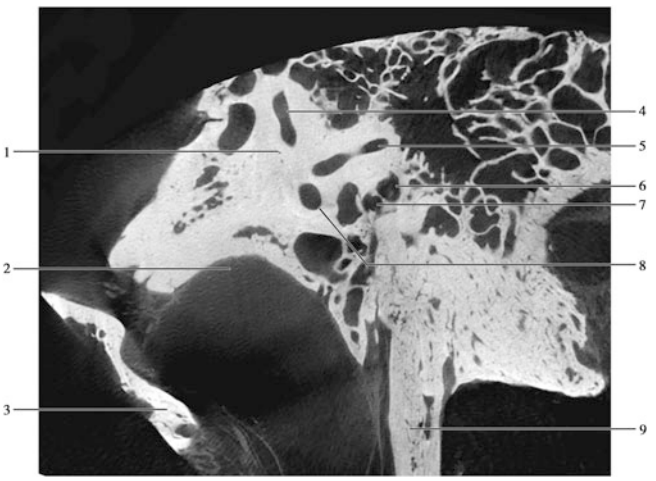

Fig. 3.86 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Second genu of facial nerve. (7) Stapedius muscle. (8) Ampulla of posterior semicircular canal. (9) Styloid process

Fig. 3.88 Second genu of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Second genu of facial nerve. (7) Stapedius muscle. (8) Ampulla of posterior semicircular canal. (9) Styloid process

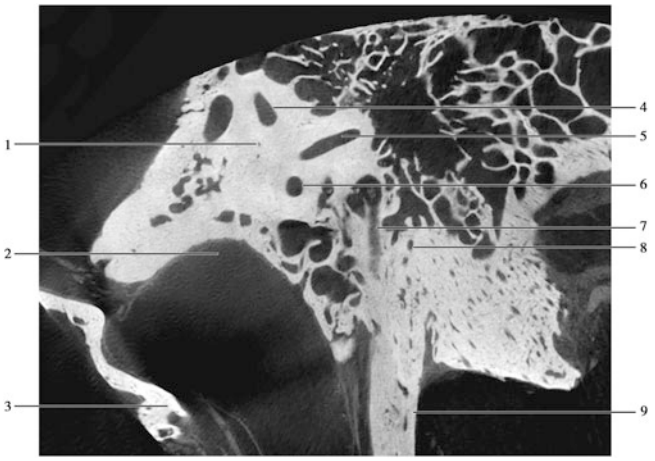

Fig. 3.89 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Ampulla of posterior semicircular canal. (7) Mastoid portion of facial nerve. (8) Chorda tympani nerve. (9) Styloid process

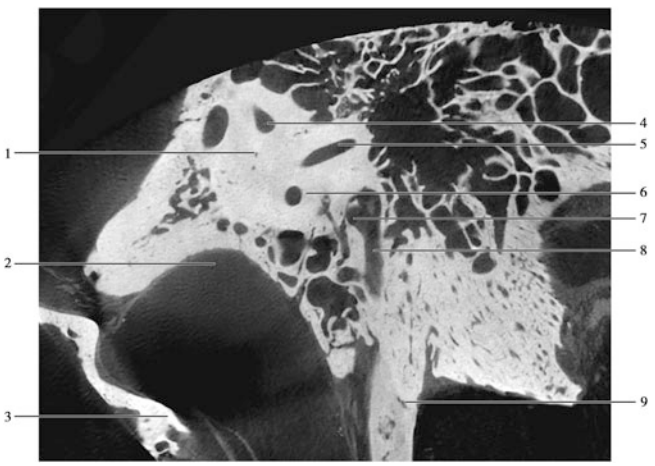

Fig. 3.90 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Common crus. (5) Lateral semicircular canal. (6) Ampulla of posterior semicircular canal. (7) Stapedius muscle. (8) Mastoid portion of facial nerve. (9) Styloid process

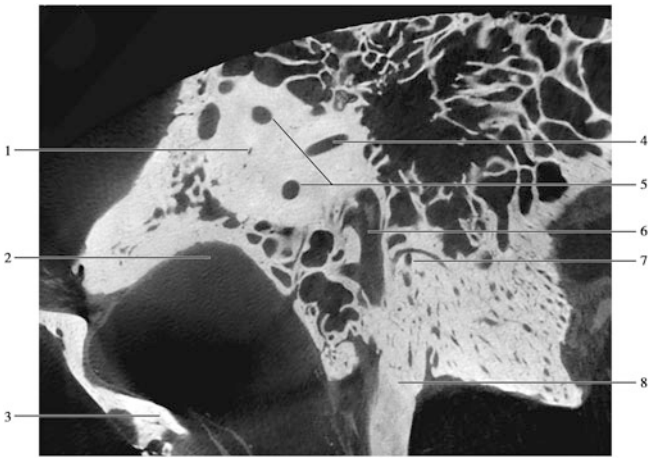

Fig. 3.91 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Lateral semicircular canal. (5) Posterior semicircular canal. (6) Mastoid portion of facial nerve. (7) Chorda tympani nerve. (8) Styloid process

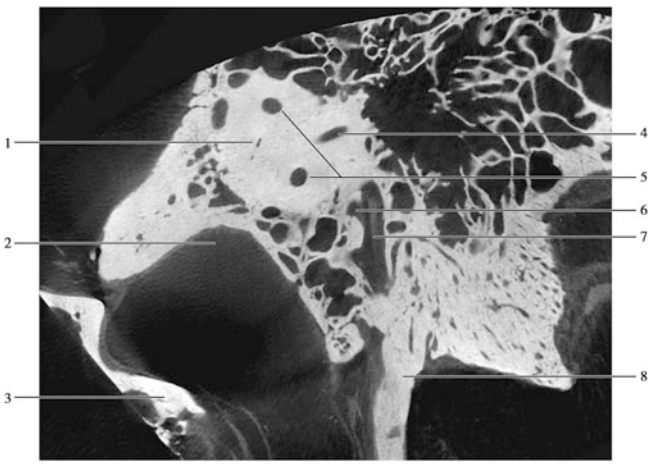

Fig. 3.92 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Lateral semicircular canal. (5) Posterior semicircular canal. (6) Stapedius muscle. (7) Mastoid portion of facial nerve. (8) Styloid process

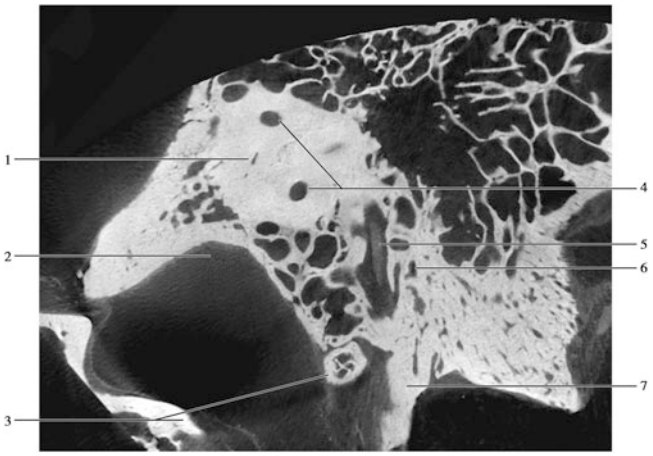

Fig. 3.93 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid portion of facial nerve. (6) Chorda tympani nerve. (7) Styloid process

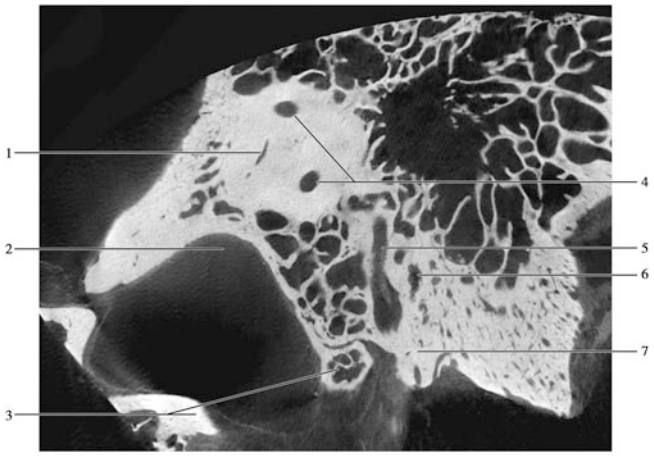

Fig. 3.95 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid portion of facial nerve. (6) Chorda tympani nerve. (7) Styloid process

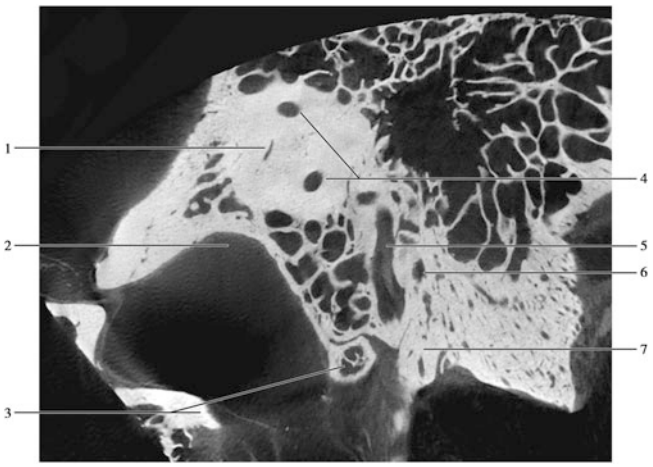

Fig. 3.94 Mastoid portion of facial nerve on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid portion of facial nerve. (6) Chorda tympani nerve. (7) Styloid process

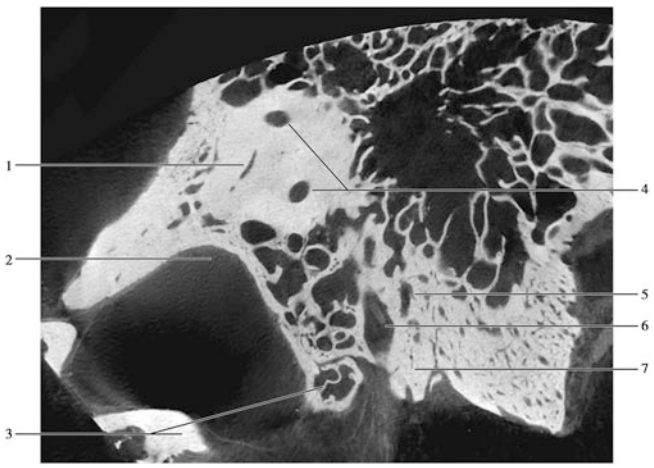

Fig. 3.96 Mastoid portion of facial nerve and posterior semicircular canal on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Styloid process

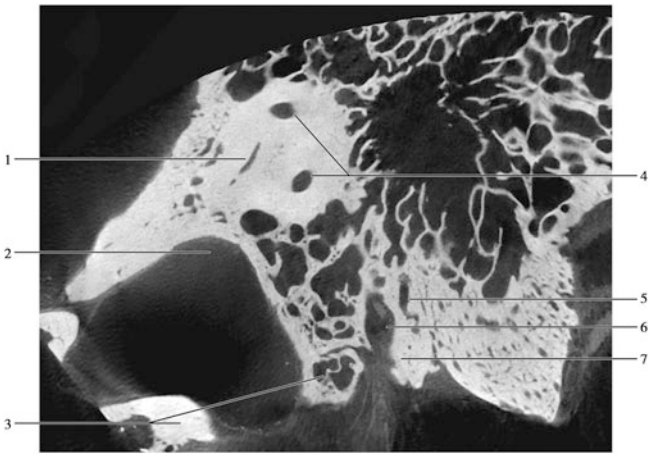

Fig. 3.97 Mastoid portion of facial nerve and posterior semicircular canal on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Styloid process

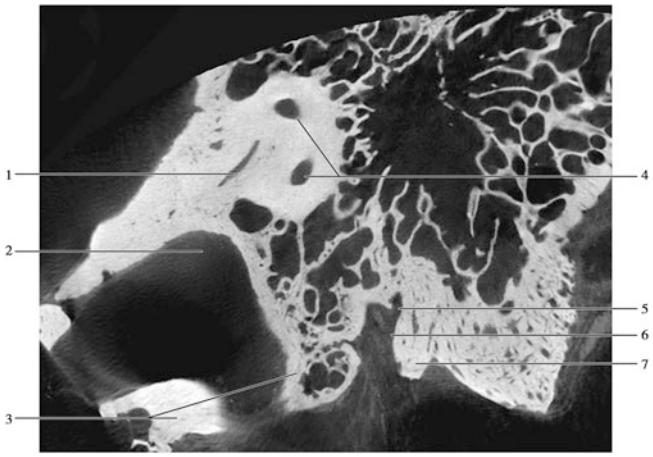

Fig. 3.99 Mastoid portion of facial nerve and posterior semicircular canal on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Styloid process

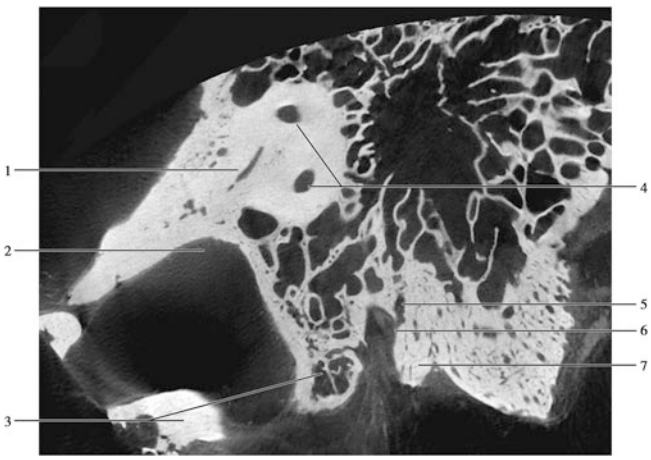

Fig. 3.98 Mastoid portion of facial nerve and posterior semicircular canal on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Styloid process

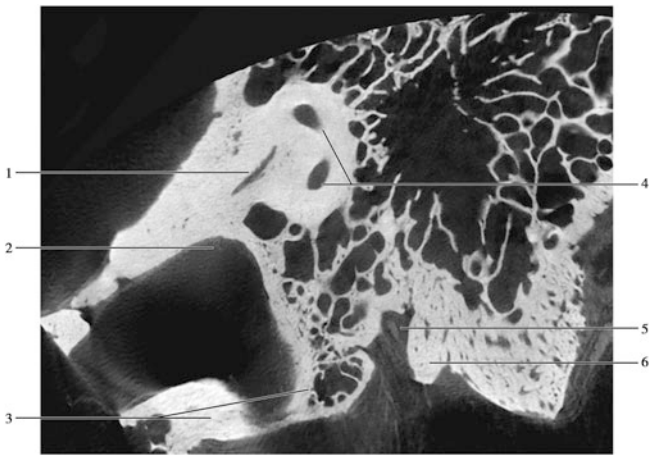

Fig. 3.100 Mastoid portion of facial nerve and posterior semicircular canal on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid portion of facial nerve. (6) Styloid process

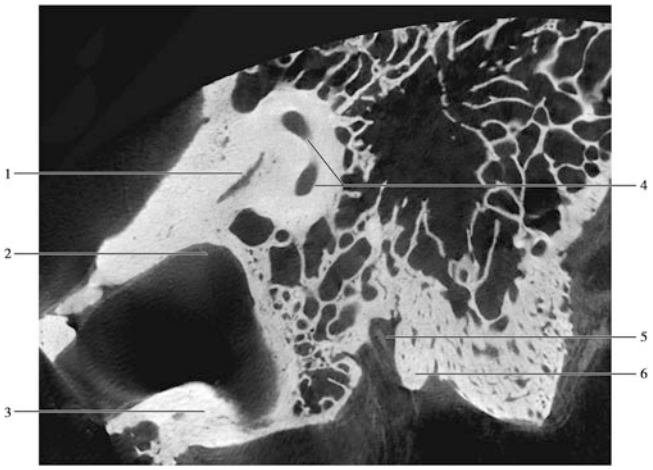

Fig. 3.101 Mastoid portion of facial nerve and posterior semicircular canal on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid portion of facial nerve. (6) Styloid process

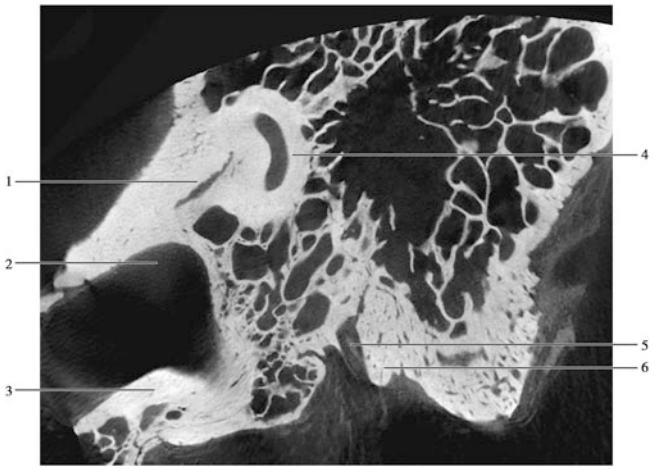

Fig. 3.103 Posterior semicircular canal and stylomastoid foramen on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Stylomastoid foramen. (6) Styloid process

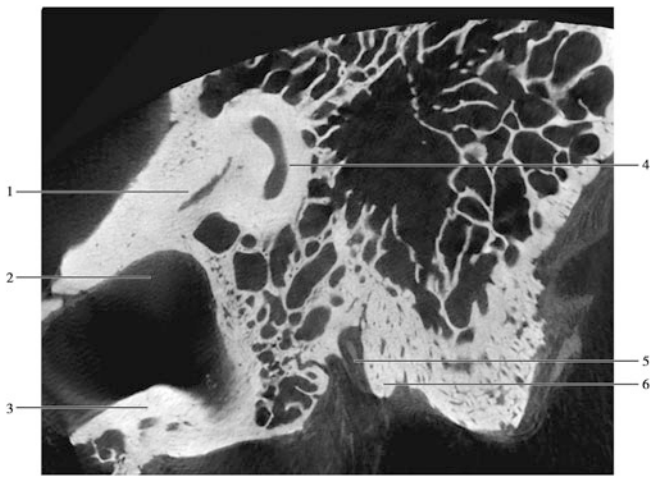

Fig. 3.102 Posterior semicircular canal and stylomastoid foramen on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Stylomastoid foramen. (6) Styloid process

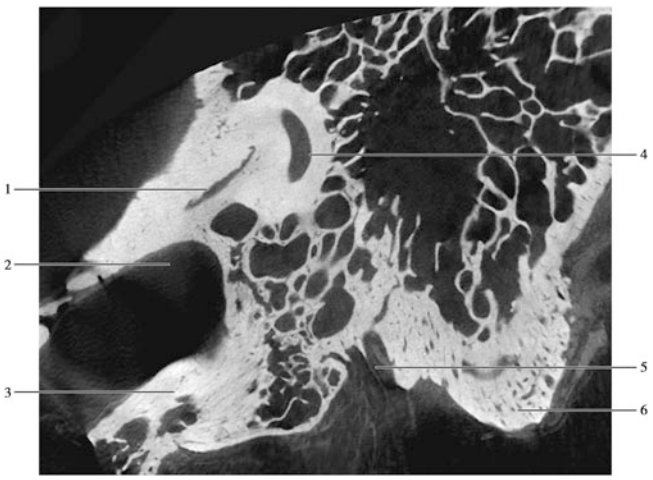

Fig. 3.104 Posterior semicircular canal and stylomastoid foramen on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Stylomastoid foramen. (6) Tip of the mastoid (mastoidale)

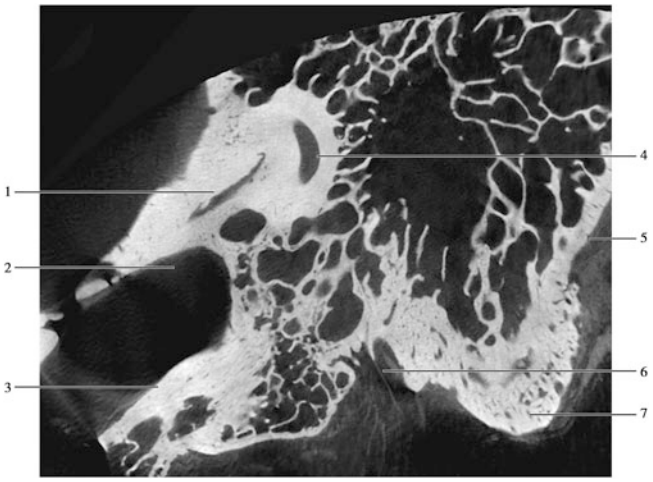

Fig. 3.105 Posterior semicircular canal and stylomastoid foramen on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid cortical bone. (6) Stylomastoid foramen. (7) Tip of the mastoid

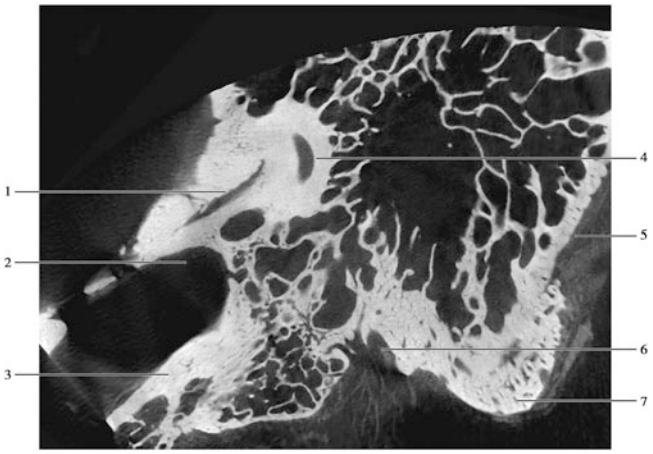

Fig. 3.106 Posterior semicircular canal and stylomastoid foramen on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid cortical bone. (6) Stylomastoid foramen. (7) Tip of the mastoid

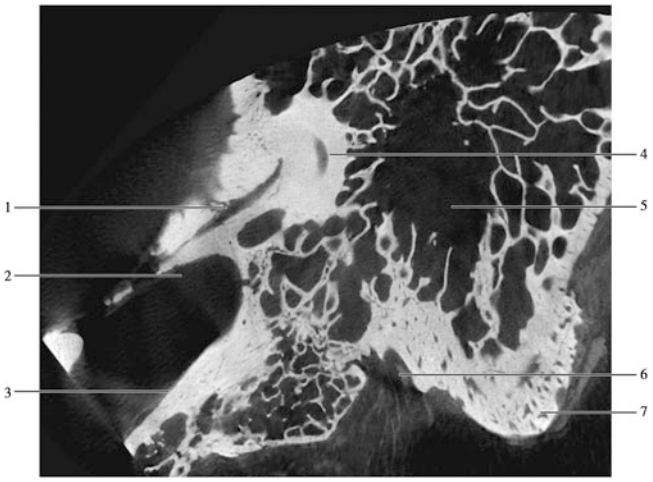

Fig. 3.107 Posterior semicircular canal and stylomastoid foramen on coronal view. (1) Vestibular aqueduct. (2) Jugular bulb. (3) Occipital bone. (4) Posterior semicircular canal. (5) Mastoid cavity. (6) Stylomastoid foramen. (7) Tip of the mastoid

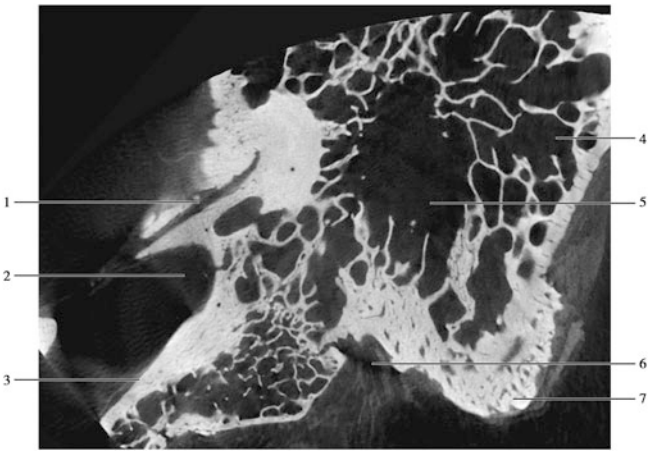

Fig. 3.108 Digastric groove on coronal view. (1) Vestibular aqueduct. (2) Jugular foramen. (3) Occipital bone. (4) Mastoid cells. (5) Mastoid cavity. (6) Digastric groove. (7) Tip of the mastoid

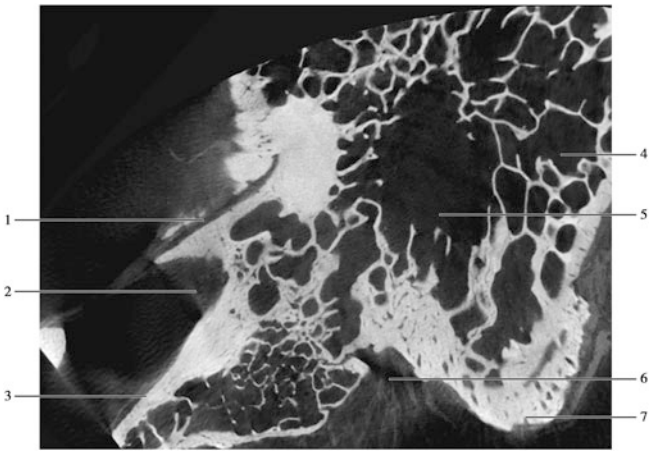

Fig. 3.109 Digastric groove on coronal view. (1) Vestibular aqueduct. (2) Sigmoid sinus. (3) Occipital bone. (4) Mastoid cells. (5) Mastoid cavity. (6) Digastric groove. (7) Tip of the mastoid

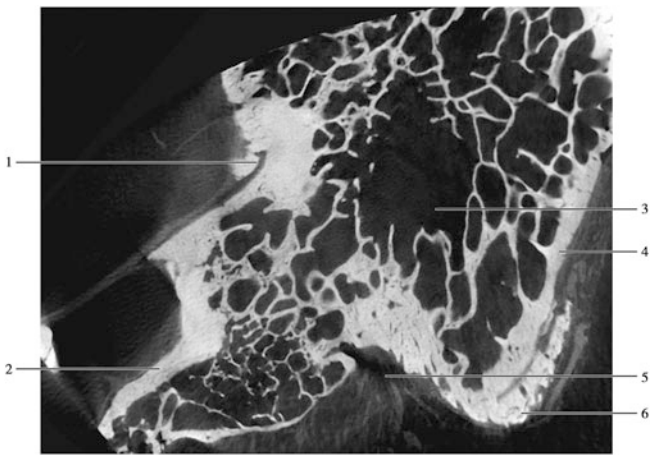

Fig. 3.110 Digastric groove on coronal view. (1) Vestibular aqueduct. (2) Occipital bone. (3) Mastoid cavity. (4) Mastoid cortical bone. (5) Digastric groove. (6) Tip of the mastoid

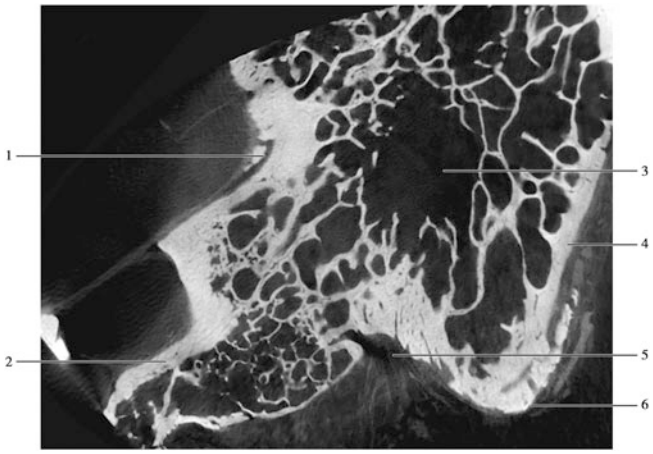

Fig. 3.111 Digastric groove on coronal view. (1) Vestibular aqueduct. (2) Occipital bone. (3) Mastoid cavity. (4) Mastoid cortical bone. (5) Digastric groove. (6) Tip of the mastoid

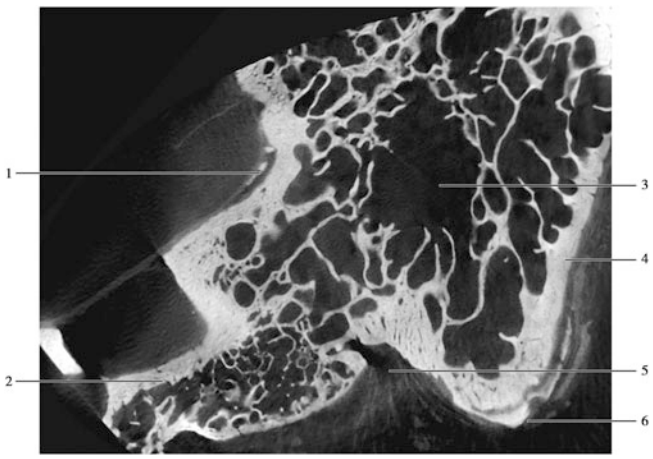

Fig. 3.112 Digastric groove on coronal view. (1) Endolymphatic sac. (2) Occipital bone. (3) Mastoid cavity. (4) Mastoid cortical bone. (5) Digastric groove. (6) Tip of the mastoid

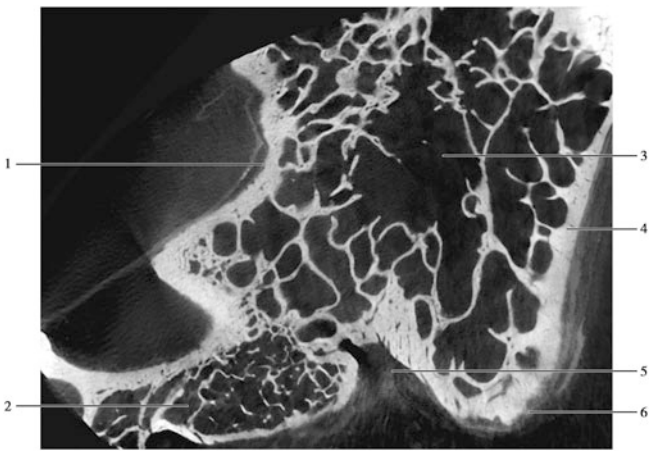

Fig. 3.113 Digastric groove on coronal view. (1) Posterior cranial fossa. (2) Occipital bone. (3) Mastoid cavity. (4) Mastoid cortical bone. (5) Digastric groove. (6) Tip of the mastoid

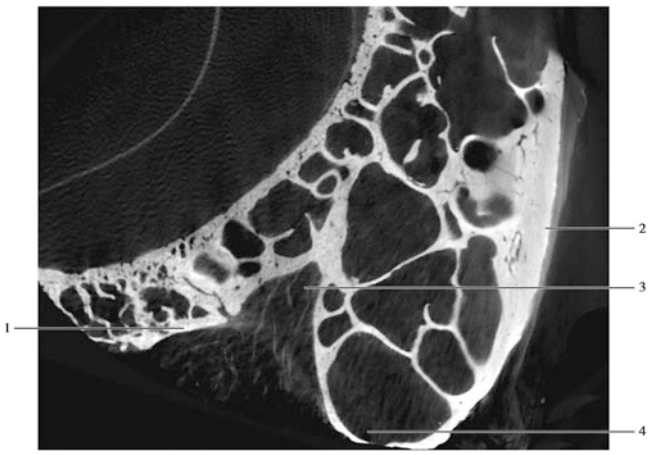

Fig. 3.115 Digastric groove on coronal view. (1) Occipital bone. (2) Mastoid cortical bone. (3) Digastric groove. (4) Tip of the mastoid

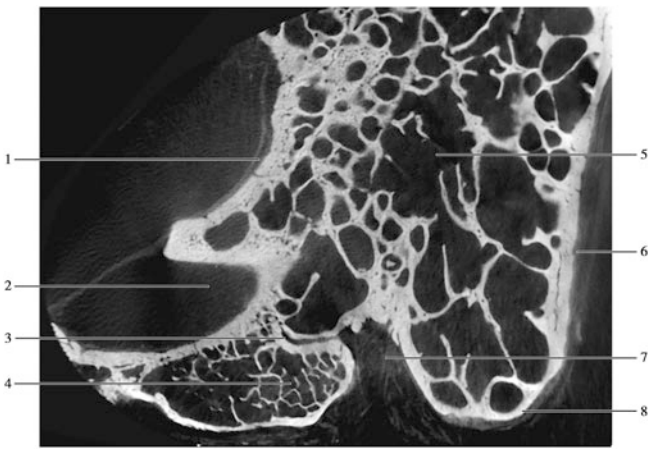

Fig. 3.114 Digastric groove on coronal view. (1) Posterior cranial fossa. (2) Sigmoid sinus. (3) Occipital-mastoid fissure. (4) Occipital bone. (5) Mastoid cavity. (6) Mastoid cortical bone. (7) Digastric groove. (8) Tip of the mastoid

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Virapongse C, Rothman SLG, Kier EL, Sarwar M (1982) Computed tomographic anatomy of the temporal bone. Am J Reontgenol 139:739–749

Two-Dimensional Reconstruction of Temporal Bone on Sagittal View

4

Zilong Yu, Luo Zhang, and Demin Han

4.1 Introduction

The temporal bone is an extremely complex structure in the body. Routine axial and coronal CT sections are quite satisfactory for imaging the anatomy of the temporal bone (Mafee et al. 1988) and the numerous ear diseases. As an important supplement, sagittal plane was found to be extremely useful for evaluating the diseases which involved the external auditory canal, tegmen tympani, infra- and supralabyrinthine air cell, sigmoid sinus plate, sinodural angle, mastoid portion of facial nerve (Mafee et al. 1988), it could also provide the fine images for the superior and inferior wall of facial canal in tympanic portion, incudomalleolar articulation, cochlear niche. Certainly, sagittal plane also owned its shortcoming in imaging the incudostapedial articulation, facial recess, stapes, vestibular window, cochlear aqueduct and fundus of internal auditory canal on one plane. Sometimes, an additional plane of section is needed to completely observe these structures (see Chaps. 5 and 6).

In this chapter, all the two-dimensional images (Figs. 4.1–4.133) were reconstructed from the left temporal bone, the scanning range was from the bony portion of the external auditory canal to the internal acoustic porus.

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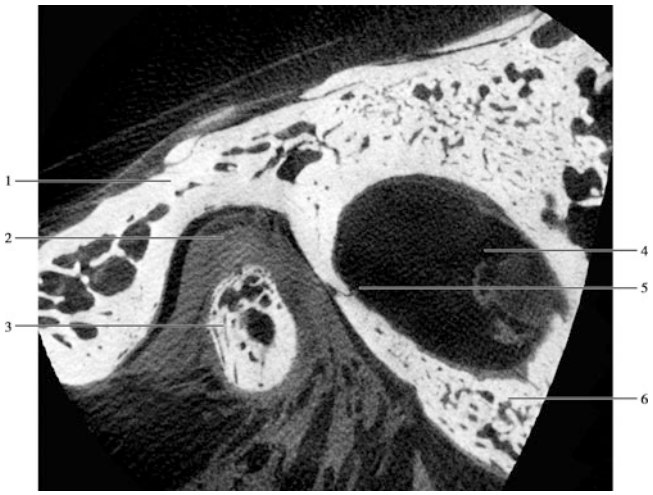

Fig. 4.1 External auditory canal on sagittal view. (1) Squamous portion of the temporal bone. (2) Temporomandibular joint. (3) Mandibular condyle. (4) External auditory canal. (5) Tympanosquamosal fissure. (6) Tympanic portion of the temporal bone (the basal wall of external auditory canal

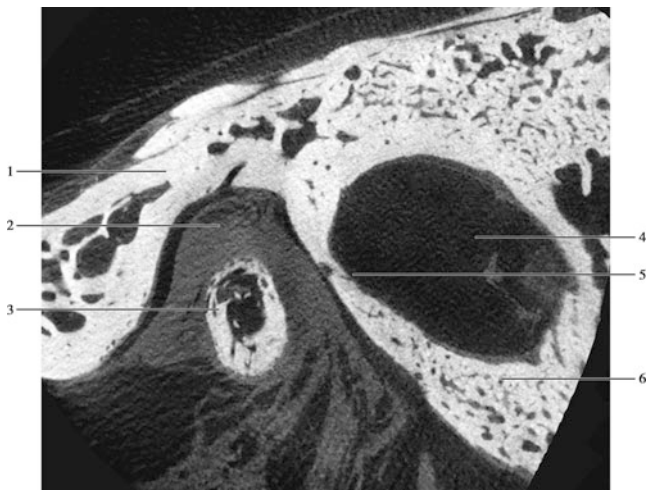

Fig. 4.2 External auditory canal on sagittal view. (1) Squamous portion of temporal bone. (2) Temporomandibular joint. (3) Mandibular condyle. (4) External auditory canal. (5) Tympanosquamosal fissure. (6) Tympanic portion of temporal bone

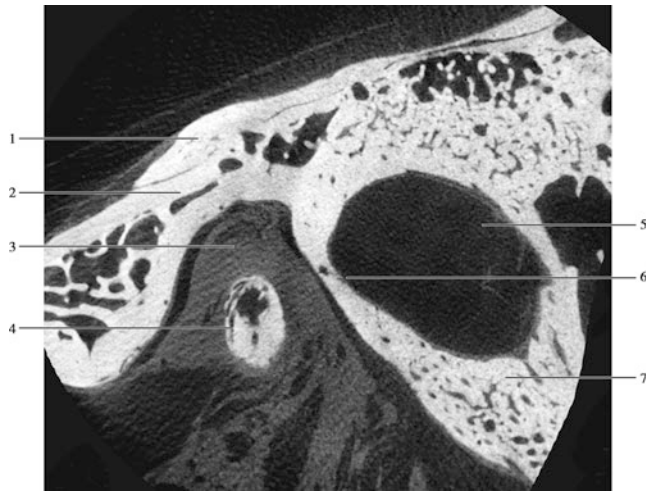

Fig. 4.3 External auditory canal on sagittal view. (1) Petrous portion of the temporal bone. (2) Squamous portion of temporal bone. (3) Temporomandibular joint. (4) Mandibular condyle. (5) External auditory canal. (6) Tympanosquamosal fissure. (7) Tympanic portion of temporal bone

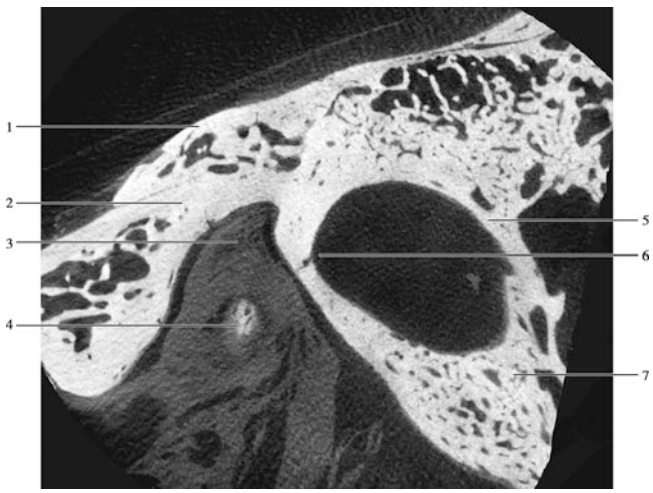

Fig. 4.4 External auditory canal on sagittal view. (1) Petrous portion of the temporal bone. (2) Squamous portion of temporal bone. (3) Temporomandibular joint. (4) Mandibular condyle. (5) External auditory canal. (6) Tympanosquamosal fissure. (7) Tympanic portion of temporal bone

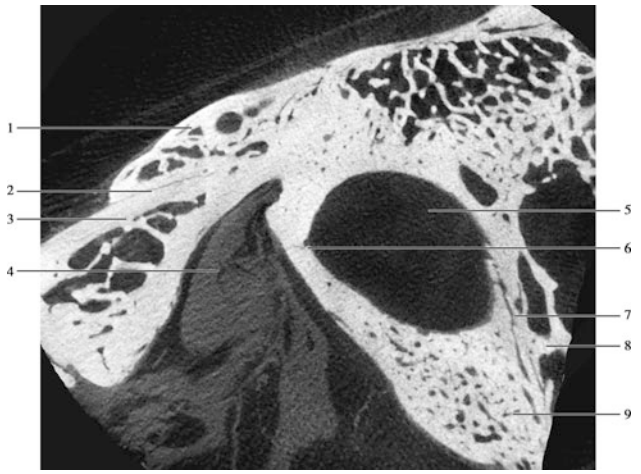

Fig. 4.5 External auditory canal on sagittal view. (1) Petrous portion of temporal bone. (2) Petrosquamosal fissure. (3) Temporal portion of temporal bone. (4) Temporomandibular joint. (5) External auditory canal. (6) Tympanosquamosal fissure. (7) Tympanomastoid fissure. (8) Mastoid portion of the temporal bone. (9) Tympanic portion of temporal bone

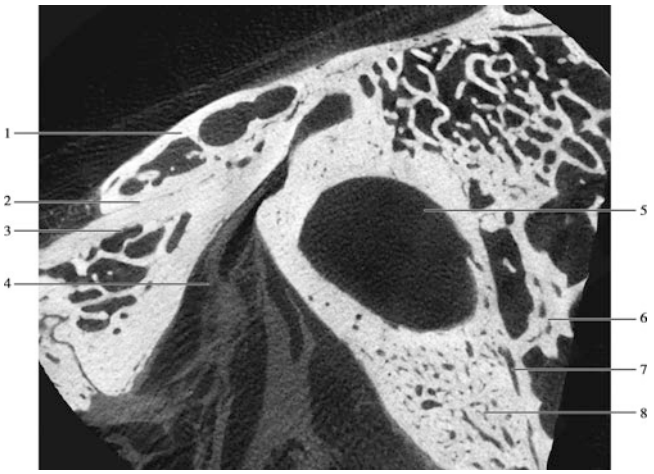

Fig. 4.7 External auditory canal on sagittal view. (1) Petrous portion. (2) Petrosquamosal fissure. (3) Temporal portion. (4) Temporomandibular joint. (5) External auditory canal. (6) Mastoid portion. (7) Tympanomastoid fissure. (8) Tympanic portion

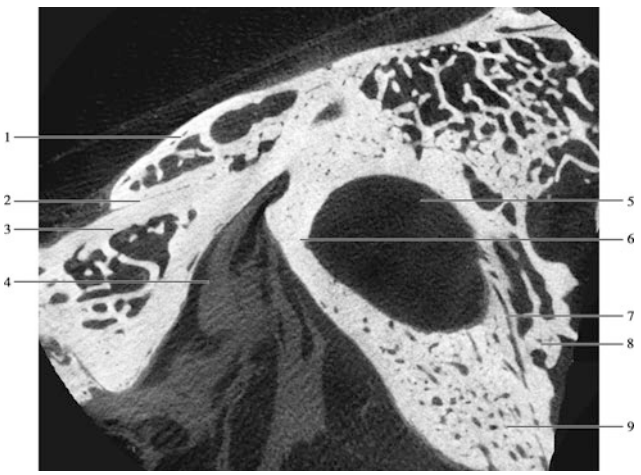

Fig. 4.6 External auditory canal on sagittal view. (1) Petrous portion of temporal bone. (2) Petrosquamosal fissure. (3) Temporal portion of temporal bone. (4) Temporomandibular joint. (5) External auditory canal. (6) Tympanosquamosal fissure. (7) Tympanomastoid fissure. (8) Mastoid portion of temporal bone. (9) Tympanic portion of temporal bone

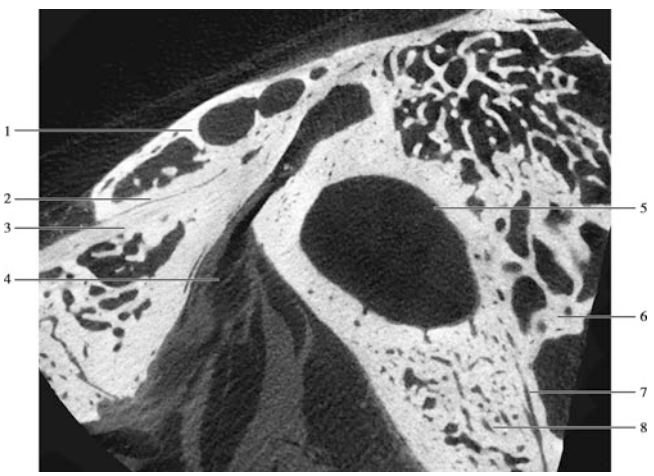

Fig. 4.8 External auditory canal on sagittal view. (1) Petrous portion. (2) Petrosquamosal fissure. (3) Temporal portion. (4) Temporomandibular joint. (5) External auditory canal. (6) Mastoid portion. (7) Tympanomastoid fissure. (8) Tympanic portion

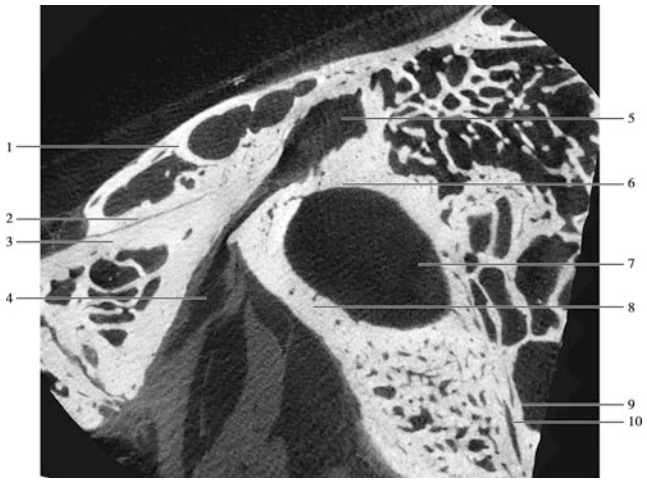

Fig. 4.9 External auditory canal on sagittal view. (1) Petrous portion of temporal bone. (2) Petrosquamosal fissure. (3) Temporal portion of temporal bone. (4) Temporomandibular joint. (5) Attic(epitympanum). (6) Scutum. (7) External auditory canal. (8) Tympanic portion of temporal bone. (9) Mastoid portion of temporal bone. (10) Tympanomastoid fissure

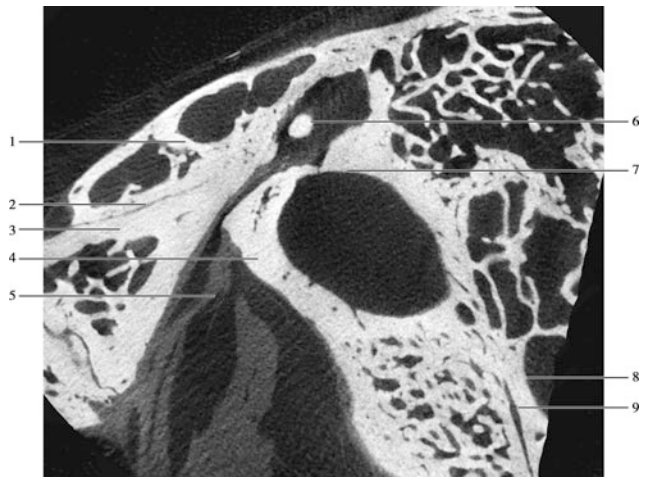

Fig. 4.10 External auditory canal and head of malleus on sagittal view. (1) Petrous portion of temporal bone. (2) Petrosquamosal fissure. (3) Temporal portion. (4) Tympanic portion. (5) Temporomandibular joint. (6) Head of the malleus. (7) Scutum. (8) Mastoid portion. (9) Tympanomastoid fissure

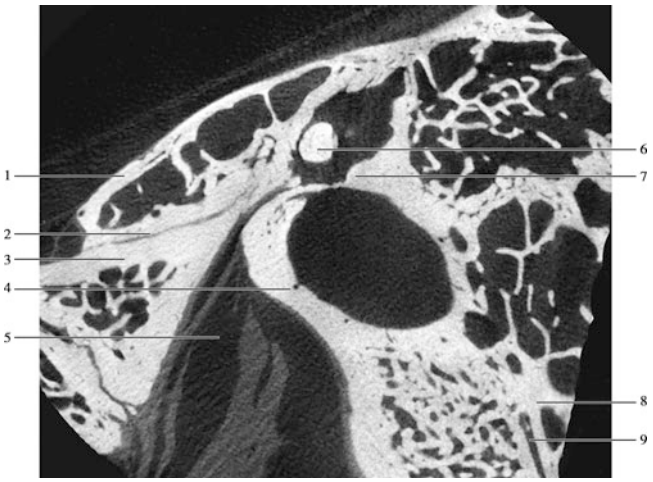

Fig. 4.11 Head of malleus on sagittal view. (1) Petrous portion of temporal bone. (2) Petrosquamosal fissure. (3) Temporal portion. (4) Tympanic portion. (5) Temporomandibular joint. (6) Head of the malleus. (7) Scutum. (8) Mastoid portion. (9) Tympanomastoid fissure

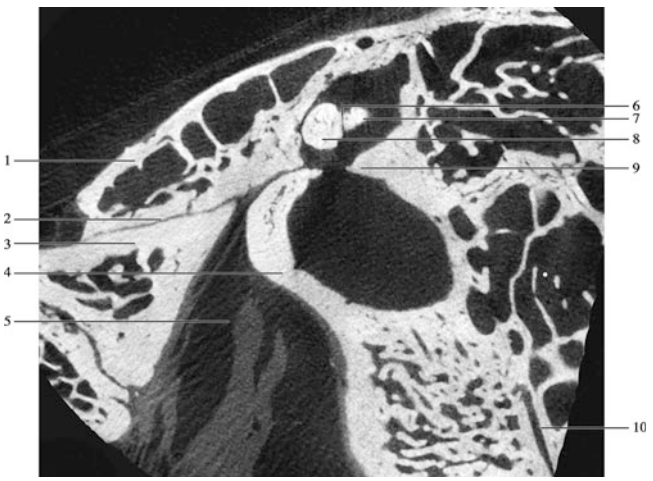

Fig. 4.12 Incudomalleolar articulation on sagittal view. (1) Petrous portion of temporal bone. (2) Petrosquamosal fissure. (3) Temporal portion. (4) Tympanic portion. (5) Temporomandibular joint. (6) Incudomalleolar articulation. (7) Body of the incus. (8) Head of the malleus. (9) Scutum. (10) Tympanomastoid fissure

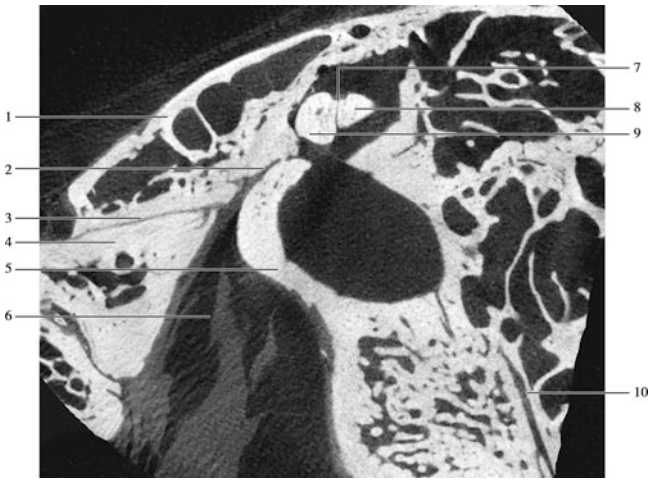

Fig. 4.13 Incudomalleolar articulation on sagittal view. (1) Petrous portion of temporal bone. (2) Petrotympanic fissure. (3) Petrosquamosal fissure. (4) Temporal portion of temporal bone. (5) Tympanic portion. (6) Temporomandibular joint. (7) Incudomalleolar articulation. (8) Body of the incus. (9) Head of the malleus. (10) Tympanomastoid fissure

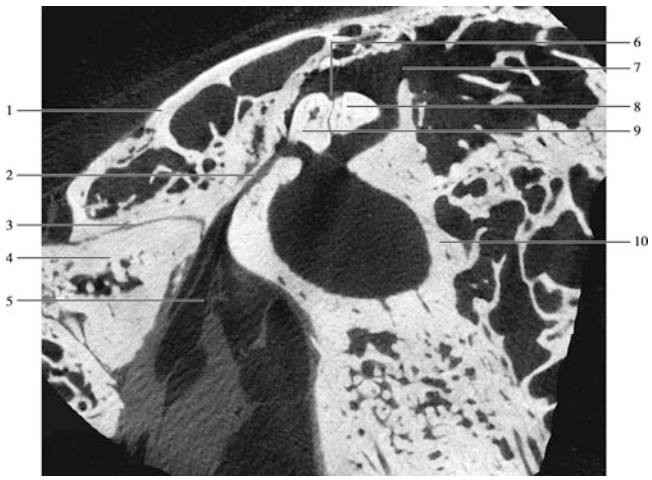

Fig. 4.14 Incudomalleolar articulation on sagittal view. (1) Petrous portion of temporal bone. (2) Petrotympanic fissure. (3) Petrosquamosal fissure. (4) Temporal portion of temporal bone. (5) Temporomandibular joint. (6) Incudomalleolar articulation. (7) Aditus ad antrum. (8) Body of the incus. (9) Head of the malleus. (10) Tympanic portion

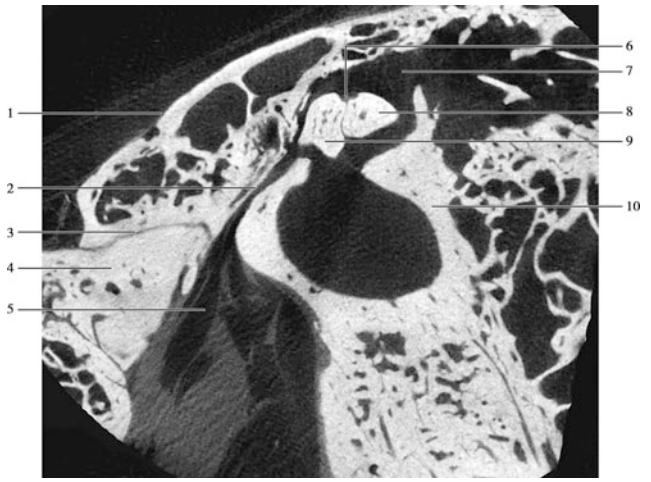

Fig. 4.15 Incudomalleolar articulation on sagittal view. (1) Petrous portion of temporal bone. (2) Petrotympanic fissure. (3) Petrosquamosal fissure. (4) Temporal portion of temporal bone. (5) Temporomandibular joint. (6) Incudomalleolar articulation. (7) Aditus ad antrum. (8) Body of the incus. (9) Head of the malleus. (10) Tympanic portion

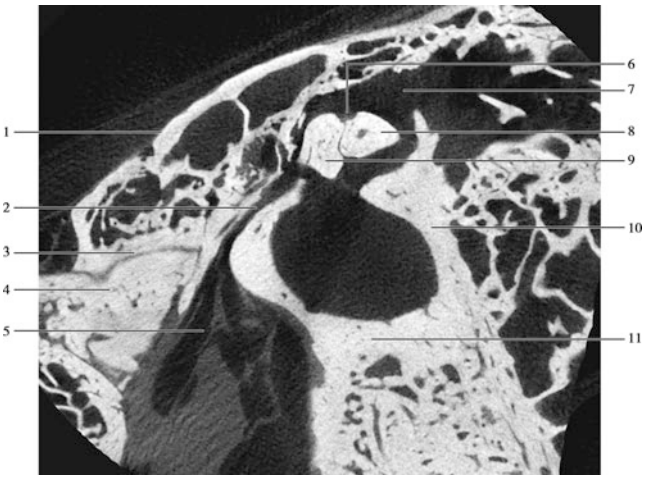

Fig. 4.16 Incudomalleolar articulation on sagittal view. (1) Petrous portion of temporal bone. (2) Petrotympanic fissure. (3) Petrosquamosal fissure. (4) Temporal portion of temporal bone. (5) Temporomandibular joint. (6) Incudomalleolar articulation. (7) Aditus ad antrum. (8) Body of the incus. (9) Head of the malleus. (10) Posterior wall of the external auditory canal. (11) Basal (inferior) wall of the external auditory canal

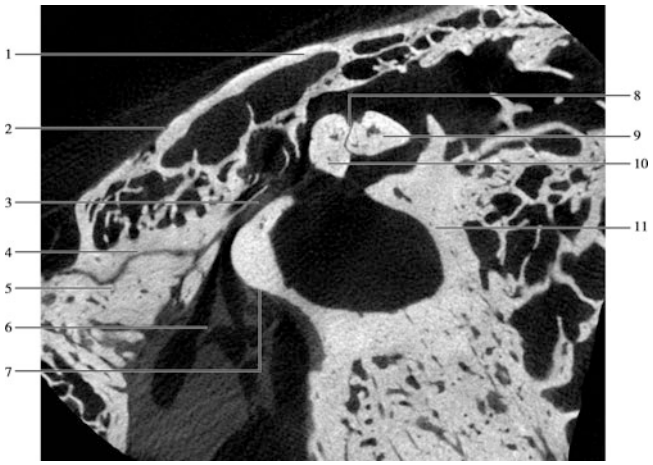

Fig. 4.17 Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Petrous portion of temporal bone. (3) Petrotympanic fissure. (4) Petrosquamosal fissure. (5) Temporal portion of temporal bone. (6) Temporomandibular joint. (7) Anterior wall of the external auditory canal/posterior wall of temporomandibular joint. (8) Incudomalleolar articulation. (9) Body of the incus. (10) Head of the malleus. (11) Posterior wall of the external auditory canal

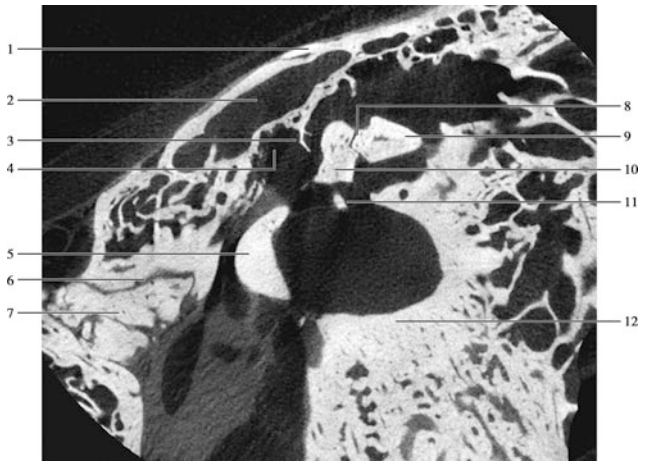

Fig. 4.19 Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Air cells in petrous portion. (3) Cog. (4) Anterior epitympanic recess. (5) Tympanic portion. (6) Petrosquamosal fissure. (7) Squamous portion of temporal bone. (8) Incudomalleolar articulation. (9) Short crus of the incus. (10) Neck of the malleus. (11) Short process of the malleus. (12) Basal wall of external auditory canal

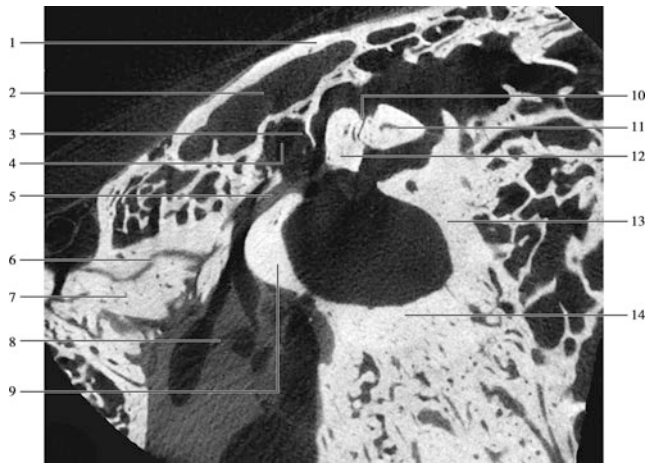

Fig. 4.18 Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Air cells in petrous portion. (3) Cog. (4) Anterior epitympanic recess. (5) Petrotympanic fissure. (6) Petrosquamosal fissure. (7) Squamous portion of temporal bone. (8) Temporomandibular joint. (9) Anterior wall of the external auditory canal. (10) Incudomalleolar articulation. (11) Body of the incus. (12) Head of the malleus. (13) Posterior wall of the external auditory canal. (14) Basal wall of external auditory canal

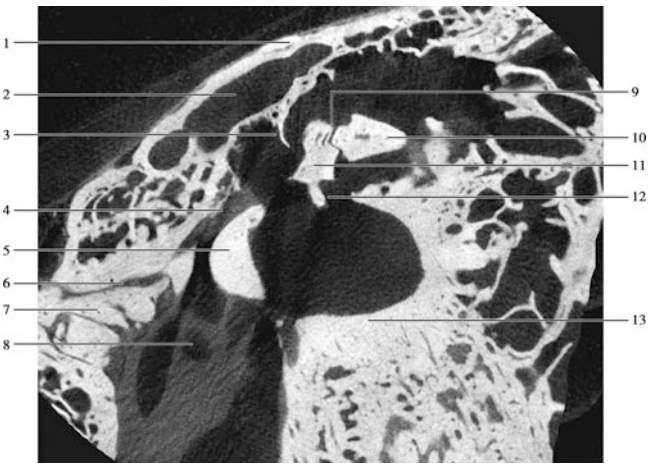

Fig. 4.20 Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Air cells in petrous portion. (3) Cog. (4) Petrotympanic fissure. (5) Tympanic portion. (6) Petrosquamosal fissure. (7) Squamous portion of temporal bone. (8) Temporomandibular joint. (9) Incudomalleolar articulation. (10) Short crus of the incus. (11) Neck of the malleus. (12) Short process of the malleus. (13) Basal wall of external auditory canal

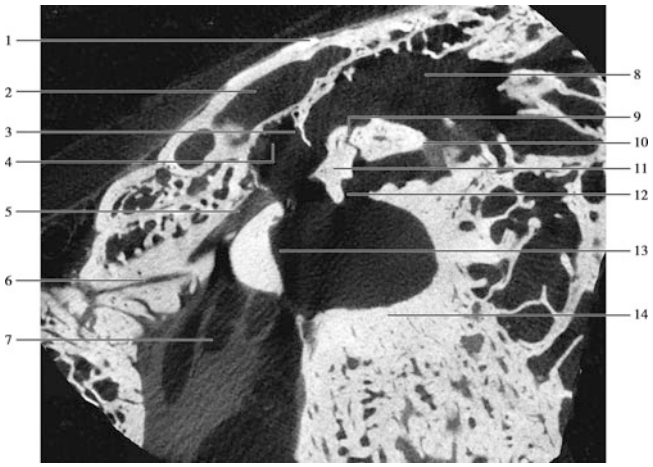

Fig. 4.21 Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Air cells in petrous portion. (3) Cog. (4) Anterior epitympanic recess. (5) Petrotympanic fissure. (6) Petrosquamosal fissure. (7) Temporomandibular joint. (8) Aditus ad antrum. (9) Incudomalleolar articulation. (10) Short crus of the incus. (11) Neck of the malleus. (12) Manubrium. (13) Anterior wall of external auditory canal. (14) Basal wall of external auditory canal

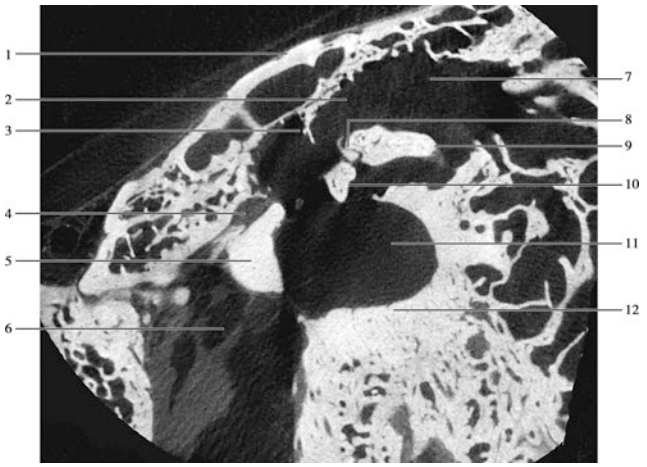

Fig. 4.23 (3) Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Cog. (4) Petrotympanic fissure. (5) Tympanic portion. (6) Temporomandibular joint. (7) Aditus ad antrum. (8) Incudomalleolar articulation. (9) Short crus of the incus. (10) Manubrium. (11) External auditory canal. (12) Basal wall of external auditory canal

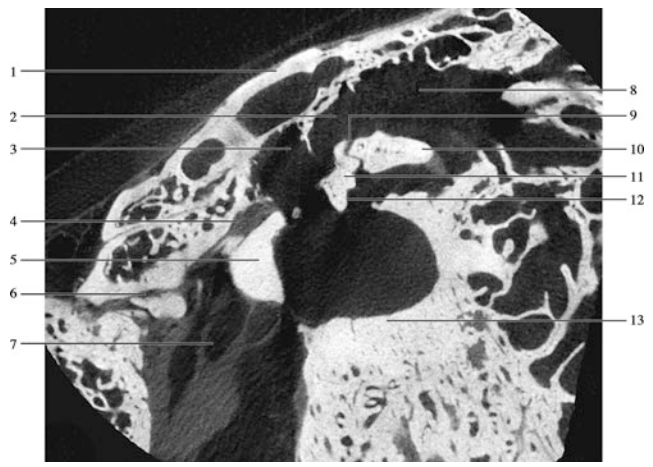

Fig. 4.22 Incudomalleolar articulation on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Anterior epitympanic recess. (4) Petrotympanic fissure. (5) Tympanic portion. (6) Petrosquamosal fissure. (7) Temporomandibular joint. (8) Aditus ad antrum. (9) Incudomalleolar articulation. (10) Short crus of the incus. (11) Neck of the malleus. (12) Manubrium. (13) Basal wall of external auditory canal

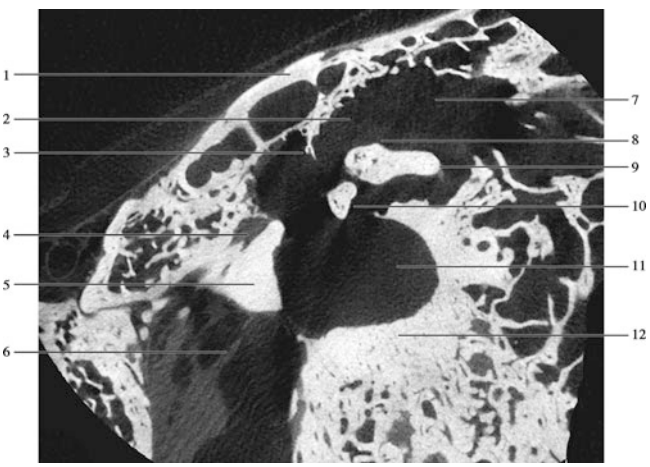

Fig. 4.24 Short crus of incus on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Cog. (4) Petrotympanic fissure. (5) Tympanic portion. (6) Temporomandibular joint. (7) Aditus ad antrum. (8) Body of the incus. (9) Short crus of the incus. (10) Manubrium. (11) External auditory canal. (12) Basal wall of external auditory canal

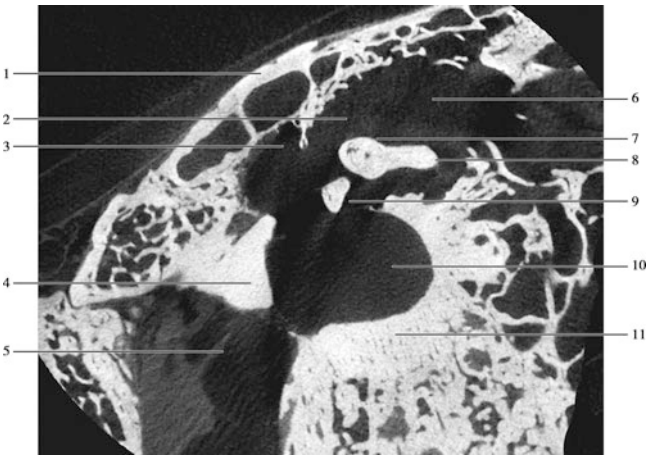

Fig. 4.25 Short crus of incus on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Anterior epitympanic recess. (4) Tympanic portion. (5) Temporomandibular joint. (6) Aditus ad antrum. (7) Body of the incus. (8) Short crus of the incus. (9) Manubrium. (10) External auditory canal. (11) Basal wall of external auditory canal

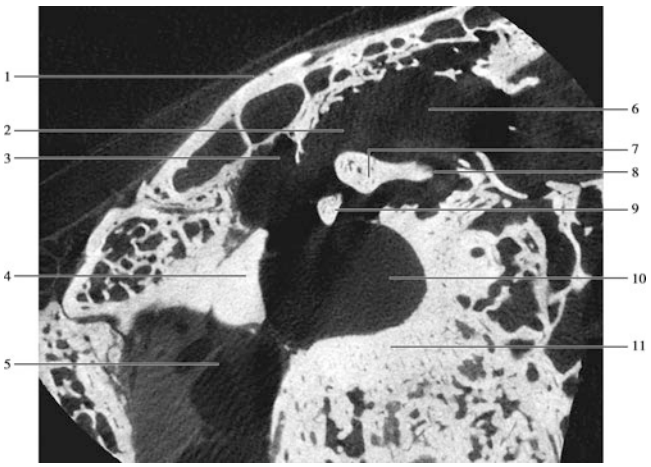

Fig. 4.26 Short crus of incus on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Anterior epitympanic recess. (4) Tympanic portion. (5) Temporomandibular joint. (6) Aditus ad antrum. (7) Body of the incus. (8) Short crus of the incus. (9) Manubrium. (10) External auditory canal. (11) Basal wall of external auditory canal

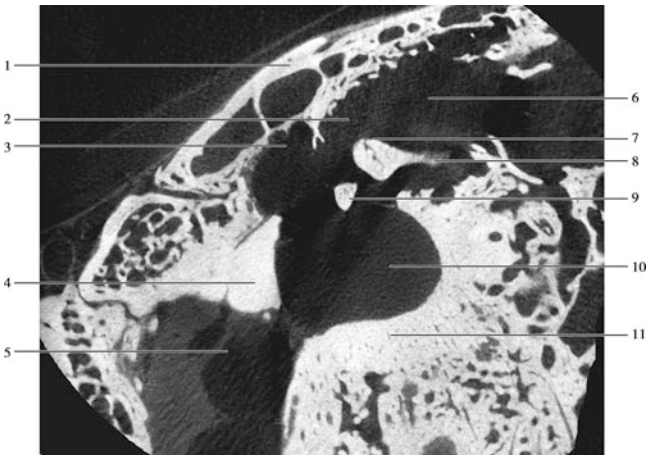

Fig. 4.27 Short crus of incus on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Anterior epitympanic recess. (4) Tympanic portion. (5) Temporomandibular joint. (6) Aditus ad antrum. (7) Body of the incus. (8) Short crus of the incus. (9) Manubrium. (10) External auditory canal. (11) Basal wall of external auditory canal

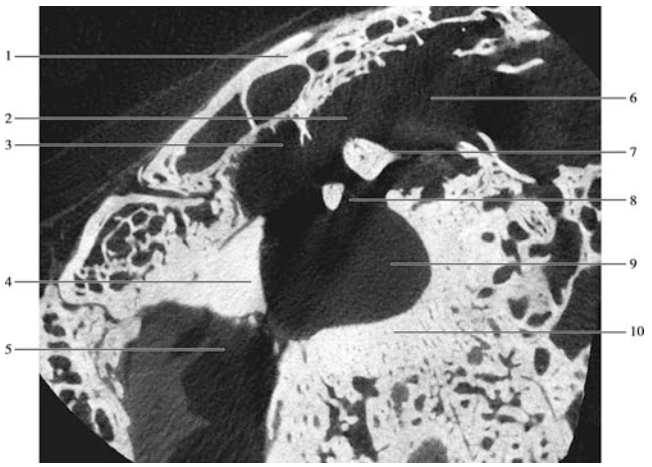

Fig. 4.28 Body of incus on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Anterior epitympanic recess. (4) Tympanic portion. (5) Temporomandibular joint. (6) Aditus ad antrum. (7) Body of the incus. (8) Manubrium. (9) External auditory canal. (10) Basal wall of external auditory canal

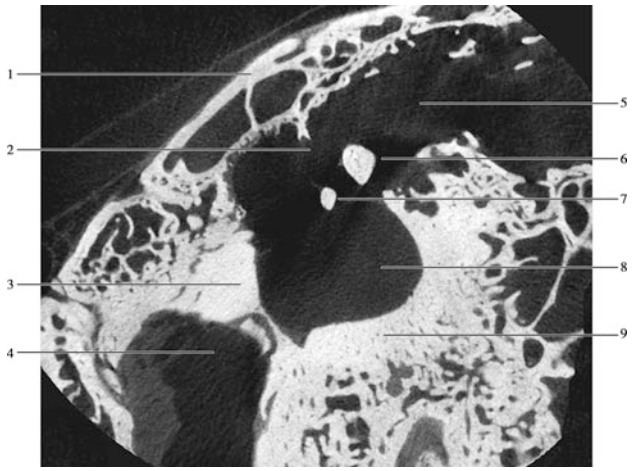

Fig. 4.29 Body of incus on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Tympanic portion (anterior wall of external auditory canal) . (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Body of the incus. (7) Manubrium. (8) External auditory canal. (9) Basal wall of external auditory canal

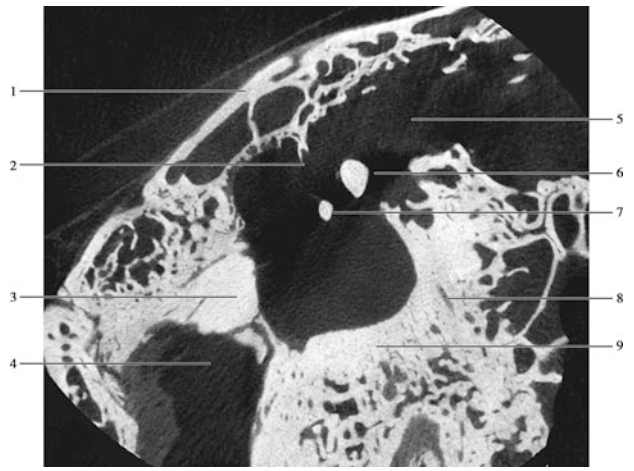

Fig. 4.30 Long crus of incus and chorda tympani nerve on sagittal view. (1) Tympanic tegmen. (2) Attic. (3) Tympanic portion. (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Manubrium. (8) Chorda tympani nerve. (9) Basal wall of external auditory canal

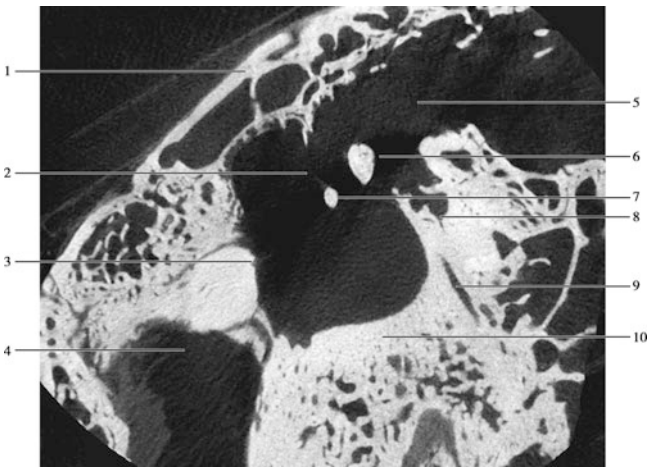

Fig. 4.31 Long crus of incus and chorda tympani nerve and facial recess on sagittal view. (1) Tympanic tegmen. (2) Mesotympanun. (3) Tympanic sulcus (anterior wall of external auditory canal) . (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Manubrium. (8) Facial recess. (9) Chorda tympani nerve. (10) Basal wall of external auditory canal

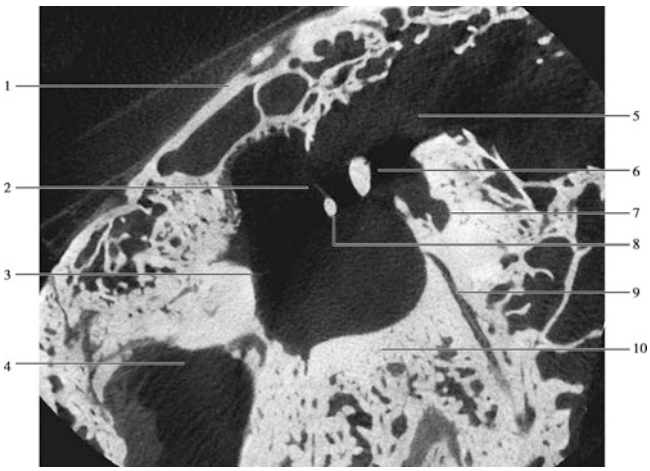

Fig. 4.32 Chorda tympani nerve and facial recess on sagittal view. (1) Tympanic tegmen. (2) Mesotympanun. (3) Tympanic sulcus. (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Facial recess. (8) Manubrium. (9) Chorda tympani nerve. (10) Basal wall of external auditory canal

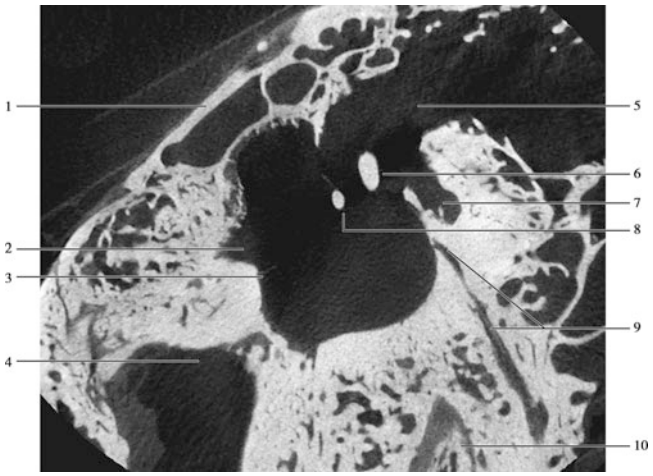

Fig. 4.33 Chorda tympani nerve and facial recess on sagittal view. (1) Tympanic tegmen. (2) Tympanic orifice of Eustachian tube. (3) Tympanic sulcus. (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Facial recess. (8) Manubrium. (9) Chorda tympani nerve. (10) Styloid process

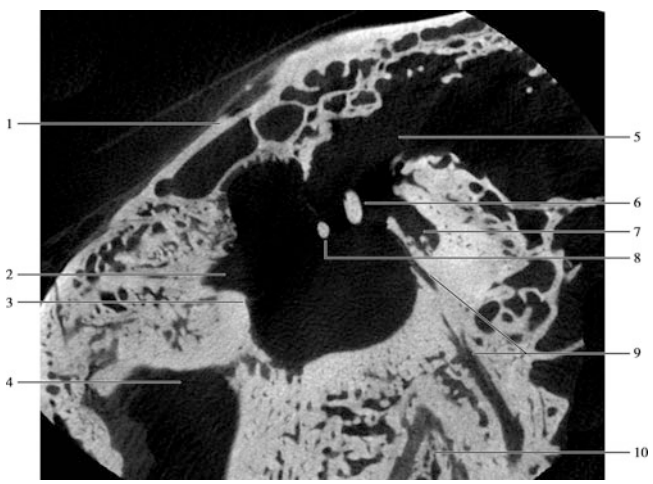

Fig. 4.34 Chorda tympani nerve and facial recess on sagittal view. (1) Tympanic tegmen. (2) Tympanic orifice of Eustachian tube. (3) Tympanic sulcus. (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Facial recess. (8) Manubrium. (9) Chorda tympani nerve. (10) Styloid process

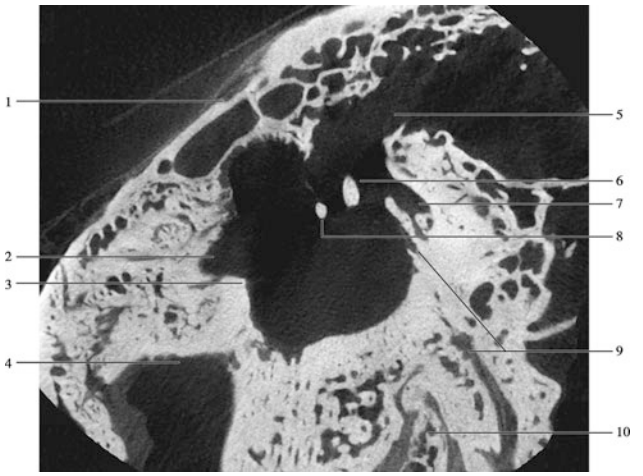

Fig. 4.35 Chorda tympani nerve and facial recess on sagittal view. (1) Tympanic tegmen. (2) Tympanic orifice of Eustachian tube. (3) Tympanic sulcus. (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Facial recess. (8) Manubrium. (9) Chorda tympani nerve. (10) Styloid process

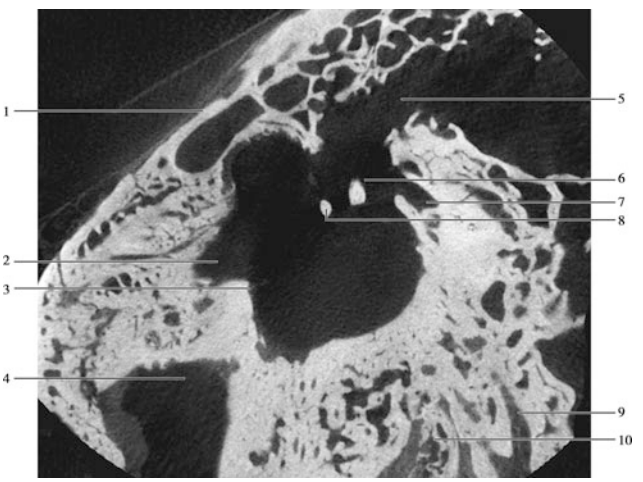

Fig. 4.36 Facial recess and long crus of incus on sagittal view. (1) Tympanic tegmen. (2) Tympanic orifice of Eustachian tube. (3) Tympanic sulcus. (4) Temporomandibular joint. (5) Aditus ad antrum. (6) Long crus of the incus. (7) Facial recess. (8) Manubrium. (9) Chorda tympani nerve. (10) Styloid process

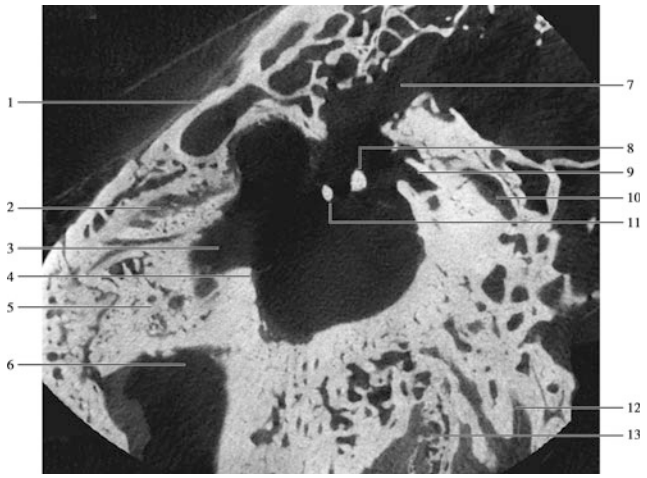

Fig. 4.37 Facial recess and long crus of incus on sagittal view. (1) Tympanic tegmen. (2) Tensor tympani muscle. (3) Eustachian tube. (4) Tympanic sulcus. (5) Tympanic portion. (6) Temporomandibular joint. (7) Aditus ad antrum. (8) Long crus of the incus. (9) Facial recess. (10) Second genu. (11) Manubrium. (12) Chorda tympani nerve. (13) Styloid process

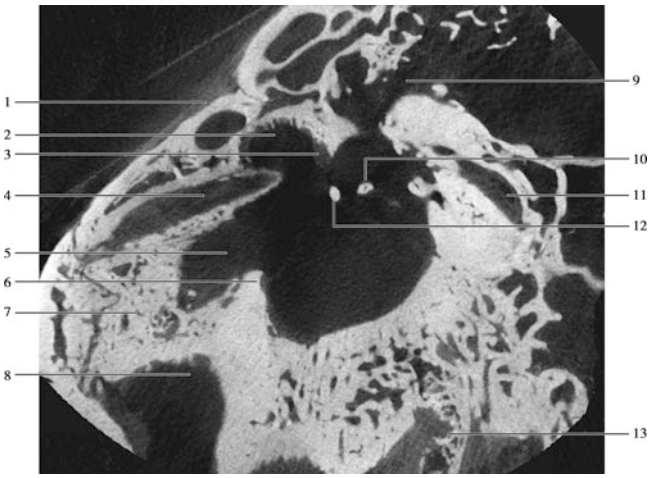

Fig. 4.39 Second genu of facial recess and lenticular process on sagittal view. (1) Tympanic tegmen. (2) Anterior epitympanic recess. (3) Processus cochleariformis. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion. (8) Temporomandibular joint. (9) Aditus ad antrum. (10) Lenticular process. (11) Second genu. (12) Manubrium. (13) Styloid process

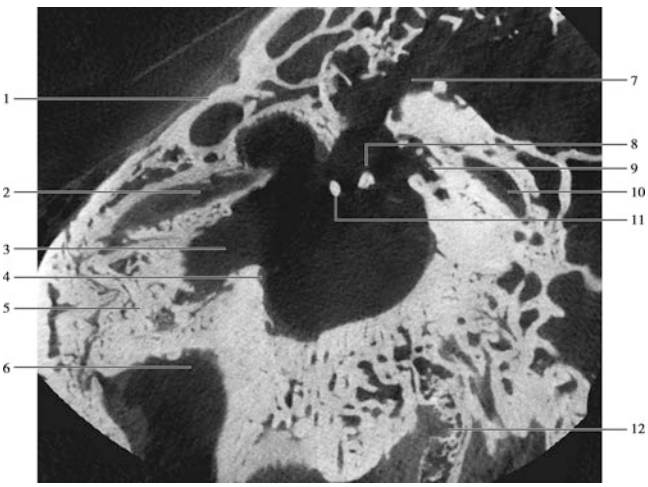

Fig. 4.38 Facial recess and long crus of incus on sagittal view. (1) Tympanic tegmen. (2) Tensor tympani muscle. (3) Eustachian tube. (4) Tympanic sulcus. (5) Tympanic portion. (6) Temporomandibular joint. (7) Aditus ad antrum. (8) Long crus of the incus. (9) Facial recess. (10) Second genu. (11) Manubrium. (12) Styloid process

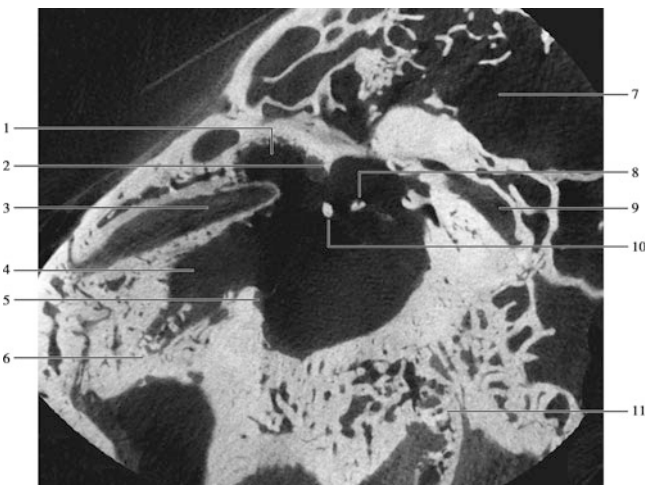

Fig. 4.40 Second genu and lenticular process on sagittal view. (1) Anterior epitympanic recess. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Antrum. (8) Lenticular process. (9) Second genu. (10) Manubrium. (11) Styloid process

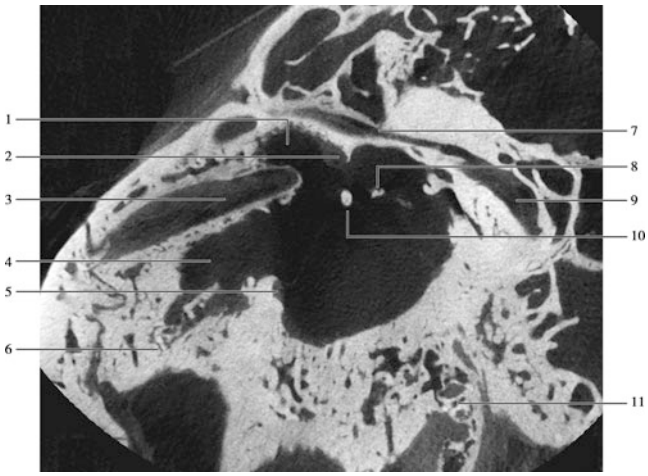

Fig. 4.41 Lenticular process and tympanic portion of facial nerve on sagittal view. (1) Anterior epitympanic recess. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Tympanic portion of facial nerve. (8) Lenticular process. (9) Second genu. (10) Manubrium. (11) Styloid process

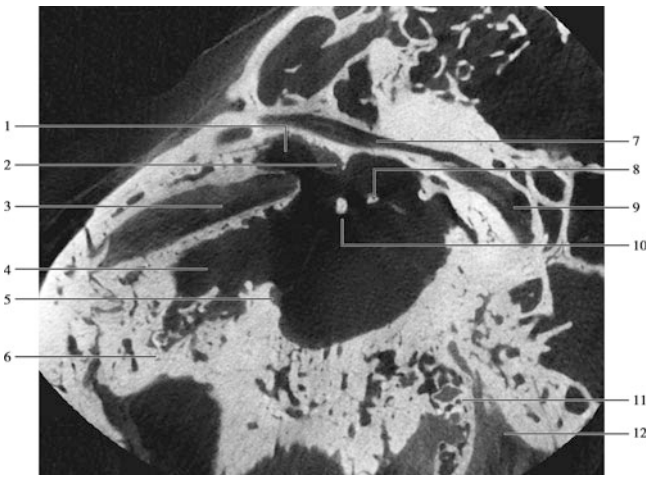

Fig. 4.42 Lenticular process and tympanic portion of facial nerve on sagittal view. (1) Anterior epitympanic recess. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Tympanic portion of facial nerve. (8) Lenticular process. (9) Second genu. (10) Manubrium. (11) Styloid process. (12) Stylomastoid foramen

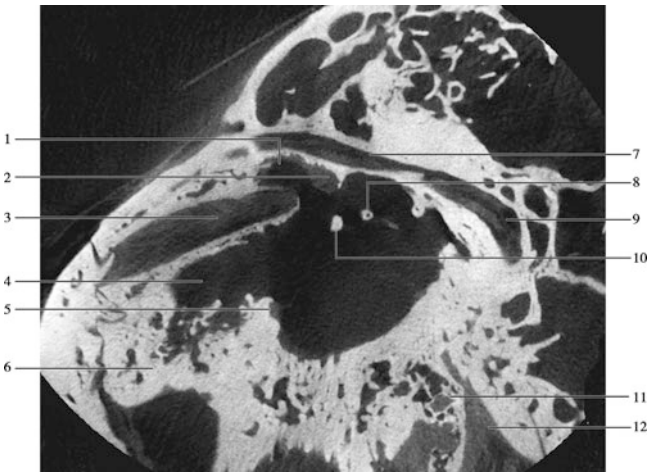

Fig. 4.43 Lenticular process and tympanic portion of facial nerve on sagittal view. (1) Anterior epitympanic recess. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Tympanic portion of facial nerve. (8) Lenticular process. (9) Second genu. (10) Manubrium. (11) Styloid process. (12) Stylomastoid foramen

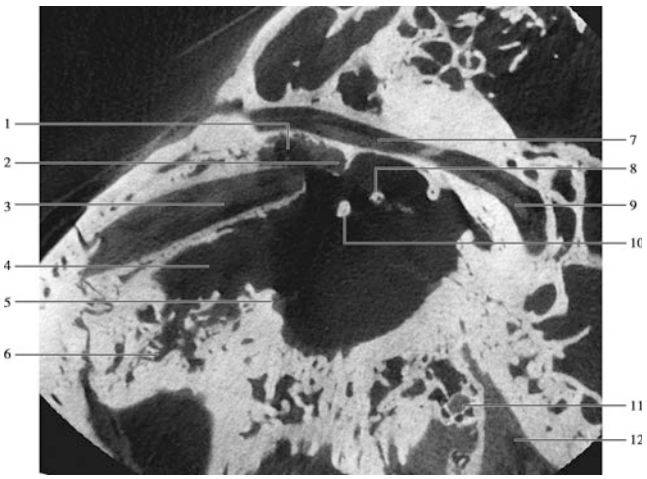

Fig. 4.44 Lenticular process and tympanic portion of facial nerve on sagittal view. (1) Anterior epitympanic recess. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Tympanic portion of facial nerve. (8) Lenticular process. (9) Second genu. (10) Manubrium. (11) Styloid process. (12) Stylomastoid foramen

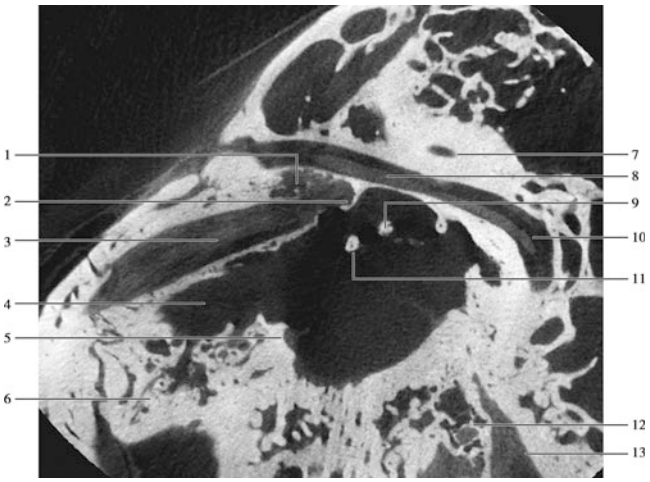

Fig. 4.45 Lenticular process and tympanic portion of facial nerve on sagittal view. (1) Anterior epitympanic recess. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Lenticular process. (10) Second genu. (11) Manubrium. (12) Styloid process. (13) Stylomastoid foramen

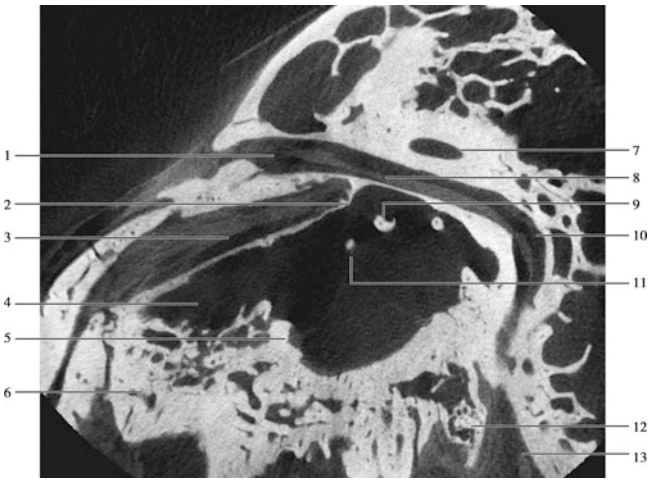

Fig. 4.47 Incudostapedial articulation and tympanic portion of facial nerve on sagittal view. (1) Geniculate ganglion. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Incudostapedial articulation. (10) Second genu. (11) Umbo. (12) Styloid process. (13) Stylomastoid foramen

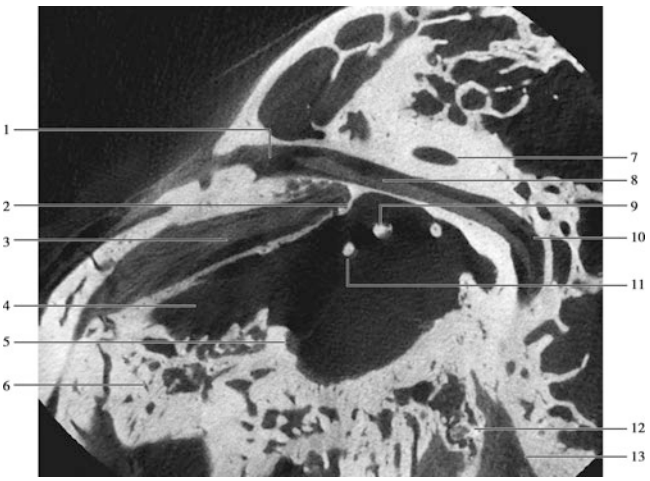

Fig. 4.46 Incudostapedial articulation and tympanic portion of facial nerve on sagittal view. (1) Geniculate ganglion. (2) Processus cochleariformis. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Incudostapedial articulation. (10) Second genu. (11) Manubrium. (12) Styloid process. (13) Stylomastoid foramen

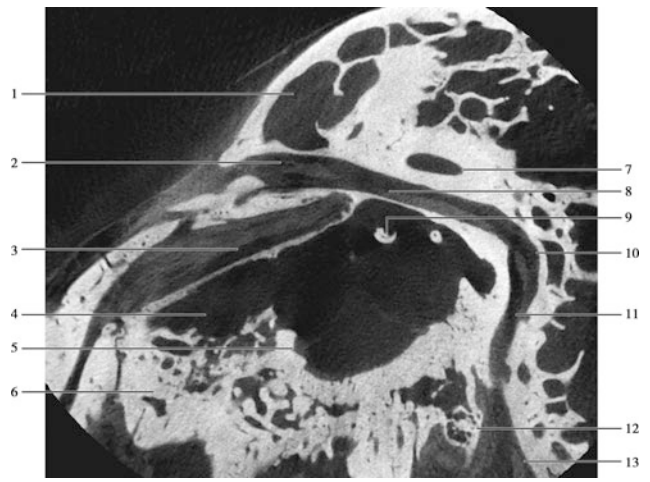

Fig. 4.48 Head of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior supralabyrinthine cells. (2) Geniculate ganglion. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Head of the stapes. (10) Second genu. (11) Mastoid portion of facial nerve. (12) Styloid process. (13) Stylomastoid foramen

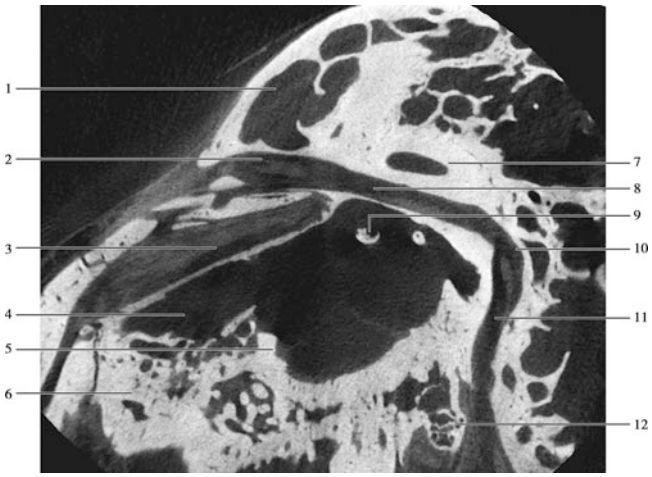

Fig. 4.49 Head of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior supralabyrinthine cells. (2) Geniculate ganglion. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Head of the stapes. (10) Second genu. (11) Mastoid portion of facial nerve. (12) Styloid process

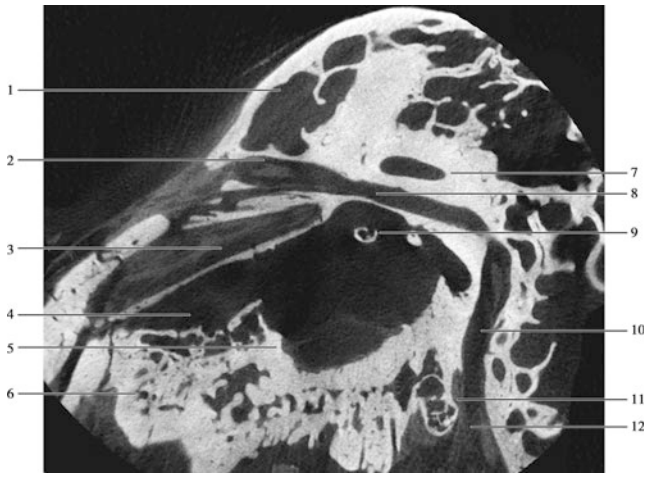

Fig. 4.51 Head of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior supralabyrinthine air cells. (2) Geniculate ganglion. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Head of the stapes. (10) Mastoid portion of facial nerve. (11) Styloid process. (12) Stylomastoid foramen

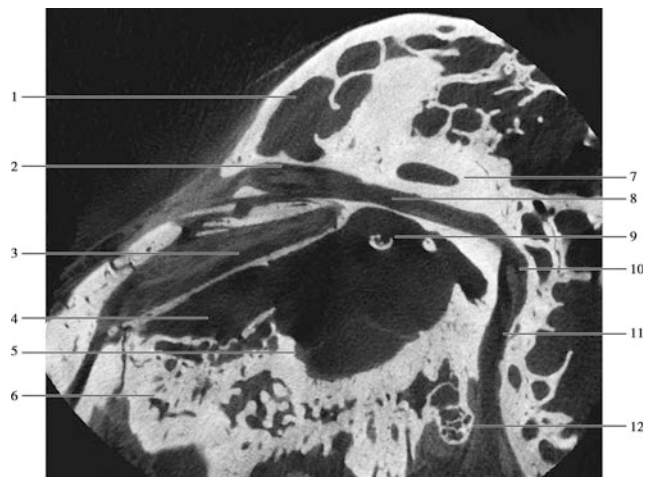

Fig. 4.50 Head of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior supralabyrinthine cells. (2) Geniculate ganglion. (3) Tensor tympani muscle. (4) Eustachian tube. (5) Tympanic sulcus. (6) Tympanic portion. (7) Lateral semicircular canal. (8) Tympanic portion of facial nerve. (9) Head of the stapes. (10) Second genu. (11) Mastoid portion of facial nerve. (12) Styloid process

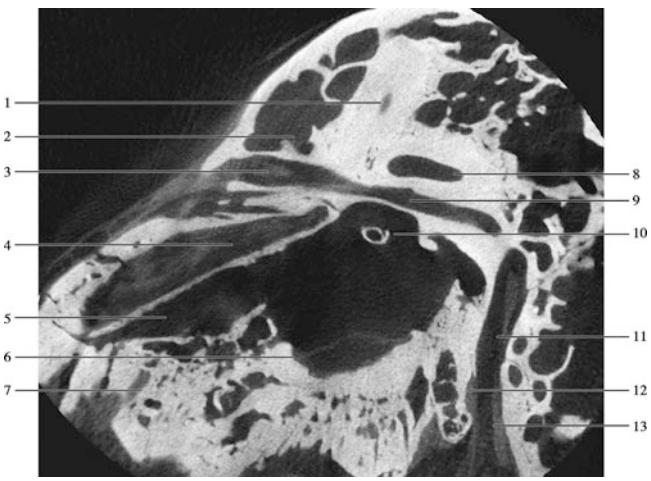

Fig. 4.52 Head of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) Head of the stapes. (11) Mastoid portion of facial nerve. (12) Styloid process. (13) Stylomastoid foramen

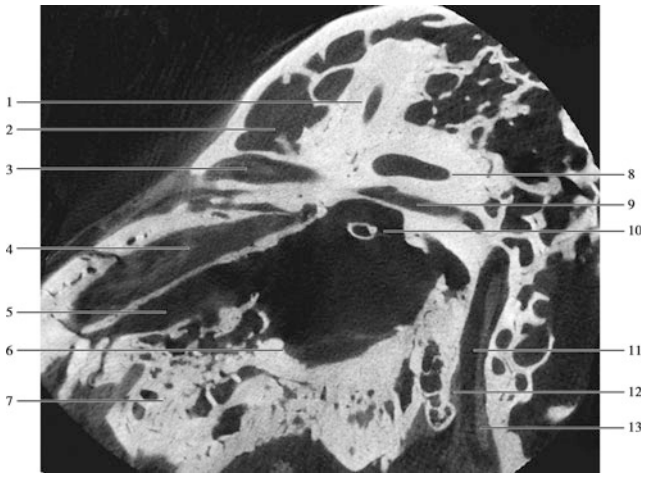

Fig. 4.53 Head of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion of temporal bone. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) Head of the stapes. (11) Mastoid portion of facial nerve. (12) Styloid process. (13) Stylomastoid foramen

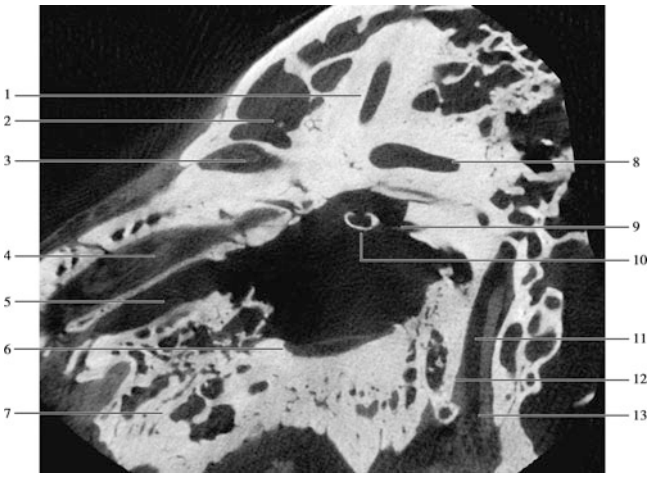

Fig. 4.55 Neck of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion of temporal bone. (8) Lateral semicircular canal. (9) Pyramidal eminence and stapedius muscle. (10) Neck of the stapes. (11) Mastoid portion of facial nerve. (12) Styloid process. (13) Stylomastoid foramen

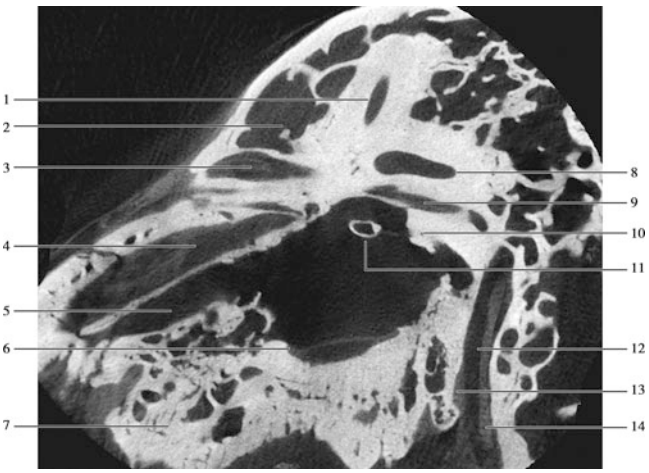

Fig. 4.54 Neck of stapes and tympanic portion of facial nerve on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion of temporal bone. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) pyramidal eminence. (11) Neck of the stapes. (12) Mastoid portion of facial nerve. (13) Styloid process. (14) Stylomastoid foramen

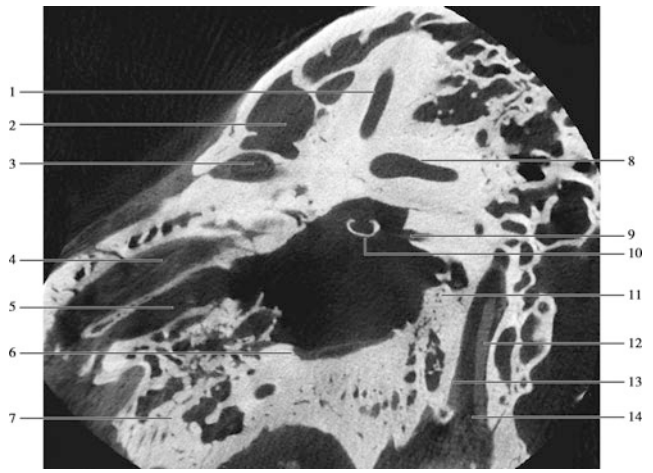

Fig. 4.56 Neck of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion of temporal bone. (8) Lateral semicircular canal. (9) Pyramidal eminence and stapedius muscle. (10) Neck of the stapes. (11) Ridge of styloid process. (12) Mastoid portion of facial nerve. (13) Styloid process. (14) Stylomastoid foramen

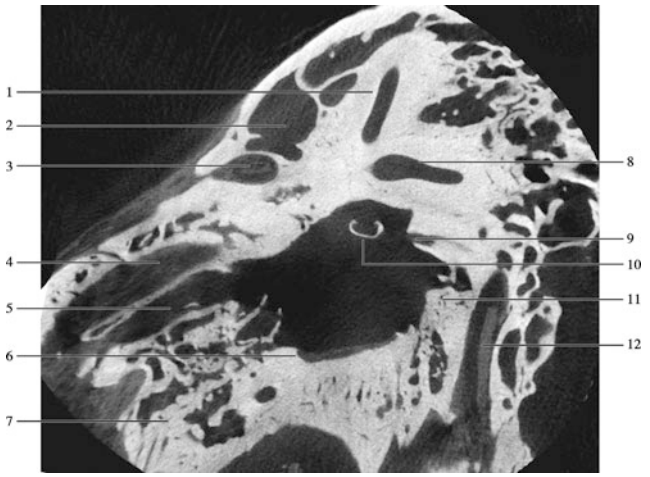

Fig. 4.57 Neck of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion of temporal bone. (8) Lateral semicircular canal. (9) Pyramidal eminence and stapedius muscle. (10) Neck of the stapes. (11) Ridge of styloid process. (12) Mastoid portion of facial nerve

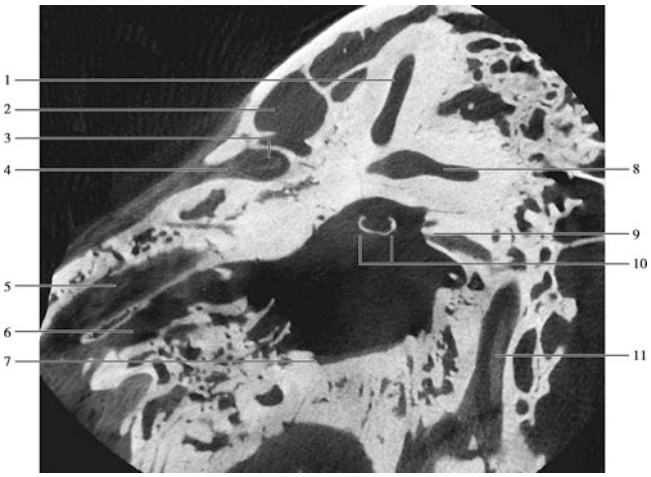

Fig. 4.59 Crura of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Greater superficial petrosal nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Tympanic sulcus. (8) Lateral semicircular canal. (9) Pyramidal eminence and stapedius muscle. (10) Crura of the stapes. (11) Mastoid portion of facial nerve

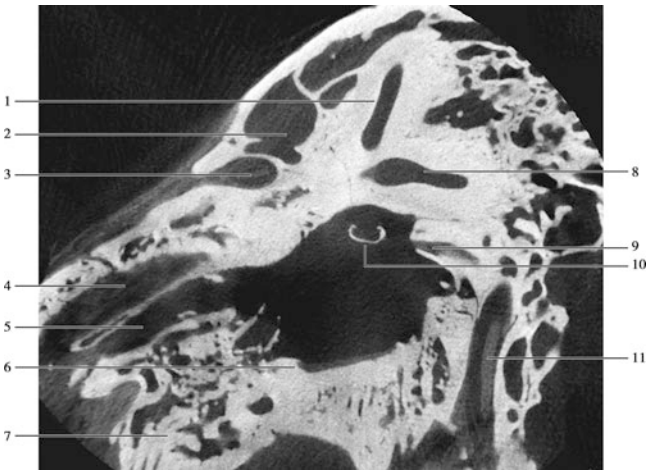

Fig. 4.58 Neck of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Tympanic sulcus. (7) Tympanic portion of temporal bone. (8) Lateral semicircular canal. (9) Pyramidal eminence and stapedius muscle. (10) Neck of the stapes. (11) Mastoid portion of facial nerve

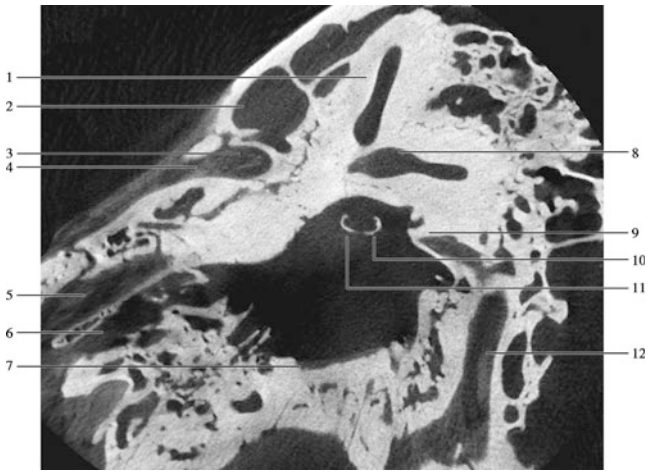

Fig. 4.60 Crura of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Greater superficial petrosal nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Tympanic sulcus. (8) Lateral semicircular canal. (9) Pyramidal eminence and stapedius muscle. (10) Anterior crus of the stapes. (11) Posterior crus of the stapes. (12) Mastoid portion of facial nerve

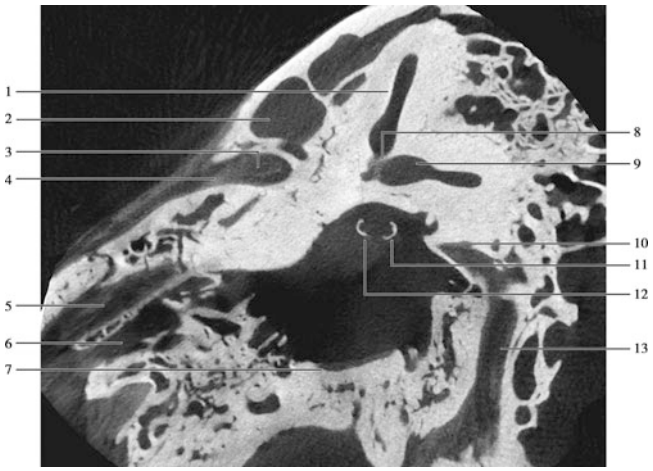

Fig. 4.61 Crura of stapes on sagittal view. (1) Anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Greater superficial petrosal nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Tympanic sulcus. (8) Superior vestibular nerve. (9) Ampulla of lateral semicircular canal. (10) Pyramidal eminence and stapedius muscle. (11) Posterior crus of the stapes. (12) Anterior crus of the stapes. (13) Mastoid portion of facial nerve

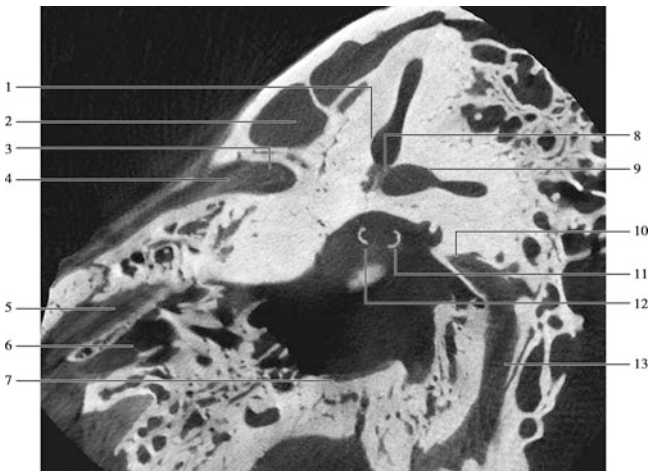

Fig. 4.62 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Greater superficial petrosal nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Tympanic sulcus. (8) Superior vestibular nerve. (9) Ampulla of lateral semicircular canal. (10) Stapedius muscle. (11) Posterior crus of the stapes. (12) Anterior crus of the stapes. (13) Mastoid portion of facial nerve

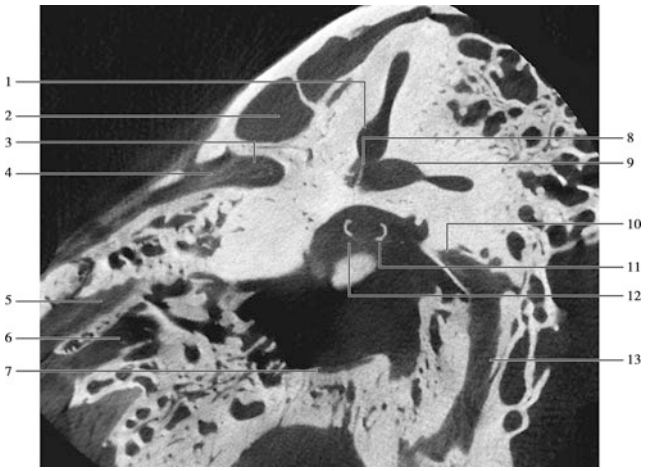

Fig. 4.63 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Anterior supralabyrinthine air cells. (3) Geniculate ganglion. (4) Greater superficial petrosal nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Tympanic sulcus. (8) Superior vestibular nerve. (9) Ampulla of lateral semicircular canal. (10) Stapedius muscle. (11) Posterior crus of the stapes. (12) Anterior crus of the stapes. (13) Mastoid portion of facial nerve

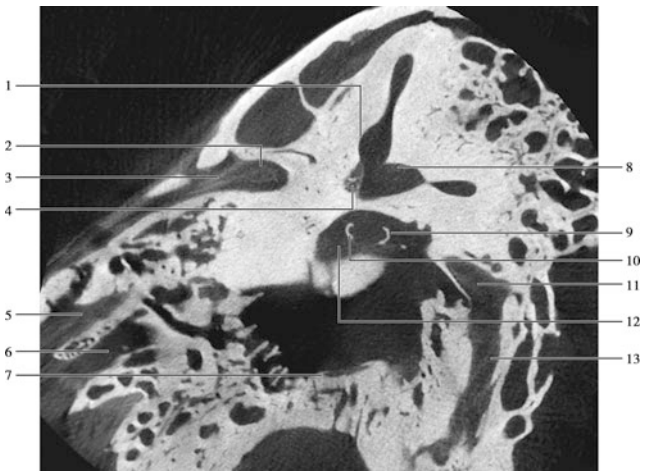

Fig. 4.64 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Geniculate ganglion. (3) Greater superficial petrosal nerve. (4) Superior vestibular nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Tympanic sulcus. (8) Ampulla of lateral semicircular canal. (9) Posterior crus of the stapes. 10Anterior crus of the stapes. (11) Stapedius muscle. (12) Vestibular window niche. (13) Mastoid portion of facial nerve

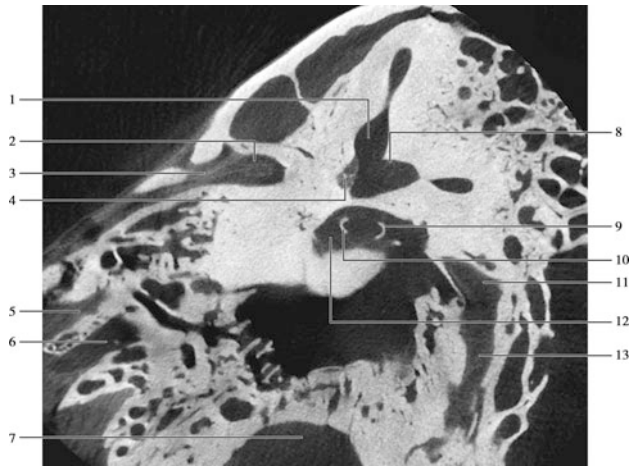

Fig. 4.65 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Geniculate ganglion. (3) Greater superficial petrosal nerve. (4) Superior vestibular nerve. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Jugular bulb. (8) Ampulla of lateral semicircular canal. (9) Posterior crus of the stapes. (10) AnteriorcCrus of the stapes. (11) Stapedius muscle. (12) Vestibular window niche. (13) Mastoid portion of facial nerve

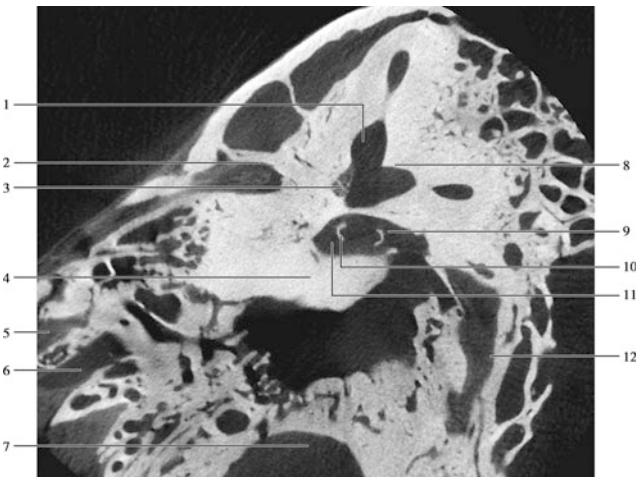

Fig. 4.66 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Promontory. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Jugular bulb. (8) Ampulla of lateral semicircular canal. (9) Posterior crus of the stapes. (10) Anterior crus of the stapes. (11) Vestibular window niche. (12) Stapedius muscle

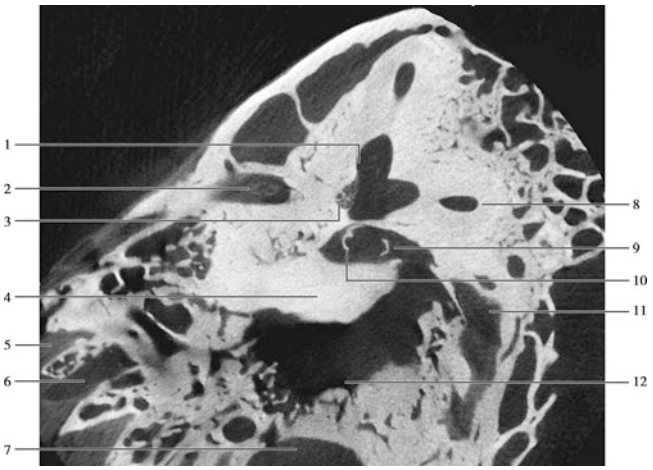

Fig. 4.67 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Promontory. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Jugular bulb. (8) Lateral semicircular canal. (9) Posterior crus of the stapes. (10) Anterior crus of the stapes. (11) Stapedius muscle. (12) Hypotympanum

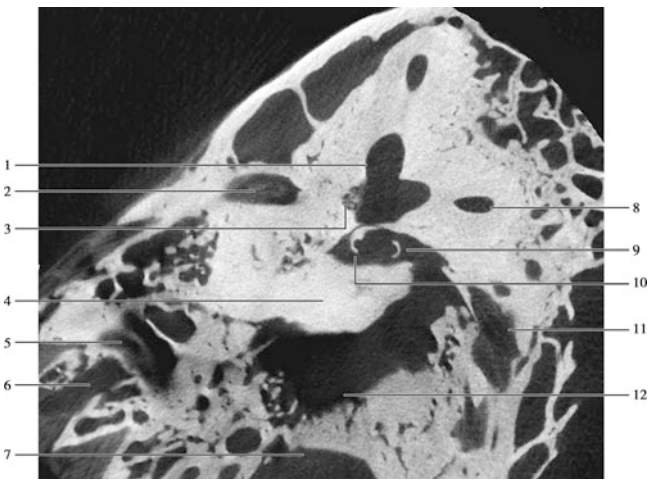

Fig. 4.68 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Promontory. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Jugular bulb. (8) Lateral semicircular canal. (9) Posterior crus of the stapes. (10) Anterior crus of the stapes. (11) Stapedius muscle. (12) Hypotympanum

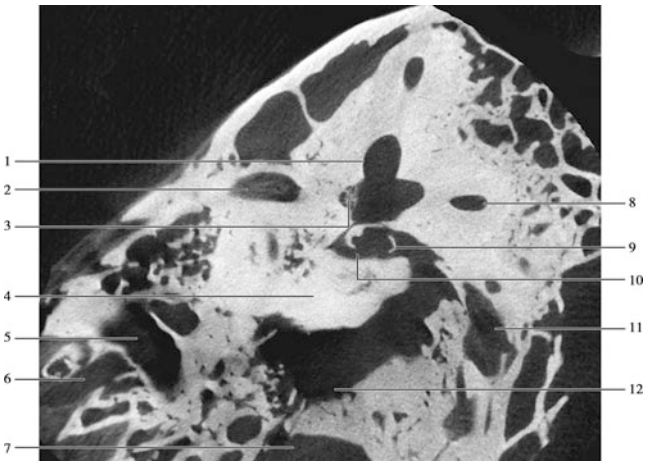

Fig. 4.69 Crura of stapes on sagittal view. (1) Ampulla of anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Promontory. (5) Internal carotid artery. (6) Eustachian tube. (7) Jugular bulb. (8) Lateral semicircular canal. (9) Posterior crus of the stapes. (10) Anterior crus of the stapes. (11) Stapedius muscle. (12) Hypotympanum

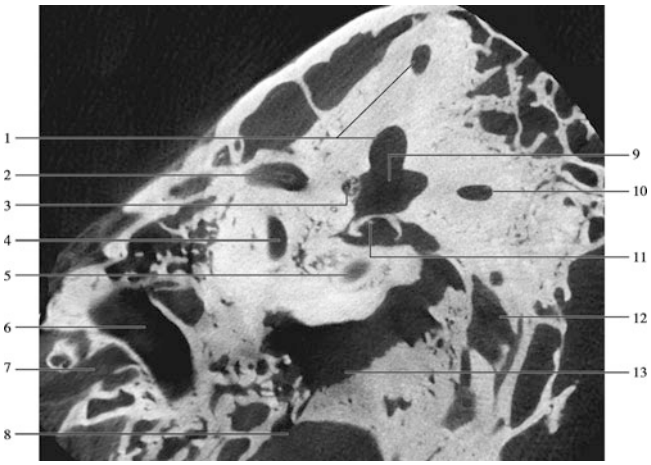

Fig. 4.71 Footplate of stapes on sagittal view. (1) Anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Cochlea. (5) Hook region of the basal turn of cochlea. (6) Internal carotid artery. (7) Eustachian tube. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Footplate of the stapes. (12) Stapedius muscle. (13) Hypotympanum

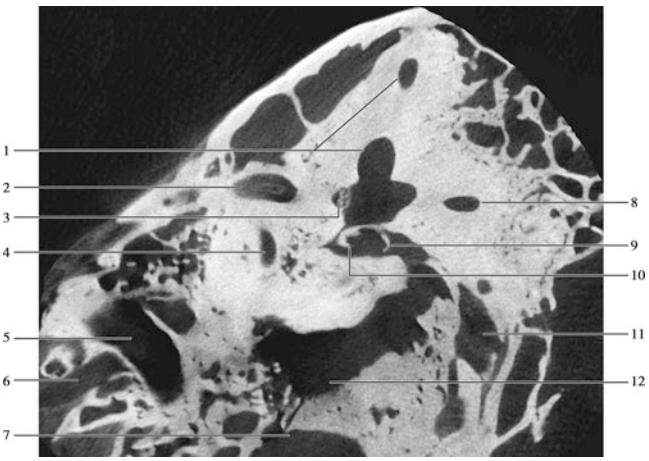

Fig. 4.70 Crura of stapes on sagittal view. (1) Anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Cochlea. (5) Internal carotid artery. (6) Eustachian tube. (7) Jugular bulb. (8) Lateral semicircular canal. (9) Posterior crus of the stapes. (10) Anterior crus of the stapes. (11) Stapedius muscle. (12) Hypotympanum

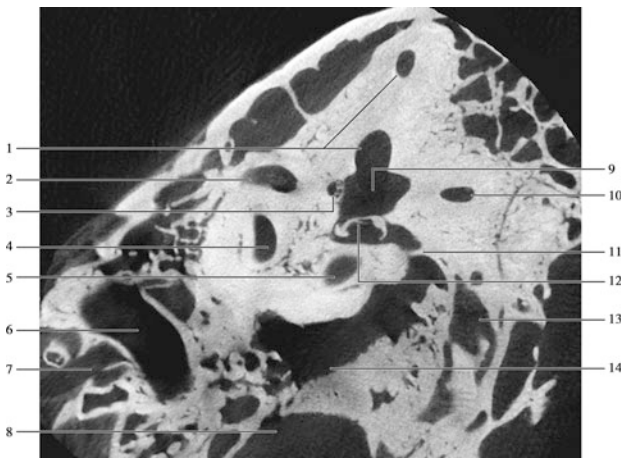

Fig. 4.72 Footplate of stapes on sagittal view. (1) Anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Cochlea. (5) Hook region of the basal turn of cochlea. (6) Internal carotid artery. (7) Eustachian tube. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Ponticulus promontorii. (12) Footplate of the stapes. (13) Stapedius muscle. (14) Hypotympanum

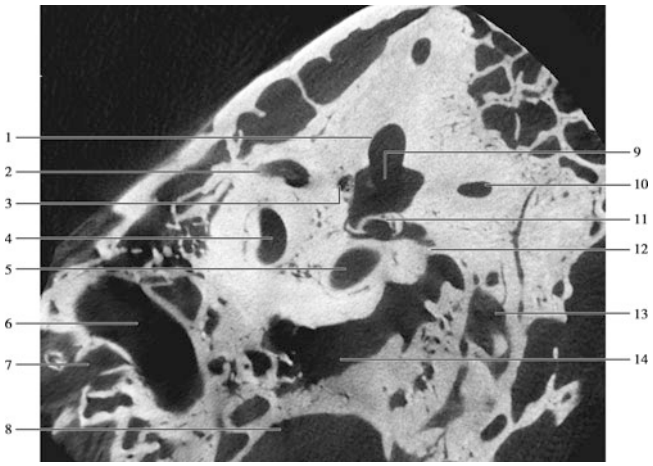

Fig. 4.73 Footplate of stapes on sagittal view. (1) Anterior semicircular canal. (2) Geniculate ganglion. (3) Superior vestibular nerve. (4) Cochlea. (5) Hook region of cochlea. (6) Internal carotid artery. (7) Eustachian tube. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Footplate of the stapes. (12) Ponticulus promontorii. (13) Stapedius muscle. (14) Hypotympanum

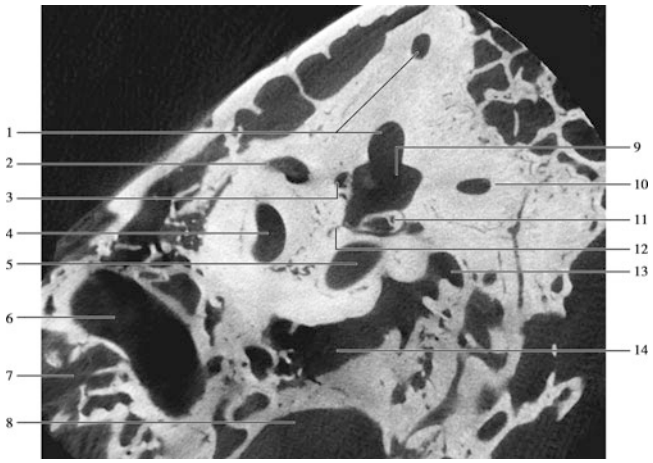

Fig. 4.74 Footplate of stapes on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Cochlea. (5) Hook region of cochlea. (6) Internal carotid artery. (7) Eustachian tube. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Footplate of the stapes. (12) Fissula ante fenestram. (13) Tympanic sinus. (14) Hypotympanum

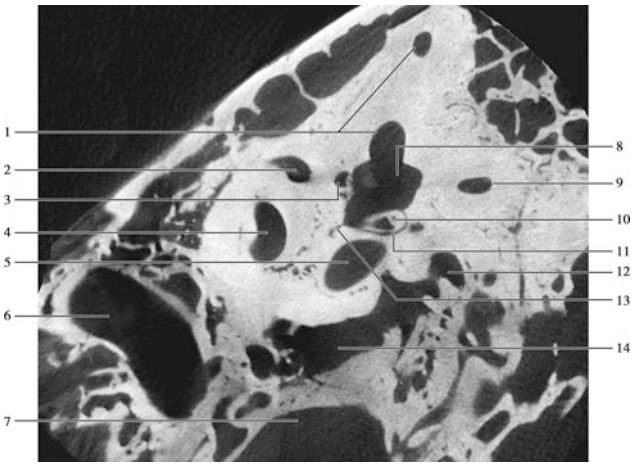

Fig. 4.75 Footplate of stapes on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Cochlea. (5) Hook region of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Vestibule. (9) Lateral semicircular canal. (10) Footplate. (11) Annular ligament. (12) Tympanic sinus. (13) Fissula ante fenestram. (14) Hypotympanum

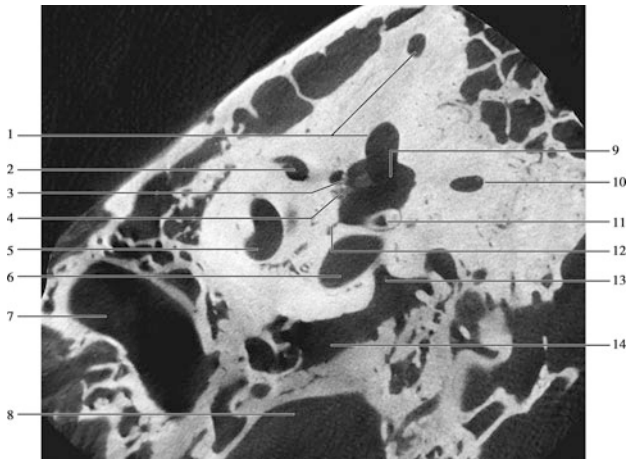

Fig. 4.76 Footplate of stapes and cochlear window niche on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Ampulla branch of superior vestibular nerve. (4) Vestibular branch of superior vestibular nerve. (5) Apical turn of cochlea. (6) Hook region of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Footplate. (12) Fissula ante fenestram. (13) Cochlear window niche. (14) Hypotympanum

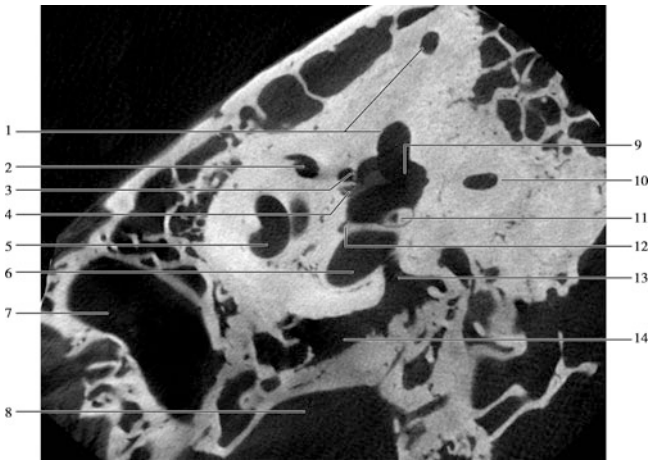

Fig. 4.77 Footplate of stapes and cochlear window niche on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Ampulla branch of superior vestibular nerve. (4) Vestibular branch of superior vestibular nerve. (5) Apical turn of cochlea. (6) Hook region of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Footplate. (12) Fissula ante fenestram. (13) Cochlear window niche. (14) Hypotympanum

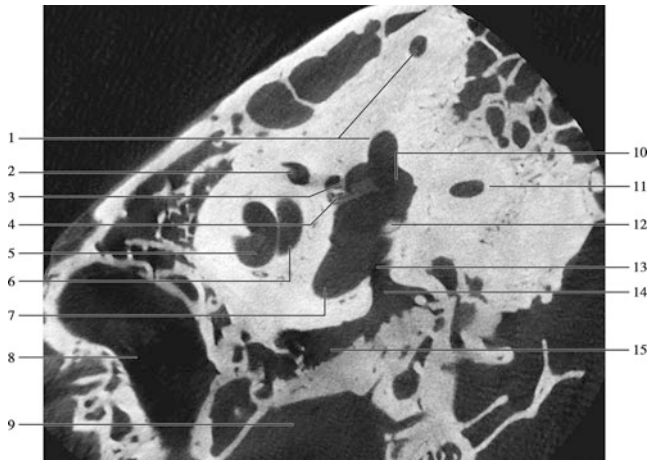

Fig. 4.79 Footplate of stapes and cochlear window niche on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Ampulla branch of superior vestibular nerve. (4) Vestibular branch of superior vestibular nerve. (5) Apical turn of cochlea. (6) Second turn of cochlea. (7) Hook region of cochlea (basal turn) . (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Footplate. (13) Cochlear window. (14) Cochlear window niche. (15) Hypotympanum

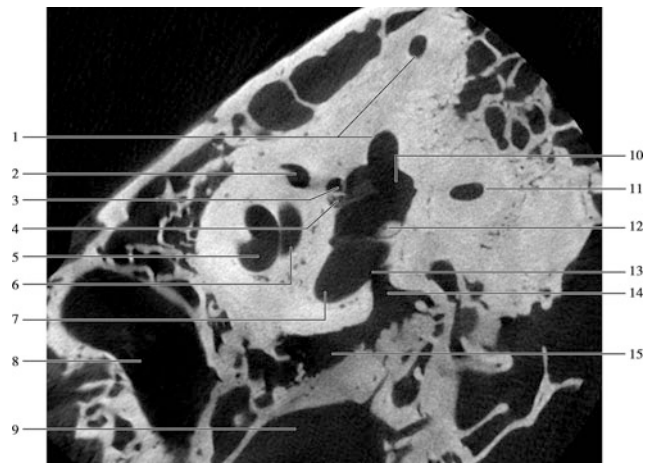

Fig. 4.78 Footplate of stapes and cochlear window niche on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Ampulla branch of superior vestibular nerve. (4) Vestibular branch of superior vestibular nerve. (5) Apical turn of cochlea. (6) Second turn of cochlea. (7) Hook region of cochlea (basal turn) . (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Footplate. (13) Cochlear window. (14) Cochlear window niche. (15) Hypotympanum

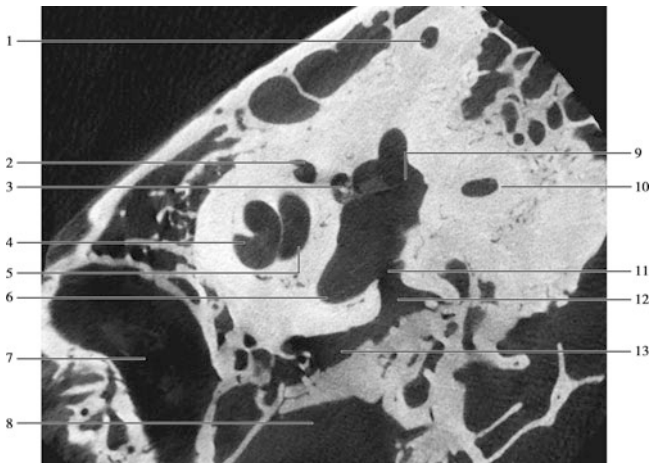

Fig. 4.80 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Apical turn of cochlea. (5) Second turn of cochlea. (6) Hook region of cochlea (basal turn) . (7) Internal carotid artery. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Cochlear window. (12) Cochlear window niche. (13) Hypotympanum

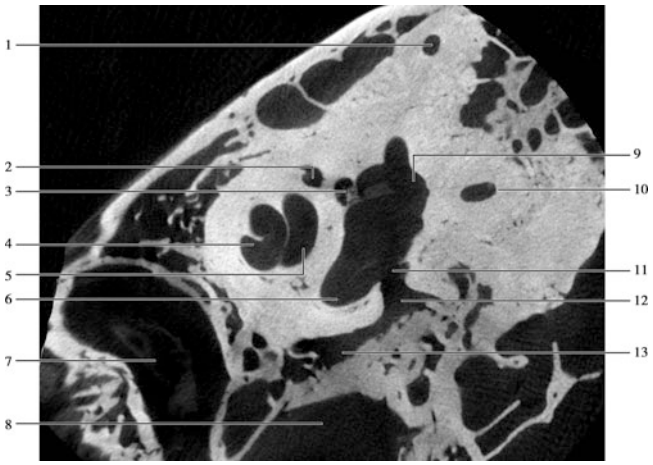

Fig. 4.81 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Apical turn of cochlea. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Cochlear window. (12) Cochlear window niche. (13) Hypotympanum

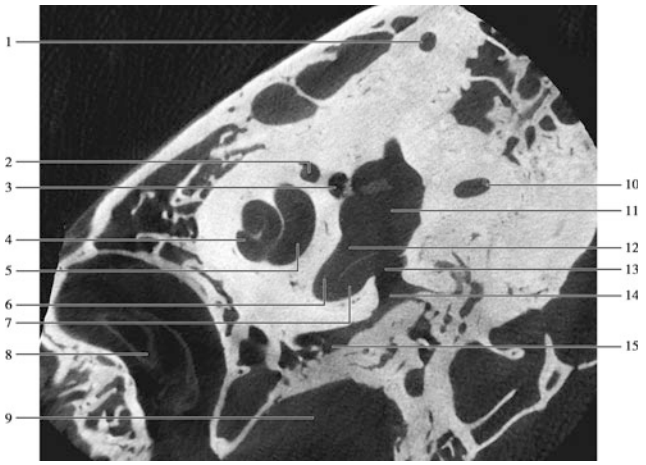

Fig. 4.83 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Apical turn of cochlea. (5) Second turn of cochlea. (6) Scala vestibuli in basal turn of cochlea. (7) Scala tympani in basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Lateral semicircular canal. (11) Vestibule. (12) Ductus reuniens. (13) Cochlear window. (14) Cochlear window niche. (15) Hypotympanum

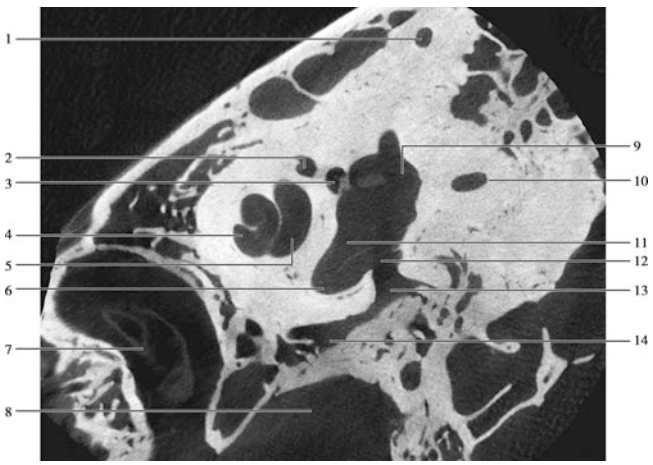

Fig. 4.82 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Apical turn of cochlea. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Ductus reuniens of cochlea-vestibule. (12) Cochlear window. (13) Cochlear window niche. (14) Hypotympanum

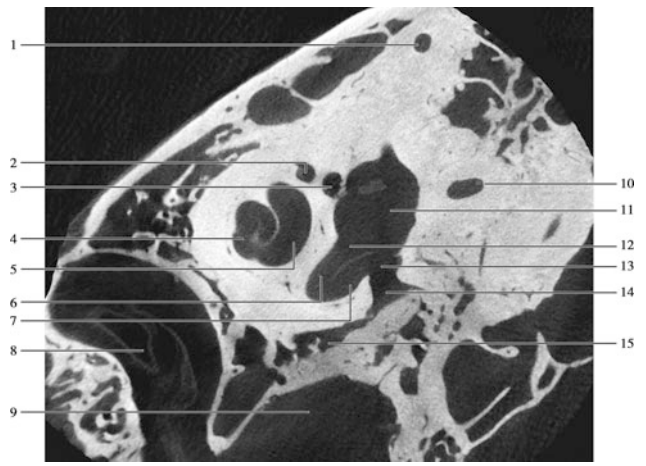

Fig. 4.84 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Apical turn of cochlea. (5) Second turn of cochlea. (6) Scala vestibuli in basal turn of cochlea. (7) Scala tympani in basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Lateral semicircular canal. (11) Vestibule. (12) Ductus reuniens. (13) Cochlear window. (14) Cochlear window niche. (15) Hypotympanum

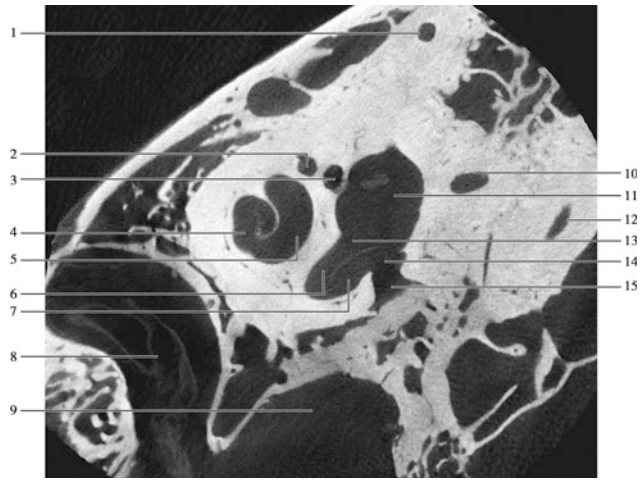

Fig. 4.85 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Apical turn of cochlea. (5) Second turn of cochlea. (6) Scala vestibuli in basal turn of cochlea. (7) Scala tympani in basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Lateral semicircular canal. (11) Vestibule. (12) Posterior semicircular canal. (13) Ductus reuniens. (14) Cochlear window. (15) Cochlear window niche

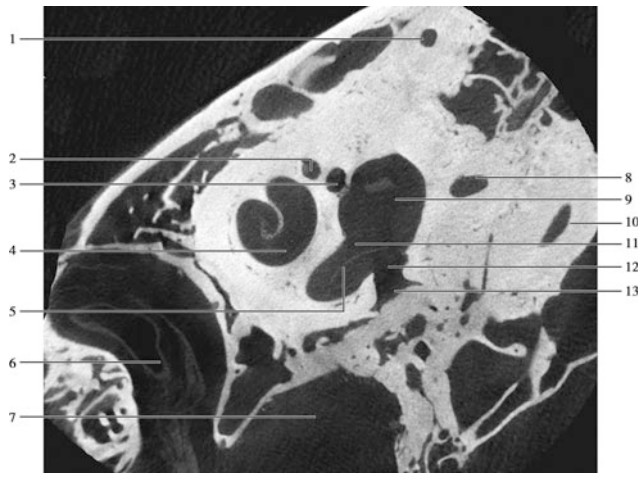

Fig. 4.86 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Second turn of cochlea. (5) Spiral lamina. (6) Internal carotid artery. (7) Jugular bulb. (8) Lateral semicircular canal. (9) Vestibule. (10) Posterior semicircular canal.11 Ductus reuniens. (12) Cochlear window. (13) Cochlear window niche

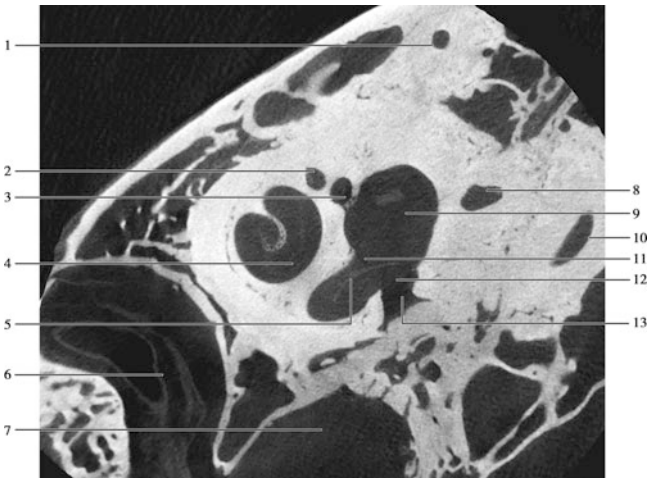

Fig. 4.87 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Second turn of cochlea. (5) Spiral lamina. (6) Internal carotid artery. (7) Jugular bulb. (8) Lateral semicircular canal. (9) Vestibule. (10) Posterior semicircular canal. (11) Ductus reuniens. (12) Cochlear window. (13) Cochlear window niche

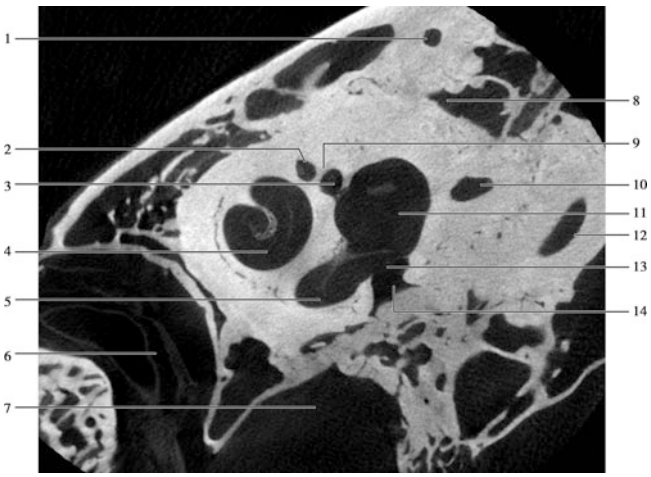

Fig. 4.88 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Second turn of cochlea. (5) Spiral lamina. (6) Internal carotid artery. (7) Jugular bulb. (8) Petromastoid canal (Subarcuate artery). (9) Bill's bar. (10) Lateral semicircular canal. (11) Vestibule. (12) Posterior semicircular canal. (13) Cochlear window. (14) Cochlear window niche

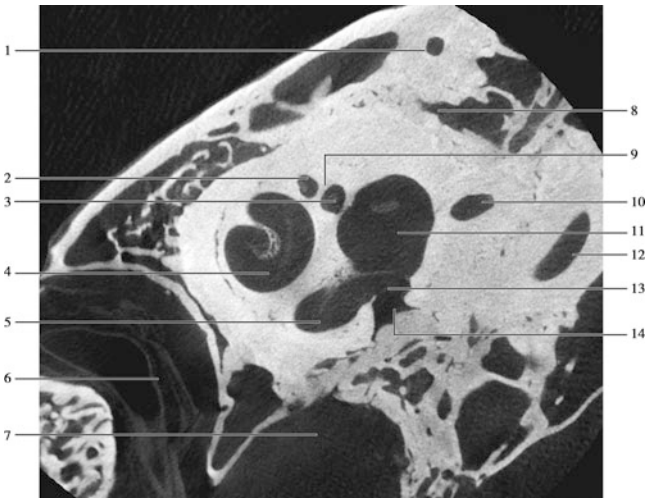

Fig. 4.89 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Second turn of cochlea. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Petromastoid canal. (9) Bill's bar. (10) Lateral semicircular canal. (11) Vestibule. (12) Posterior semicircular canal. (13) Cochlear window. (14) Cochlear window niche

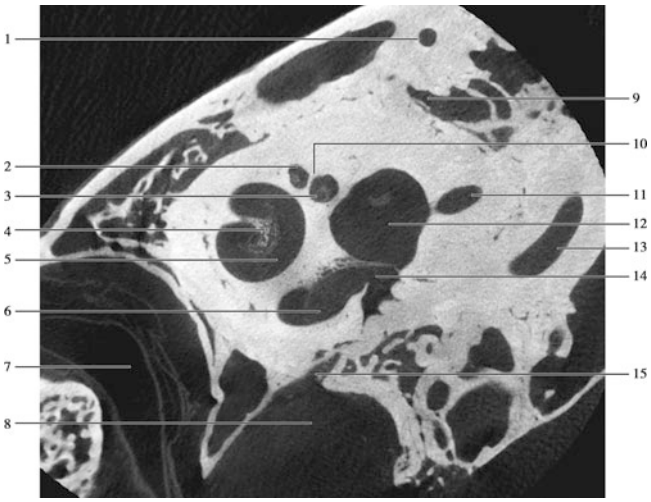

Fig. 4.91 Cochlear window and vestibule on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Bill's bar. (11) Lateral semicircular canal. (12) Vestibule. (13) Posterior semicircular canal. (14) Cochlear window. (15) Tympanic canaliculus

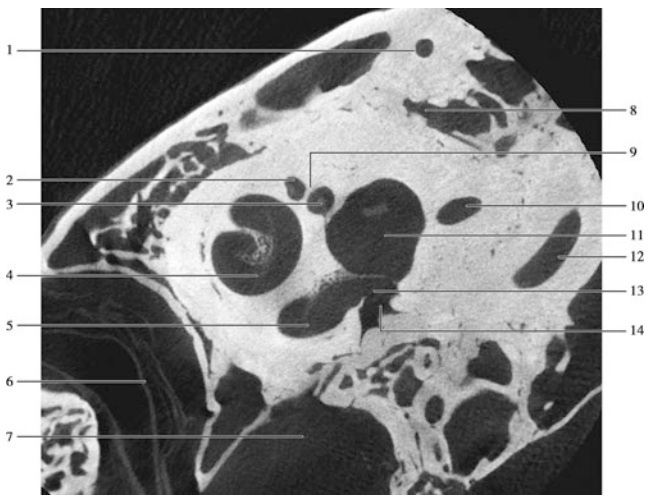

Fig. 4.90 Cochlear window niche and cochlear window on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Second turn of cochlea. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Petromastoid canal. (9) Bill's bar. (10) Lateral semicircular canal. (11) Vestibule. (12) Posterior semicircular canal. (13) Cochlear window. (14) Cochlear window niche

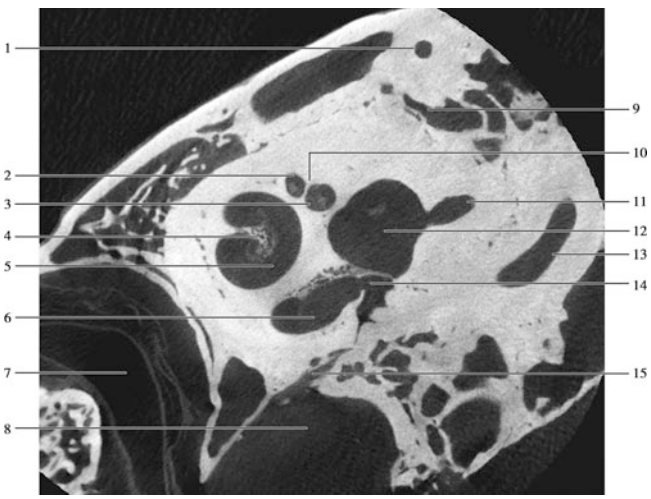

Fig. 4.92 Cochlear window and vestibule on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Bill's bar. (11) Lateral semicircular canal. (12) Vestibule. (13) Posterior semicircular canal. (14) Cochlear window. (15) Tympanic canaliculus

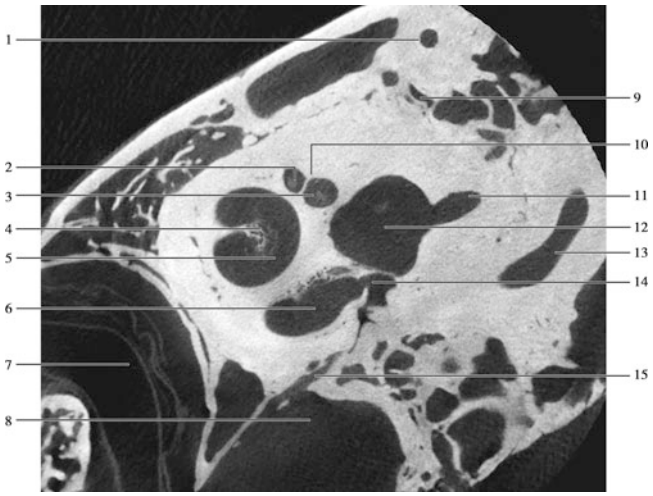

Fig. 4.93 Cochlear window and vestibule on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Bill's bar. (11) Lateral semicircular canal. (12) Vestibule. (13) Posterior semicircular canal. (14) Cochlear window. (15) Tympanic canaliculus

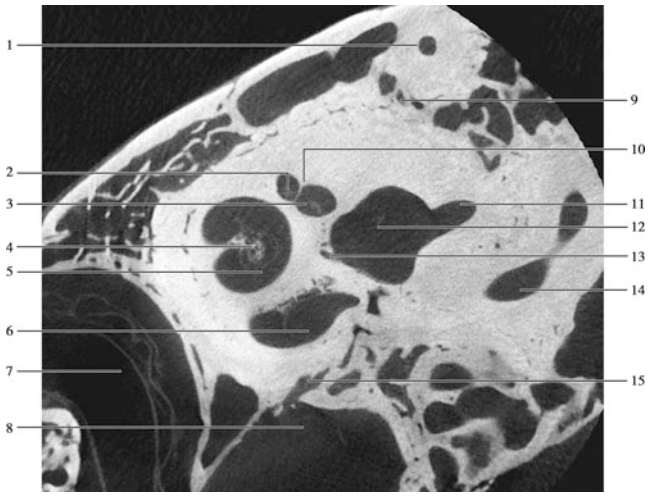

Fig. 4.95 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve orifice in fundus. (3) Superior vestibular nerve orifice in fundus. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Bill's bar. (11) Lateral semicircular canal. (12) Vestibule. (13) Inferior vestibular nerve. (14) Posterior semicircular canal. (15) Tympanic canaliculus

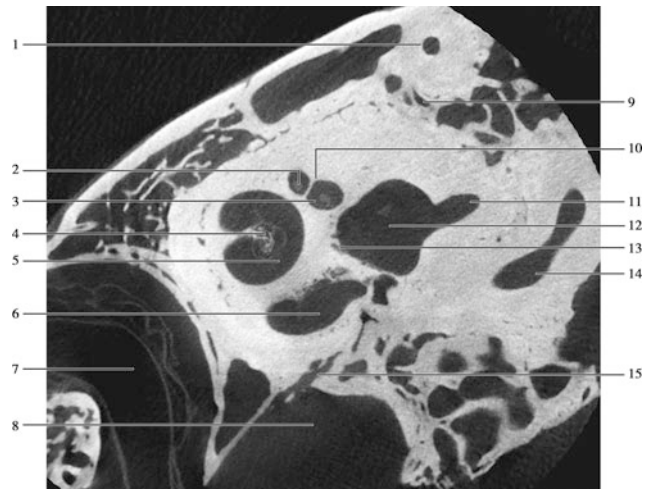

Fig. 4.94 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Superior vestibular nerve. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Bill's bar. (11) Lateral semicircular canal. (12) Vestibule. (13) Inferior vestibular nerve. (14) Posterior semicircular canal. (15) Tympanic canaliculus

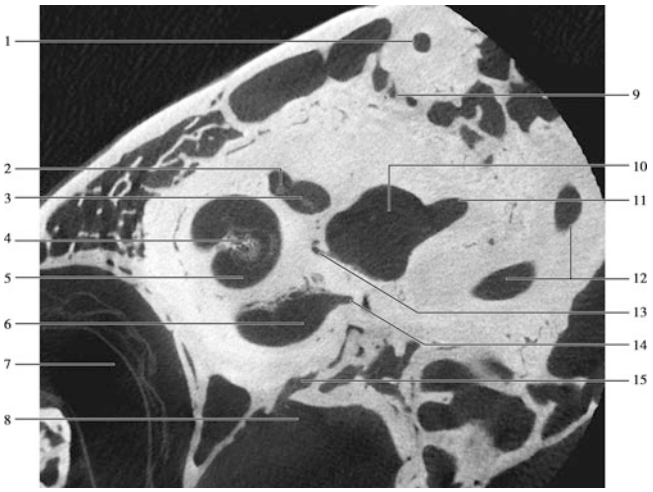

Fig. 4.96 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Inferior vestibular nerve. (14) Cochlear aqueduct. (15) Tympanic canaliculus

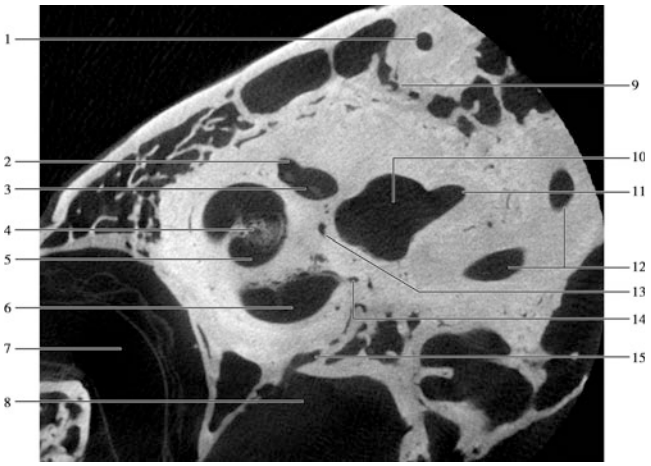

Fig. 4.97 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Petromastoid canal. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Inferior vestibular nerve. (14) Cochlear aqueduct. (15) Tympanic canaliculus

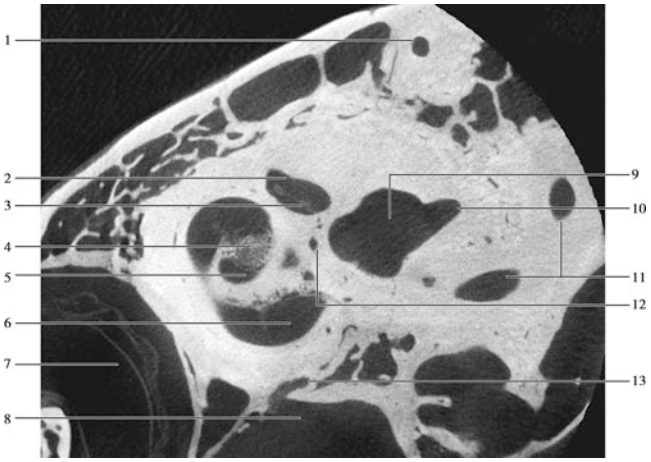

Fig. 4.98 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Modiolus. (5) Second turn of cochlea. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Vestibule. (10) Lateral semicircular canal. (11) Posterior semicircular canal. (12) Inferior vestibular nerve. (13) Tympanic canaliculus

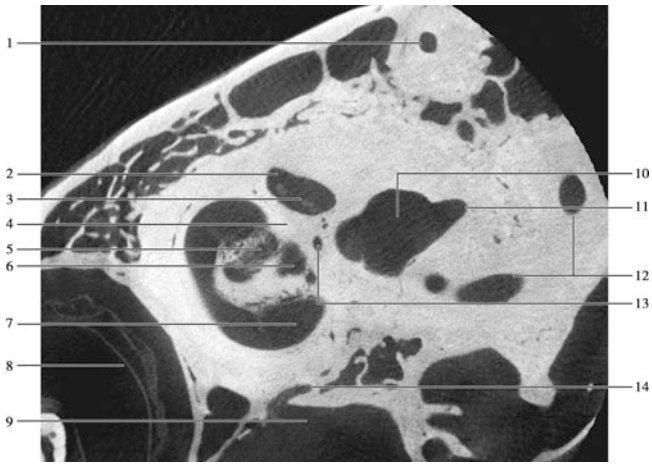

Fig. 4.99 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve orifice(canal) . (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Inferior vestibular nerve. (14) Tympanic canaliculus

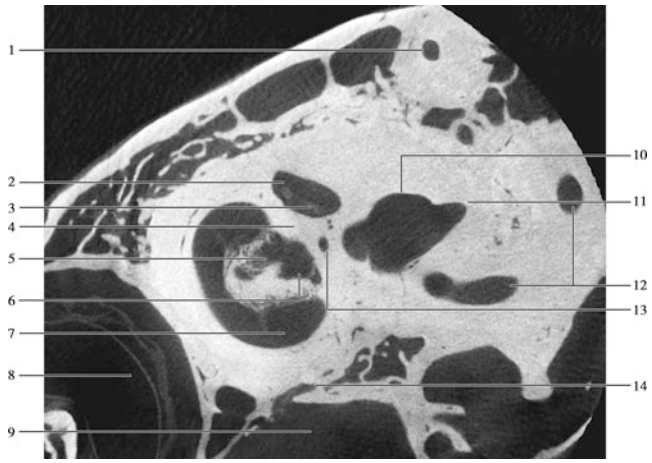

Fig. 4.100 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve orifice(canal) . (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Inferior vestibular nerve. (14) Tympanic canaliculus

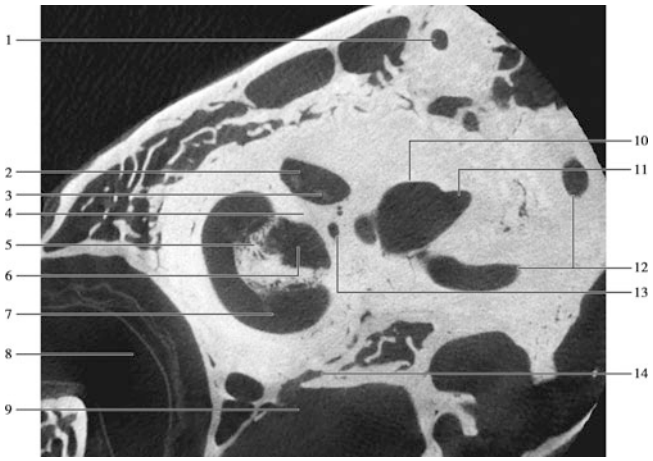

Fig. 4.101 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Inferior vestibular nerve. (14) Tympanic canaliculus

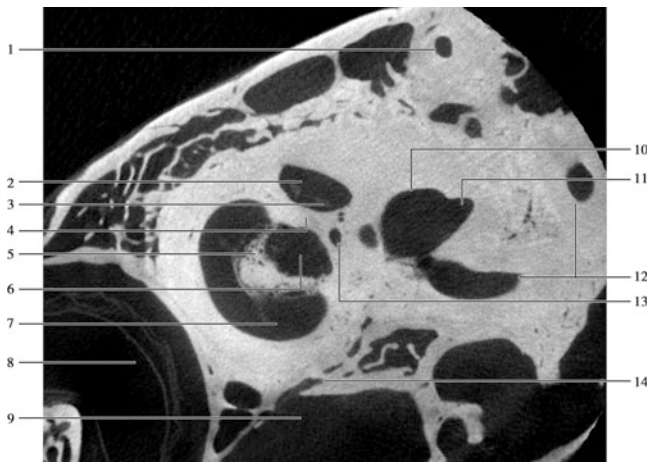

Fig. 4.102 Vestibule and inferior vestibular nerve on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Inferior vestibular nerve. (14) Tympanic canaliculus

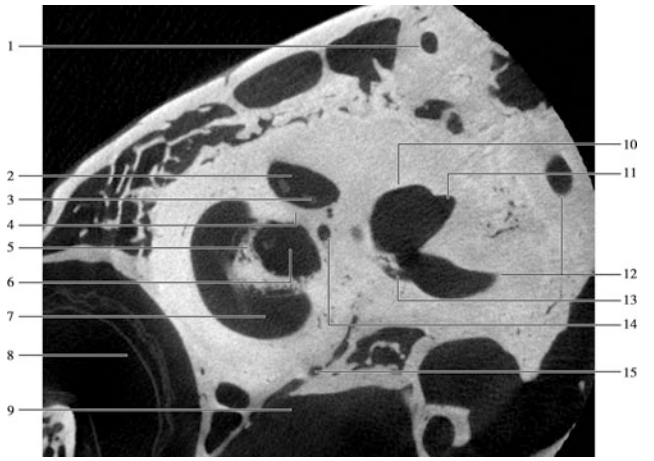

Fig. 4.103 Inferior vestibular nerve and singular foramen on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Singular foramen. (14) Inferior vestibular nerve. (15) Tympanic canaliculus

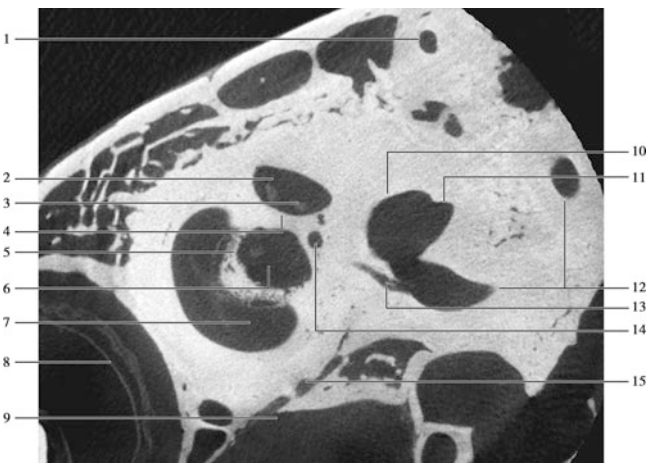

Fig. 4.104 Inferior vestibular nerve and singular foramen on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Vestibule. (11) Lateral semicircular canal. (12) Posterior semicircular canal. (13) Singular foramen. (14) Inferior vestibular nerve. (15) Tympanic canaliculus

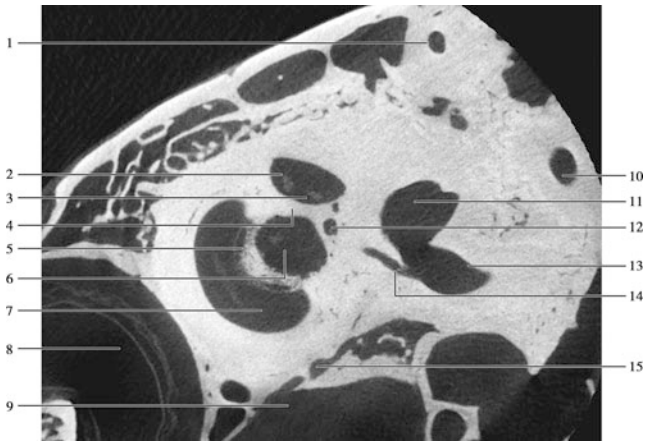

Fig. 4.105 Inferior vestibular nerve and singular foramen on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Posterior semicircular canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Ampulla of posterior semicircular canal. (14) Singular foramen. (15) Tympanic canaliculus

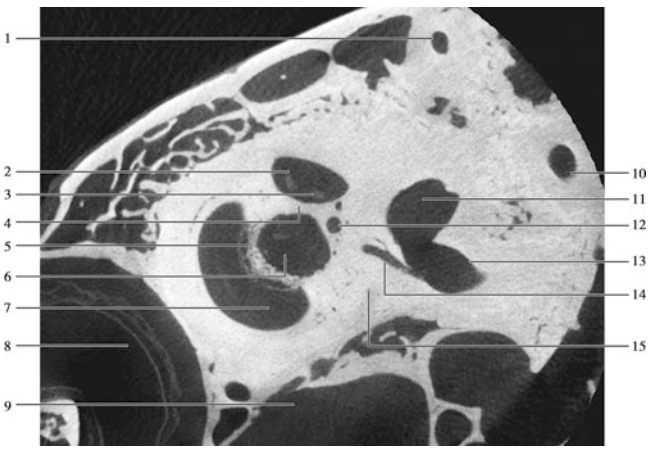

Fig. 4.106 Inferior vestibular nerve and singular foramen on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Posterior semicircular canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Ampulla of posterior semicircular canal. (14) Singular foramen. (15) Cochlear aqueduct

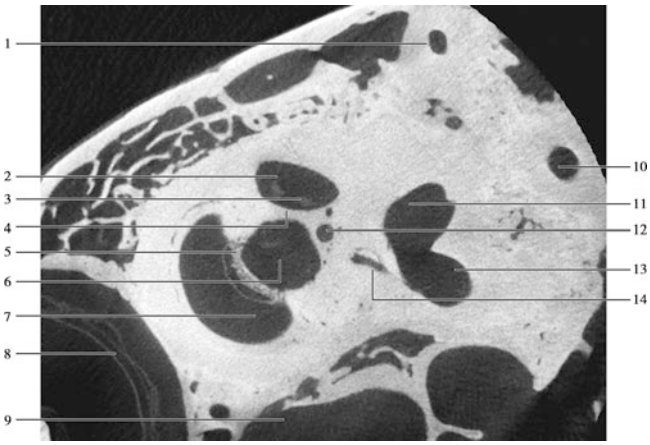

Fig. 4.107 Inferior vestibular nerve and singular foramen on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Posterior semicircular canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Ampulla of posterior semicircular canal. (14) Singular foramen

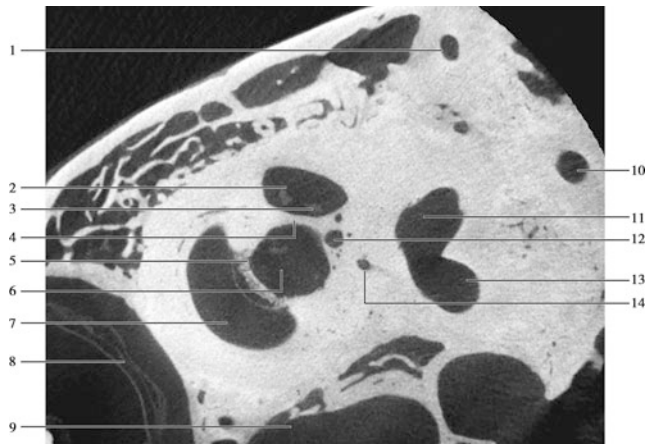

Fig. 4.108 Inferior vestibular nerve and singular foramen on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Posterior semicircular canal. (11) Vestibule. (12) Inferior vestibular nerve. (13) Ampulla of posterior semicircular canal. (14) Singular foramen

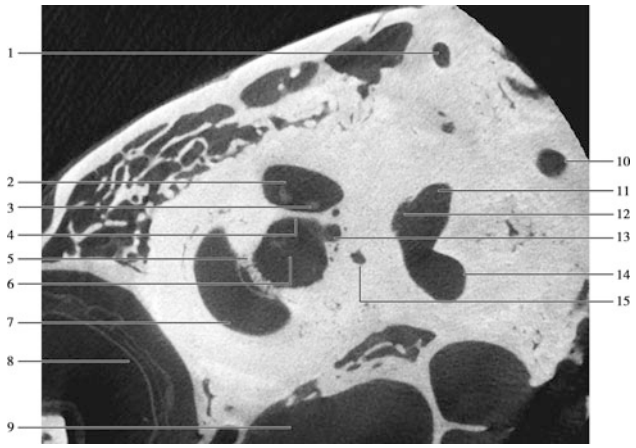

Fig. 4.109 Inferior vestibular nerve and singular foramen & common crus on sagittal view. (1) Anterior semicircular canal. (2) Facial nerve in internal auditory canal. (3) Superior vestibular nerve in internal auditory canal. (4) Transverse crest. (5) Modiolus. (6) Cochlear nerve canal. (7) Basal turn of cochlea. (8) Internal carotid artery. (9) Jugular bulb. (10) Posterior semicircular canal. (11) Common crus. (12) Internal orifice of vestibular aqueduct. (13) Inferior vestibular nerve. (14) Ampulla of posterior semicircular canal. (15) Singular foramen

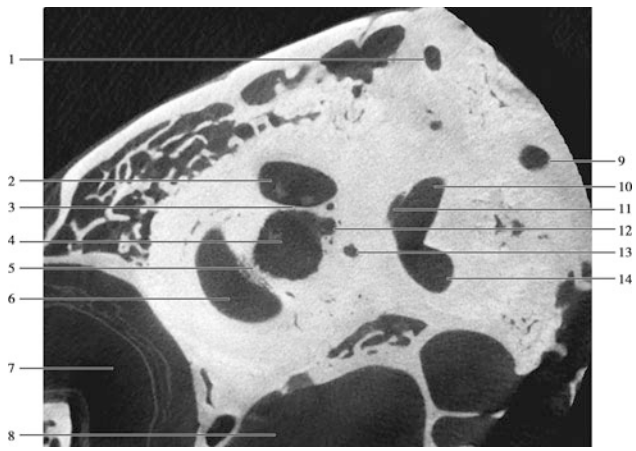

Fig. 4.110 Inferior vestibular nerve and singular foramen & common crus on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Modiolus. (6) Basal turn of cochlea. (7) Internal carotid artery. (8) Jugular bulb. (9) Posterior semicircular canal. (10) Common crus. (11) Internal orifice of vestibular aqueduct. (12) Inferior vestibular nerve. (13) Singular foramen. (14) Ampulla of posterior semicircular canal

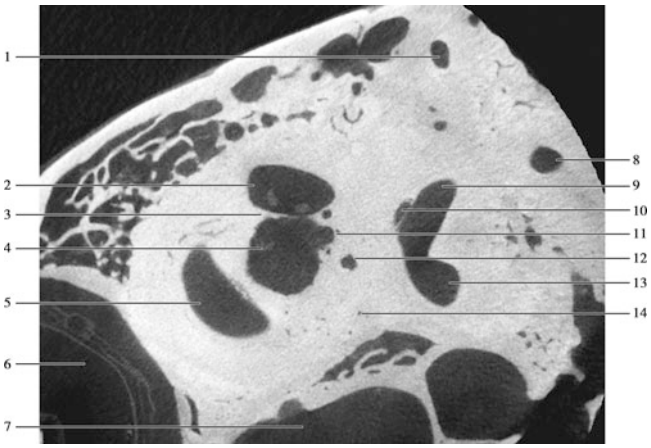

Fig. 4.111 Inferior vestibular nerve and singular foramen & common crus on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Posterior semicircular canal. (9) Common crus. (10) Internal orifice of vestibular aqueduct. (11) Inferior vestibular nerve. (12) Singular foramen. (13) Ampulla of posterior semicircular canal. (14) Cochlear aqueduct

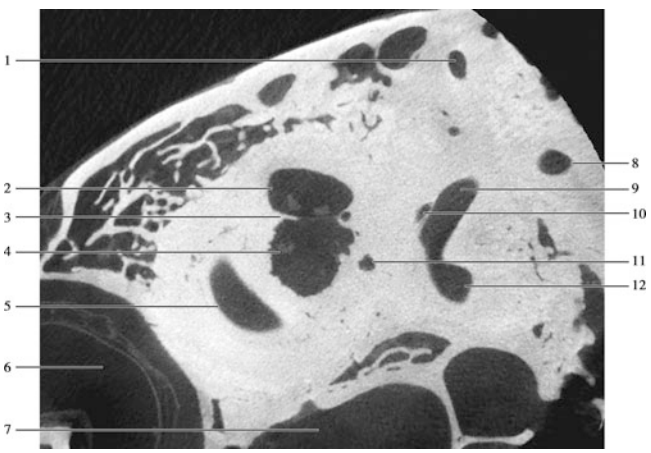

Fig. 4.112 Singular foramen and common crus on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Posterior semicircular canal. (9) Common crus. (10) Vestibular aqueduct. (11) Singular foramen. (12) Ampulla of posterior semicircular canal

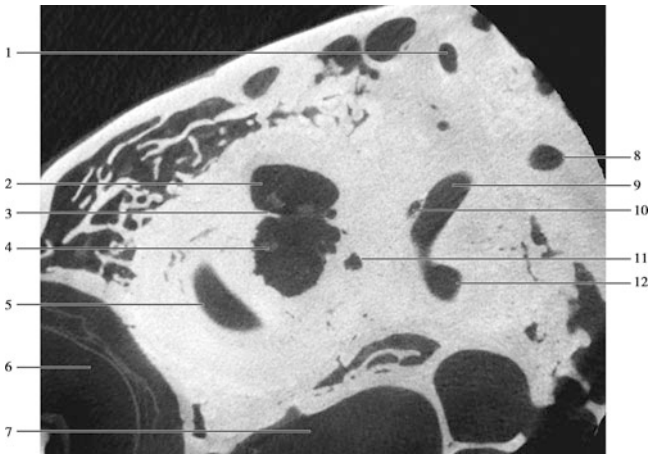

Fig. 4.113 Singular foramen and common crus on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Posterior semicircular canal. (9) Common crus. (10) Vestibular aqueduct. (11) Singular foramen. (12) Ampulla of posterior semicircular canal

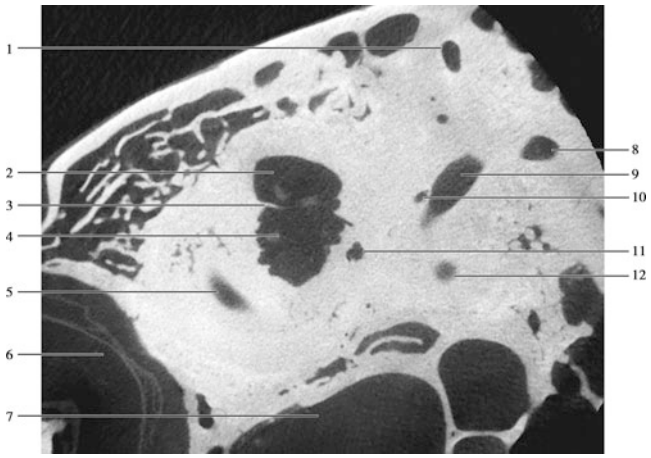

Fig. 4.115 Singular foramen and common crus &vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Posterior semicircular canal. (9) Common crus. (10) Vestibular aqueduct. (11) Singular foramen. (12) Ampulla of posterior semicircular canal

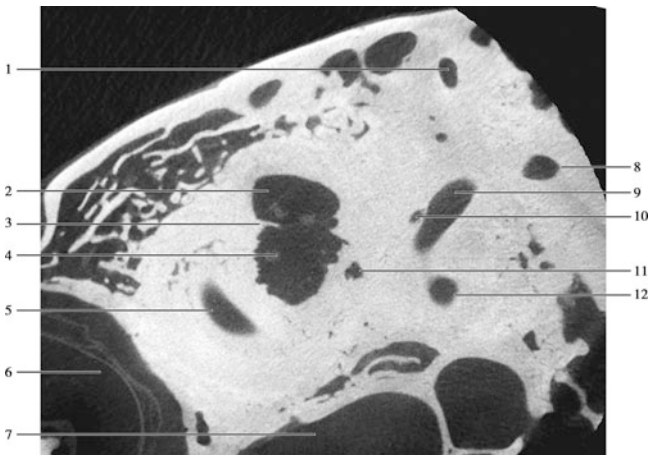

Fig. 4.114 Singular foramen and common crus &vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Basal turn of cochlea. (6) Internal carotid artery. (7) Jugular bulb. (8) Posterior semicircular canal. (9) Common crus. (10) Vestibular aqueduct. (11) Singular foramen. (12) Ampulla of posterior semicircular canal

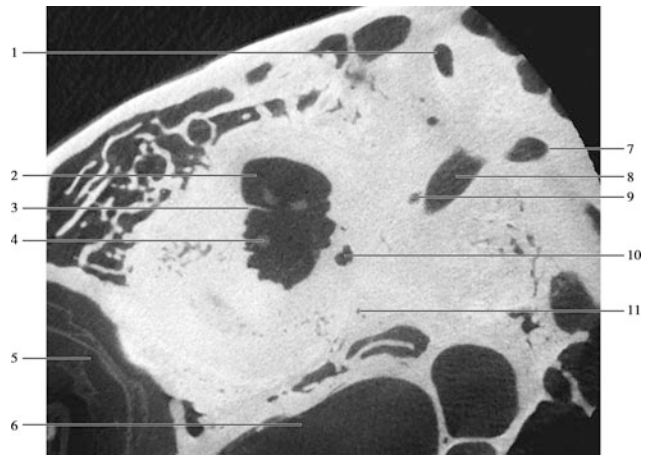

Fig. 4.116 Singular foramen and common crus &vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Internal carotid artery. (6) Jugular bulb. (7) Posterior semicircular canal. (8) Common crus. (9) Vestibular aqueduct. (10) Singular foramen. (11) Cochlear aqueduct

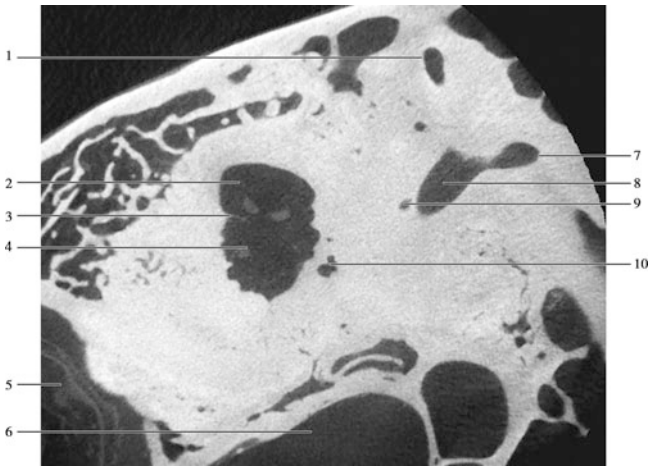

Fig. 4.117 Singular foramen and common crus & vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Superior part of fundus. (3) Transverse crest. (4) Inferior part of fundus. (5) Internal carotid artery. (6) Jugular bulb. (7) Posterior semicircular canal. (8) Common crus. (9) Vestibular aqueduct. (10) Singular foramen

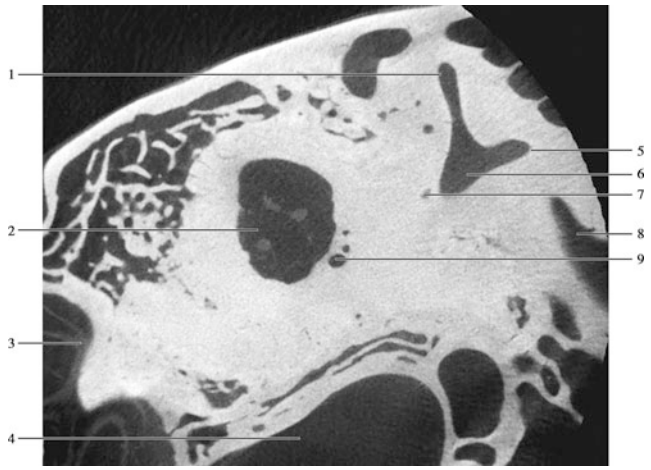

Fig. 4.119 Singular foramen and common crus & vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Internal auditory canal. (3) Internal carotid artery. (4) Jugular bulb. (5) Posterior semicircular canal. (6) Common crus. (7) Vestibular aqueduct. (8) Fissure of endolymphatic sac. (9) Singular foramen

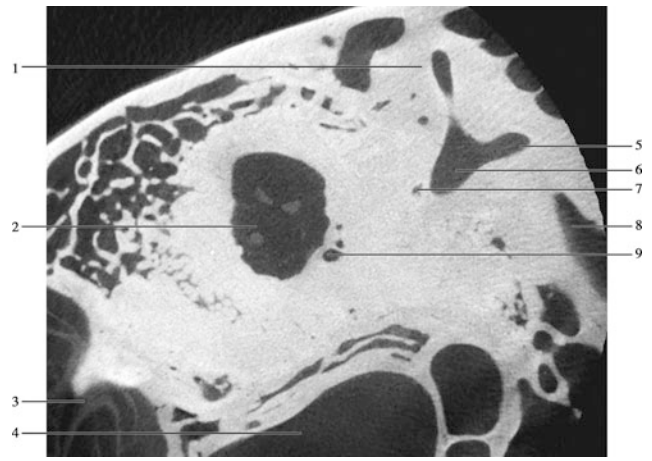

Fig. 4.118 Singular foramen and common crus & vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Internal auditory canal. (3) Internal carotid artery. (4) Jugular bulb. (5) Posterior semicircular canal. (6) Common crus. (7) Vestibular aqueduct. (8) Fissure of endolymphatic sac. (9) Singular foramen

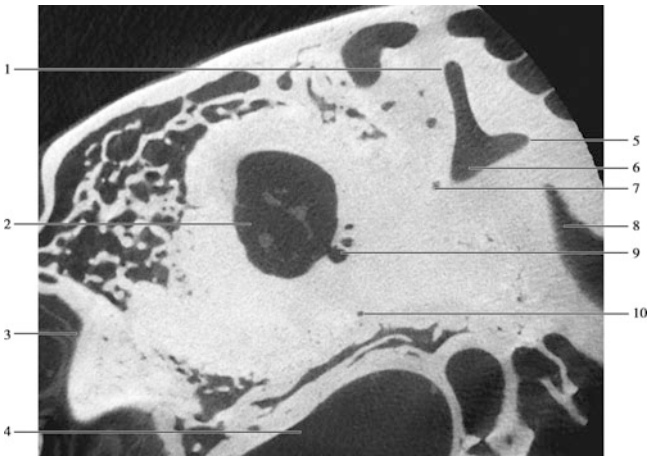

Fig. 4.120 Singular foramen and common crus & vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Internal auditory canal. (3) Internal carotid artery. (4) Jugular bulb. (5) Posterior semicircular canal. (6) Common crus. (7) Vestibular aqueduct. (8) Fissure of endolymphatic sac. (9) Singular foramen. (10) Cochlear aqueduct

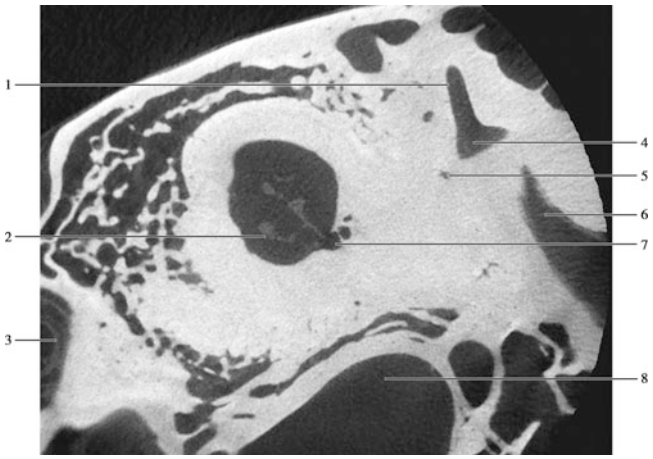

Fig. 4.121 Singular foramen and common crus & vestibular aqueduct on sagittal view. (1) Anterior semicircular canal. (2) Internal auditory canal. (3) Internal carotid artery. (4) Common crus. (5) Vestibular aqueduct. (6) Fissure of endolymphatic sac. (7) Singular foramen. (8) Jugular bulb

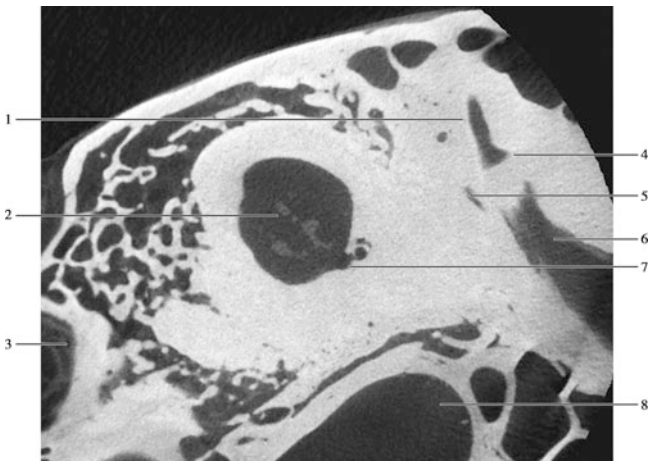

Fig. 4.122 Singular foramen and internal auditory canal on sagittal view. (1) Anterior semicircular canal. (2) Internal auditory canal. (3) Internal carotid artery. (4) Posterior semicircular canal. (5) Vestibular aqueduct. (6) Fissure of endolymphatic sac. (7) Singular foramen. (8) Jugular bulb

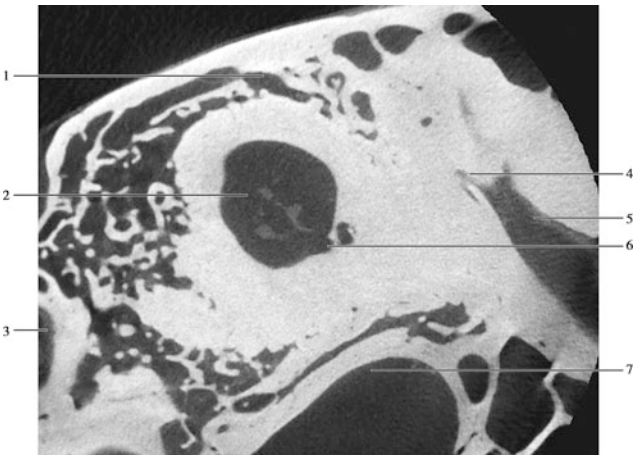

Fig. 4.123 Singular foramen and internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Internal carotid artery. (4) Vestibular aqueduct. (5) Fissure of endolymphatic sac. (6) Singular foramen. (7) Jugular bulb

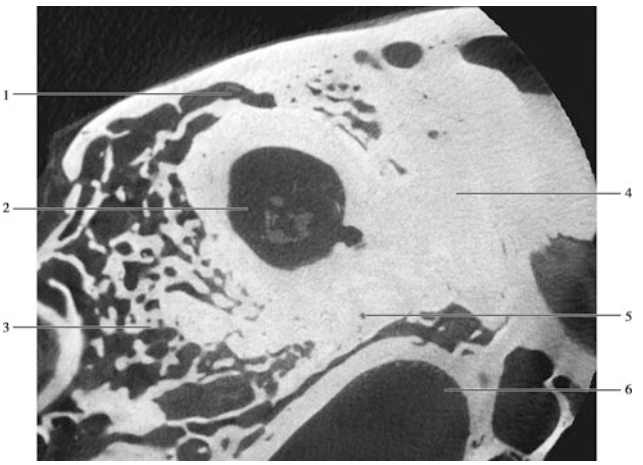

Fig. 4.124 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Cochlear aqueduct. (6) Jugular bulb

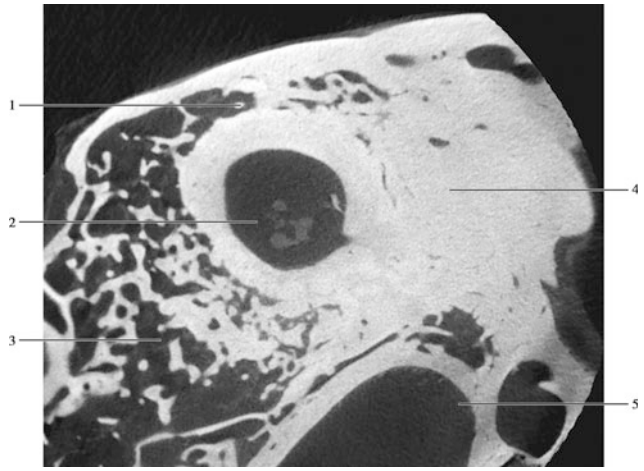

Fig. 4.125 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Jugular bulb

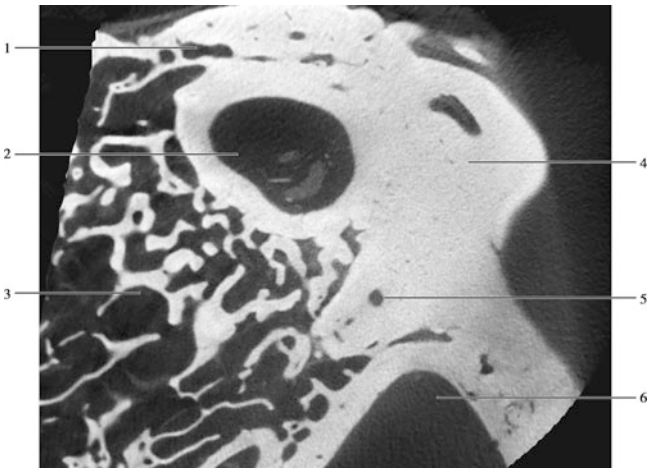

Fig. 4.127 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Cochlear aqueduct. (6) Jugular bulb

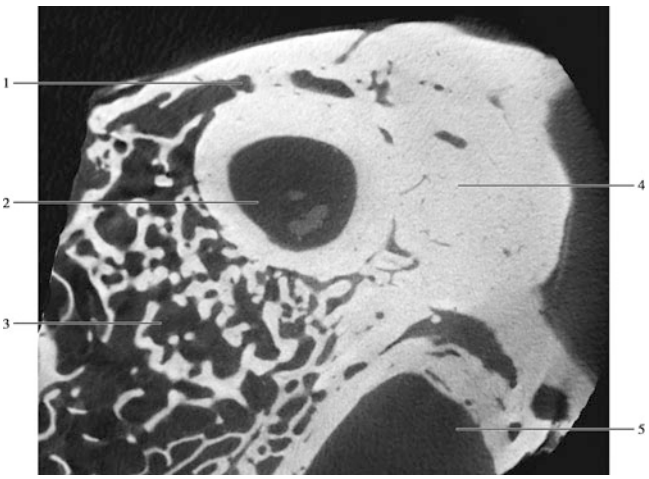

Fig. 4.126 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Jugular bulb

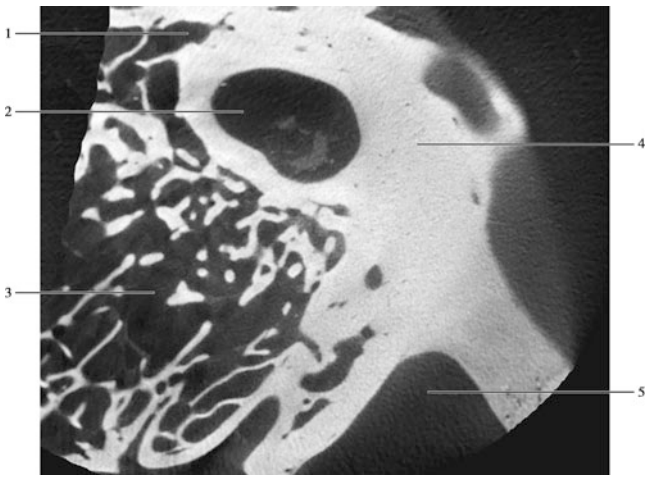

Fig. 4.128 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Jugular bulb

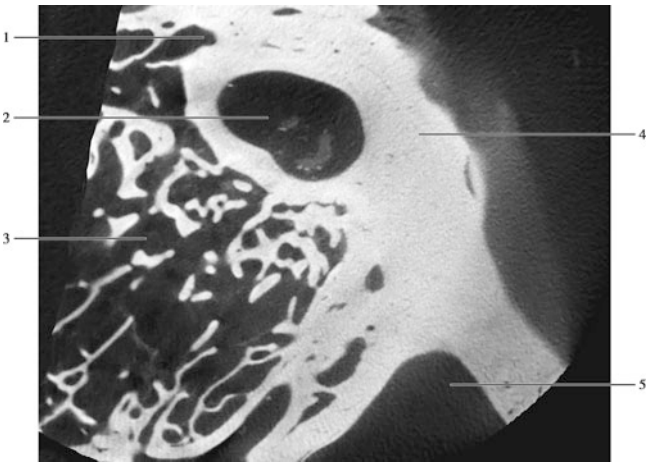

Fig. 4.129 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Jugular bulb

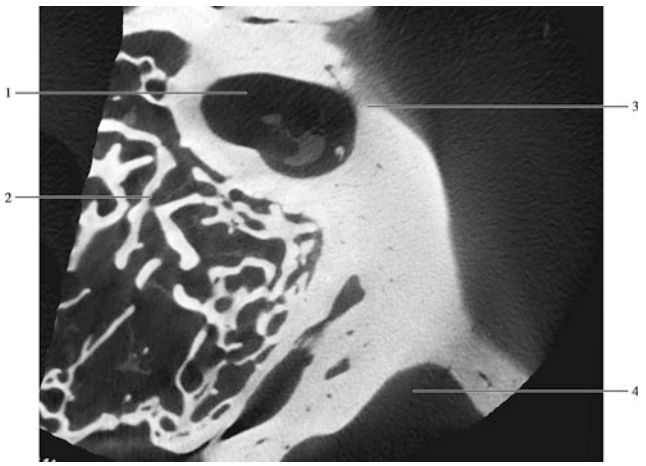

Fig. 4.131 Internal auditory canal on sagittal view. (1) Superior air cells of internal auditory canal. (2) Internal auditory canal. (3) Posterior wall of internal acoustic porus. (4) Jugular bulb

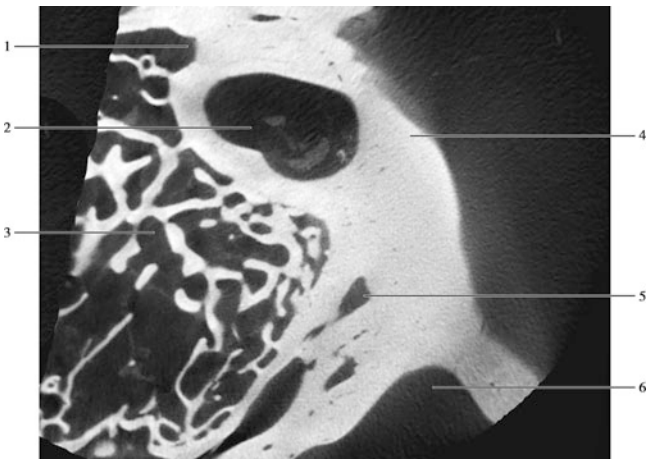

Fig. 4.130 Internal auditory canal on sagittal view. (1) Superior cells of internal auditory canal. (2) Internal auditory canal. (3) Petrous air cells. (4) Posterior wall of internal auditory canal. (5) Outer foramen of cochlear aqueduct. (6) Jugular bulb

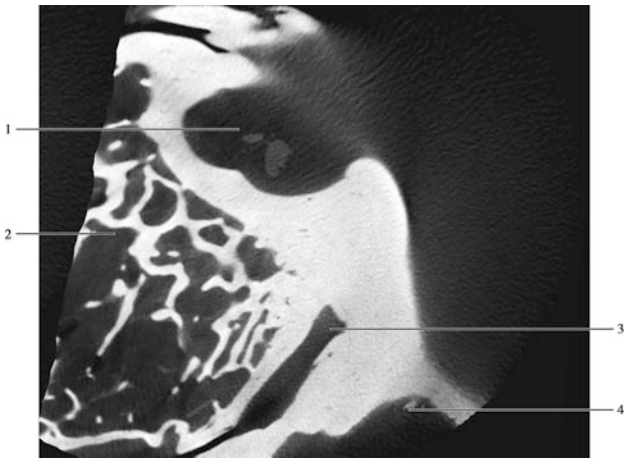

Fig. 4.132 Internal acoustic porus on sagittal view. (1) Internal acoustic porus. (2) Petrous air cells. (3) Petro-occipital fissure. (4) Jugular bulb

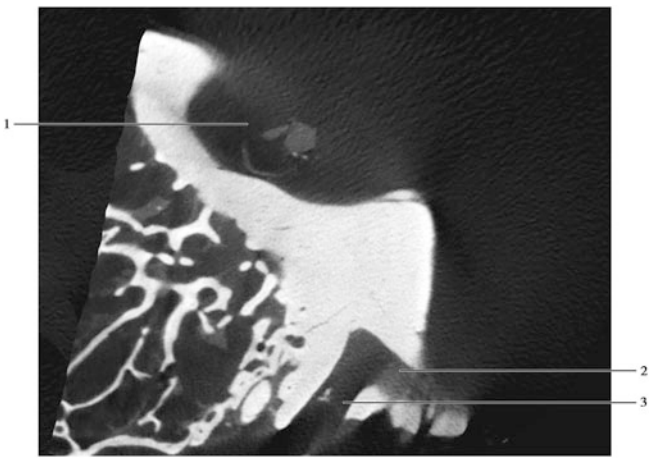

Fig. 4.133 Internal acoustic porus on sagittal view. (1) Internal acoustic porus. (2) Nerve portion of jugular foramen. (3) Petro-occipital fissure

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Two-Dimensional Reconstruction of Stapes

5

Zilong Yu, Luo Zhang, and Demin Han

The human ossicular chain composes of the malleus, incus, and stapes, although the stapes is the smallest, it plays an important role in the sound transmission in the middle ear acting as a mechanical transformer. The stapedial footplate fits into the vestibular window and separates the inner ear from the middle ear. The mechanical behavior of the footplate and its annular ligament depend critically on their shape and orientation in the vestibular window (Hagr et al. 2004), and the morphological observation of the stapes at high resolution will help us to understand its dynamics (Hagr et al. 2004) and build the finite element analytical model of the middle ear (Sim et al. 2010). The stapedial dysplasia (such as the aplasia of the footplate superstructure, congenital dehiscence of footplate, even the atresia of the vestibular window), the trauma of the stapes (the fenestration, dislocation, and fracture of the stapedial footplate), et al., usually cause the significance conductive hearing loss, or sensorineural hearing loss, even cerebrospinal fluid leakage and intracranial infection. In otologic surgery, whether the stapes is movable or fixed is a crucial factor in obtaining hearing (Tsuzuki et al. 2006), cases in which stapes footplate was fixated had the worst result in terms of hearing (Aslan et al. 2010).

As we know, the stapes does not position horizontally, the anterior crus and posterior crus slightly tilt to the promontory. The clinical conventional CT scan could not show the head, the neck, the crura, and the footplate of the stapes on one axial plane, the footplate could not be shown on one sagittal plane. In order to observe the panorama of the stapes and its adjacent structure clearly, we took the stapedial crura plane as the reference axial view, the plane of the footplate was regarded as the reference sagittal view and the plane be perpendicular to the stapedial crura plane (above reference axial plane) as the reference coronal view.

In this chapter, micro-CT scan of the temporal bone was performed in situ stapes. Qualitatively, the footplate was shaped like a human footprint in moist sand (Calligas and Jrt 2018) on sagittal view (Fig. 5.12).

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5.1 Two-Dimensional Reconstruction of Stapes on Reference Axial View

The reconstruction of the stapes was carried out superiorly to inferiorly (Figs. 5.1–5.4).

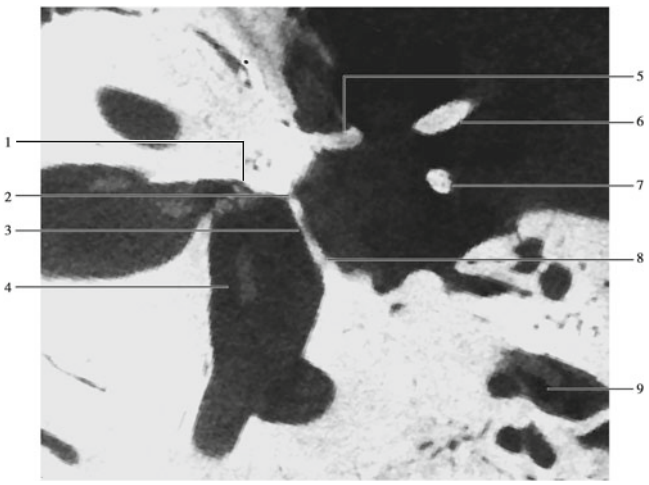

Fig. 5.1 Two-dimensional reconstruction of stapes on reference axial view. (1) Superior vestibular nerve. (2) Anterior edge of vestibular window (annular ligament). (3) Footplate. (4) Vestibule. (5) Cochleariform process. (6) Manubrium. (7) Lenticular process. (8) Posterior edge of vestibular window (annular ligament). (9) Facial nerve

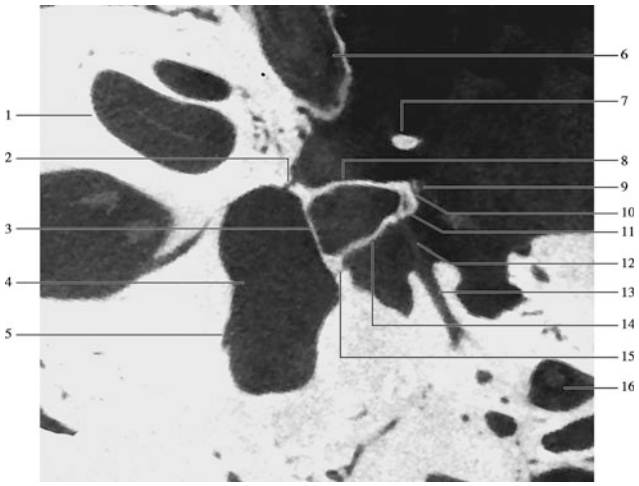

Fig. 5.3 Two-dimensional reconstruction of stapes on reference axial view. (1) Cochlea. (2) Anterior edge of vestibular window (annular ligament). (3) Footplate. (4) Vestibule. (5) Vestibular aqueduct. (6) Tensor tympani muscle. (7) Manubrium. (8) Anterior crus of the stapes. (9) Lenticular process. (10) Incudostapedial articulation. (11) Head of the stapes. (12) Tendon of stapedius muscle. (13) Pyramidal eminence and stapedius muscle. (14) Posterior crus of the stapes. (15) Posterior edge of vestibular window (annular ligament). (16) Facial nerve

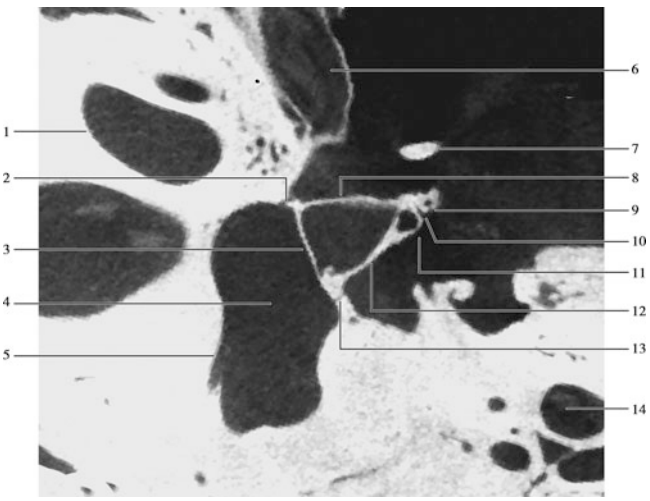

Fig. 5.2 Two-dimensional reconstruction of stapes on reference axial view. (1) Cochlea. (2) Anterior edge of vestibular window (annular ligament). (3) Footplate. (4) Vestibule. (5) Vestibular aqueduct. (6) Tensor tympani muscle. (7) Manubrium. (8) Anterior crus of the stapes. (9) Lenticular process. (10) Incudostapedial articulation. (11) Head of the stapes. (12) Posterior crus of the stapes. (13) Posterior edge of vestibular window (annular ligament). (14) Facial nerve

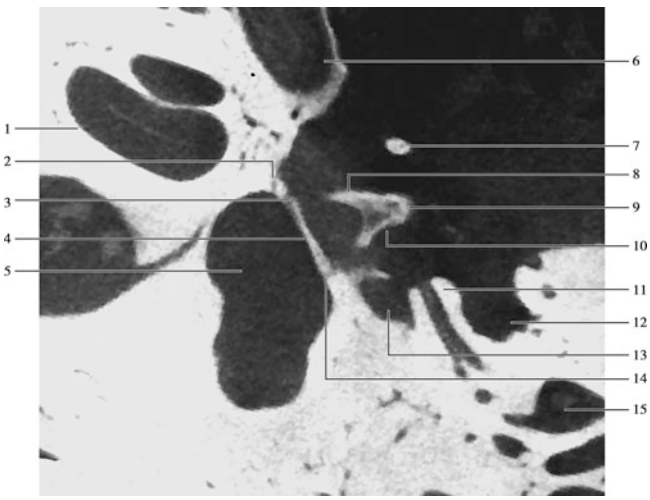

Fig. 5.4 Two-dimensional reconstruction of stapes on reference axial view. (1) Cochlea. (2) Fissula ante fenestram. (3) Anterior edge of vestibular window (annular ligament). (4) Footplate. (5) Vestibule. (6) Tensor tympani muscle. (7) Manubrium. (8) Anterior crus of the stapes. (9) Head of the stapes. (10) Neck of the stapes. (11) Pyramidal eminence and stapedius muscle. (12) Facial recess. (13) Tympanic sinus. (14) Posterior edge of vestibular window (annular ligament). (15) Facial nerve

5.2 Two-Dimensional Reconstruction of Stapes on Reference Coronal View

The reconstruction of the stapes was carried out anteriorly to posteriorly (Figs. 5.5–5.8).

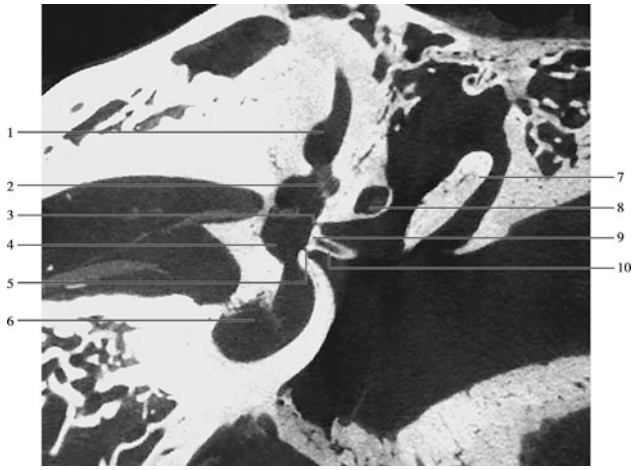

Fig. 5.5 Two-dimensional reconstruction of stapes on reference coronal view. (1) Anterior semicircular canal. (2) Superior vestibular nerve. (3) Superior edge of vestibular window (annular ligament). (4) Vestibule. (5) Inferior edge of vestibular window (annular ligament). (6) Cochlea. (7) Body of the incus. (8) Facial nerve. (9) Footplate. (10) Anterior crus of the stapes

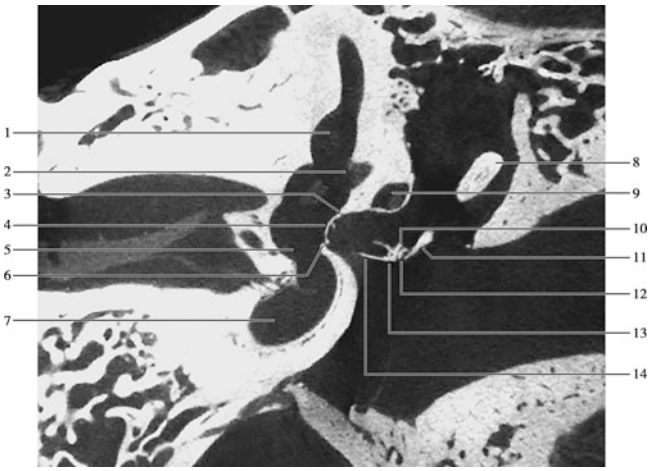

Fig. 5.7 Two-dimensional reconstruction of stapes on reference coronal view. (1) Anterior semicircular canal. (2) Superior vestibular nerve. (3) Superior edge of vestibular window (annular ligament). (4) Footplate. (5) Vestibule. (6) Inferior edge of vestibular window (annular ligament). (7) Cochlea. (8) Body of the incus. (9) Facial nerve. (10) Incudostapedial articulation. (11) Long crus of the incus. (12) Lenticular process. (13) Head of the stapes. (14) Anterior crus of the stapes

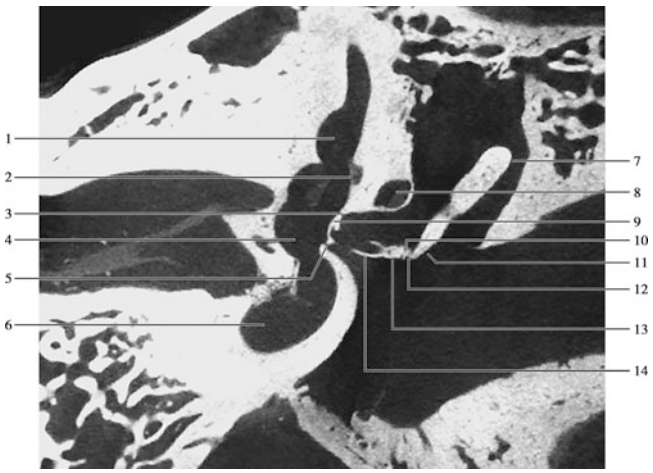

Fig. 5.6 Two-dimensional reconstruction of stapes on reference coronal view. (1) Anterior semicircular canal. (2) Superior vestibular nerve. (3) Superior edge of vestibular window (annular ligament). (4) Vestibule. (5) Inferior edge of vestibular window (annular ligament). (6) Cochlea. (7) Body of the incus. (8) Facial nerve. (9) Footplate. (10) Incudostapedial articulation. (11) Long crus of the incus (12) Lenticular process. (13) Head of the stapes. (14) Anterior crus of the stapes

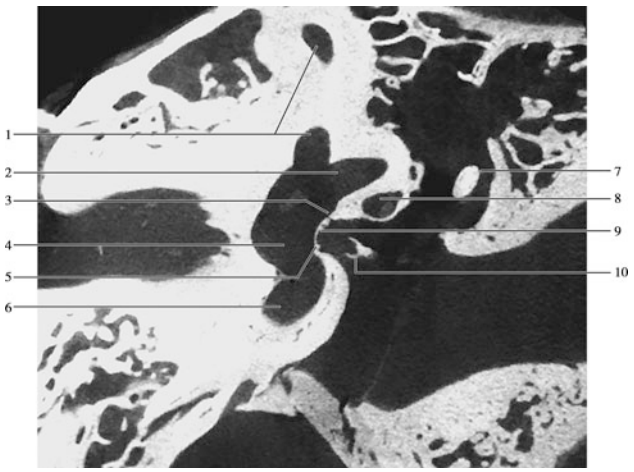

Fig. 5.8 Two-dimensional reconstruction of stapes on reference coronal view. (1) Anterior semicircular canal. (2) Superior vestibular nerve. (3) Superior edge of vestibular window (annular ligament). (4) Vestibule. (5) Inferior edge of vestibular window (annular ligament). (6) Cochlea. (7) Short crus of the incus. (8) Facial nerve. (9) Footplate. (10) Posterior crus of the stapes

5.3 Two-Dimensional Reconstruction of Stapes on Reference Sagittal View

The reconstruction of the stapes was carried out laterally to medially (Figs. 5.9–5.12).

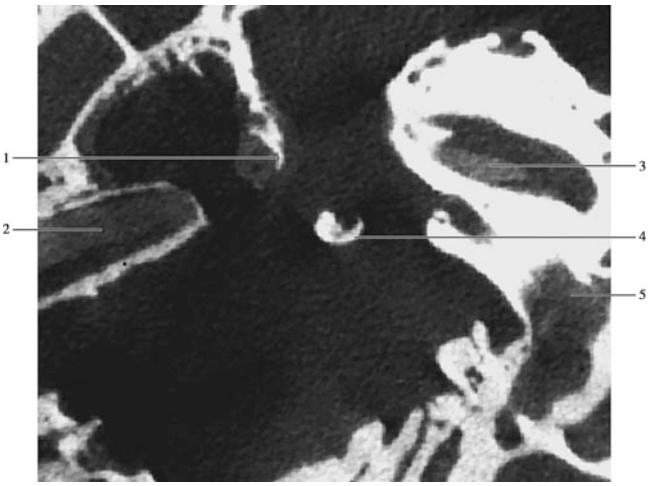

Fig. 5.9 Two-dimensional reconstruction of stapes on reference sagittal view. (1) Cochleariform process. (2) Tensor tympani muscle. (3) Facial nerve. (4) Head of the stapes. (5) Stapedius muscle

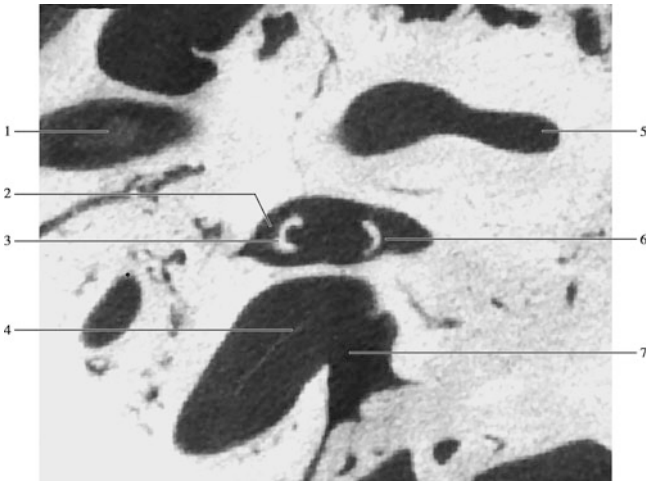

Fig. 5.11 Two-dimensional reconstruction of stapes on reference sagittal view. (1) Geniculate ganglion. (2) Vestibular window niche. (3) Anterior crus of the stapes. (4) Basal turn of the cochlea. (6) Posterior crus of the stapes. (7) Cochlear window

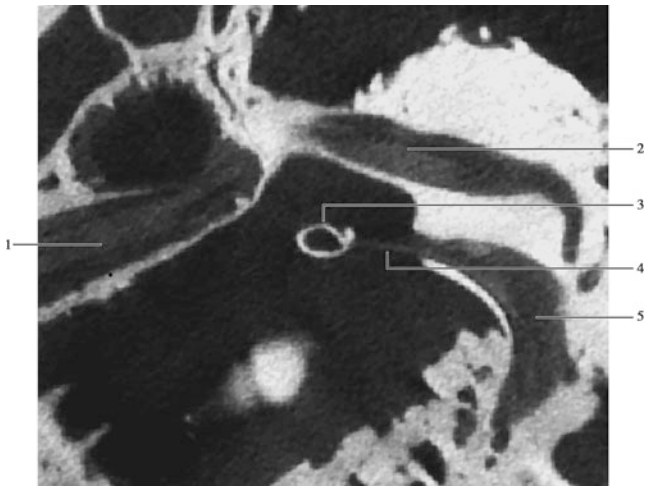

Fig. 5.10 Two-dimensional reconstruction of stapes on reference sagittal view. (1) Tensor tympani muscle. (2) Facial nerve. (3) Head of the stapes. (4) Tendon of stapedius muscle. (5) Stapedius muscle

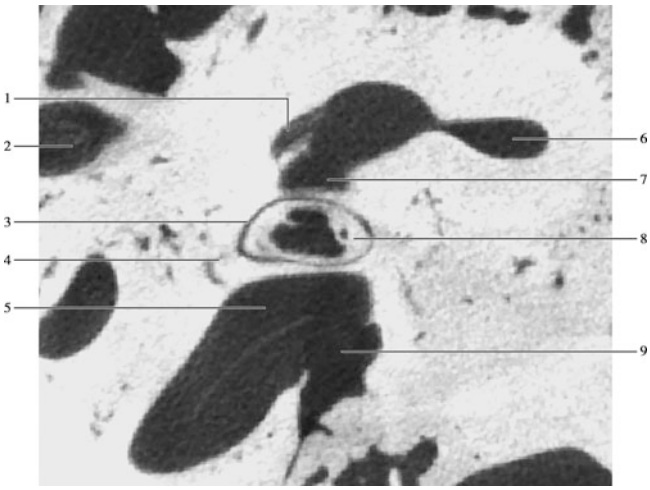

Fig. 5.12 Two-dimensional reconstruction of stapes on reference sagittal view. (1) Superior vestibular nerve. (2) Geniculate ganglion. (3) Annular ligament (4) Fissula ante fenestram. (5) Basal turn of the cochlea. (6) Lateral semicircular canal. (7) Vestibule. (8) Footplate. (9) Cochlear window

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Two-Dimensional Reconstruction of Cochlea

6

Zilong Yu, Luo Zhang, and Demin Han

The cochlea, the auditory portion of the inner ear, is coiled upon itself around the modiolus like a snail shell and makes 2½ to 2¾ turns. The basal turn (the largest in diameter) is the medial wall of the middle ear, which is a domelike prominence called the promontory. The actual starting point of the basal turn which is located within the hook region near the round window could not be shown on the outer surface of the cochlea (Erixon et al. 2009). There are three compartments within the cochlea. Two of them, the scala vestibuli (associated with the vestibular window) and the scala tympani (associated with the cochlear window), contain perilymph. The third, the cochlear duct, contains endolymph. The organ of Corti, the neural end organ of hearing, rests on the basilar membrane, which connects the medial spiral lamina and lateral spiral ligament.

Clinical CT imaging has previously been used to identify detailed anatomical structures of the temporal bone. However, the complex and fine anatomy of the cochlea may not always be understood on clinical conventional CT images (Erixon et al. 2009) with a maximum resolution of about 0.5 mm. It was reported that one-third of less-severe malformations of cochlea is not detected on conventional CT images (Johnson and Lalwani 2000). However, micro-CT images might be alternatives to overcome the resolution limitations of conventional CT images (Verbist et al. 2009; Jang et al. 2011; Martinez-Monedero et al. 2011). Although it is impossible to apply micro-CT to patients, the data from micro-CT scan can be used to determine quantitative criteria for defining the normal cochlea, which would be useful for otology surgeons diagnosing cochlear malformations and for designers of cochlear implants (Shin et al. 2013).

The two-dimensional image of the cochlea has been shown on axial, coronal, and sagittal views as above (see Chaps. 2, 3, and 4), but the position of cochlea is not on horizontal plane, its long axis (modiolus) orients from medial-posterosuperiorly to lateral-anteroinferiorly. In order to show the morphology of the cochlea in different directions for clinical practice, we choose the plane which parallels to the bony spiral plate as the transverse section, and the plane which parallels to the modiolus as the longitudinal section to observe the cochlea further.

6.1 Two-Dimensional Reconstruction of Cochlea on Transverse-Section View

The reconstruction of the cochlea was made from the basal turn to the apical turn (Figs. 6.1–6.12).

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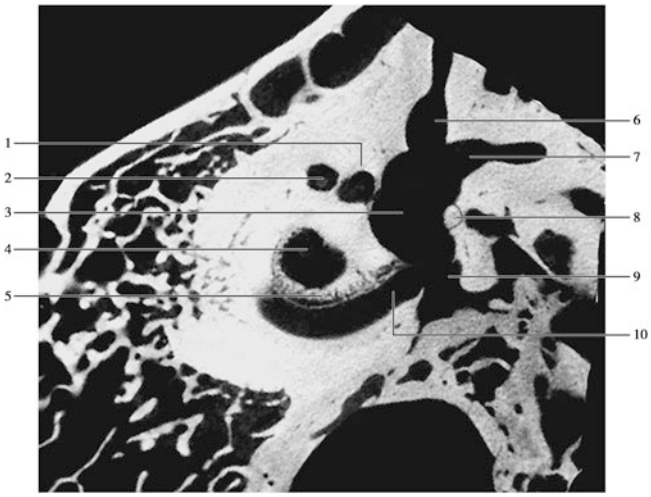

Fig. 6.1 Basal turn of two-dimensional cochlea on transverse-section view. (1) Superior vestibular nerve. (2) Labyrinthine portion of facial nerve. (3) Vestibule. (4) Cochlear nerve canal. (5) Osseous spiral lamina. (6) Ampulla of anterior semicircular canal. (7) Ampulla of external semicircular canal. (8) Footplate. (9) Cochlear window niche. (10) Hook region of the basal turn of cochlea

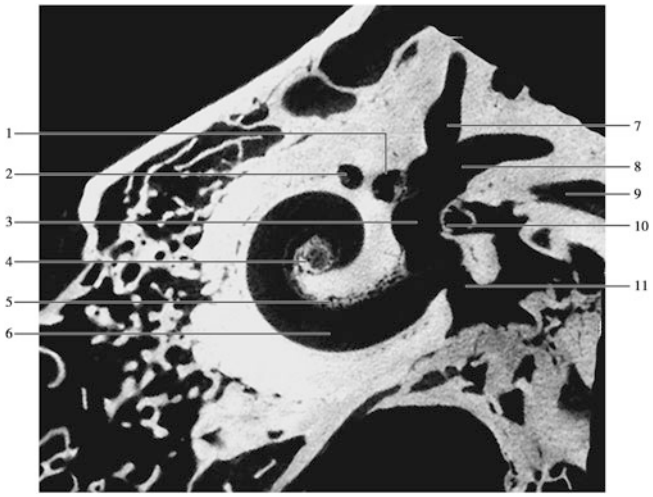

Fig. 6.3 Basal turn of two-dimensional cochlea on transverse-section view. (1) Superior vestibular nerve. (2) Labyrinthine portion of facial nerve. (3) Vestibule. (4) Modiolus. (5) Osseous lamina. (6) Basal turn of cochlea. (7) Ampulla of anterior semicircular canal. (8) Ampulla of external semicircular canal. (9) Facial nerve. (10) Footplate. (11) Cochlear window niche

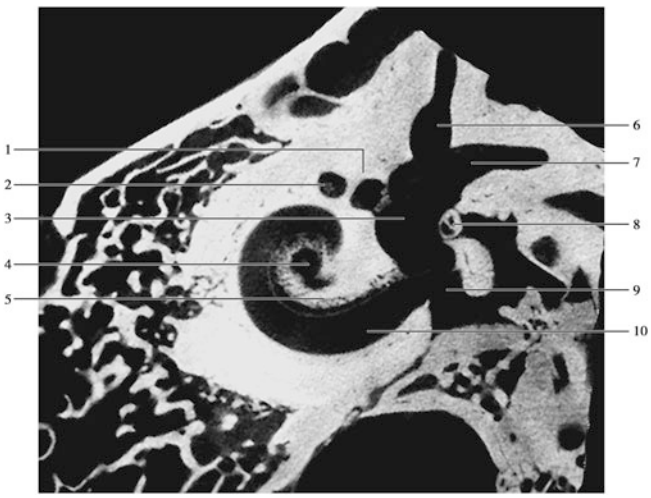

Fig. 6.2 Basal turn of two-dimensional cochlea on transverse-section view. (1) Superior vestibular nerve. (2) Labyrinthine portion of facial nerve. (3) Vestibule. (4) Cochlear nerve canal. (5) Osseous spiral lamina. (6) Ampulla of anterior semicircular canal. (7) Ampulla of external semicircular canal. (8) Footplate. (9) Cochlear window niche. (10) Basal turn of cochlea

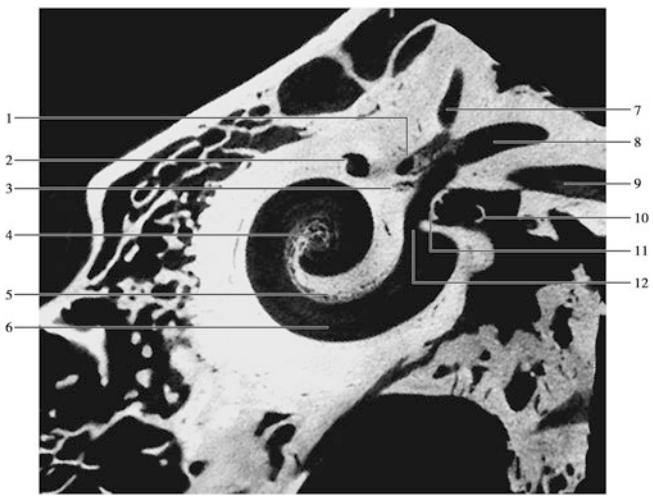

Fig. 6.4 Basal turn of two-dimensional cochlea on transverse-section view. (1) Semicircular canal branch of superior vestibular nerve. (2) Labyrinthine portion of facial nerve. (3) Maculae staticae branch of vestibular nerve. (4) Modiolus. (5) Osseous spiral lamina. (6) Basal turn of cochlea. (7) Anterior semicircular canal. (8) External semicircular canal. (9) Facial nerve. (10) Posterior crus of the stapes. (11) anterior edge of footplate. (12) Ductus reuniens

Fig. 6.5 Basal-second turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Osseous spiral lamina. (3) Second turn of cochlea. (4) Basal turn of cochlea. (5) Ampulla of external semicircular canal. (6) External semicircular canal. (7) Facial nerve. (8) Posterior crus of the stapes. (9) Anterior edge of footplate. (10) Fissula ante fenestram

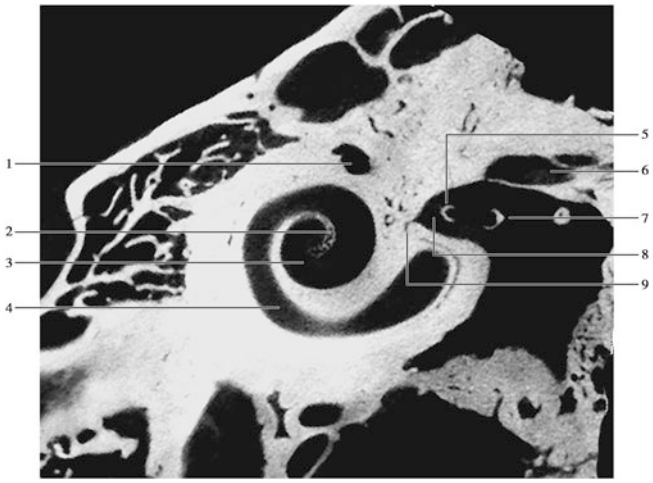

Fig. 6.7 Basal-second turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Osseous spiral lamina. (3) Second turn of cochlea. (4) Basal turn of cochlea. (5) Anterior crus of the stapes. (6) Facial nerve. (7) Posterior crus of the stapes. (8) Vestibular window niche. (9) Fissula ante fenestram

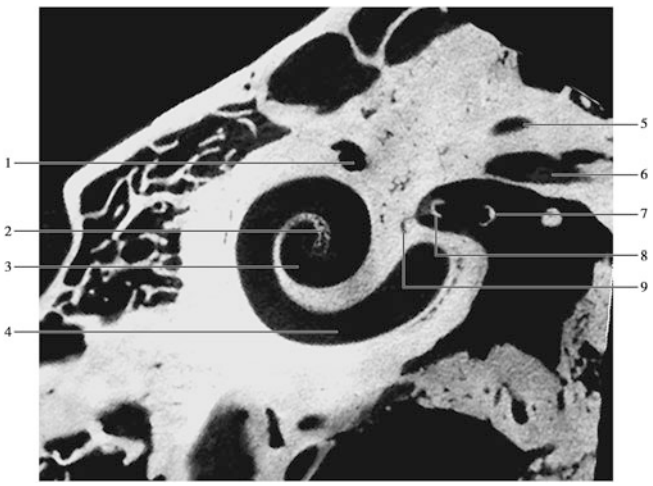

Fig. 6.6 Basal-second turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Osseous spiral lamina. (3) Second turn of cochlea. (4) Basal turn of cochlea. (5) External semicircular canal. (6) Facial nerve. (7) Posterior crus of the stapes. (8) Anterior crus of the stapes. (9) Fissula ante fenestram

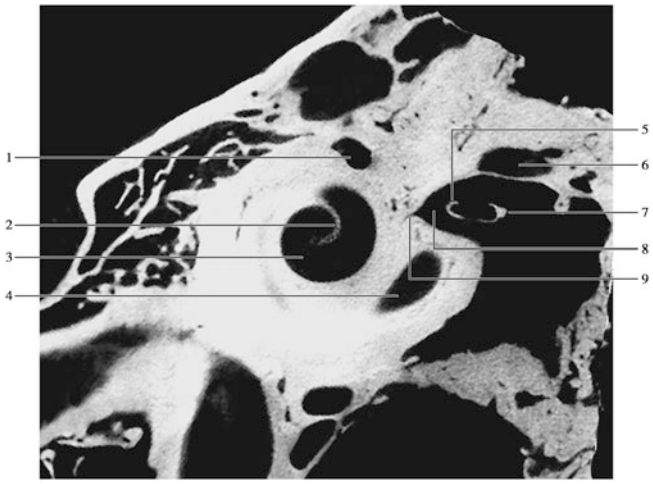

Fig. 6.8 Second turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Osseous spiral lamina. (3) Second turn of cochlea. (4) Basal turn of cochlea. (5) Anterior crus of the stapes. (6) Facial nerve. (7) Posterior crus of the stapes. (8) Vestibular window niche. (9) Fissula ante fenestram

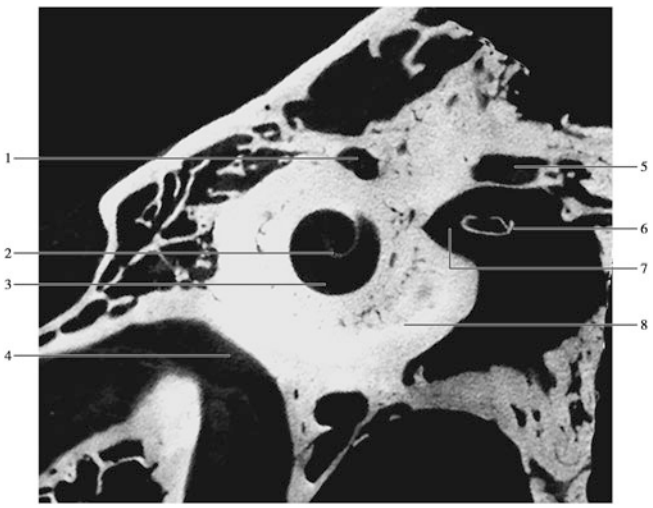

Fig. 6.9 Second turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Osseous spiral lamina. (3) Second turn of cochlea. (4) Internal carotid artery. (5) Facial nerve. (6) Neck of the stapes. (7) Vestibular window niche. (8) Promontory

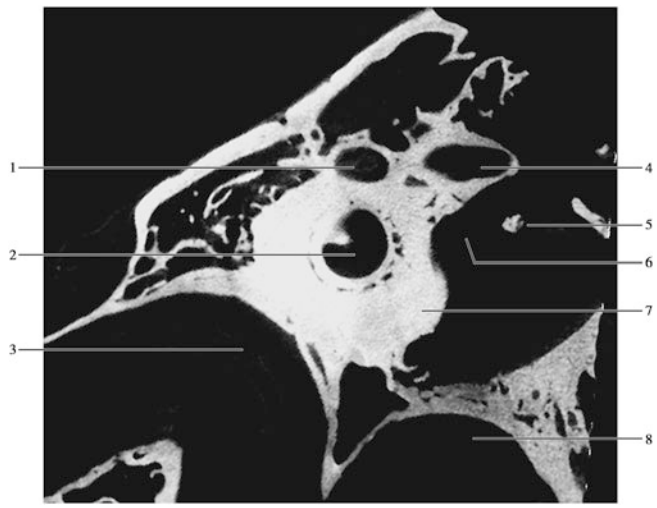

Fig. 6.11 Apical turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Apical turn of cochlea. (3) Internal carotid artery. (4) Facial nerve. (5) Head of the stapes. (6) Vestibular window niche. (7) Promontory. (8) Jugular bulb

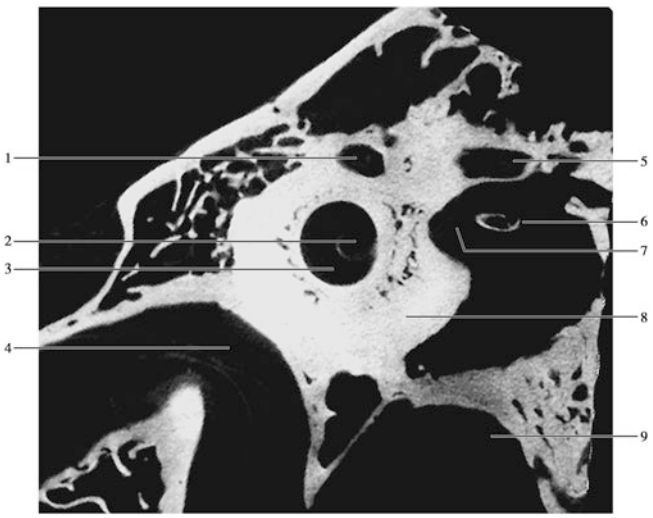

Fig. 6.10 Second-apical turn of two-dimensional cochlea on transverse-section view. (1) Labyrinthine portion of facial nerve. (2) Apical turn of cochlea. (3) Second turn of cochlea. (4) Internal carotid artery. (5) Facial nerve. (6) Neck of the stapes. (7) Vestibular window niche. (8) Promontory. (9) Jugular bulb

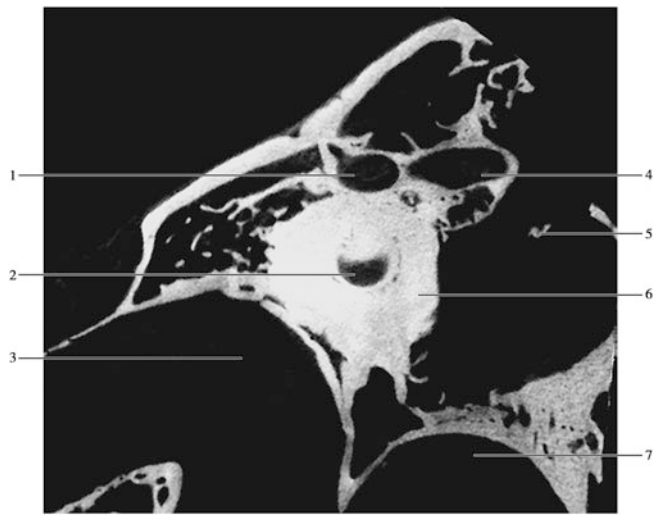

Fig. 6.12 Apical turn of two-dimensional cochlea on transverse-section view. (1) Geniculate ganglion. (2) Apical turn of cochlea. (3) Internal carotid artery. (4) Facial nerve. (5) Head of the stapes. (6) Promontory. (7) Jugular bulb

6.2 Two-Dimensional Reconstruction of Cochlea on Longitudinal-Section View

The reconstruction of the cochlea was made from superiorly to inferiorly (Figs. 6.13–6.18).

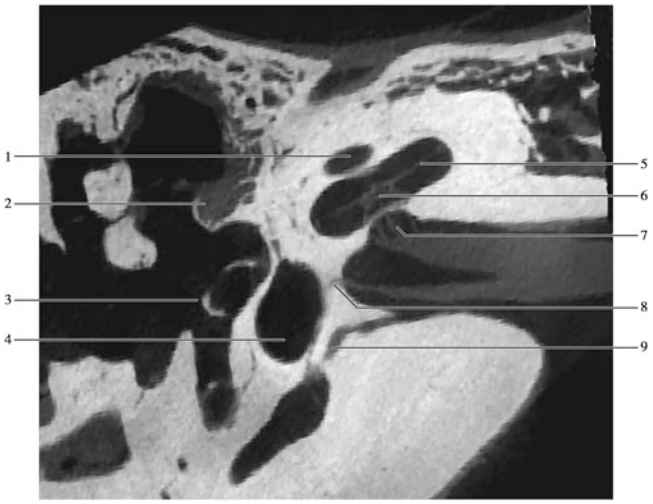

Fig. 6.13 Two-dimensional cochlea on longitudinal-section view. (1) Second turn of cochlea. (2) Cochleariform process. (3) Stapes. (4) Vestibule. (5) Osseous spiral lamina. (6) Modiolus. (7) Cochlear nerve. (8) Inferior vestibular nerve. (9) Singular foramen

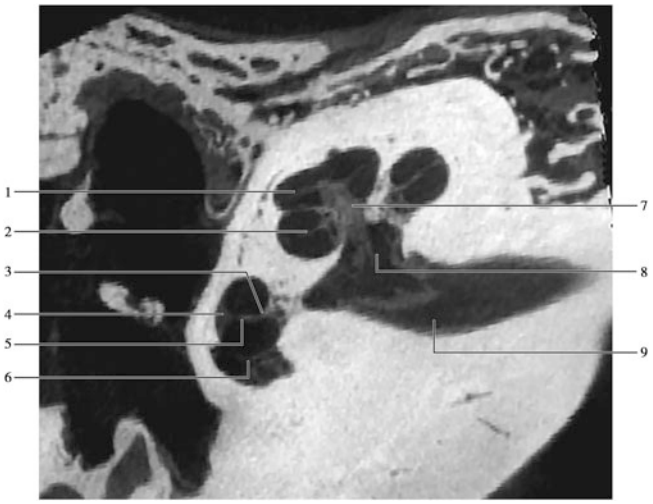

Fig. 6.15 Two-dimensional cochlea on longitudinal-section view. (1) Osseous spiral lamina of apical turn of cochlea. (2) Osseous spiral lamina of second turn of cochlea. (3) Osseous spiral lamina of basal turn of cochlea. (4) Spiral ligament. (5) Basilar membrane. (6) Cochlear window. (7) Modiolus. (8) Cochlear nerve canal and cochlear nerve. (9) Internal auditory canal

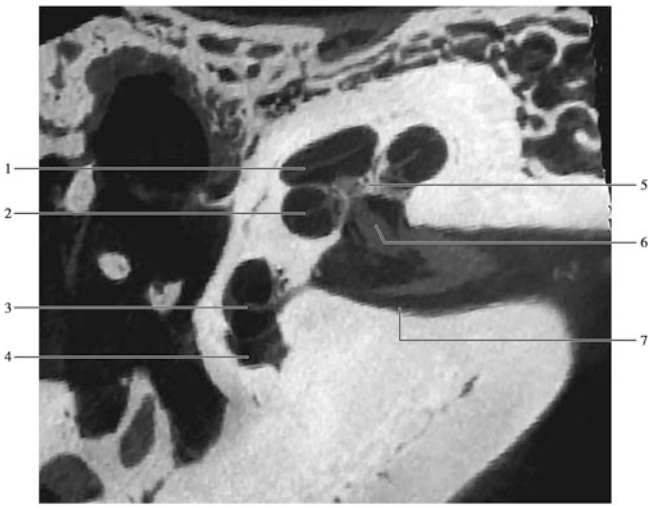

Fig. 6.14 Two-dimensional cochlea on longitudinal-section view. (1) Osseous spiral lamina of apical turn of cochlea. (2) Osseous spiral lamina of second turn of cochlea. (3) Osseous spiral lamina of basal turn of cochlea. (4) Cochlear window niche. (5) Modiolus. (6) Cochlear nerve foramen and cochlear nerve. (7) Internal auditory canal

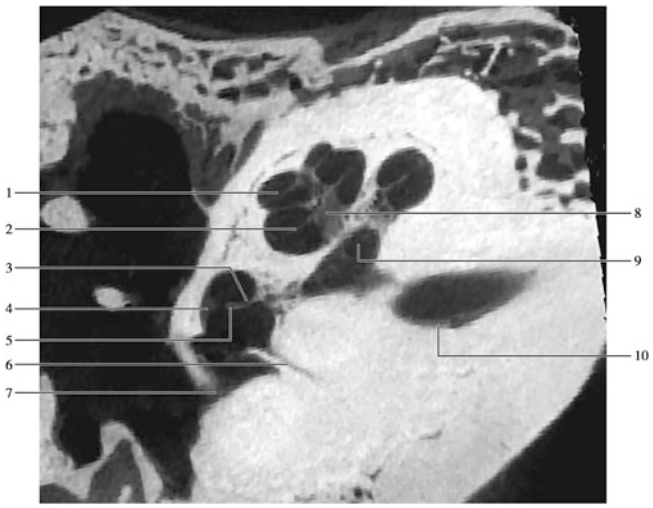

Fig. 6.16 Two-dimensional cochlea on longitudinal-section view. (1) Osseous spiral lamina of apical turn of cochlea. (2) Osseous spiral lamina of second turn of cochlea. (3) Osseous spiral lamina of basal turn of cochlea. (4) Spiral ligament. (5) Basilar membrane. (6) Cochlear aqueduct. (7) Cochlear window niche. (8) Modiolus. (9) Cochlear nerve canal and cochlear nerve. (10) Internal auditory canal

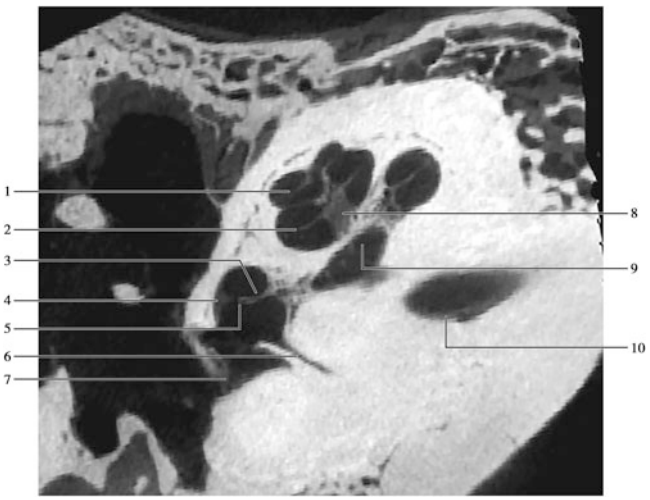

Fig. 6.17 Two-dimensional cochlea on longitudinal-section view. (1) Osseous spiral lamina of apical turn of cochlea. (2) Osseous spiral lamina of second turn of cochlea. (3) Osseous spiral lamina of basal turn of cochlea. (4) Spiral ligament. (5) Basilar membrane. (6) Cochlear aqueduct. (7) Cochlear window niche. (8) Modiolus. (9) Cochlear nerve canal and cochlear nerve. (10) Internal auditory canal

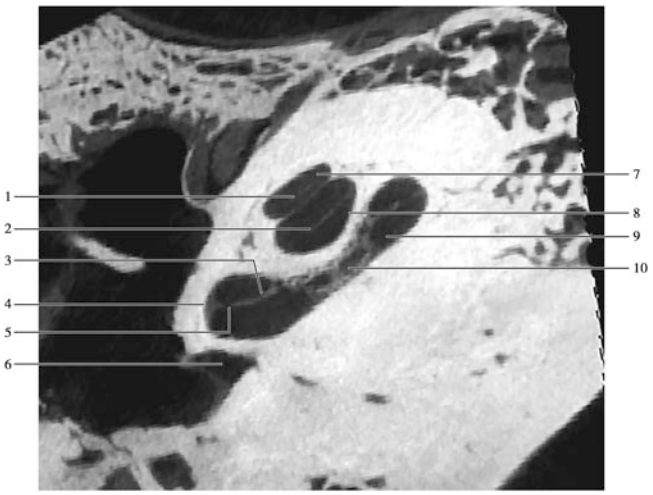

Fig. 6.18 Two-dimensional cochlea on longitudinal-section view. (1) Osseous spiral lamina of apical turn of cochlea. (2) Osseous spiral lamina of second turn of cochlea. (3) Osseous spiral lamina of basal turn of cochlea. (4) Spiral ligament. (5) Basilar membrane. (6) Cochlear window niche. (7) Apical turn of cochlea. (8) Second turn of cochlea. (9) Basal turn of cochlea. (10) Modiolus

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Three-Dimensional Reconstruction of Temporal Bone

7

Zilong Yu, Luo Zhang, and Demin Han

The temporal bone houses the end organs of hearing and equilibrium systems, the smallest separate bones and its articulates, the brain nerves (such as the facial nerve and cochlear nerve) and the carotid artery run through the temporal bone. The Three-dimensional (3-D) reconstruction of the temporal bone from micro-CT data can show the excellent micro-architecture and their spatial relationships. Except the special annotation, all the Three-dimensional images were reconstructed from the left temporal bone in this chapter.

7.1 The General Three-Dimensional Reconstruction of Temporal Bone

The spatial relationships among the external auditory canal, the ossicular chain, Eustachian tube, the muscles, the nerves, the inner ear, the endolymphatic duct, and the internal auditory canal, etc., were exhibited from outside to inside (Figs. 7.1–7.13).

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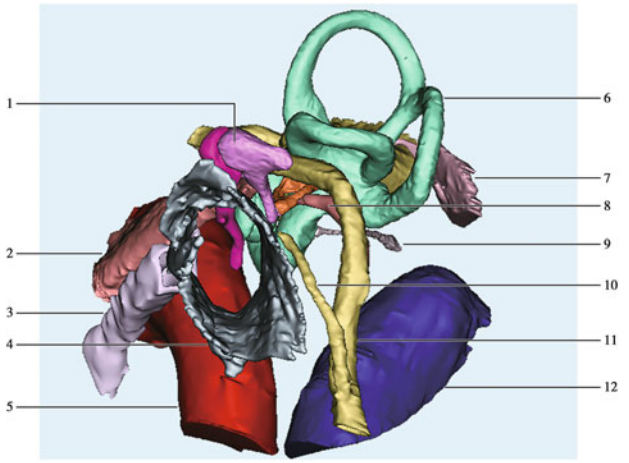

Fig. 7.1 Three-dimensional reconstruction of temporal bone on external auditory canal view. (1) Ossicular chain. (2) Tensor tympani muscle. (3) Eustachian tube. (4) External auditory canal. (5) Internal carotid artery. (6) Semicircular canal. (7) Endolymphatic sac. (8) Stapedius muscle. (9) Cochlear aqueduct. (10) Chorda tympani nerve. (11) Facial nerve. (12) Jugular bulb

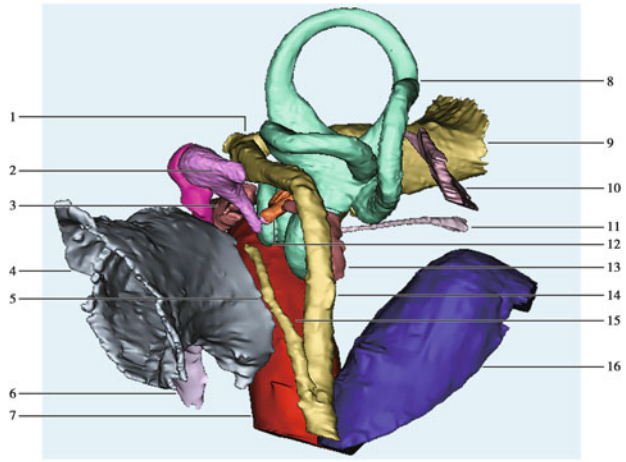

Fig. 7.3 Three-dimensional reconstruction of temporal bone on lateroposterior view. (1) Geniculate ganglion. (2) Ossicular chain (incus). (3) Tensor tympani muscle. (4) External auditory canal. (5) Chorda tympani nerve. (6) Eustachian tube. (7) Internal carotid artery. (8) Semicircular canal. (9) Internal auditory canal. (10) Endolymphatic sac. (11) Cochlear aqueduct. (12) Stapes. (13) Stapedius muscle. (14) Facial nerve. (15) Chorda tympani nerve. (16) Jugular bulb

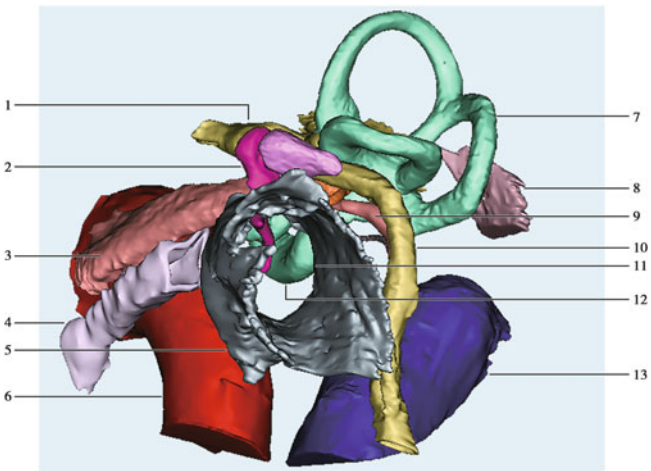

Fig. 7.2 Three-dimensional reconstruction of temporal bone on posterior wall of external auditory canal view. (1) Geniculation ganglion. (2) Ossicular chain (malleus). (3) Tensor tympani muscle. (4) Eustachian tube. (5) External auditory canal. (6) Internal carotid artery. (7) Semicircular canal. (8) Endolymphatic sac. (9) Stapedius muscle. (10) Facial nerve. (11) Medial end of posterior wall of external auditory canal. (12) Cochlea. (13) Jugular bulb

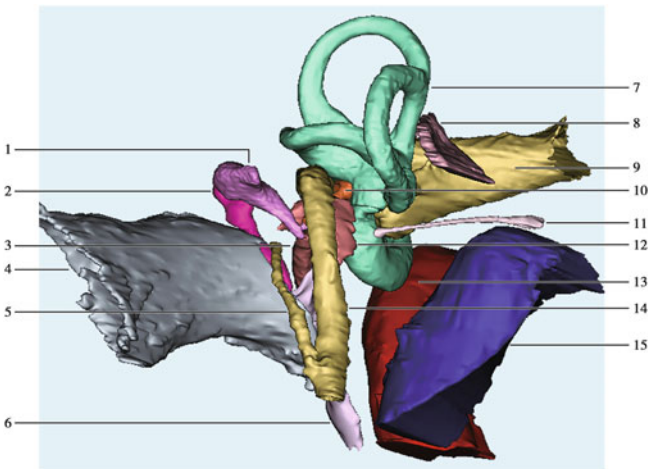

Fig. 7.4 Three-dimensional reconstruction of temporal bone on posteroanterior view. (1) Incus. (2) Malleus. (3) Tensor tympani muscle. (4) External auditory canal. (5) Chorda tympani nerve. (6) Eustachian tube. (7) Semicircular canal. (8) Endolymphatic sac. (9) Internal auditory canal. (10) Stapes. (11) Cochlear aqueduct. (12) Stapedius muscle. (13) Internal carotid artery. (14) Facial nerve. (15) Jugular bulb

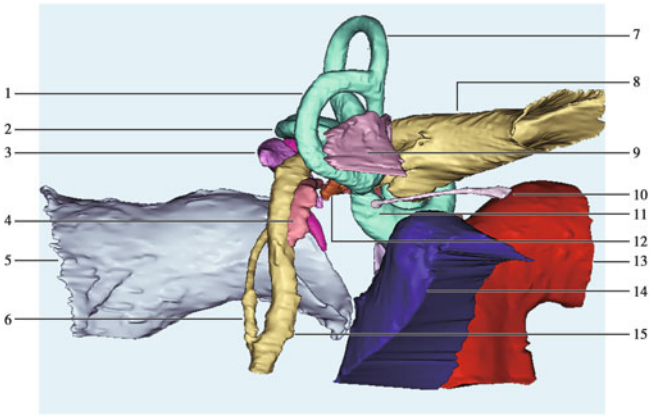

Fig. 7.5 Three-dimensional reconstruction of temporal bone on posterior cranial fossa view. (1) Posterior semicircular canal. (2) Lateral semicircular canal. (3) Incus. (4) Stapedius muscle. (5) External auditory canal. (6) Chorda tympani nerve. (7) Anterior semicircular canal. (8) Internal auditory canal. (9) Endolymphatic sac. (10) Cochlear aqueduct. (11) Cochlea. (12) Stapes. (13) Internal carotid artery. (14) Jugular bulb. (15) Facial nerve

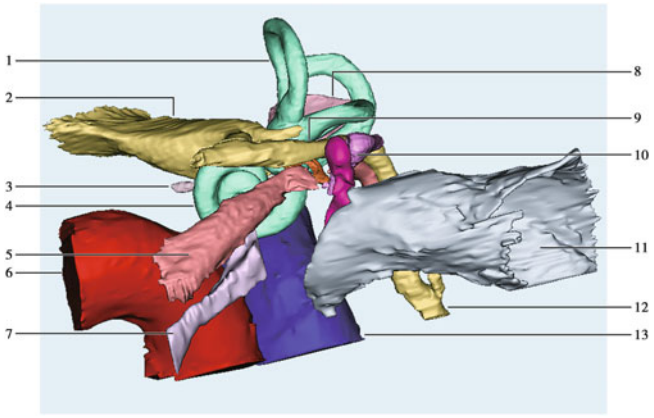

Fig. 7.7 Three-dimensional reconstruction of temporal bone on petrous apex view. (1) Anterior semicircular canal. (2) Internal auditory canal. (3) Cochlear aqueduct. (4) Cochlea. (5) Tensor tympani muscle. (6) Internal carotid artery. (7) Eustachian tube. (8) Endolymphatic sac. (9) Tympanic portion of facial nerve. (10) Incudomalleolar articulation. (11) External auditory canal. (12) Mastoid portion of facial nerve. (13) Jugular bulb

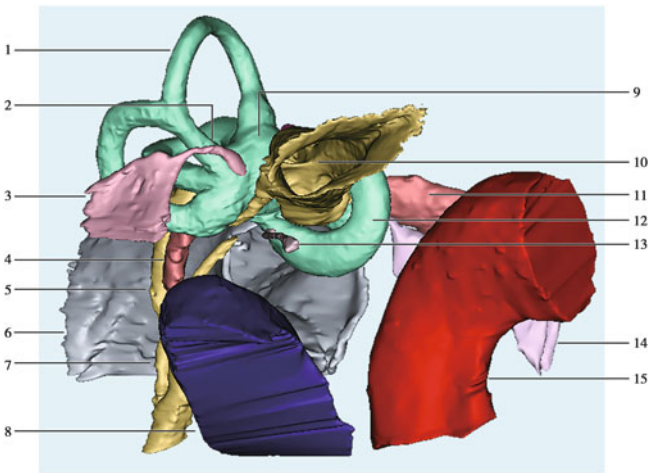

Fig. 7.6 Three-dimensional reconstruction of temporal bone on internal acoustic porus view. (1) Anterior semicircular canal. (2) Vestibular aqueduct. (3) Endolymphatic sac. (4) Stapedius muscle. (5) Facial nerve (6) External auditory canal. (7) Chorda tympani nerve. (8) Jugular bulb. (9) Vestibule. (10) Internal auditory canal. (11) Tensor tympani muscle. (12) Cochlea. (13) Cochlear aqueduct. (14) Eustachian tube. (15) Internal carotid artery

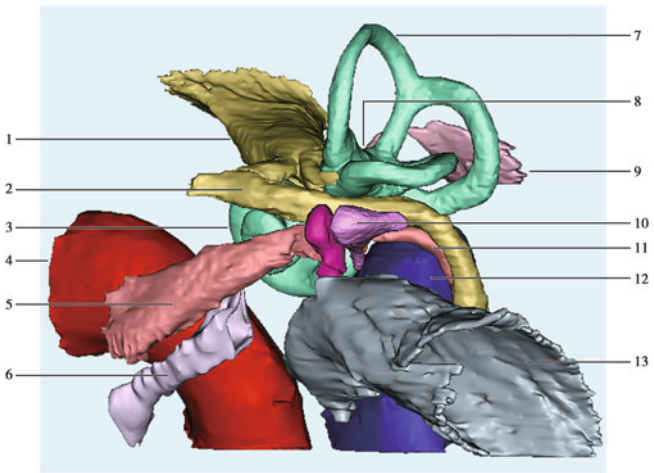

Fig. 7.8 Three-dimensional reconstruction of temporal bone on lateral view. (1) Internal auditory canal. (2) Geniculate ganglion. (3) Cochlea. (4) Internal carotid artery. (5) Tensor tympani muscle. (6) Eustachian tube. (7) Anterior semicircular canal. (8) Vestibule. (9) Endolymphatic sac. (10) Incus. (11) Stapedius muscle. (12) Jugular bulb. (13) External auditory canal

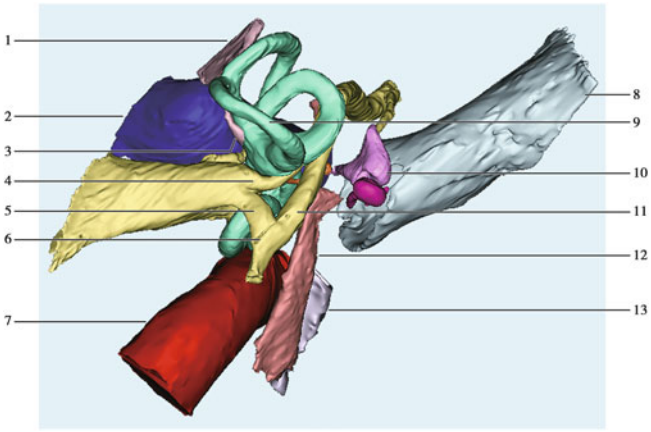

Fig. 7.9 Three-dimensional reconstruction of temporal bone on middle cranial fossa view. (1) Endolymphatic sac. (2) Jugular bulb. (3) Vestibular aqueduct. (4) Superior vestibular nerve. (5) Labyrinthine portion of facial nerve. (6) Geniculate ganglion. (7) Internal carotid artery. (8) External auditory canal. (9) Anterior semicircular canal. (10) Incus. (11) Tympanic portion of facial nerve. (12) Tensor tympani muscle. (13) Eustachian tube

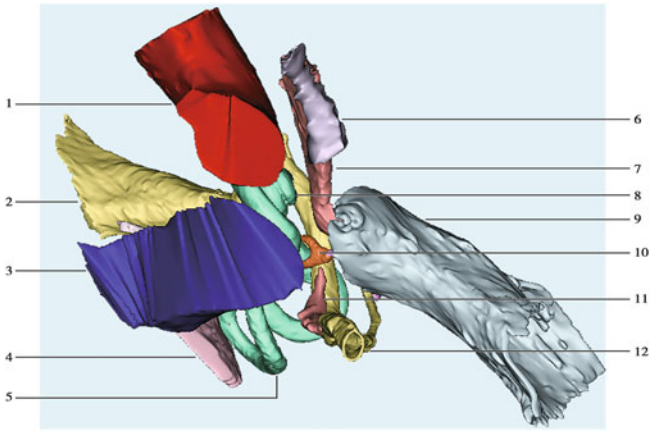

Fig. 7.11 Three-dimensional reconstruction of temporal bone on basis crania externa view. (1) Internal carotid artery. (2) Internal auditory canal. (3) Jugular bulb. (4) Endolymphatic sac. (5) Posterior semicircular canal. (6) Eustachian tube. (7) Tensor tympani muscle. (8) Cochlea. (9) External auditory canal. (10) Stapes. (11) Stapedius muscle. (12) Mastoid portion of facial nerve

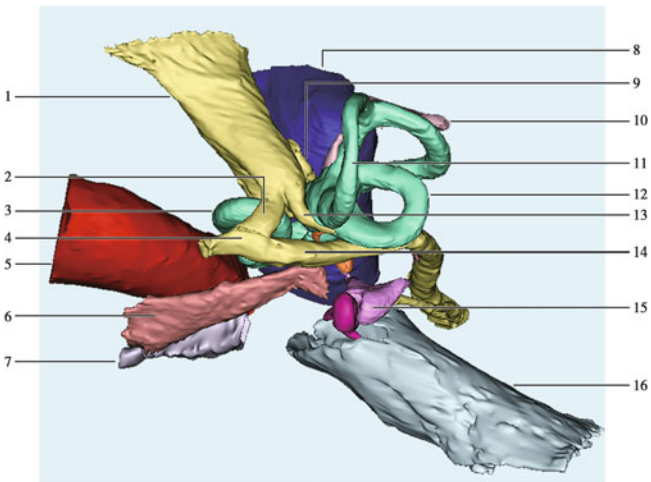

Fig. 7.10 Three-dimensional reconstruction of temporal bone on temporal lobe view. (1) Internal auditory canal. (2) Labyrinthine portion of facial nerve. (3) Cochlea. (4) Geniculate ganglion. (5) Internal carotid artery. (6) Tensor tympani muscle. (7) Eustachian tube. (8) Jugular bulb. (9) Singular foramen nerve. (10) Endolymphatic sac. (11) Anterior semicircular canal. (12) Laternal semicircular canal. (13) Superior vestibular nerve. (14) Tympanic portion of facial nerve. (15) Incus. (16) External auditory canal

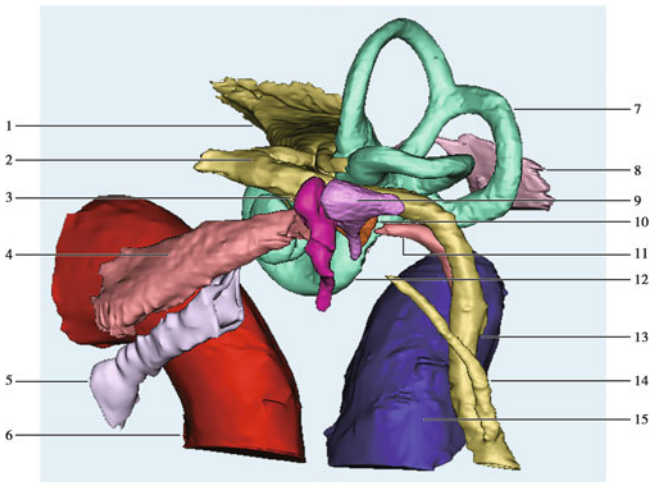

Fig. 7.12 Three-dimensional reconstruction of temporal bone (without external auditory canal) on lateral view. (1) Internal auditory canal. (2) Geniculate ganglion. (3) Mallues. (4) Tensor tympani muscle. (5) Eustachian tube. (6) Internal carotid artery. (7) Posterior semicircular canal. (8) Endolymphatic sac. (9) Incus. (10) Stapes. (11) Stapedius muscle. (12) Cochlea. (13) Mastoid portion of facial nerve. (14) Chorda tympani nerve. (15) Jugular bulb

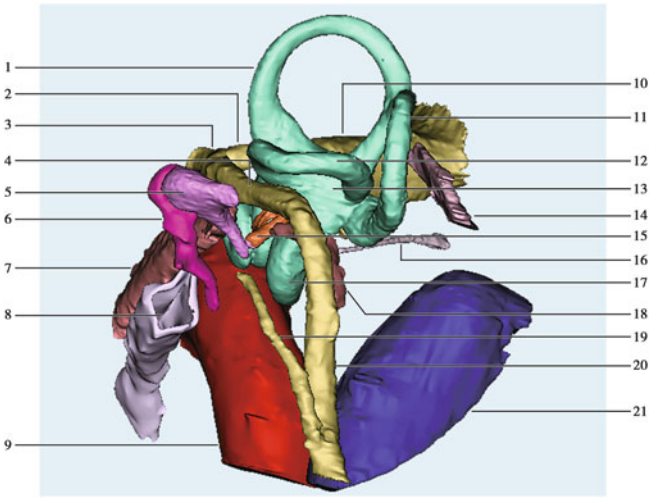

Fig. 7.13 Three-dimensional reconstruction of temporal bone (without external auditory canal) on lateroposterior view. (1) Anterior semicircular canal. (2) Labyrinthine portion of facial nerve. (3) Geniculate ganglion. (4) Tymapic portion of facial nerve. (5) Incus. (6) Mallues. (7) Tensor tympani muscle. (8) Eustachian tube. (9) Internal carotid artery. (10) Internal auditory canal. (11) Posterior semicircular canal. (12) Lateral semicircular canal. (13) Vestibule. (14) Endolymphatic sac. (15) Stapes. (16) Cochlear aqueduct. (17) Cochlea. (18) Stapedius muscle. (19) Chorda tympani nerve. (20) Mastoid portion of facial nerve. (21) Jugular bulb

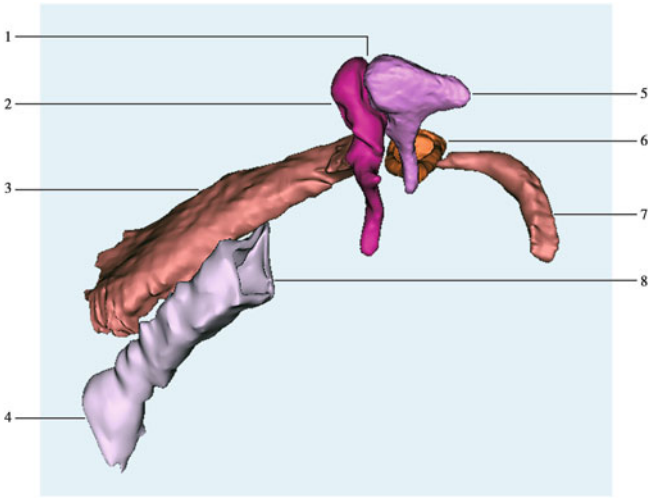

Fig. 7.14 Three-dimensional reconstruction of middle ear on lateral view. (1) Incudomalleolar articulation. (2) Malleus. (3) Tensor tympani muscle. (4) Pharyngeal orifice of eustachian tube. (5) Incus. (6) Stapes. (7) Stapedius muscle. (8) Tympanic orifice of eustachian tube

7.2 Three-Dimensional Reconstruction of Middle Ear

The contents of the middle ear (tympanic cavity) mainly consist of the ossicular chain, muscles and ligaments. The ossicular chain includes the malleus, incus and stapes. They compose the incudomalleolar articulation and the incudostapedial articulation. The ossicular chain laterally connects the tympanic membrane via the manubrium of the malleus and internally fits into the vestibular window by the stapes, they represent the normal path of sound transmission across the middle ear space, the disconnect of ossicular chain can cause conductive hearing loss. The muscles in tympanic cavity include the tensor tympani muscle and the stapedius muscle.

The tensor tympani muscle originates from a bony semicanal above the eustachian tube, attaches the neck of the mallues by its tendon, and is supplied by a branch of the fifth nerve. The stapedius muscle is the smallest muscle in the body, it arises from a bony pyramid in the posterior wall of the middle ear and attaches to the neck of the stapes. It is supplied by a branch of the facial nerve. The tendons of the tensor tympani muscle and the stapedius muscle don't present clearly because of lacking of the apparent contrast with the surrounding tissues.

The eustachian tube connects the middle ear and the nasopharynx, and it is the only channel of the tympanic cavity and the mastoid to connect the outside, the diameter of the eustachian tube is the greatest at the pharyngeal end and narrowing to an isthmus at the junction of the cartilaginous and bony portions (Figs. 7.14–7.29).

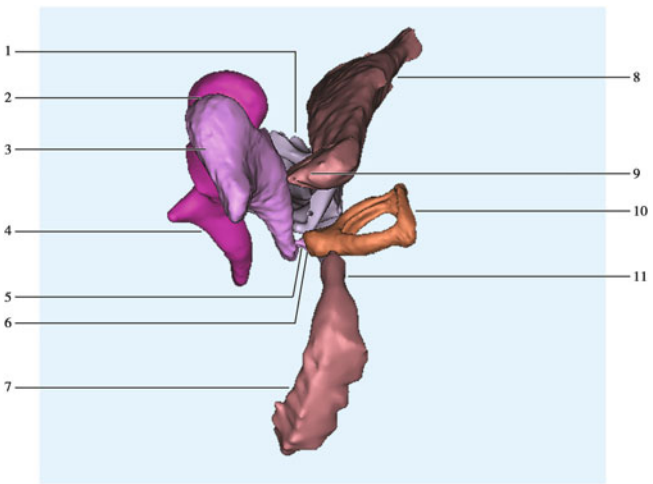

Fig. 7.15 Three-dimensional reconstruction of middle ear on superoposterior view. (1) Eustachian tube. (2) Incudomalleolar articulation. (3) Incus. (4) Malleus. (5) Lenticular process. (6) Incudostapedial articulation. (7) Stapedius muscle. (8) Tensor tympani muscle. (9) Tendon of tensor tympani muscle. (10) Stapes. (11) Tendon of stapedius muscle

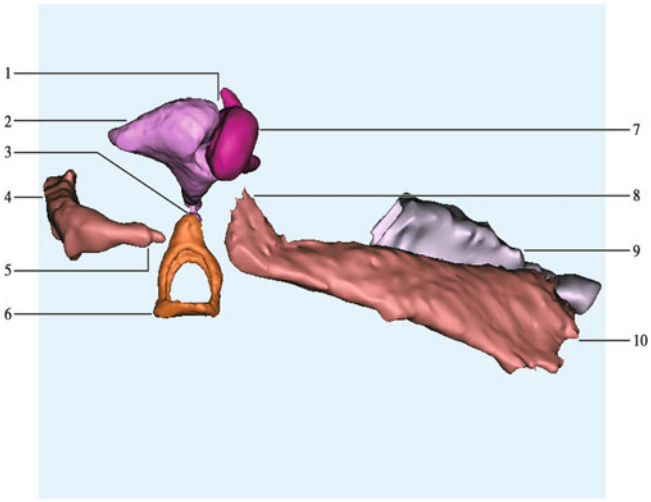

Fig. 7.16 Three-dimensional reconstruction of middle ear on middle cranial fossa view. (1) Incudomalleolar articulation. (2) Incus. (3) Incudostapedial articulation. (4) Stapedius muscle. (5) Tendon of stapedius muscle. (6) Stapes. (7) Malleus. (8) Tendon of tensor tympani muscle. (9) Eustachian tube. (10) Tensor tympani muscle

Fig. 7.18 Three-dimensional reconstruction of mallues on anterior view. (1) Head. (2) Neck. (3) Manubrium. (4) Articular surface. (5) Long process. (6) Short process

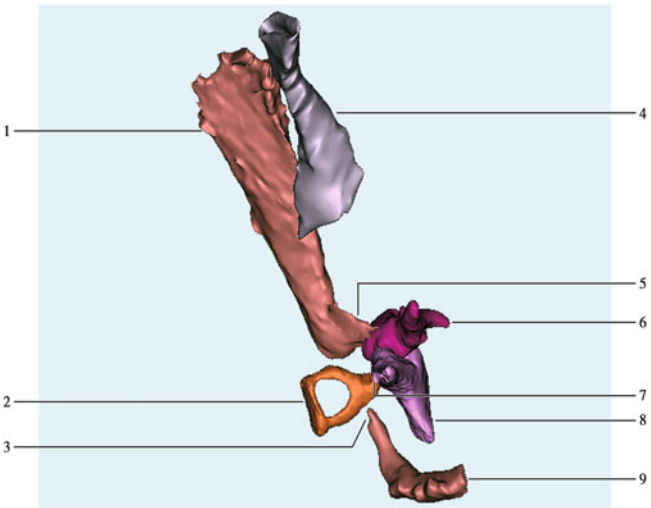

Fig. 7.17 Three-dimensional reconstruction of middle ear on basis crania externa view. (1) Tensor tympani muscle. (2) Stapes. (3) Tendon of stapedius muscle. (4) Eustachian tube. (5) Tendon of tensor tympani muscle. (6) Malleus. (7) Incudostapedial articulation. (8) Incus. (9) Stapedius muscle

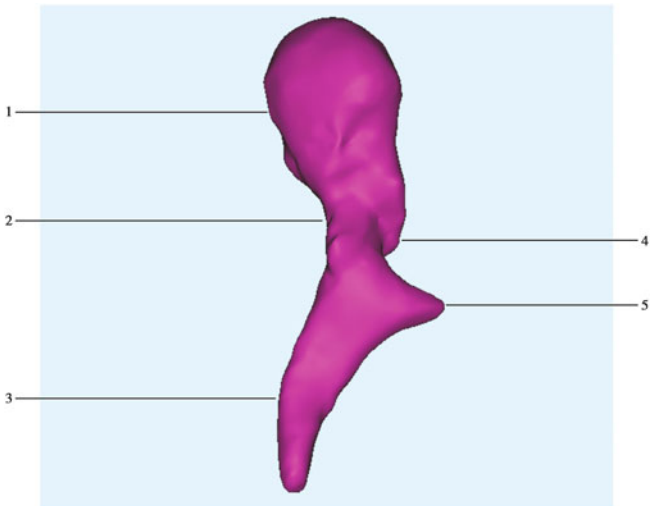

Fig. 7.19 Three-dimensional reconstruction of mallues on lateral view. (1) Head. (2) Neck. (3) Manubrium. (4) Long process. (5) Short process

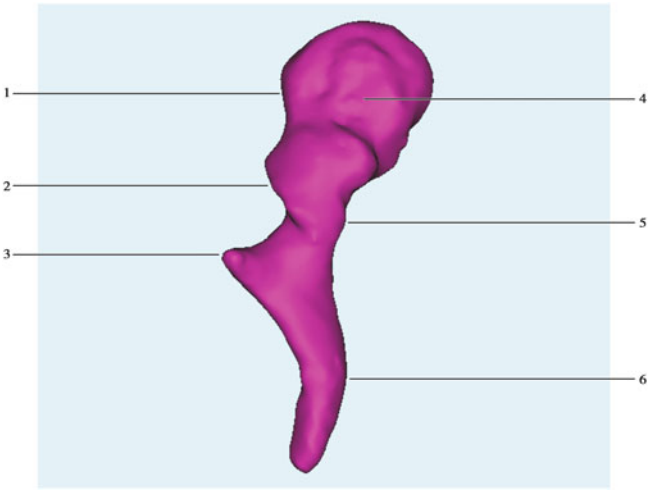

Fig. 7.20 Three-dimensional reconstruction of mallues on posterior view. (1) Head. (2) Long process. (3) Short process. (4) Articular surface. (5) Neck. (6) Manubrium

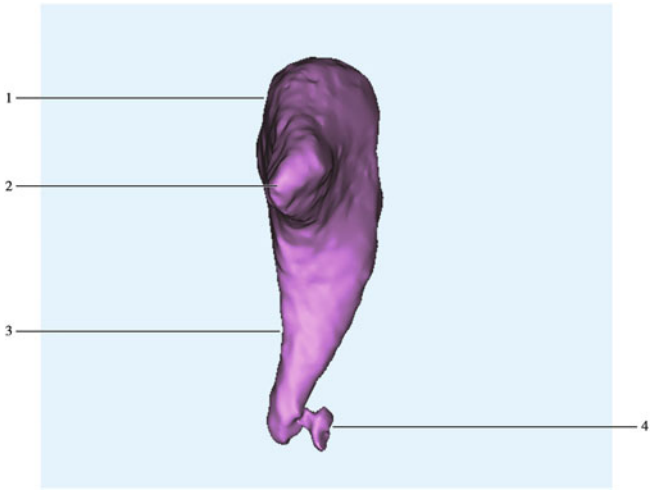

Fig. 7.22 Three-dimensional reconstruction of incus on posterior view. (1) Body. (2) Short incus. (3) Long crus. (4) Lenticular process

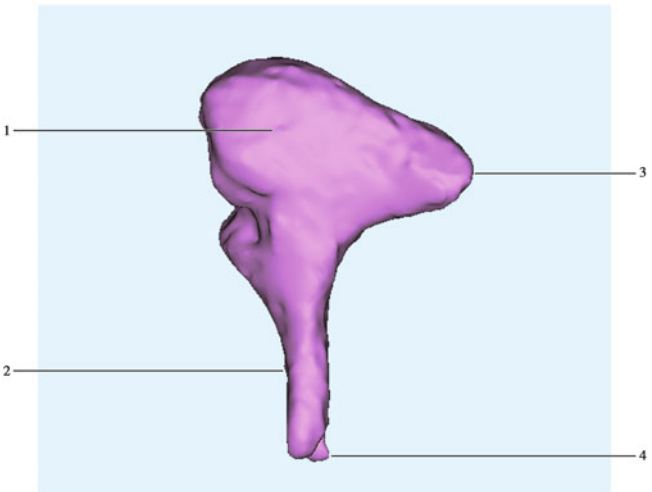

Fig. 7.21 Three-dimensional reconstruction of incus on lateral view. (1) Body. (2) Long crus. (3) Short incus. (4) Lenticular process

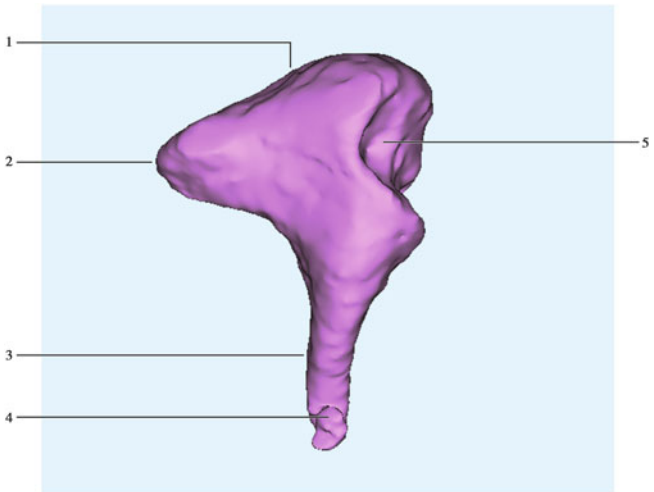

Fig. 7.23 Three-dimensional reconstruction of incus on medial view. (1) Body. (2) Short incus. (3) Long crus. (4) Lenticular process. (5) Articular surface

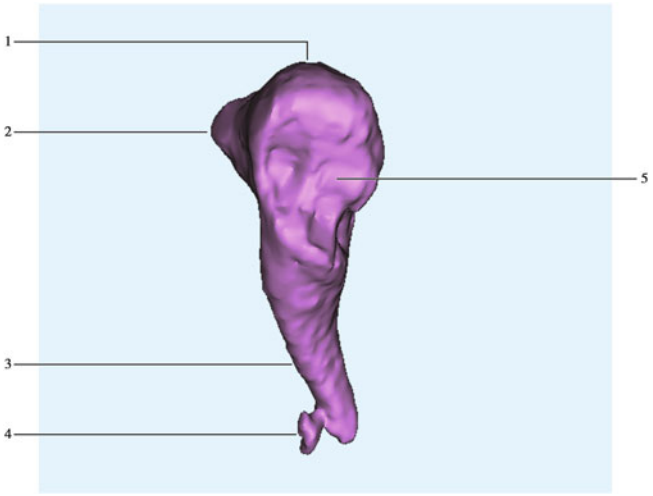

Fig. 7.24 Three-dimensional reconstruction of incus on anterior view. (1) Body. (2) Short incus. (3) Long crus. (4) Lenticular process. (5) Articular surface

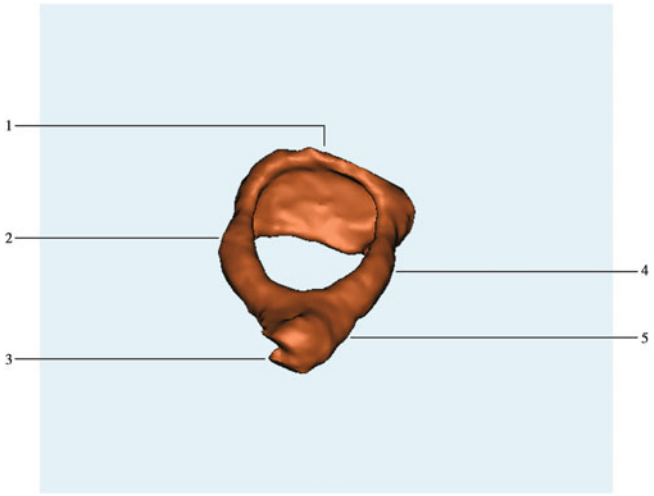

Fig. 7.26 Three-dimensional reconstruction of stapes on superolateral (attic) view. (1) Footplate. (2) Anterior incus. (3) Head. (4) Posterior crus. (5) Neck

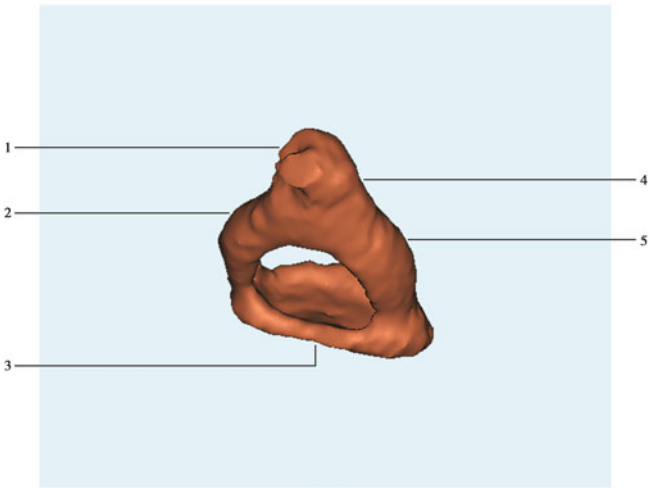

Fig. 7.25 Three-dimensional reconstruction of stapes on inferolateral (promontory) view. (1) Head. (2) Anterior incus. (3) Footplate. (4) Neck. (5) Posterior crus

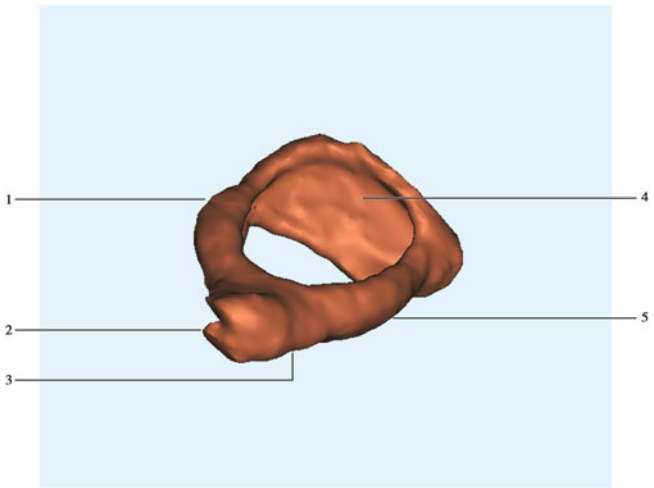

Fig. 7.27 Three-dimensional reconstruction of stapes on Posterosuperior (Fenestration of footplate) view. (1) Anterior incus. (2) Head. (3) Footplate. (4) Neck. (5) Posterior crus

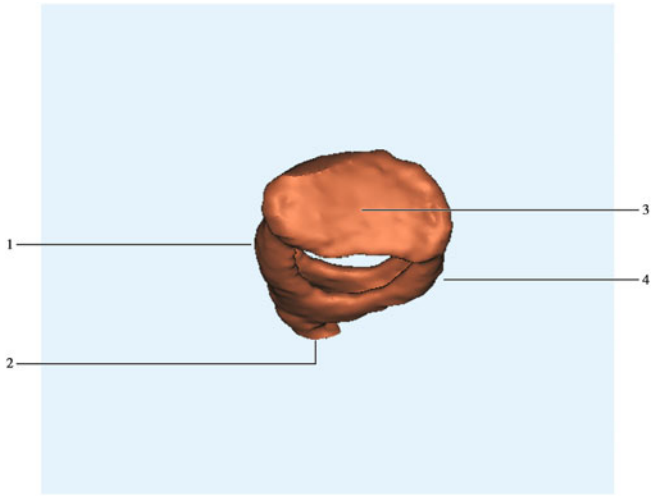

Fig. 7.28 Three-dimensional reconstruction of stapes on intracranial view. (1) Posterior crus. (2) Head. (3) Footplate. (4) Anterior incus

The semicircular canals are known as the lateral, the anterior and the posterior canals. Both ends of each semicircular canal open into the vestibule. The posterior crus of the anterior canal and the inferior crus of the posterior canal incorporate one crus (called the common crus), so there are five orifices in the vestibule for three semicircular canals.

In addition, the vestibular aqueduct and the cochlear aqueduct both affiliate to the inner ear. The aqueduct of the vestibule originates from the medial wall of the vestibule and medially bypasses the common crus of the semicircular canal, turns postero-laterally to the posterior surface of petrous portion, forms the endolymphatic sac, the shape of the aqueduct and the sac looks like 'a piece of the gingko leaf'. The large vestibular aqueduct is one of the most common malformations of the inner ear. The cochlear aqueduct, a small canal through bone, provides direct exchange of the perilymphatic fluid with the spinal fluid (Figs. 7.30–7.37).

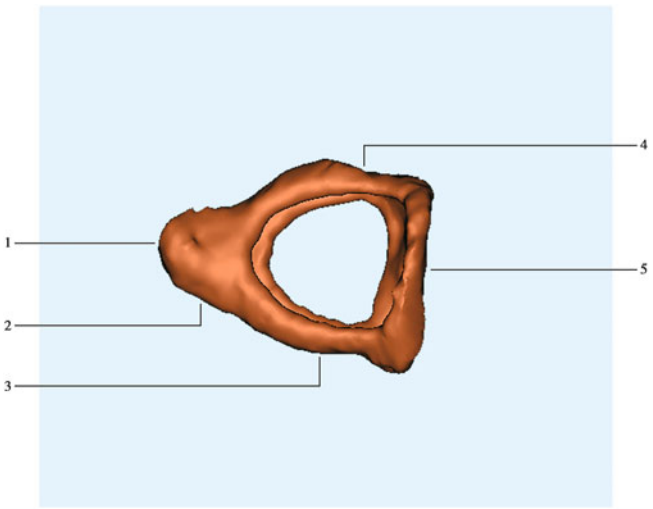

Fig. 7.29 Three-dimensional reconstruction of stapes on middle cranial fossa view. (1) Head. (2) Neck. (3) Posterior crus. (4) Anterior incus. (5) Footplate

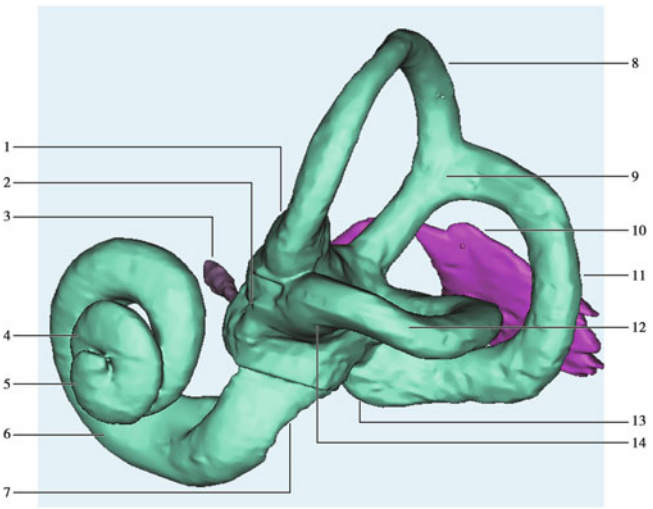

Fig. 7.30 Three-dimensional reconstruction of inner ear on lateral view. (1) Ampulla of anterior semicircular canal. (2) Vestibule. (3) Cochlear aqueduct. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Basal turn of cochlea. (7) Hook region of cochlea. (8) Anterior semicircular canal. (9) Common crus. (10) Endolymphatic sac. (11) Posterior semicircular canal. (12) Lateral semicircular canal, (13) Ampulla of posterior semicircular canal. (14) Ampulla of lateral semicircular canal

7.3 Three-Dimensional Reconstruction of Inner Ear

The inner ear consists of the cochlea, the vestibule and the semicircular canals. They are the end organ receptors for hearing and equilibrium and both embedded in the petrous portion of the temporal bone. The cochlea is coiled upon itself like a snail shell and makes two and one-half turn. The vestibule is composed of the saccule and the utricle, and it connects the cochlea with the semicircular canals.

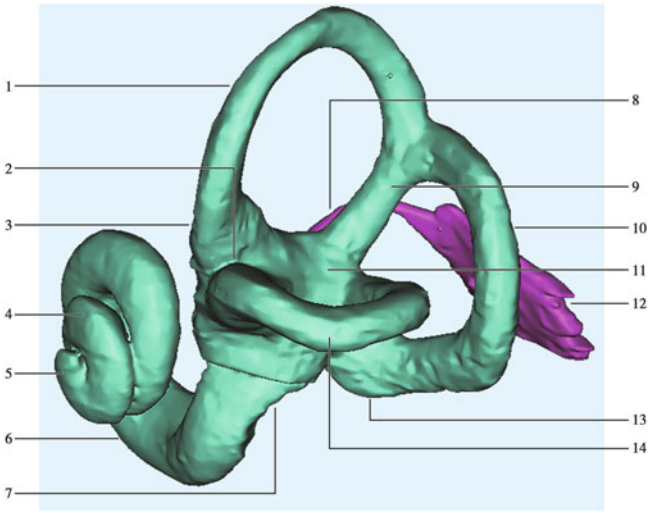

Fig. 7.31 Three-dimensional reconstruction of inner ear on posterolateral view. (1) Anterior semicircular canal. (2) Ampulla of lateral semicircular canal. (3) Ampulla of anterior semicircular canal. (4) Second turn of cochlea. (5) Apical turn of cochlea. (6) Basal turn of cochlea. (7) Hook region of cochlea. (8) Vestibular aqueduct. (9) Common crus. (10) Posterior semicircular canal. (11) Vestibule. (12) Endolymphatic sac. (13) Ampulla of posterior semicircular canal. (14) Lateral semicircular canal

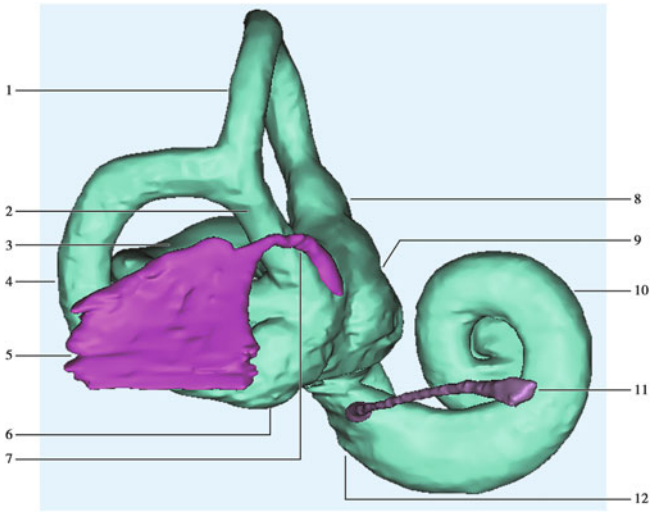

Fig. 7.33 Three-dimensional reconstruction of inner ear on posterior cranial fossa view. (1) Anterior semicircular canal. (2) Common crus. (3) Lateral semicircular canal. (4) Posterior semicircular canal. (5) Endolymphatic sac. (6) Ampulla of posterior semicircular canal. (7) Vestibular aqueduct. (8) Ampulla of anterior semicircular canal. (9) Vestibule. (10) Basal turn of cochlea. (11) Cochlear aqueduct. (12) Hook region of cochlea

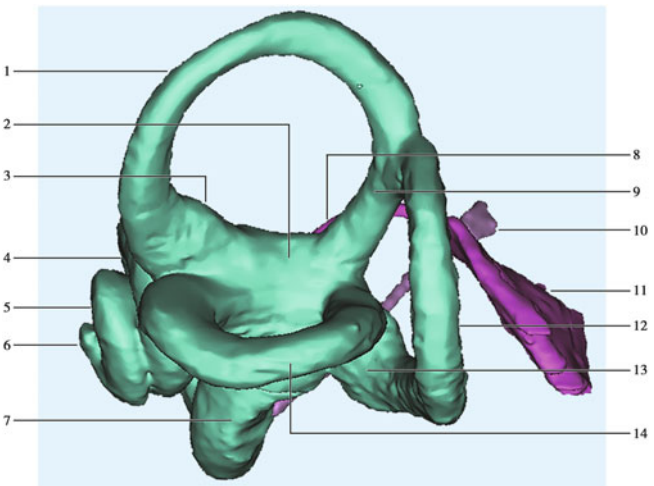

Fig. 7.32 Three-dimensional reconstruction of inner ear on posterior view. (1) Anterior semicircular canal. (2) Vestibule. (3) Ampulla of anterior semicircular canal. (4) Basal turn of cochlea. (5) Second turn of cochlea. (6) Apical turn of cochlea. (7) Hook region of cochlea. (8) Vestibular aqueduct. (9) Common crus. (10) Cochlear aqueduct. (11) Endolymphatic sac. (12) Posterior semicircular canal. (13) Ampulla of posterior semicircular canal. (14) Lateral semicircular canal

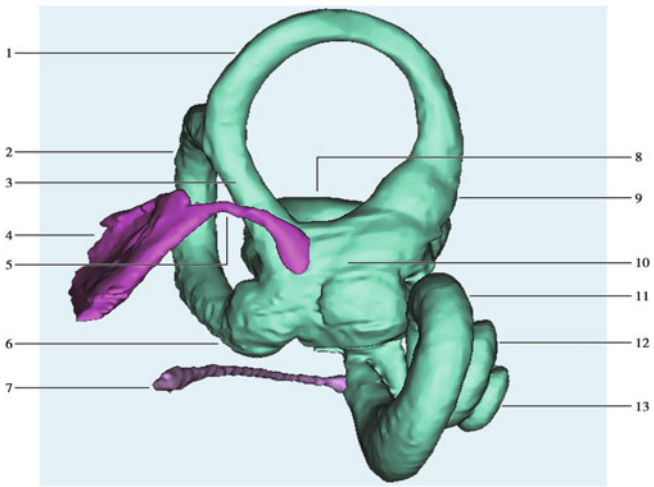

Fig. 7.34 Three-dimensional reconstruction of inner ear on petrous apex view. (1) Anterior semicircular canal. (2) Posterior semicircular canal. (3) Common crus. (4) Endolymphatic sac. (5) Vestibular aqueduct. (6) Ampulla of posterior semicircular canal. (7) Cochlear aqueduct. (8) Lateral semicircular canal. (9) Ampulla of anterior semicircular canal. (10) Vestibule. (11) Basal turn of cochlea. (12) Second turn of cochlea. (13) Apical turn of cochlea

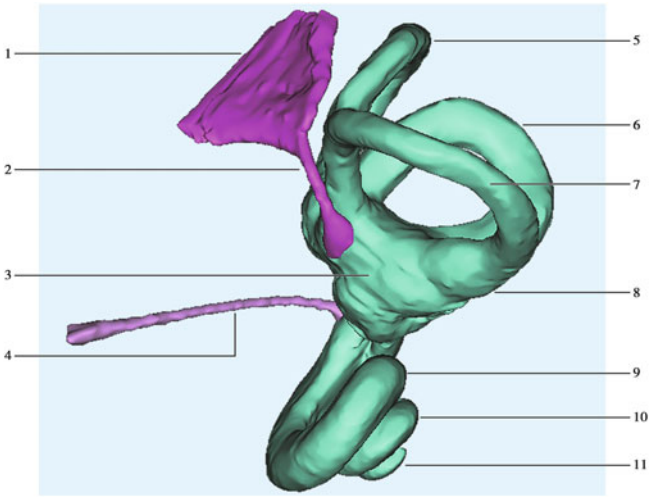

Fig. 7.35 Three-dimensional reconstruction of inner ear on middle cranial fossa view. (1) Endolymphatic sac. (2) Vestibular aqueduct. (3) Vestibule. (4) Cochlear aqueduct. (5) Posterior semicircular canal. (6) Lateral semicircular canal. Ampulla of posterior semicircular canal. (7) Anterior semicircular canal. (8) Ampulla of anterior semicircular canal. (9) Basal turn of cochlea. (10) Second turn of cochlea. (11) Apical turn of cochlea

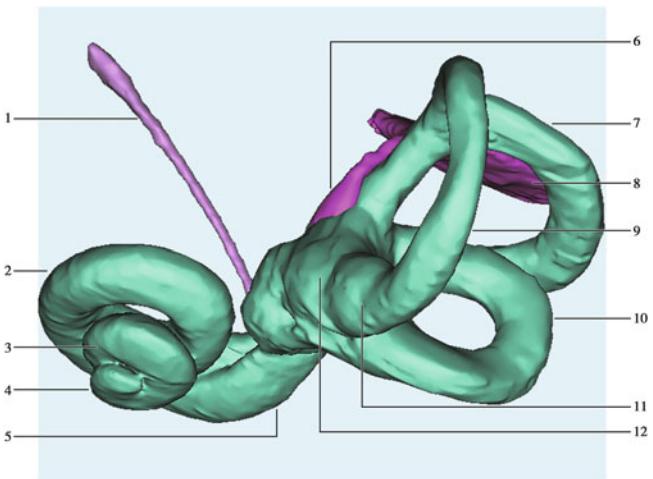

Fig. 7.36 Three-dimensional reconstruction of inner ear on temporal lobe view. (1) Cochlear aqueduct. (2) Basal turn of cochlea. (3) Second turn of cochlea. (4) Apical turn of cochlea. (5) Hook region of cochlea. (6) Vestibular aqueduct. (7) Posterior semicircular canal. (8) Endolymphatic sac. (9) Anterior semicircular canal. (10) Lateral semicircular canal. (11) Ampulla of anterior semicircular canal. (12) Vestibule

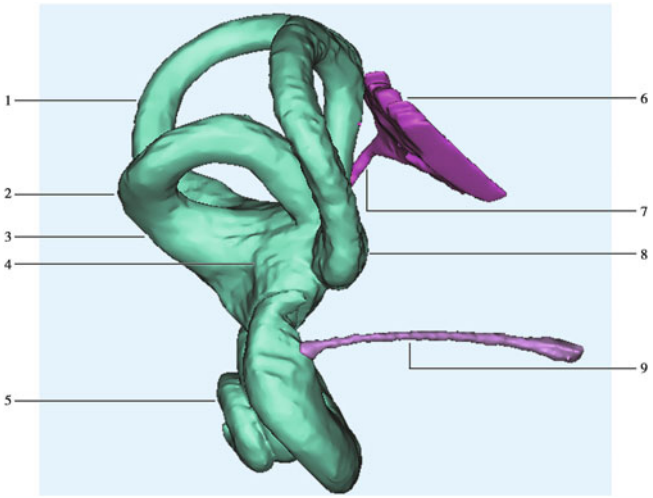

Fig. 7.37 Three-dimensional reconstruction of inner ear on basis crania externa view. (1) Anterior semicircular canal. (2) Lateral semicircular canal. (3) Ampulla of laternal semicircular canal. (4) Vestibule. (5) Cochlea. (6) Endolymphatic sac. (7) Vestibular aqueduct. (8) Ampulla of posterior semicircular canal. (9) Cochlear aqueduct

7.4 Three-Dimensional Reconstruction of Internal Auditory Canal and Intratemporal Nerves

The internal auditory canal (also called internal acoustic meatus) runs through the petrous portion of the temporal bone, which locates between the inner ear and the porus acusticus internus. The porus acusticus internus owns an oval-shaped opening to the posterior cranial fossa. At the lateral end of the internal auditory canal, a thin cribriform plate (fundus) of bone forms the lateral boundary of the canal. The internal auditory canal houses the vestibulocochlear nerve, facial nerve, intermediate nerve, labyrinthine vessel, and the vestibular ganglion. The congenital stenosis of the internal auditory canal can cause ipsilateral sensorineural hearing loss, even the profound hearing loss, this condition can be usually founded inadvertently among the older children without the history of mumps.

The fundus separates the internal auditory canal from the inner ear, and it is also separated by horizontally transverse crest(also called falciform crest) into superior and inferior parts: Facial nerve area (situated anteriorly) and superior vestibular area (situated posteriorly) lie in the superior part; cochlear area (situated anteriorly), inferior vestibular area, and singular foramen (situated posteriorly) lie in the inferior part. In the meantime, the facial nerve area is separated by Bill's bar (which is a vertical crest (Kozerska and Skrzat 2015)) from the superior vestibular area. This crest is sometimes less prominent and situates more laterally (Moren et al. 2018) compared with the transverse crest. In contrast to the

superior vestibular nerve, the inferior vestibular nerve has more and shorter nerve canals.

Knowledge on the detailed anatomy and morphology of the fundus of the internal auditory canal is necessary for evaluation of the temporal bone trauma, the neoplasm, and the congenital anomalies, especially for the neurootologic surgical procedures (Marchioni et al. 2012). For instance, the singular foramen can be used as a landmark for certain surgical procedures on the internal acoustic meatus and labyrinth (Muren et al. 1991).

The cochlear nerve canal forms a short, anterior angled entrance to the cochlea. A cribriform helica-shaped plate was view from the fundus (Kozerska and Skrzat 2015), and 2½-2¾ turns of the bony spiral lamina could be seen from the promontory view. The cochlear nerve canal has tremendous clinical significance, because changes of its diameter may be the reason of cochlear nerve deficiency which was believed to be one of the causes of sensorineural hearing loss (Li et al. 2015).

The facial canal, also known as the fallopian canal, runs through the temporal bone from the fundus to the stylomastoid foramen and its course resembles the letter 'Z', about 30 mm in length. The facial canal is divided into three segments: the labyrinthine, the tympanic and the mastoid segment, and has two turns named as the first genu (geniculate ganglion) and second genus. From the fundus to the geniculate ganglion, the facial nerve diverges in an anterolateral direction to enter the labyrinthine segment, the narrowest and shortest of all parts of the facial canal (Shin et al. 2014). At the geniculate ganglion, it makes an acute bent near the flood of the middle fossa to continue with in the bony canal in its tympanic segment, which lies below the lateral semicircular canal and above the cochleariform process and vestibular window, identification of this segment canal on clinical HRCT scan can be problematic due to its relatively thin bony wall or the presence of the potential dehiscences (Weiglein et al. 1994). The mastoid segment descends from the second genu vertically and slightly laterally towards the stylomastoid foramen.

The greater superficial petrosal nerve emerges from the geniculate ganglion at the facial hiatus. The branch of the stapedius muscle originates from the pyramidal eminence, the chorda tympani nerve emits from the facial nerve before or after this nerve leaves the temporal bone (Figs. 7.38–7.50).

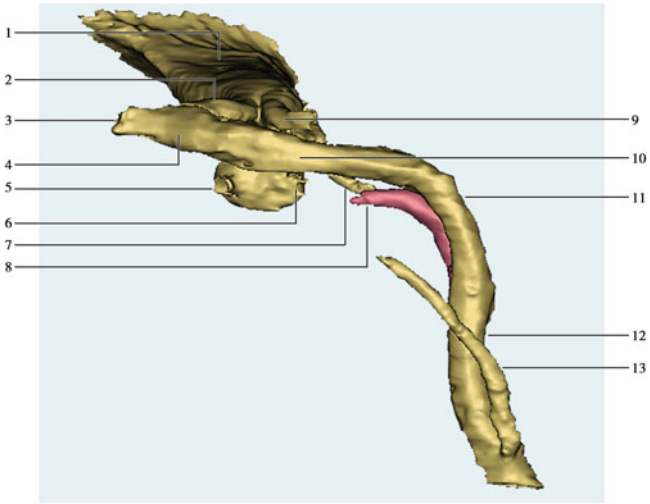

Fig. 7.38 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on lateral view. (1) Internal auditory canal. (2) Labyrinthine portion of facial nerve. (3) Greater superficial petrosal nerve. (4) Geniculate ganglion. (5) Cochlear nerve. (6) Inferior vestibular nerve. (7) Singular foramen nerve. (8) Stapedius muscle. (9) Superior vestibular nerve. (10) Tympanic portion of facial nerve. (11) Second genu. (12) Mastoid portion of facial nerve. (13) Chorda tympani nerve

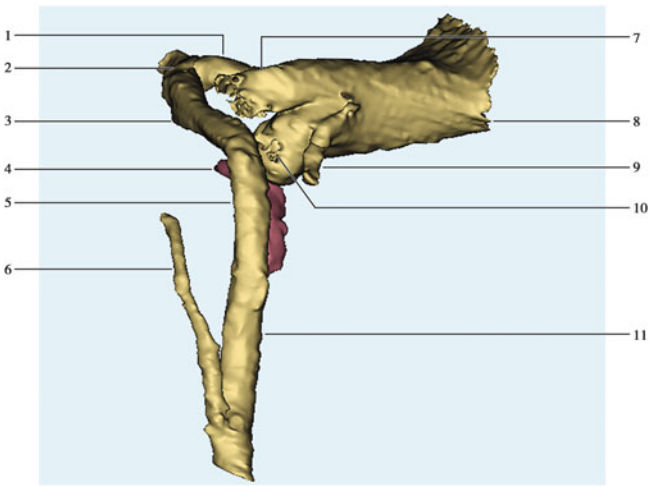

Fig. 7.39 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on posterolateral view. (1) Labyrinthine portion of facial nerve. (2) Geniculate ganglion. (3) Tympanic portion of facial nerve. (4) Stapedius muscle. (5) Second genu. (6) Chorda tympani nerve. (7) Superior vestibular nerve. (8) Internal auditory canal. (9) Singular foramen nerve. (10) Inferior vestibular nerve. (11) Mastoid portion of facial nerve

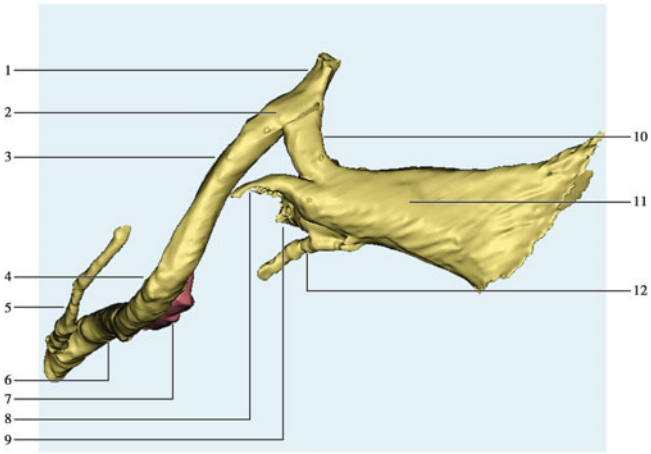

Fig. 7.40 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on posterosuperior view. (1) Greater superficial petrosal nerve. (2) Geniculate ganglion. (3) Tympanic portion of facial nerve. (4) Second genu. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve. (7) Stapedius muscle. (8) Superior vestibular nerve. (9) Inferior vestibular nerve. (10) Labyrinthine portion of facial nerve. (11) Internal auditory canal. (12) Singular foramen nerve

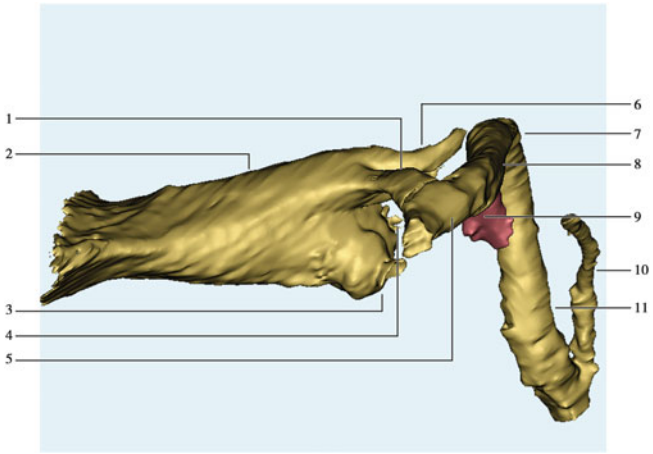

Fig. 7.42 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on anterior (petrous apex) view. (1) Labyrinthine portion of facial nerve. (2) Internal auditory canal. (3) Cochlear nerve. (4) Inferior vestibular nerve. (5) Geniculate ganglion. (6) Superior vestibular nerve. (7) Second genu. (8) Tympanic portion of facial nerve. (9) Stapedius muscle. (10) Chorda tympani nerve. (11) Mastoid portion of facial nerve

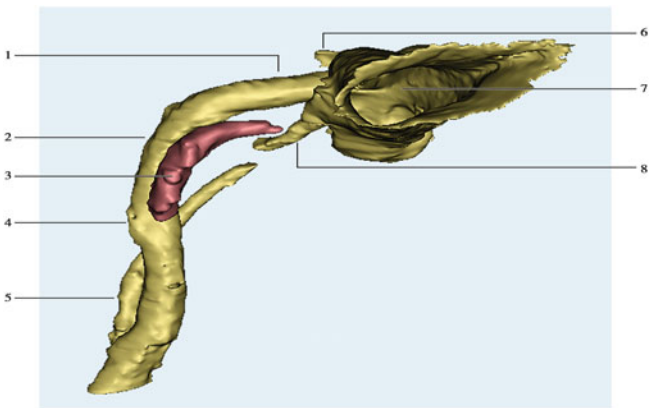

Fig. 7.41 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on medial (internal acoustic porus) view. (1) Tympanic portion of facial nerve. (2) Second genu. (3) Stapedius muscle. (4) Mastoid portion of facial nerve. (5) Chorda tympani nerve. (6) Superior vestibular nerve. (7) Fundus of internal auditopry canal. (8) Singular foramen nerve

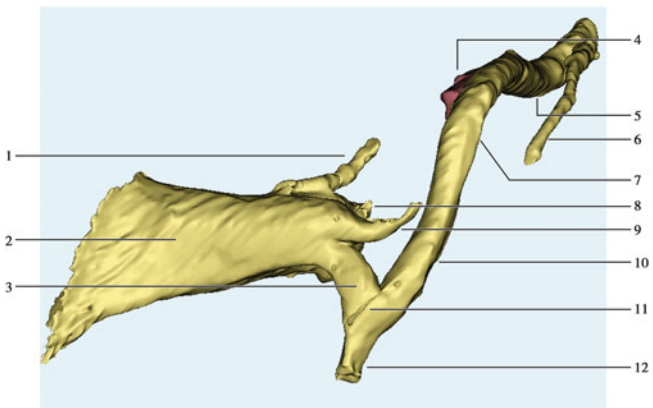

Fig. 7.43 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on medial (middle cranial fossa) view. (1) Singular foramen nerve. (2) Internal auditory canal. (3) Labyrinthine portion of facial nerve. (4) Stapedius muscle. (5) Mastoid portion of facial nerve. (6) Chorda tympani nerve. (7) Second genu. (8) Inferior vestibular nerve. (9) Superior vestibular nerve. (10) Tympanic portion of facial nerve. (11) Geniculate ganglion. (12) Greater superficial petrosal nerve

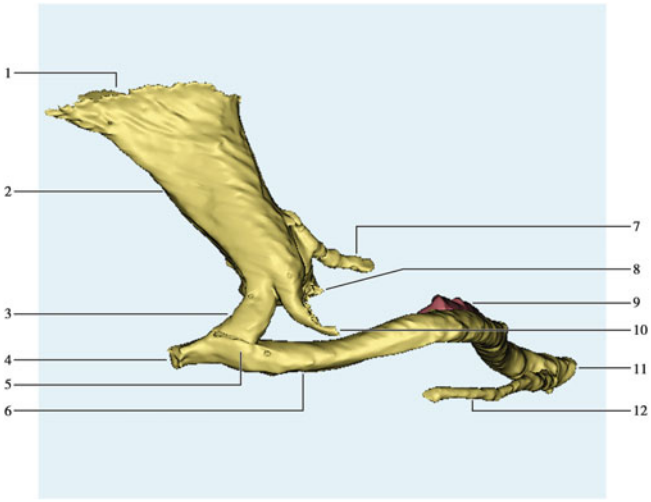

Fig. 7.44 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on temporal lobe view. (1) Internal acoustic porus. (2) Internal auditory canal. (3) Labyrinthine portion of facial nerve. (4) Greater superficial petrosal nerve. (5) Geniculate ganglion. (6) Tympanic portion of facial nerve. (7) Singular foramen nerve. (8) Inferior vestibular nerve. (9) Stapedius muscle. (10) Superior vestibular nerve. (11) Mastoid portion of facial nerve. (12) Chorda tympani nerve

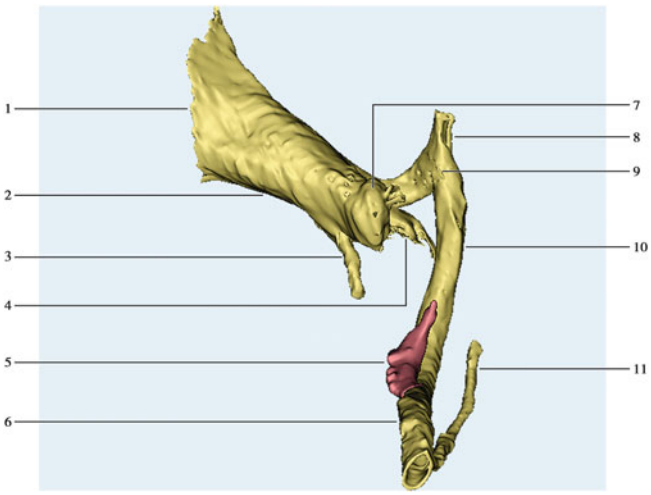

Fig. 7.45 Three-dimensional reconstruction of internal auditory canal and intratemporal nerves on basis crania externa view. (1) Internal acoustic porus. (2) Internal auditory canal. (3) Singular foramen nerve. (4) Superior vestibular nerve. (5) Stapedius muscle. (6) Mastoid portion of facial nerve. (7) Cochlear nerve. (8) Greater superficial petrosal nerve. (9) Geniculate ganglion. (10) Tympanic portion of facial nerve. (11) Chorda tympani nerve

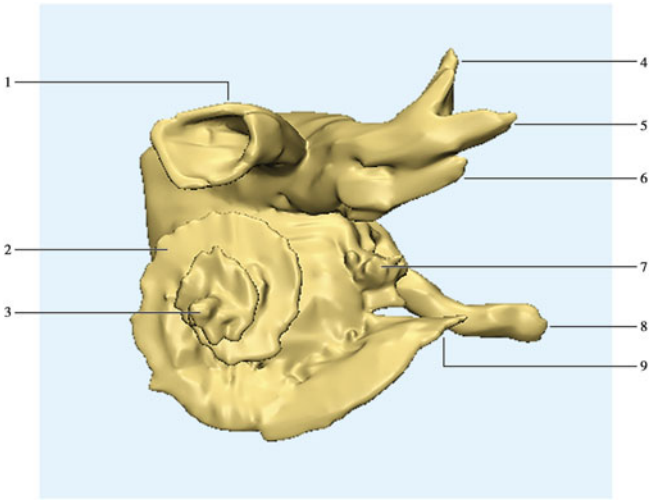

Fig. 7.46 Three-dimensional reconstruction of fundus of internal auditory canal on lateral view. (1) Labyrinthine portion of facial nerve. (2) Osseous spiral lamina. (3) Modiolus. (4) Anterior ampullary nerve of superior vestibular nerve. (5) Lateral ampullary nerve. (6) Utricular nerve. (7) Inferior vestibular nerve (saccular nerve). (8) Singular foramen nerve (posterior ampullar nerve). (9) Hook region of cochlea

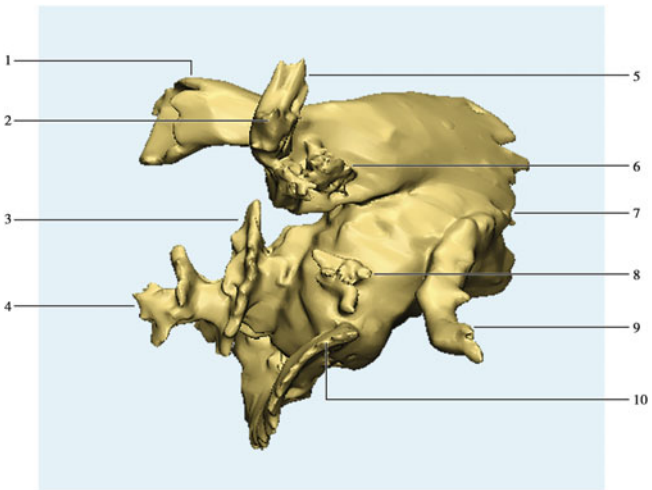

Fig. 7.47 Three-dimensional reconstruction of fundus of internal auditory canal on posterolateral view. (1) Labyrinthine portion of facial nerve. (2) Lateral ampullary nerve. (3) Osseous spiral lamina. (4) Modiolus. (5) Anterior ampullary nerve of superior vestibular nerve. (6) Utricular nerve. (7) Fundus of internal auditory canal. (8) Inferior vestibular nerve (saccular nerve). (9) Singular foramen nerve (posterior ampullar nerve). (10) Hook region of cochlea

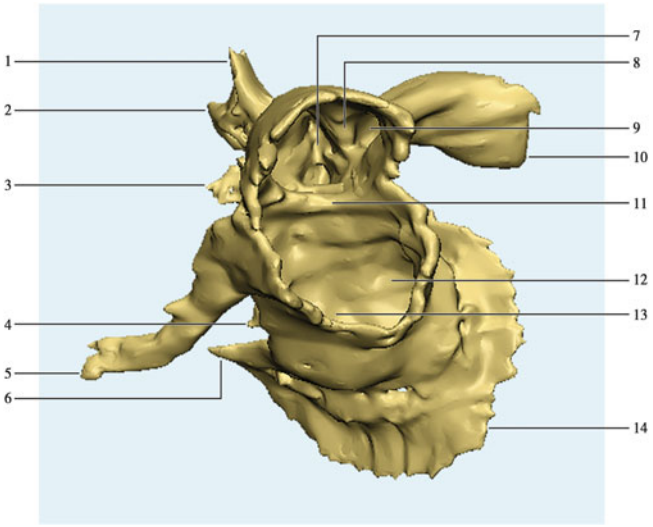

Fig. 7.48 Three-dimensional reconstruction of fundus of internal auditory canal on internal acoustic porus view. (1) Anterior ampullary nerve of superior vestibular nerve. (2) Lateral ampullary nerve. (3) Utricular nerve. (4) Inferior vestibular nerve (saccular nerve). (5) Singular foramen nerve (posterior ampullar nerve). (6) Hook region of cochlea. (7) Superior vestibular nerve foramen. (8) Bill's bar. (9) Facial neve foramen. (10) Labyrinthine portion of facial nerve. (11) Transverse crest. (12) Cochlear nerve foramen. (13) Inferior vestibular nerve foramen. (14) Osseous spiral lamina

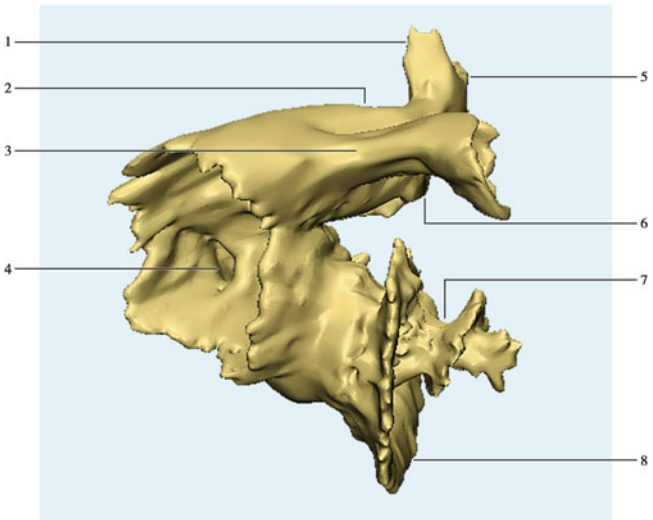

Fig. 7.49 Three-dimensional reconstruction of fundus of internal auditory canal on petrous apex view. (1) Anterior ampullary nerve. (2) Superior vestibular nerve. (3) Labyrinthine portion of facial nerve. (4) Posterior ampullar nerve foramen (singular foramen). (5) Lateral ampullary nerve. (6) Utricular nerve. (7) Modiolus. (8) Osseous spiral lamina

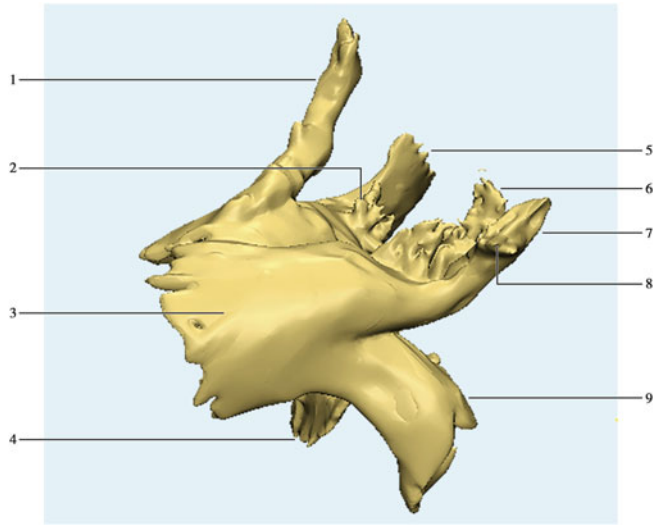

Fig. 7.50 Three-dimensional reconstruction of fundus of internal auditory canal on middle cranial fossa view. (1) Posterior ampullar nerve (singular foramen). (2) Saccular nerve. (3) Fundus of internal auditory canal. (4) Osseous spiral lamina. (6) Utricular nerve. (7) Lateral ampullary nerve. (8) Anterior ampullary nerve. (9) Labyrinthine portion of facial nerve

7.5 Three-Dimensional Reconstruction of External Auditory Canal and Facial Nerve

Surgery of the transcanal approach often places the facial nerve at risk for injury as the nerve courses vertically in the posterior wall of the external auditory canal, such as canaloplasty, hypotympanotomy, and removal of tumors of the external auditory canal (Green et al. 1994; Adad et al. 1999).

In the adult, the external auditory canal is approximately 24 mm long, ends blindly at the tympanic membrane. It is oblique, so that the posterior wall is about 5 mm shorter than its anteroinferior wall. This is in accordance with the oblique position of the tympanic membrane. About 7 mm from the tympanic membrane it forms a constriction known as the isthmus. The fiber annulus of the tympanic membrane is fixed in the tympanic sulcus at the medial end of the external auditory canal. The facial nerve courses inferolaterally in mastoid portion, closer to the tympanic sulus inferiorly, the shortest distance between the nerve and the sulus is only 2-3 mm, the nerve may run laterally to the tympanic sulus at the posteroinferior wall of the external auditory canal. The relation of the facial nerve's course to the tympanic sulcus can be the only identifiable landmark in the external auditory canal (Adad et al. 1999) (Figs. 7.51–7.54).

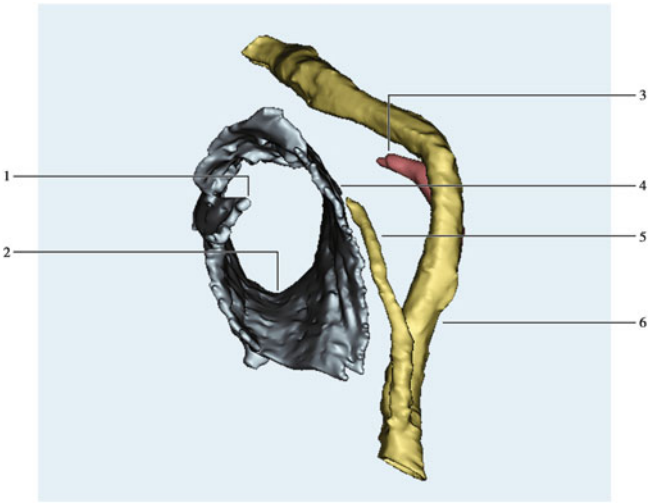

Fig. 7.51 Three-dimensional reconstruction of external auditory canal and facial nerve on lateral view. (1) Anterosuperior ridge. (2) Basal wall of external auditory canal. (3) Stapedius muscle. (4) Posterior wall of external auditory canal. (5) Chorda tympani nerve. (6) Mastoid portion of facial nerve

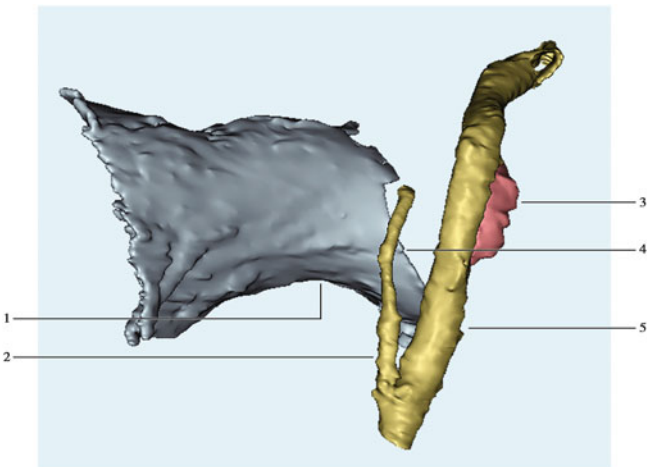

Fig. 7.52 Three-dimensional reconstruction of external auditory canal and facial nerve on posterior view. (1) Basal wall of external auditory canal. (2) Chorda tympani nerve. (3) Stapedius muscle. (4) Medial end of external auditory canal. (5) Mastoid portion of facial nerve. Note: At the plane of basal wall of external auditory canal, the facial nerve locates at the lateral of the medial end of external auditory canal

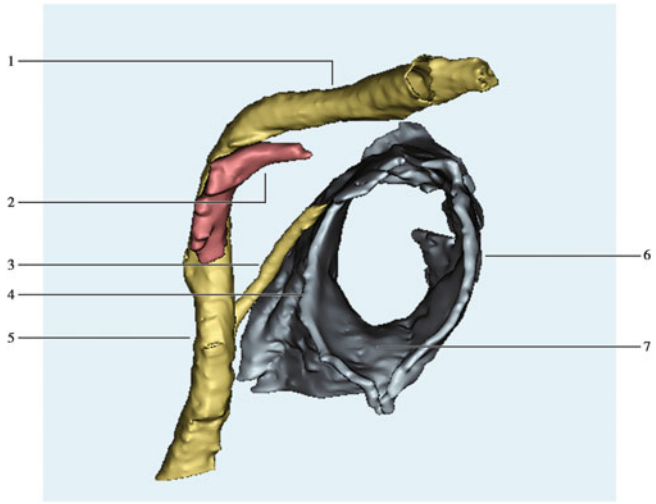

Fig. 7.53 Three-dimensional reconstruction of external auditory canal and facial nerve on medial view. (1) Tympanic portion of facial nerve. (2) Stapedius muscle. (3) Chorda tympani nerve. (4) Posterior wall of external auditory canal. (5) Mastoid portion of facial nerve. (6) Anterior wall of external auditory canal (posterior wall of temporomandibular joint). (7) Basal wall of external auditory canal

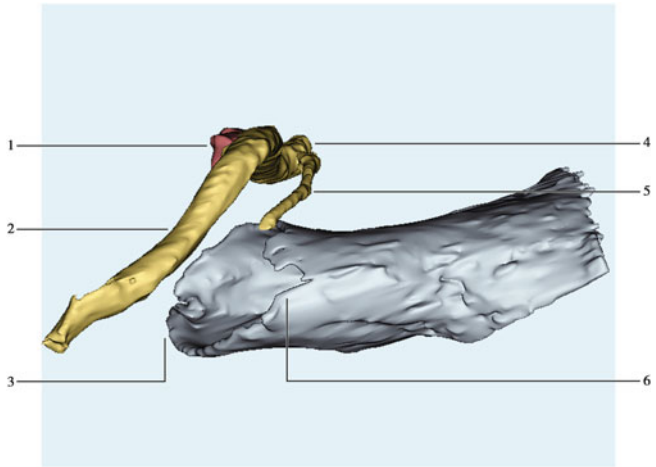

Fig. 7.54 Three-dimensional reconstruction of external auditory canal and facial nerve on middle cranial fossa view. (1) Stapedius muscle. (2) Tympanic portion of facial nerve. (3) Medial end of basal wall of external auditory canal. (4) Mastoid portion of facial nerve. (5) Chorda tympani nerve. (6) Medial end of superior wall of external auditory canal

7.6 Three-Dimensional Reconstruction of Facial Nerve and Stapedius Muscle

The osseus canal of stapedius muscle was a sole chamber and always localized medially to the mastoid portion of the facial nerve, micro-CT provides adequate images for anatomic studies of stapedius muscle (Wojciechowski et al. 2020) (Figs. 7.55–7.58).

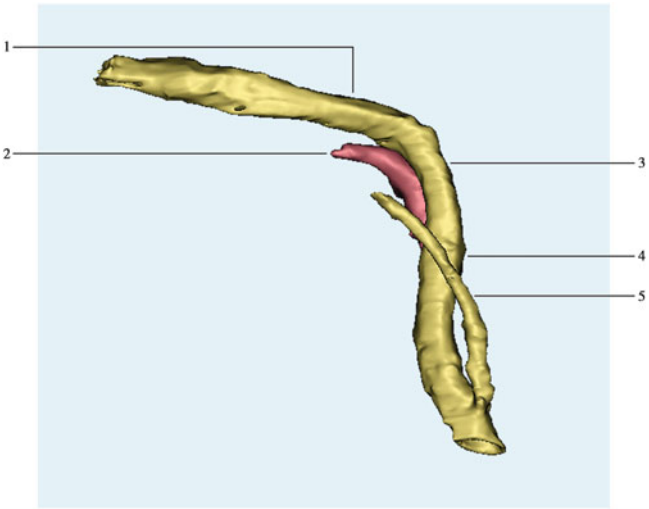

Fig. 7.55 Three-dimensional reconstruction of facial nerve and stapedius muscle on lateral view. (1) Tympanic portion of facial nerve. (2) Stapedius muscle. (3) Second genu. (4) Mastoid portion of facial nerve. (5) Chorda tympani nerve

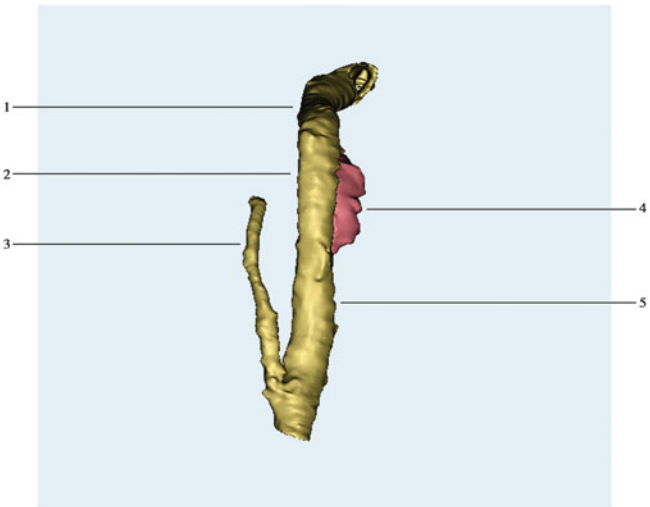

Fig. 7.56 Three-dimensional reconstruction of facial nerve and stapedius muscle on posterior view. (1) Tympanic portion of facial nerve. (2) Second genu. (3) Chorda tympani nerve. (4) Stapedius muscle. (5) Mastoid portion of facial nerve

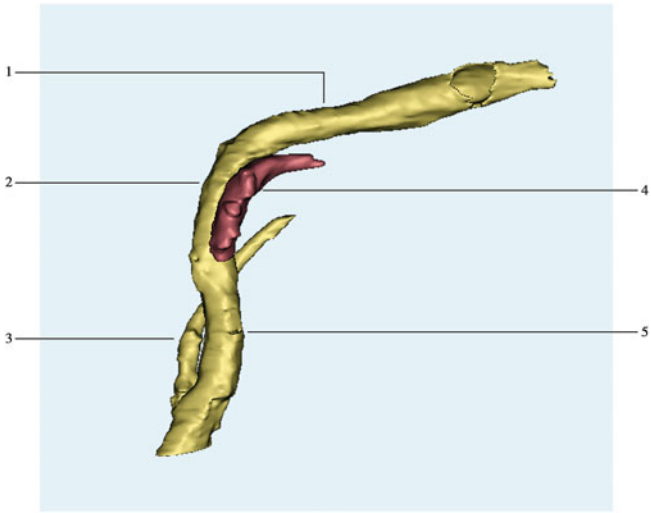

Fig. 7.57 Three-dimensional reconstruction of facial nerve and stapedius muscle on medial view. (1) Tympanic portion of facial nerve. (2) Second genu. (3) Chorda tympani nerve. (4) Stapedius muscle. (5) Mastoid portion of facial nerve

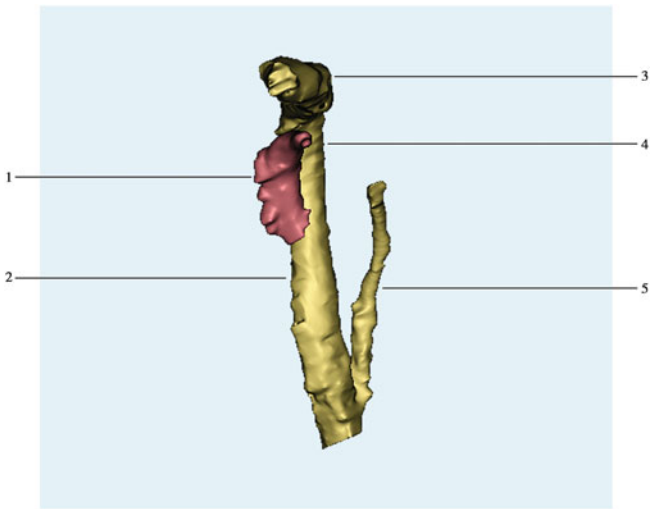

Fig. 7.58 Three-dimensional reconstruction of facial nerve and stapedius muscle on petrous apex view. (1) Stapedius muscle. (2) Mastoid portion of facial nerve. (3) Tympanic portion of facial nerve. (4) Second genu. (5) Chorda tympani nerve

7.7 Three-Dimensional Reconstruction of Inner Ear and Nerves

The lateral wall of the internal auditory canal composed of a partial internal wall of the inner ear (labyrinth). The labyrinthine segment of the facial nerve runs through the bone above the cochlea and reaches the anterolateral geniculate ganglion, then this nerve makes an acute bent posterolaterally to form the tympanic segment, which lies above the cochlea, on the outside of vestibule, below the lateral semicircular canal and above the vestibular window. The second genu and the superior part of the mastoid segment of the facial nerve locate at the outside of the posterior semicircular canal or the posterior curs of the lateral semicircular canal. Occasionally, a cochlea–facial dehiscence can found with micro-CT scan, which can be the reason for facial nerve stimulation at cochlear implant (Moren et al. 2018).

The cochlear nerve canal (round or ellipse) starts at a helical-shaped cribriform area of the fundus, angulates anteriorly so that the anterior wall of the internal acoustic canal is partly obscured it when viewed through internal auditory canal, and the cochlear nerve stretches helically in the cochlear modiolus and spreads around spiral plate from the basal turn to the top turn.

The superior vestibular nerve innervates three structures—the superior and lateral semicircular canals, and the utricle. The inferior vestibular nerve canal owns more extensive anatomic variations compared with superior vestibular nerve canal. Lots of short inferior vestibular nerves run through the fundus to innervate the remaining vestibular structures—the posterior semicircular canal and the saccule. The singular foramen nerve canal opens at some distance away from the fundus in the posterior-inferior wall of internal auditory canal, courses posterior-laterally and forms an obtuse angle at its midportion. This canal carries the posterior ampullary nerves (Figs. 7.59–7.69).

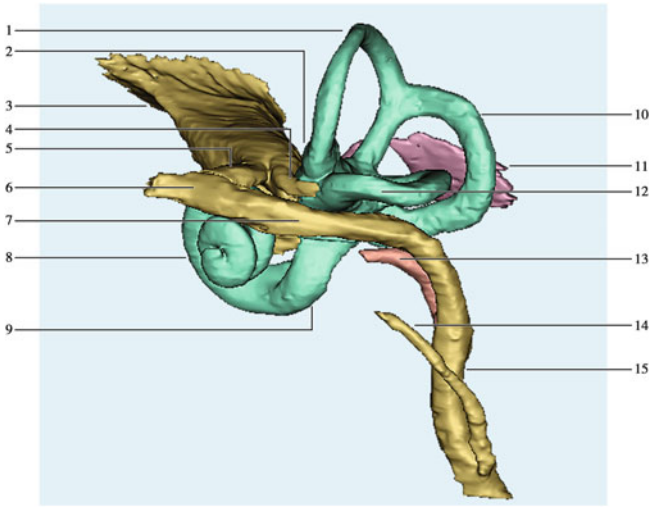

Fig. 7.59 Three-dimensional reconstruction of inner ear and nerves on lateral view. (1) Anterior semicircular canal. (2) Ampulla of anterior semicircular canal. (3) Internal auditory canal. (4) Superior vestibular nerve. (5) Labyrinthine portion of facial nerve. (6) Geniculate ganglion. (7) Tympanic portion of facial nerve. (8) Cochlea. (9) Hook region of cochlea. (10) Posterior semicircular canal. (11) Endolymphatic sac. (12) Lateral semicircular canal. (13) Stapedius muscle. (14) Chorda tympani nerve. (15) Mastoid portion of facial nerve

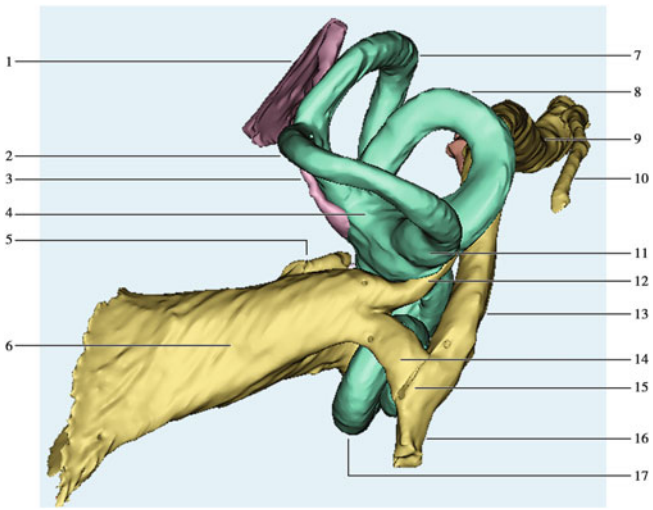

Fig. 7.60 Three-dimensional reconstruction of inner ear and nerves on middle cranial fossa view. (1) Endolymphatic sac. (2) Anterior semicircular canal. (3) Vestibular aqueduct. (4) Vestibule. (5) Singular foramen nerve (ampullar nerve of posterior semicircular canal). (6) Internal auditory canal. (7) Posterior semicircular canal. (8) Lateral semicircular canal. (9) Mastoid portion of facial nerve. (10) Chorda tympani nerve. (11) Ampulla of anterior semicircular canal. (12) Superior vestibular nerve. (13) Tympanic portion of facial nerve. (14) Labyrinthine portion of facial nerve. (15) Geniculate ganglion. (16) Greater superficial petrosal nerve. (17) Cochlea

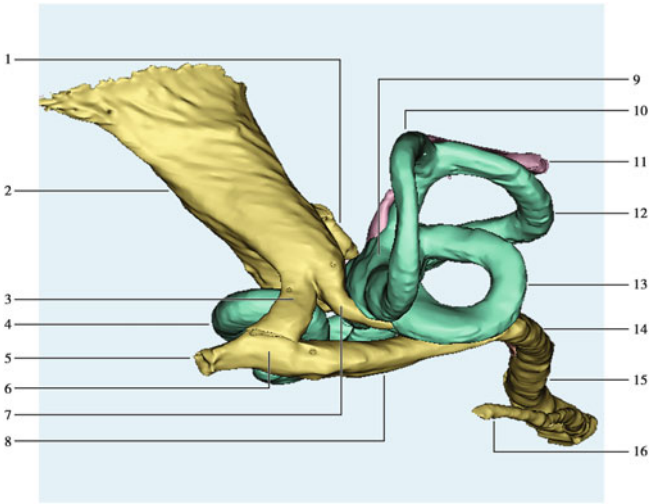

Fig. 7.61 Three-dimensional reconstruction of inner ear and nerves on temporal lobe view. (1) Singular foramen nerve. (2) Internal auditory canal. (3) Labyrinthine portion of facial nerve. (4) Cochlea. (5) Greater superficial petrosal nerve. (6) Geniculate ganglion. (7) Superior vestibular nerve. (8) Tympanic portion of facial nerve. (9) Vestibule. (10) Anterior semicircular canal. (11) Endolymphatic sac. (12) Posterior semicircular canal. (13) Lateral semicircular canal. (14) Second genu. (15) Mastoid portion of facial nerve. (16) Chorda tympani nerve

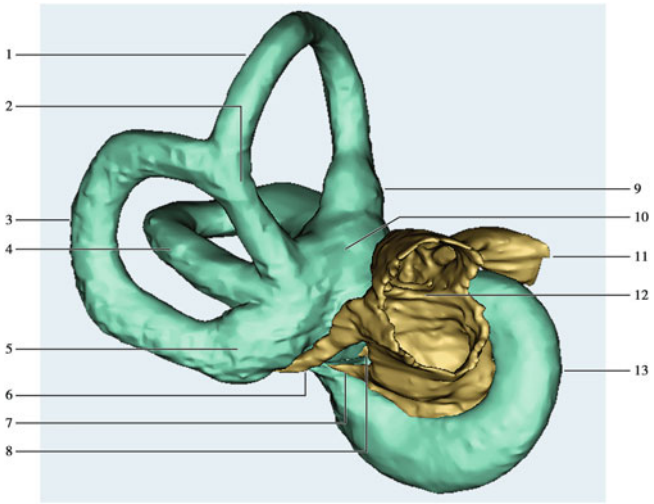

Fig. 7.63 Three-dimensional reconstruction of inner ear and fundus of internal auditory canal on internal acoustic porus view. (1) Anterior semicircular canal. (2) Common crus. (3) Posterior semicircular canal. (4) Lateral semicircular canal. (5) Ampulla of posterior semicircular canal. (6) Singular foramen nerve. (7) Hook region of cochlea. (8) Saccular branch of inferior vestibular nerve. (9) Ampulla of anterior semicircular canal. (10) Vestibule. (11) Labyrinthine portion of facial nerve. (12) Fundus of internal auditory canal. (13) Cochlea

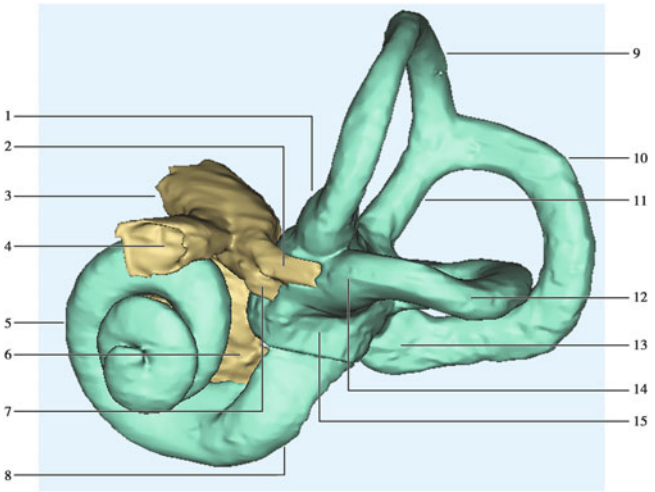

Fig. 7.62 Three-dimensional reconstruction of inner ear and fundus of internal auditory canal on lateral view. (1) Ampulla of anterior semicircular canal. (2) Semicircular branch of superior vestibular nerve. (3) Fundus of internal auditory canal. (4) Labyrinthine portion of facial nerve. (5) Cochlea. (6) Modiolus. (7) Utricular branch of superior vestibular nerve. (8) Hook region of cochlea. (9) Anterior semicircular canal. (10) Posterior semicircular canal. (11) Common crus. (12) Lateral semicircular canal. (13) Ampulla of posterior semicircular canal. (14) Ampulla of lateral semicircular canal. (15) Vestibule

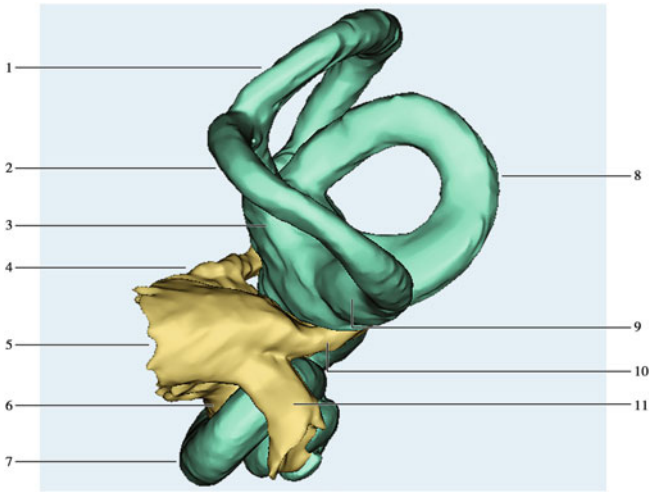

Fig. 7.64 Three-dimensional reconstruction of inner ear and fundus of internal auditory canal on middle cranial fossa view. (1) Posterior semicircular canal. (2) Anterior semicircular canal. (3) Vestibule. (4) Singular foramen nerve. (5) Fundus of internal auditory canal. (6) Modiolus. (7) Cochlea. (8) Lateral semicircular canal. (9) Ampulla of anterior semicircular canal. (10) Superior vestibular nerve. (11) Labyrinthine portion of facial nerve

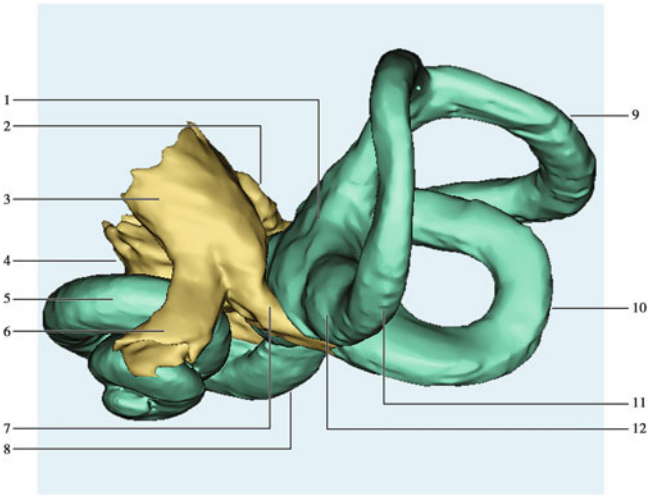

Fig. 7.65 Three-dimensional reconstruction of inner ear and fundus of internal auditory canal on temporal lobe view. (1) Vestibule. (2) Singular foramen nerve. (3) Fundus of internal auditory canal. (4) Modiolus. (5) Cochlea. (6) Labyrinthine portion of facial nerve. (7) Superior vestibular nerve. (8) Hook region of cochlea. (9) Posterior semicircular canal. (10) Lateral semicircular canal. (11) Anterior semicircular canal. (12) Ampulla of anterior semicircular canal

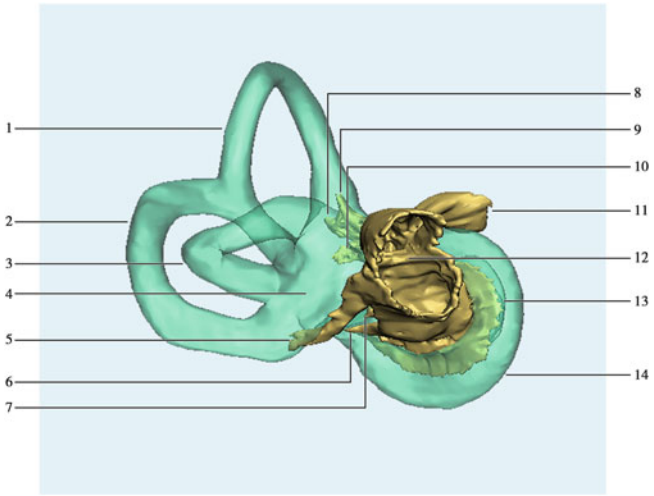

Fig. 7.67 Three-dimensional reconstruction of inner ear (semitransparent) and fundus of internal auditory canal on internal acoustic porus view. (1) Anterior semicircular canal. (2) Posterior semicircular canal. (3) Lateral semicircular canal. (4) Vestibule. (5) Singular foramen nerve. (6) Hook region of cochlea. (7) Saccular nerve. (8) Lateral ampullar nerve. (9) Anterior ampullar nerve. (10) Utricular nerve. (11) Labyrinthine portion of facial nerve. (12) Fundus of internal auditory canal. (13) Osseous spiral lamina. (14) Cochlea

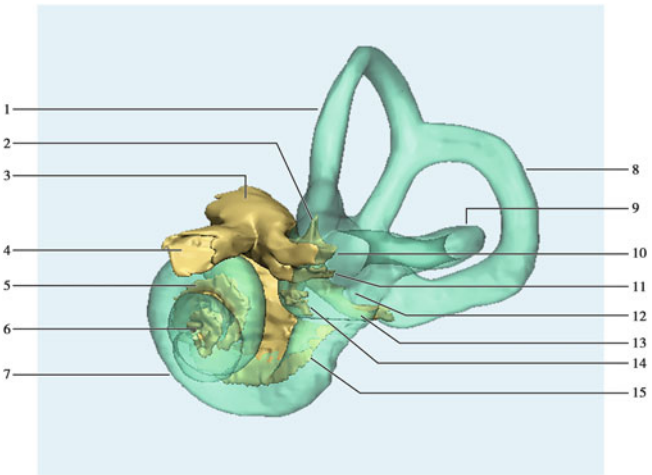

Fig. 7.66 Three-dimensional reconstruction of inner ear (semitransparent) and fundus of internal auditory canal on lateral view. (1) Anterior semicircular canal. (2) Anterior ampullar nerve. (3) Fundus of internal auditory canal. (4) Labyrinthine portion of facial nerve. (5) Osseous spiral lamina. (6) Modiolus. (7) Cochlea. (8) Posterior semicircular canal. (9) Lateral semicircular canal. (10) Lateral ampullar nerve. (11) Utricular nerve. (12) Vestibule. (13) Singular foramen nerve. (14) Saccular nerve (inferior vestibular nerve). (15) Hook region of cochlea

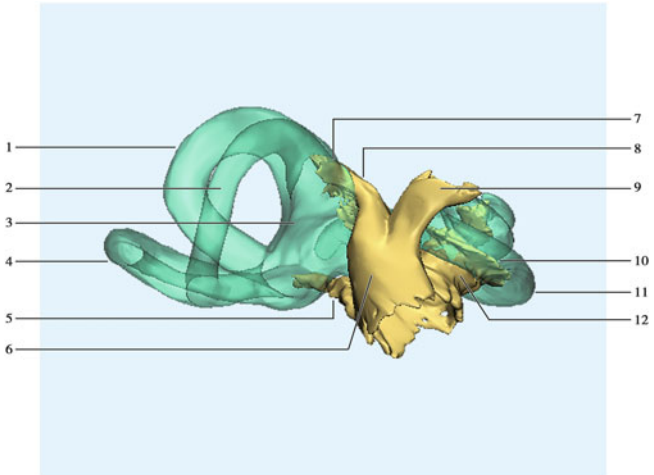

Fig. 7.68 Three-dimensional reconstruction of inner ear (semitransparent) and fundus of internal auditory canal on basis crania interna view. (1) Lateral semicircular canal. (2) Anterior semicircular canal. (3) Vestibule. (4) Posterior semicircular canal. (5) Singular foramen nerve. (6) Fundus of internal auditory canal. (7) Ampullar branch of anterolateral semicircular canal nerve. (8) Superior vestibular nerve. (9) Labyrinthine portion of facial nerve. (10) Osseous spiral lamina. (11) Cochlea. (12) Modiolus

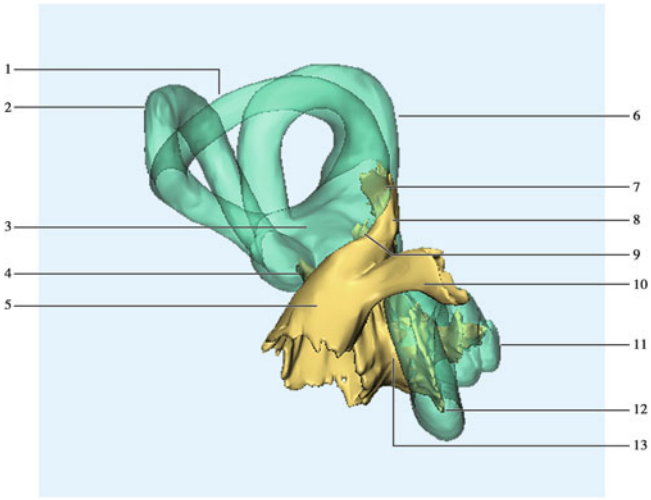

Fig. 7.69 Three-dimensional reconstruction of inner ear (semi-transparent) and fundus of internal auditory canal on middle cranial fossa view. (1) Anterior semicircular canal. (2) Posterior semicircular canal. (3) Vestibule. (4) Singular foramen nerve. (5) Fundus of internal auditory canal. (6) Lateral semicircular canal. (7) Ampullar branch of anterolateral semicircular canal nerve. (8) Superior vestibular nerve. (9) Utricular nerve. (10) Labyrinthine portion of facial nerve. (11) Cochlea. (12) Osseous spiral lamina. (13) Modiolus

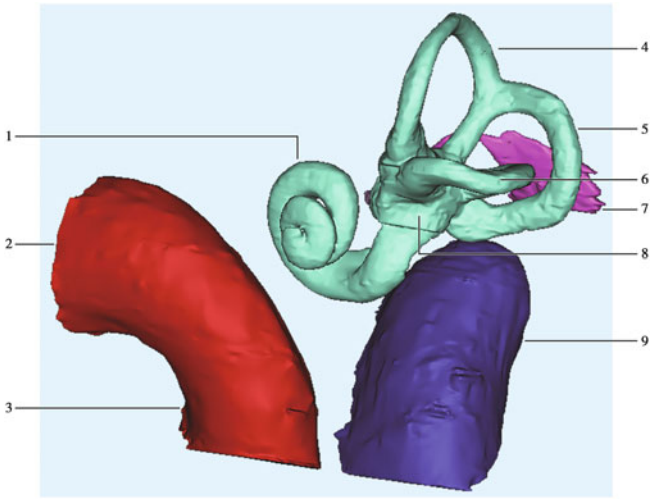

Fig. 7.70 Three-dimensional reconstruction of inner ear and blood vessel on lateral view. (1) Cochlea. (2) Horizontal portion of internal carotid artery. (3) Vertical portion of internal carotid artery. (4) Anterior semicircular canal. (5) Posterior semicircular canal. (6) Lateral semicircular canal. (7) Endolymphatic sac. (8) Vestibule. (9) Jugular bulb

7.8 Three-Dimensional Reconstruction of Inner Ear and Blood Vessel

The jugular bulb is located in the foramen jugulare, and connects the lateral sinus and the internal jugular vein. The jugular bulb is located medial and posteroinferior to the semicircular canals. Its distance from the labyrinth and the bulb varies, and the bulb is variably positioned posterior-medially in the hypotympanum.

The carotid artery enters the temporal bone through the carotid foramen. It ascends vertically and emerges in the anterior area just beneath the cochlea. It then turns anteromedially at almost a right angle toward the petrous apex, forming a horizontal segment just medial to the Eustachian tube (Figs. 7.70–7.76).

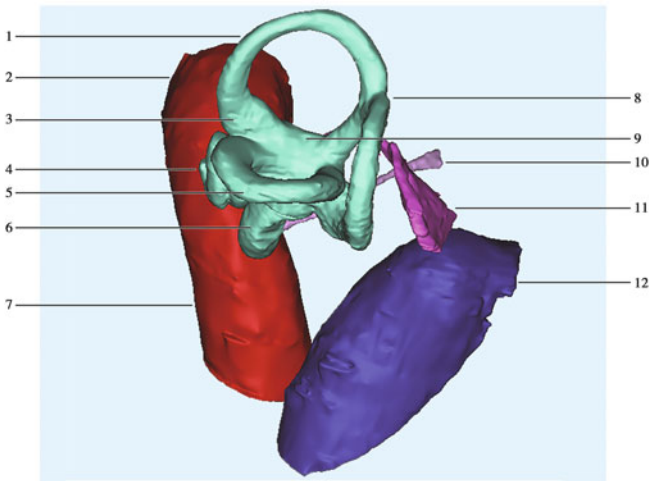

Fig. 7.71 Three-dimensional reconstruction of inner ear and blood vessel on posterior view. (1) Anterior semicircular canal. (2) Horizontal portion of internal carotid artery. (3) Ampulla of anterior semicircular canal. (4) Cochlea.5 Lateral semicircular canal. (6) Hook region of cochlea. (7) Vertical portion of internal carotid artery. (8) Common crus. (9) Vestibule. (10) Cochlear aqueduct. (11) Endolymphatic sac. (12) Jugular bulb

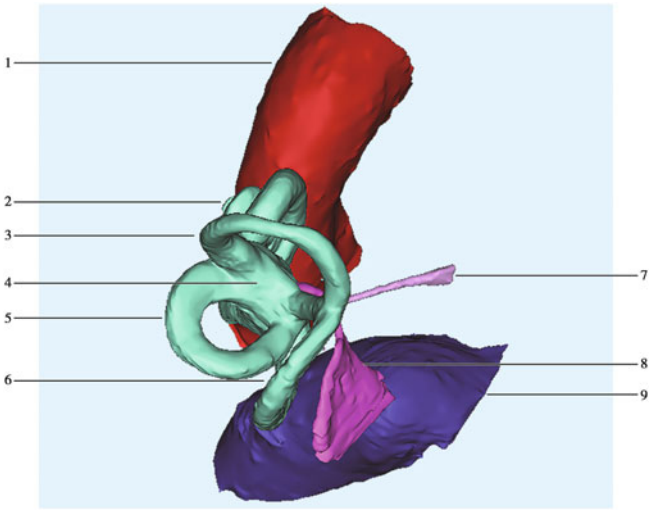

Fig. 7.72 Three-dimensional reconstruction of inner ear and blood vessel on basis crania interna view. (1) Internal carotid artery. (2) Cochlea. (3) Anterior semicircular canal. (4) Vestibule. (5) Lateral semicircular canal. (6) Posterior semicircular canal. (7) Cochlear aqueduct. (8) Endolymphatic sac. (9) Jugular bulb

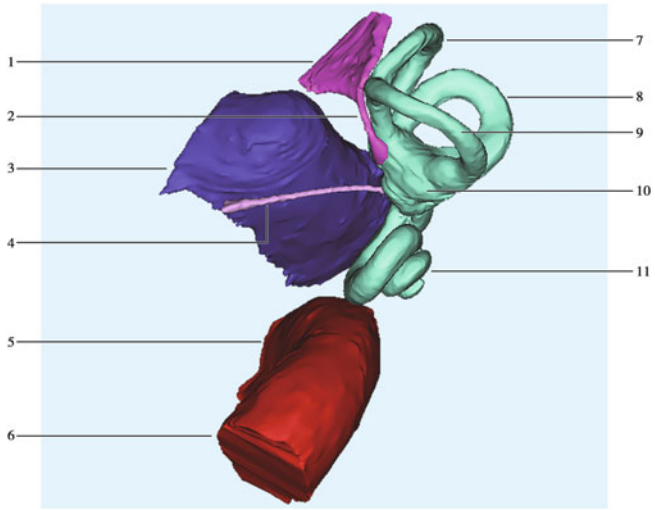

Fig. 7.74 Three-dimensional reconstruction of inner ear and blood vessel on basis crania externa view. (1) Endolymphatic sac. (2) Vestibular aqueduct. (3) Jugular bulb. (4) Cochlear aqueduct. (5) Vertical portion of internal carotid artery. (6) Horizontal portion of internal carotid artery. (7) Posterior semicircular canal. (8) Lateral semicircular canal. (9) Anterior semicircular canal. (10) Vestibule. (11) Cochlea

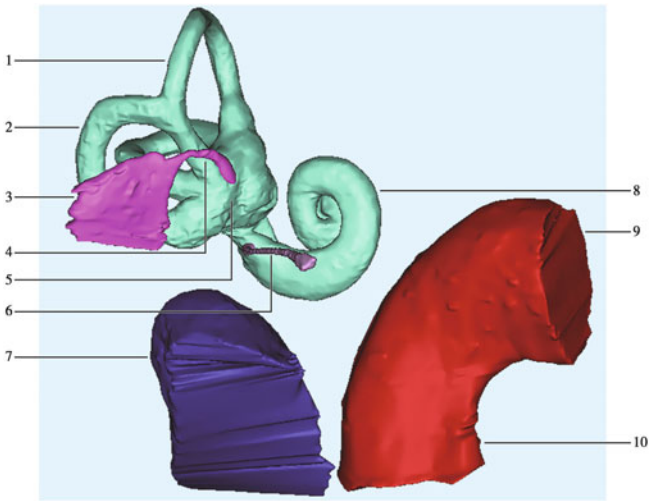

Fig. 7.73 Three-dimensional reconstruction of inner ear and blood vessel on internal (internal acoustic porus) view. (1) Anterior semicircular canal. (2) Posterior semicircular canal. (3) Endolymphatic sac. (4) Vestibular aqueduct. (5) Vestibule. (6) Cochlear aqueduct. (7) Jugular bulb. (8) Cochlea. (9) Horizontal portion of internal carotid artery. (10) Vertical portion of internal carotid artery

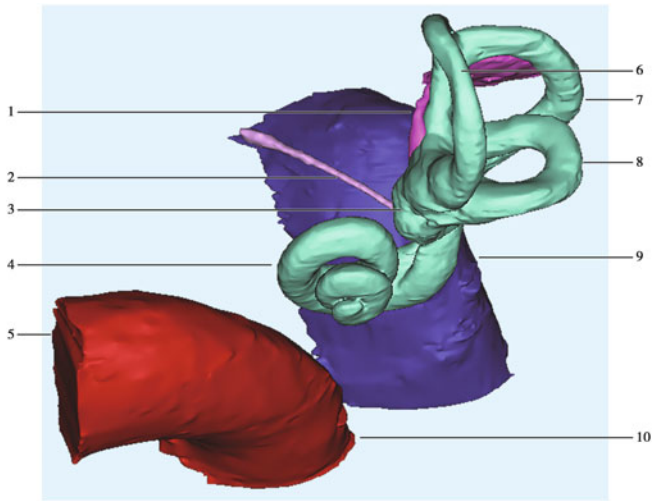

Fig. 7.75 Three-dimensional reconstruction of inner ear and blood vessel on temporal lobe view. (1) Vestibular aqueduct. (2) Cochlear aqueduct. (3) Vestibule. (4) Cochlea. (5) Horizontal portion of internal carotid artery. (6) Anterior semicircular canal. (7) Posterior semicircular canal. (8) Lateral semicircular canal. (9) Jugular bulb. (10) Vertical portion of internal carotid artery

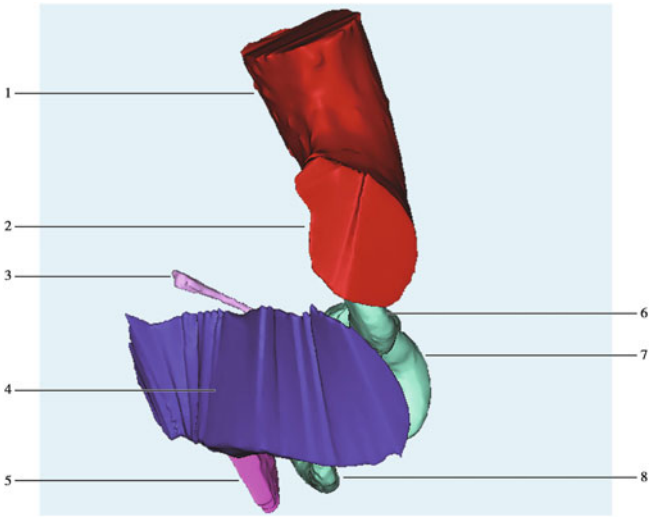

Fig. 7.76 Three-dimensional reconstruction of inner ear and blood vessel on basis crania externa view. (1) Horizontal portion of internal carotid artery. (2) Vertical portion of internal carotid artery. (3) Cochlear aqueduct. (4) Jugular bulb. (5) Endolymphatic sac. (6) Cochlea. (7) Lateral semicircular canal. (8) Posterior semicircular canal

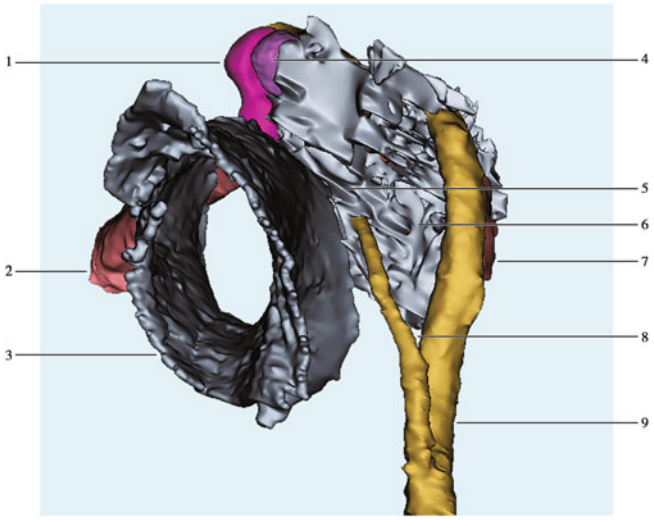

Fig. 7.77 Three-dimensional reconstruction of vestibular and cochlear niche on posterolateral view. (1) Malleus. (2) Tensor tympani muscle. (3) External auditory canal. (4) Incus. (5) Lateral wall of posterior tympanum. (6) Lateral wall of facial recess. (7) Stapedium muscle. (8) Chorda tympani nerve. (9) Mastoid portion of facial nerve

7.9 Three-Dimensional Reconstruction of Vestibular and Round Windows

The stapes footplate fits into the vestibular window to transmit mechanical energy to the scala vestibuli of the cochlea. This window is located at the bottom of a deep depression (vestibular window niche) surrounded by eminences: the anteroinferior promontory, the superior facial nerve canal, the anterosuperior cochleariform process, and the posterior pyramidal eminence. The window edge and the stapes footplate are connected by the connective tissue called the annular ligament. Except for the sound transmission function, recent study showed the stapes and the surrounding annular ligament might influence the diffusion of therapeutic agents through the vestibular window niche (Zou et al. 2012; Salt et al. 2012; Mohammadi et al. 2017).

The cochlear window is located in the cochlear window niche, inferiorly to the vestibular window. The cochlear window is another opening of the labyrinth to the middle ear. The cochlear window membrane is located in the superior aspect of the cochlear window niche and lies mostly in the horizontal plane.

The facial recess locates in the posterior wall of the tympanic cavity. It is bordered by the chorda tympani nerve laterally, the facial canal medially, and the incudial fossa superiorly. This recess will be removed for posterior tympanotomy in canal wall up tympanoplasty and cochlear implant surgery. Through this recess, these two windows can be surveyed clearly (Figs. 7.77–7.90).

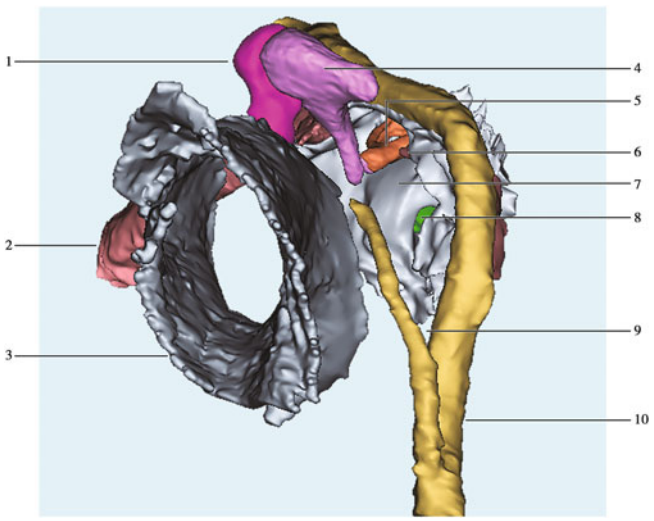

Fig. 7.78 Three-dimensional reconstruction of vestibular and cochlear niche on posterolateral view. (1) Malleus. (2) Tensor tympani muscle. (3) External auditory canal. (4) Incus. (5) Stapes. (6) Pyramidal eminence and tendon of stapedius muscle. (7) Promontory. (8) Cochlear window. (9) Chorda tympani nerve. (10) Mastoid portion of facial nerve

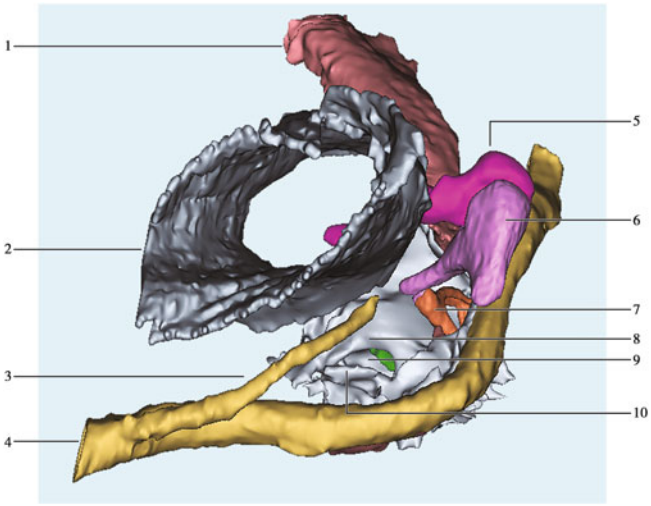

Fig. 7.79 Three-dimensional reconstruction of vestibular and cochlear niche on facial recess view. (1) Tensor tympani muscle. (2) External auditory canal. (3) Chorda tympani nerve. (4) Mastoid portion of facial nerve. (5) Malleus. (6) Incus. (7) Stapes. (8) Promontory (anterior edge of cochlear window niche). (9) Cochlear window. (10) Posterior wall of tympanum

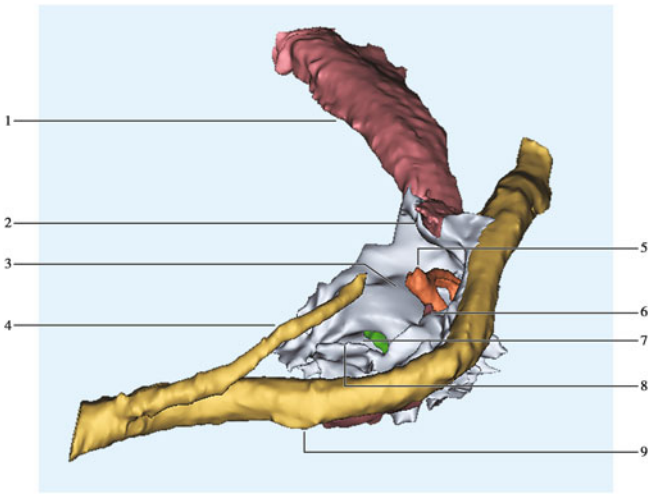

Fig. 7.80 Three-dimensional reconstruction of vestibular and cochlear niche on facial recess view. (1) Tensor tympani muscle. (2) Processus cochleariformis and tensor tympani muscle. (3) Vestibular window niche. (4) Chorda tympani nerve. (5) Stapes. (6) Pyramidal eminence and tendon of stapedius muscle. (7) Cochlear window niche. (8) Posterior wall of tympanum. (9) Mastoid portion of facial nerve

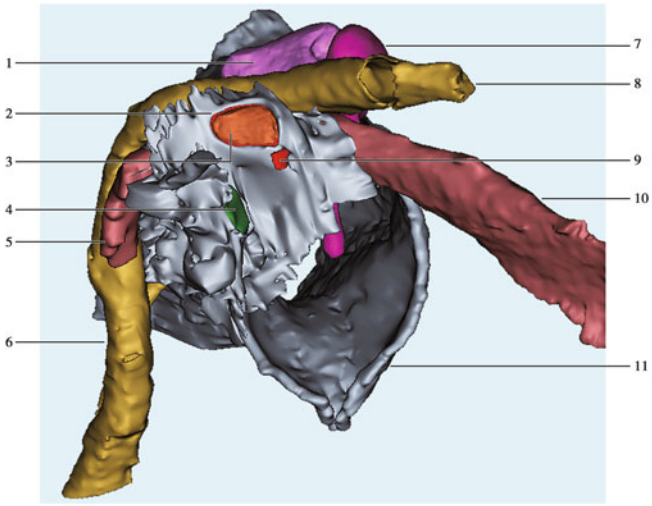

Fig. 7.81 Three-dimensional reconstruction of vestibular and cochlear niche on internal (intracranial) view. (1) Incus. (2) Annular ligament. (3) Footplate. (4) Cochlear window. (5) Stapedius muscle. (6) Mastoid portion of facial nerve. (7) Malleus. (8) Greater superficial petrosal nerve. (9) Fissula ante fenestram. (10) Tensor tympani muscle. (11) External auditory canal

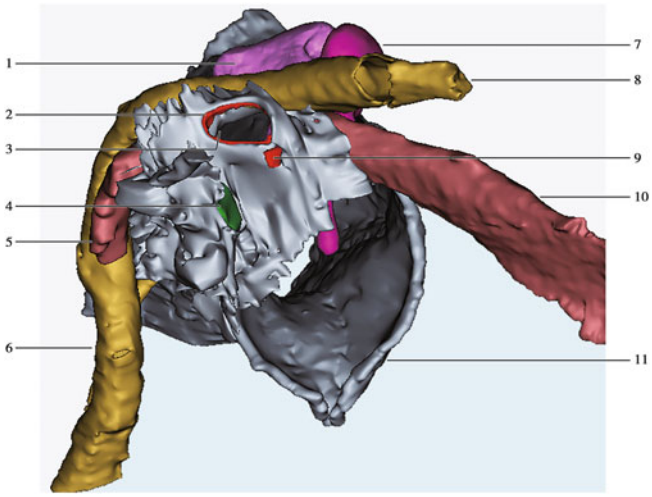

Fig. 7.82 Three-dimensional reconstruction of vestibular and cochlear niche on internal (intracranial) view. (1) Incus. (2) Annular ligament. (3) Vestibular window. (4) Cochlear window. (5) Stapedius muscle. (6) Mastoid portion of facial nerve. (7) Malleus. (8) Greater superficial petrosal nerve. (9) Fissula ante fenestram. (10) Tensor tympani muscle. (11) External auditory canal

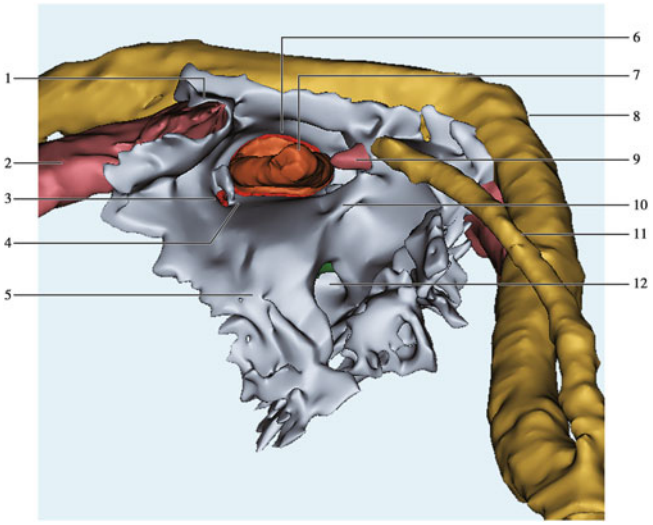

Fig. 7.83 Three-dimensional reconstruction of vestibular and cochlear niche on lateral view. (1) Processus cochleariformis. (2) Tensor tympani muscle. (3) Fissula ante fenestram. (4) Vestibular window niche. (5) Promontory. (6) Annular ligament. (7) Stapes. (8) Facial nerve. (9) Tendon of stapedius muscle. (10) Ponticulus promontorii. (11) Chorda tympani nerve. (12) Cochlear window niche

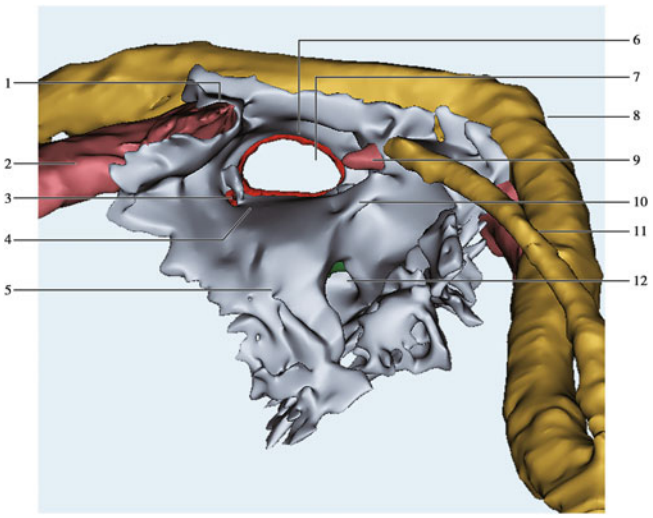

Fig. 7.84 Three-dimensional reconstruction of vestibular and cochlear niche on lateral view. (1) Processus cochleariformis. (2) Tensor tympani muscle. (3) Fissula ante fenestram. (4) Vestibular window niche. (5) Promontory. (6) Annular ligament. (7) Vestibular window. (8) Facial nerve. (9) Tendon of stapedius muscle. (10) Ponticulus promontorii. (11) Chorda tympani nerve. (12) Cochlear window niche

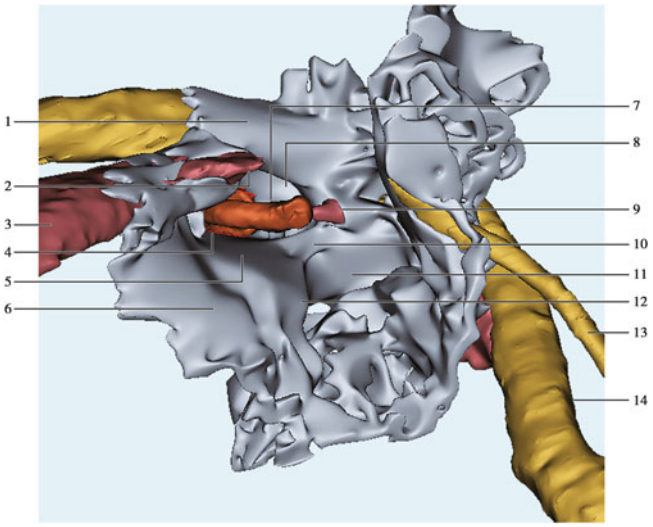

Fig. 7.85 Three-dimensional reconstruction of vestibular and cochlear niche on anterolateral view. (1) Tympanic portion of facial nerve canal. (2) Tendon of tensor tympani muscle. (3) Tensor tympani muscle. (4) Annular ligament. (5) Vestibular window niche. (6) Promontory. (7) Stapes. (8) Posterior tympanic sinus (9) Pyramidal eminence and tendon of stapedius muscle. (10) Ponticulus promontorii. (11) Tympanic sinus. (12) Promontory (anterior edge of cochlear window niche). (13) Chorda tympani nerve. (14) Mastoid portion of facial nerve

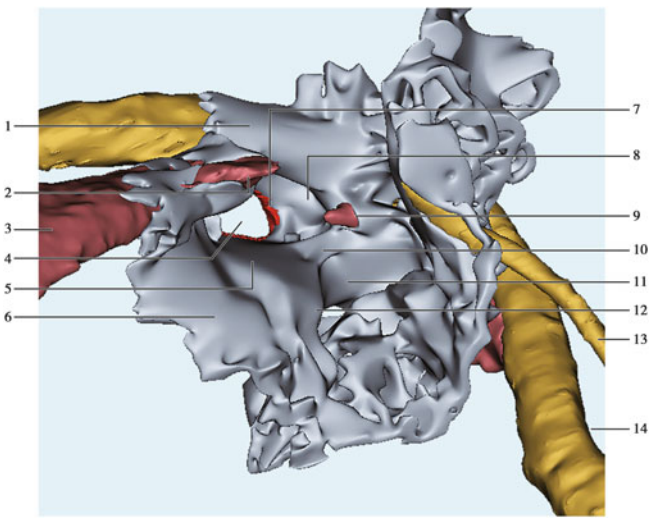

Fig. 7.86 Three-dimensional reconstruction of vestibular and cochlear niche on anterolateral view. (1) Tympanic portion of facial nerve canal. (2) Tendon of tensor tympani muscle. (3) Tensor tympani muscle. (4) Vestibular window. (5) Vestibular window niche. (6) Promontory. (7) Annular ligament. (8) Posterior tympanic sinus (9) Pyramidal eminence and tendon of stapedius muscle. (10) Ponticulus promontorii. (11) Tympanic sinus. (12) Promontory (anterior edge of cochlear window niche). (13) Chorda tympani nerve. (14) Mastoid portion of facial nerve

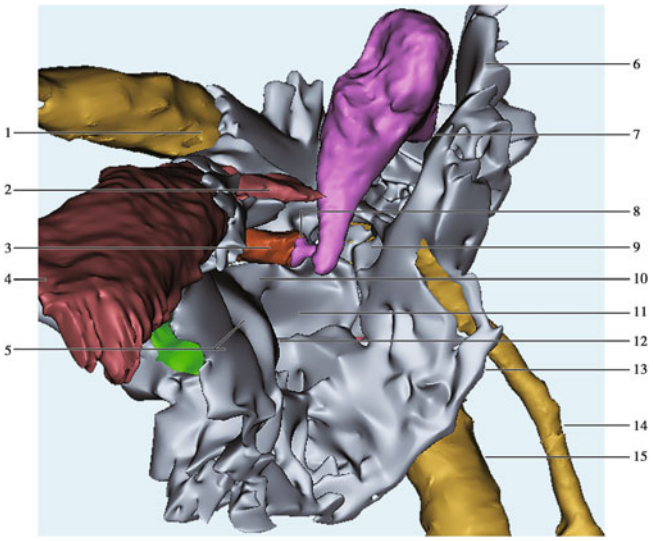

Fig. 7.87 Three-dimensional reconstruction of vestibular and cochlear niche on anterior view. (1) Tympanic portion of facial nerve. (2) Tendon of tensor tympani muscle. (3) Stapes. (4) Tensor tympani muscle. (5) Promontory. (6) Lateral wall of aditus ad antrum. (7) Short crus of incus (fossa). (8) Incudostapedial articulation. (9) Facial nerve recess. (10) Ponticulus promontorii. (11) Tympanic sinus. (12) Anterior edge of cochlear window niche. (13) Posteroinferior wall of tympanum. (14) Chorda tympani nerve. (15) Mastoid portion of facial nerve

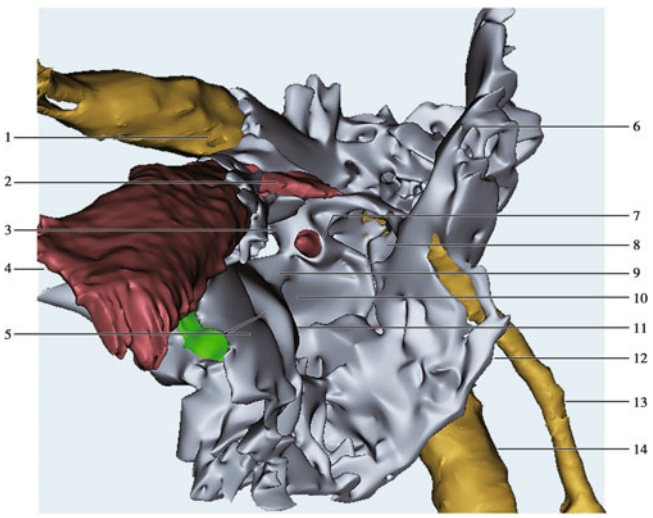

Fig. 7.88 Three-dimensional reconstruction of vestibular and cochlear niche on anterior view. (1) Tympanic portion of facial nerve. (2) Tendon of tensor tympani muscle. (3) Posterior edge of vestibular window. (4) Tensor tympani muscle. (5) Promontory. (6) Lateral wall of aditus ad antrum. (7) Pyramidal eminence. (8) Facial recess. (9) Ponticulus promontorii. (10) Cochlear window niche. (11) Anterior edge of cochlear window niche. (12) Posteroinferior wall of tympanum. (13) Chorda tympani nerve. (14) Mastoid portion of facial nerve

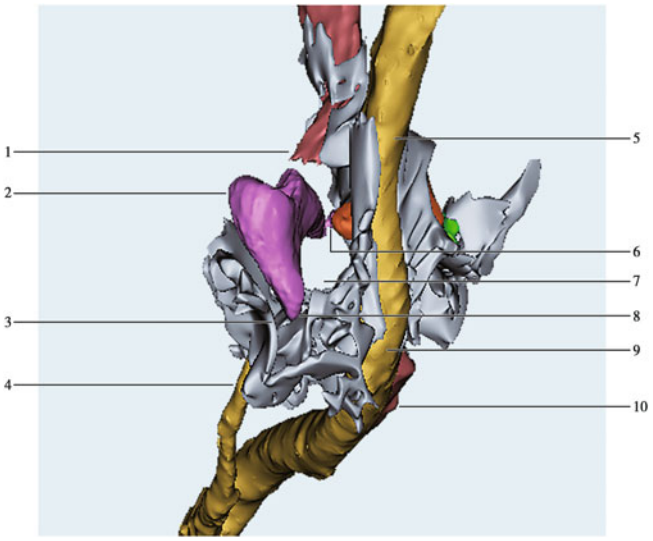

Fig. 7.89 Three-dimensional reconstruction of vestibular and cochlear niche on posterosuperior view. (1) Tendon of tensor tympani muscle. (2) incus. (3) Lateral wall of aditus ad antrum. (4) Chorda tympani nerve. (5) Tympanic portion of facial nerve. (6) Incudostapedial articulation. (7) Posterior tympanic sinus. (8) Short crus of incus (fossa). (9) Second genu. (10) Stapedius muscle

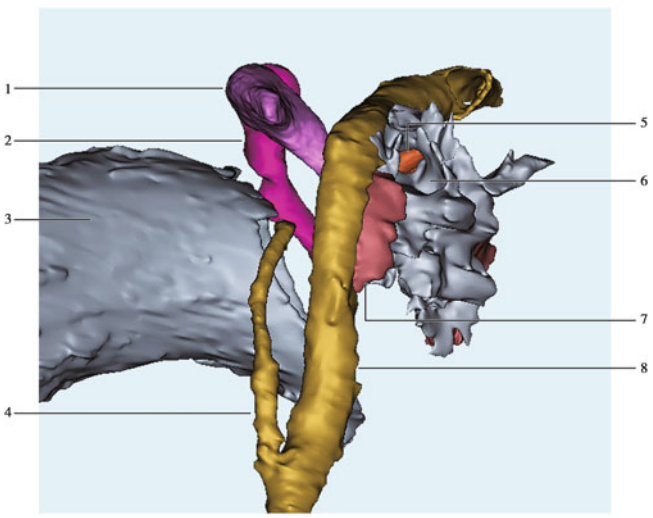

Fig. 7.90 Three-dimensional reconstruction of vestibular and cochlear niche on posterior view. (1) Incus. (2) Malleus. (3) External auditory canal. (4) Chorda tympani nerve. (5) Tendon of stapedius muscle. (6) Posterior tympanic sinus. (7) Stapedius muscle. (8) Mastoid portion of facial nerve

7.10 Three-Dimensional Reconstruction of Anterior Supralabyrinthine Region

The anterior supralabyrinthine region (or air cell tract) locates among the anterior semicircular canal, the geniculate ganglion, the labyrinthine and tympanic portions of the facial nerve, and the adjacent middle fossa dura (Gluth et al. 2011). The attic communicates with the petrous apex through this region. At the meantime, this is an area that commonly requires fine surgical dissection when managing attic cholesteatoma, irreversible mucosa disease (Sheahan and Walsh 2003), facial nerve trauma, or neurotological skull base surgery (Magliulo et al. 1998) (Figs. 7.91–7.96).

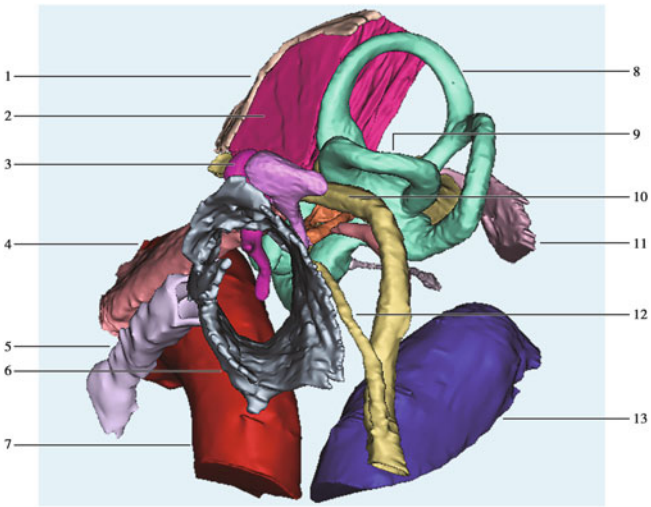

Fig. 7.91 Three-dimensional reconstruction of anterior supralabyrinthine region on lateral view. (1) Middle fossa dura. (2) Anterior supralabyrinthine region. (3) Ossicular chain. (4) Tensor tympani muscle. (5) Eustachian tube. (6) External auditory canal. (7) Internal carotid artery. (8) Anterior semicircular canal. (9) Lateral semicircular canal. (10) Facial nerve. (11) Endolymphatic sac. (12) Chorda tympani nerve. (13) Jugular bulb

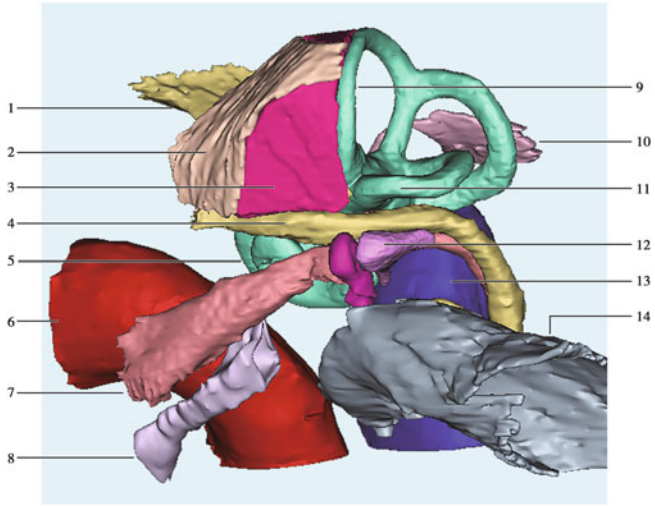

Fig. 7.93 Three-dimensional reconstruction of anterior supralabyrinthine region on temporal lobe view. (1) Internal auditory canal. (2) Middle fossa dura. (3) Anterior supralabyrinthine region. (4) Tympanic portion of facial nerve. (5) Cochlea. (6) Internal carotid artery. (7) Tensor tympani muscle. (8) Eustachian tube. (9) Anterior semicircular canal. (10) Endolymphatic sac. (11) Lateral semicircular canal. (12) Ossicular chain. (13) Jugular bulb. (14) External auditory canal

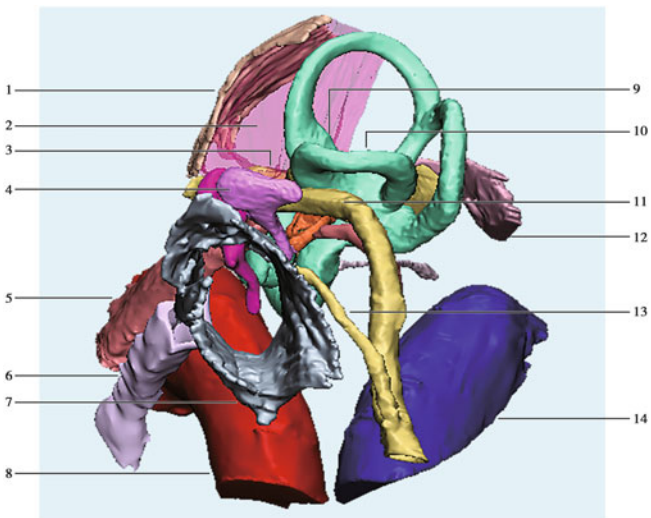

Fig. 7.92 Three-dimensional reconstruction of anterior supralabyrinthine region (semi-transparent) on lateral view. (1) Middle fossa dura. (2) Anterior supralabyrinthine region. (3) Labyrinthine portion of facial nerve. (4) Ossicular chain. (5) Tensor tympani muscle. (6) Eustachian tube. (7) External auditory canal. (8) Internal carotid artery. (9) Ampulla of anterior semicircular canal. (10) Lateral semicircular canal. (11) Facial nerve. (12) Endolymphatic sac. (13) Chorda tympani nerve. (14) Jugular bulb

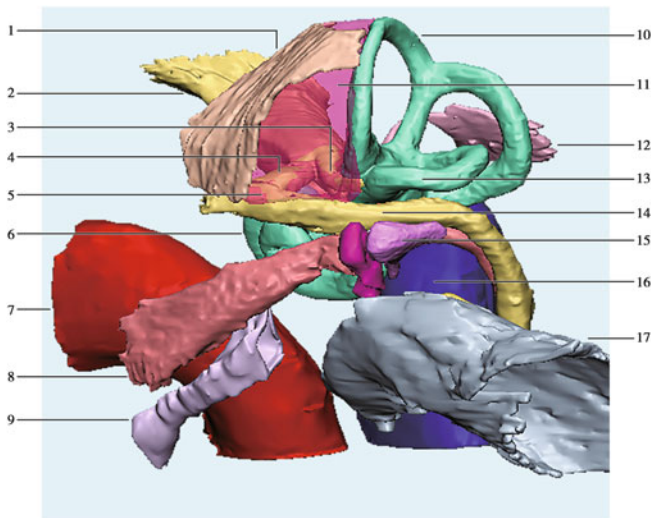

Fig. 7.94 Three-dimensional reconstruction of anterior supralabyrinthine region (semi-transparent) on temporal lobe view. (1) Middle fossa dura. (2) Internal auditory canal. (3) Superior vestibular nerve. (4) Labyrinthine portion of facial nerve. (5) Geniculate ganglion. (6) Cochlea. (7) Internal carotid artery. (8) Tensor tympani muscle. (9) Eustachian tube. (10) Anterior semicircular canal. (11) Anterior supralabyrinthine region. (12) Endolymphatic sac. (13) Lateral semicircular canal. (14) Tympanic portion of facial nerve. (15) Ossicular chain. (16) Jugular bulb. (17) External auditory canal

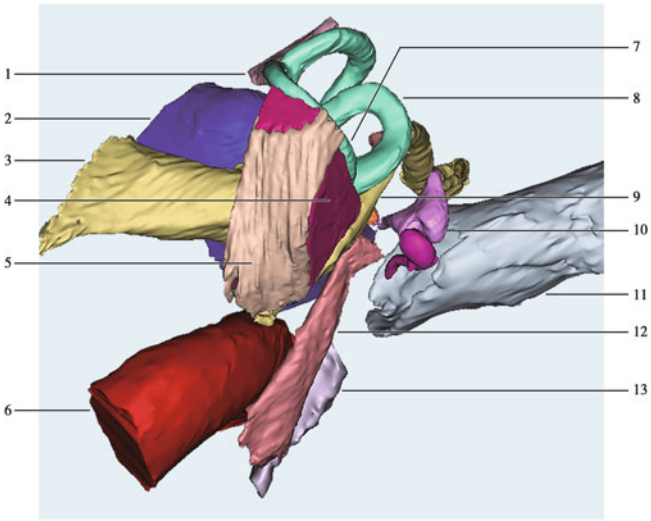

Fig. 7.95 Three-dimensional reconstruction of anterior supralabyrinthine region on middle cranial fossa view. (1) Endolymphatic sac. (2) Jugular bulb. (3) Internal auditory canal. (4) Anterior supralabyrinthine region. (5) Middle fossa dura. (6) Internal carotid artery. (7) Anterior semicircular canal. (8) Lateral semicircular canal. (9) Tympanic portion of facial nerve. (10) Ossicular chain. (11) External auditory canal. (12) Tensor tympani muscle. (13) Eustachian tube

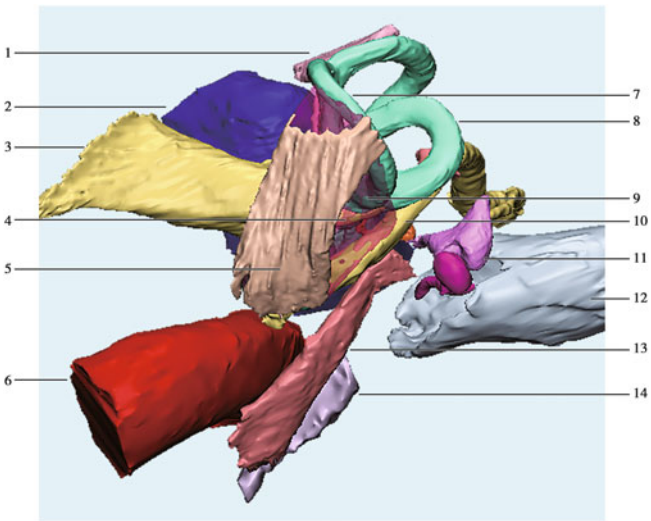

Fig. 7.96 Three-dimensional reconstruction of anterior supralabyrinthine region (semi-transparent) on middle cranial fossa view. (1) Endolymphatic sac. (2) Jugular bulb. (3) Internal auditory canal. (4) Superior vestibular nerve. (5) Middle fossa dura. (6) Internal carotid artery. (7) Anterior semicircular canal. (8) Lateral semicircular canal. (9) Anterior supralabyrinthine region. (10) Tympanic portion of facial nerve. (11) Ossicular chain. (12) External auditory canal. (13) Tensor tympani muscle. (14) Eustachian tube

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8 Two-Dimensional Observation of Man-Made Tiny Lesion Models in Temporal Bone

Zilong Yu, Luo Zhang, and Demin Han

8.1 Introduction

The small size and complex components of the ear need application of high resolution imaging techniques for accurate depiction of their anatomy (Hermans et al. 1995). In practice, high resolution images are delivered by HRCT whose spatial resolution is about 0.5–1.0 mm (Hermans et al. 1995; Bellos et al. 2014), but some tiny lesions (their diameters are about 1 mm or less, or called micro-lesions) are very difficult to be identified by HRCT scan because of the partial volume effect. These tiny lesions such as the dislocation, fenestration, and fracture of the stapedial footplates, the dislocation of incudostapedial articulation, dehiscence of fallopian canal, fenestration of the promontory (cochlear implant), and so on are not unusual in otology practice. As one of the state-of–the-art techniques (Clark and Badea 2014), micro-CT scan may provide beneficial information in exploring micro-architecture because of its extra high resolution (5–80 μm). In this chapter, we will use this technique (pixel size about 30 μm) to verify its ability to find those lesions and aim to provide artificial models for clinical diseases.

All images were reconstructed from the left temporal bone in this chapter (Figs. 8.1–8.34).

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8.2 Dislocation of Incudomalleolar Articulation

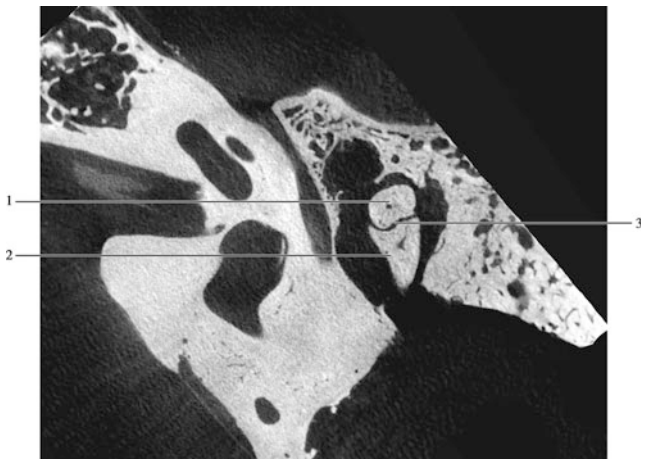

Fig. 8.1 Two-dimensional reconstruction of dislocation of incudomalleolar articulation on axial view. (1) Malleus. (2) Incus. (3) Enlarged fissure of incudomalleolar articulation

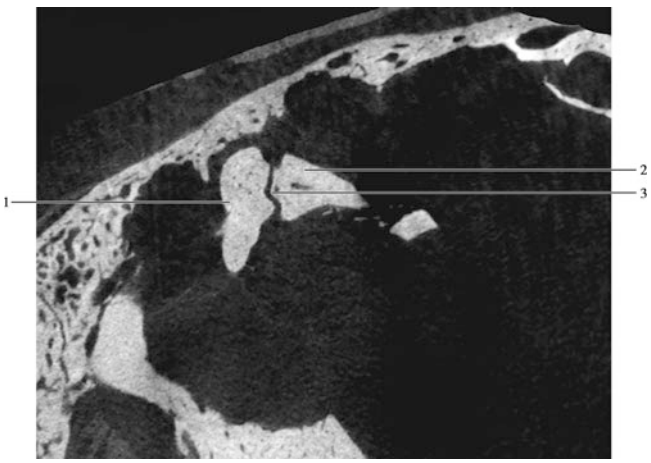

Fig. 8.3 Two-dimensional reconstruction of dislocation of incudomalleolar articulation on sagittal view. (1) Malleus. (2) Incus. (3) Enlarged fissure of incudomalleolar articulation

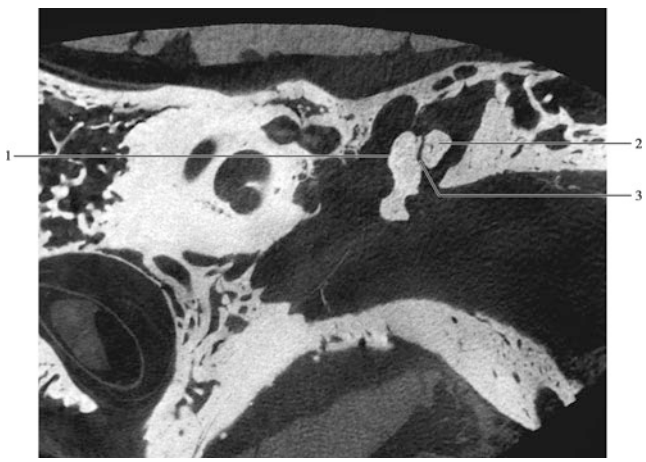

Fig. 8.2 Two-dimensional reconstruction of dislocation of incudomalleolar articulation on coronal view. (1) Malleus. (2) Incus. (3) Enlarged fissure of incudomalleolar articulation

8.3 Dislocation of Incudostapedial Articulation

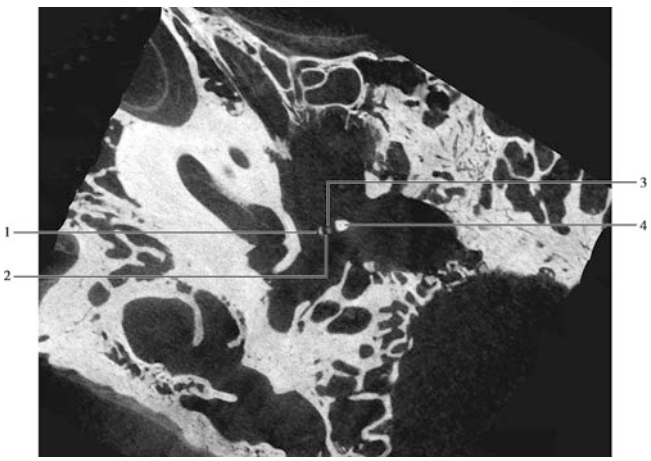

Fig. 8.4 Two-dimensional reconstruction of dislocation of incudostapedial articulation on axial coronal view. (1) Head of stapes. (2) Enlarged fissure of incudostapedial articulation. (3) Lenticulate process. (4) Long crus of incus

8.4 Man-Made Tiny Lesion Models in Stapes

8.4.1 Fenestration on Stapedial Footplate

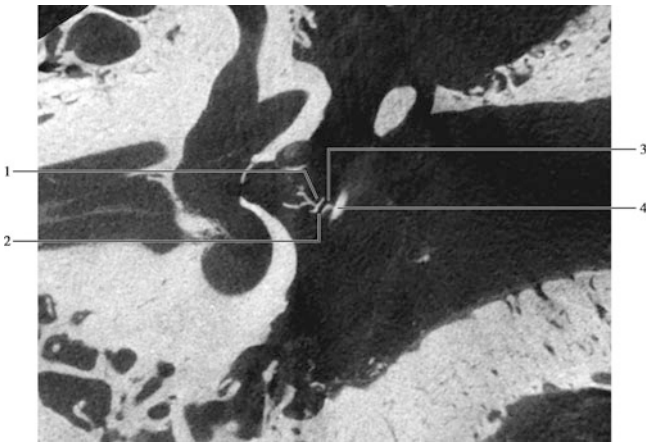

Fig. 8.5 Two-dimensional reconstruction of dislocation of incudostapedial articulation on coronal view. (1) Head of stapes. (2) Enlarged fissure of incudostapedial articulation. (3) Lenticulate process. (4) Long crus of incus

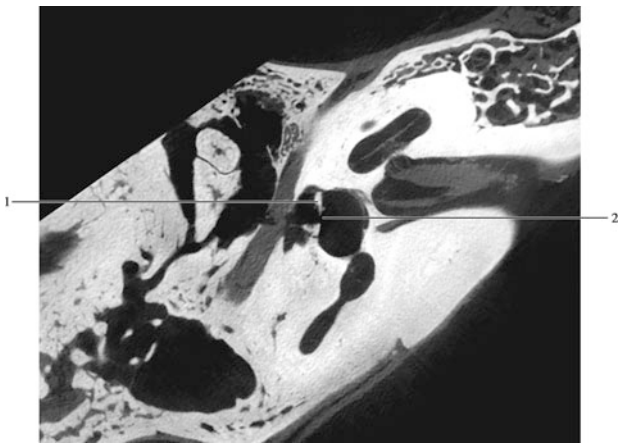

Fig. 8.7 Two-dimensional reconstruction of fenestration on stapedial footplate on axial view. (1) Footplate of stapes. (2) Partial absence (fenestration) of stapedial footplate

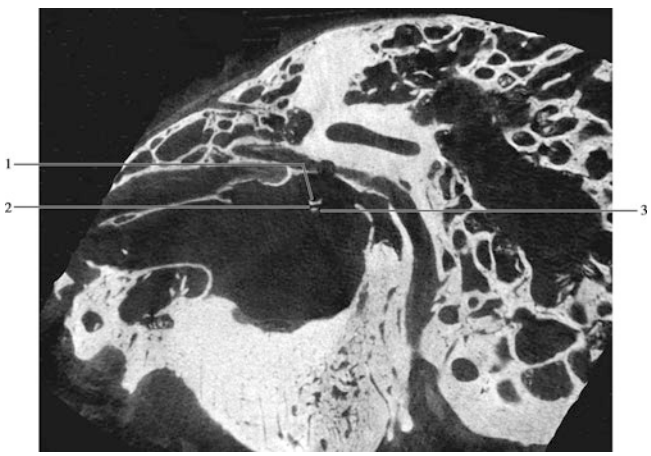

Fig. 8.6 Two-dimensional reconstruction of dislocation of incudostapedial articulation on sagittal view. (1) Head of stapes. (2) Enlarged fissure of incudostapedial articulation. (3) Lenticulate process

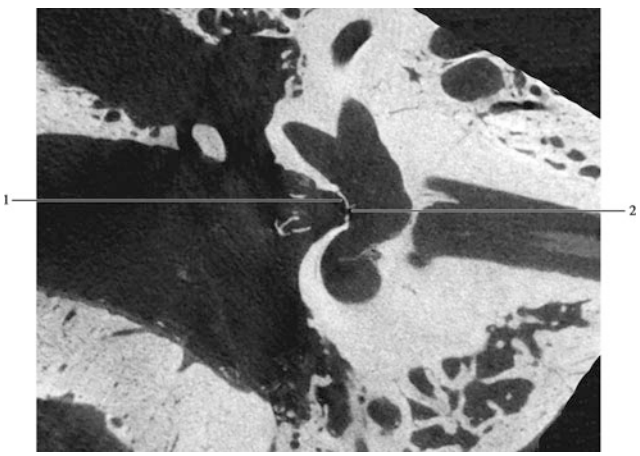

Fig. 8.8 Two-dimensional reconstruction of fenestration on stapedial footplate on coronal view. (1) Footplate of stapes. (2) Partial absence (fenestration) of stapedial footplate

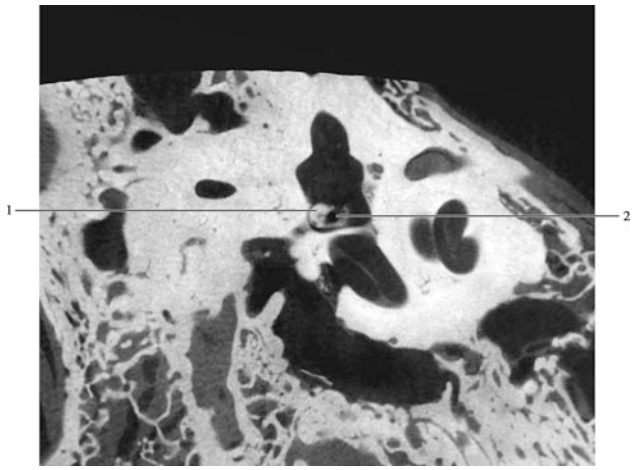

Fig. 8.9 Two-dimensional reconstruction of fenestration on stapedial footplate on Sagittal view. (1) Footplate of stapes. (2) Partial absence (fenestration) of stapedial footplate

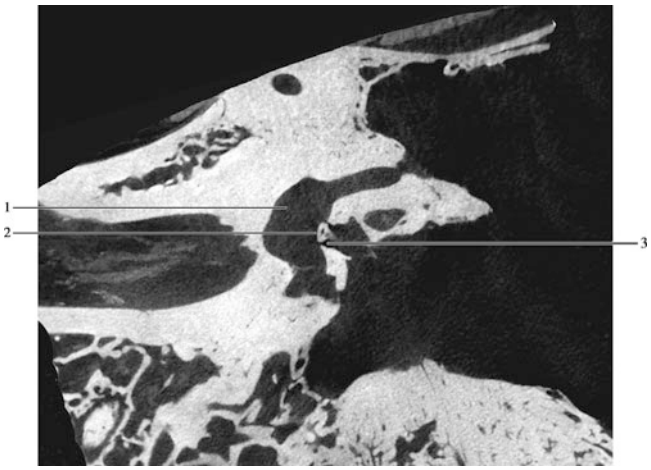

Fig. 8.11 Two-dimensional reconstruction of dislocation of stapedial footplate on coronal view. (1) Vestibule. (2) Dislocated stapedial footplate. (3) Inferior edge of vestibular window

8.4.2 Dislocation of Stapedial Footplate

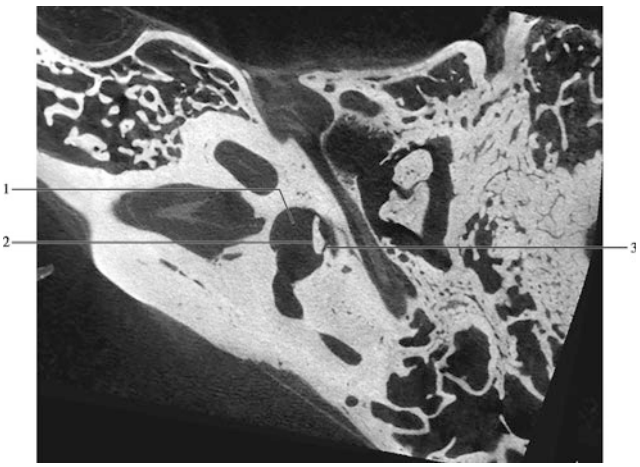

Fig. 8.10 Two-dimensional reconstruction of dislocation of stapedial footplate on axial view. (1) Vestibule. (2) Dislocated stapedial footplate. (3) Posterior edge of vestibular window

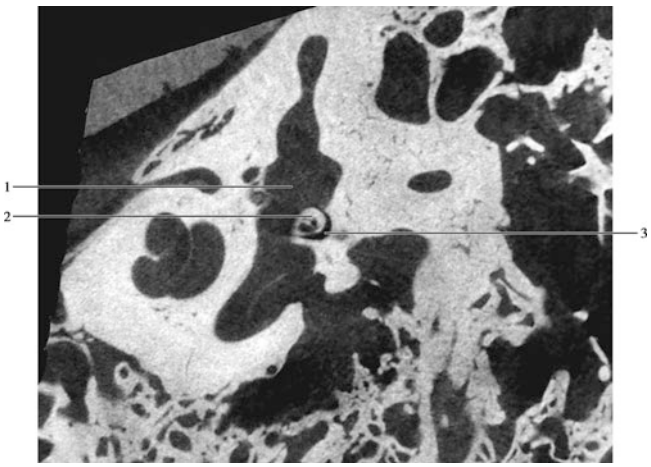

Fig. 8.12 Two-dimensional reconstruction of dislocation of stapedial footplate on sagittal view. (1) Vestibule. (2) Dislocated stapedial footplate. (3) Enlarged fissure between footplate and vestibular window

8.4.3 Fracture of Stapedial Footplate

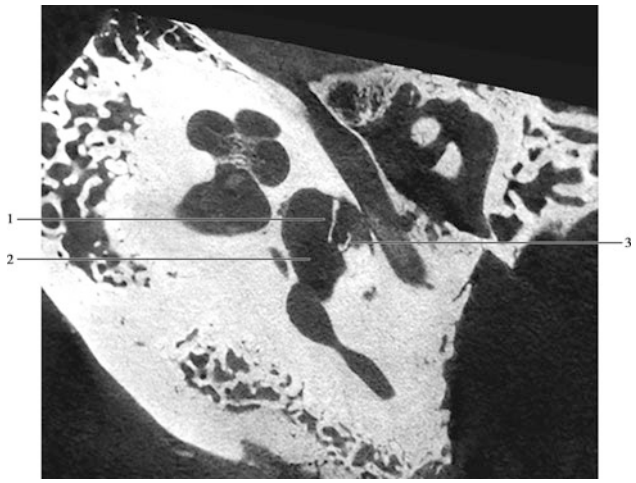

Fig. 8.13 Two-dimensional reconstruction of fracture of stapedial footplate on axial view. (1) Fractured (discontinuous) stapedial footplate. (2) Vestibule. (3) Posterior crus of stapes

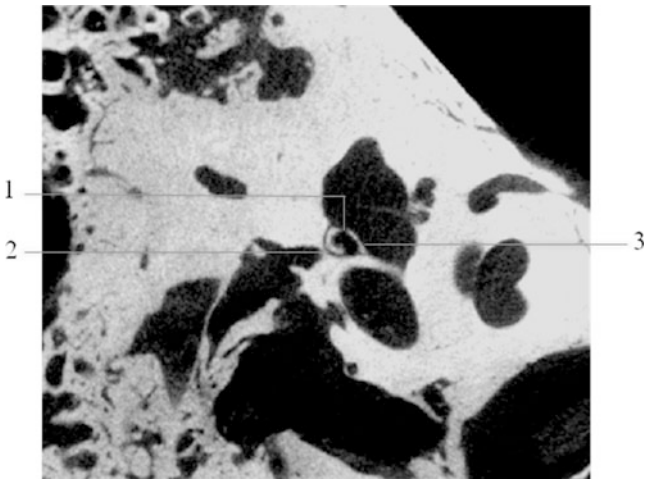

Fig. 8.15 Two-dimensional reconstruction of fracture of stapedial footplate on sagittal view. (1) Fractured (discontinuous) stapedial footplate. (3) Posterior edge of vestibular window (annular ligament) (3) Footplate of stapes

8.5 Man-Made Tiny Lesion Models in Lateral Semicircular Canal

8.5.1 Thinning of Lateral Semicircular Canal

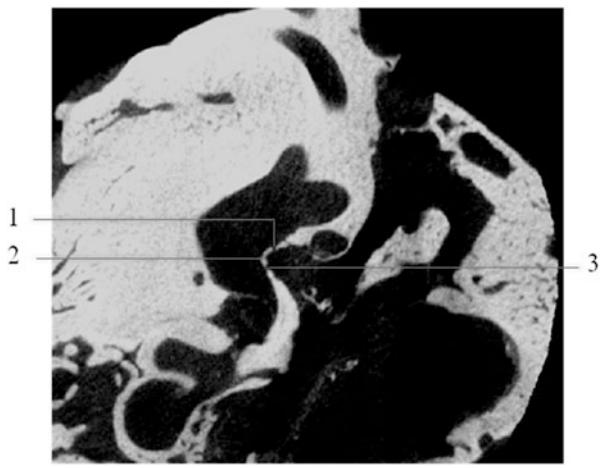

Fig. 8.14 Two-dimensional reconstruction of fracture of stapedial footplate on coronal view. (1) Fractured (discontinuous) stapedial footplate. (2) Footplate of footplate. (3) Posterior edge of vestibular window (annular ligament)

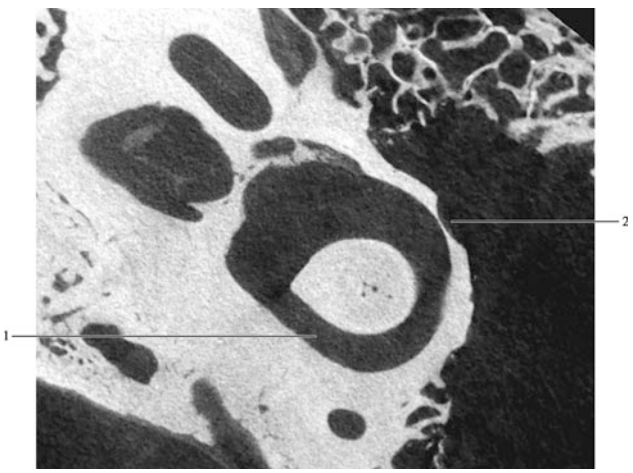

Fig. 8.16 Two-dimensional reconstruction of thinning of lateral semicircular canal on axial view. (1) Lateral semicircular canal. (2) Local bone thinning of lateral semicircular canal

8.5.2 Fenestration on Lateral Semicircular Canal

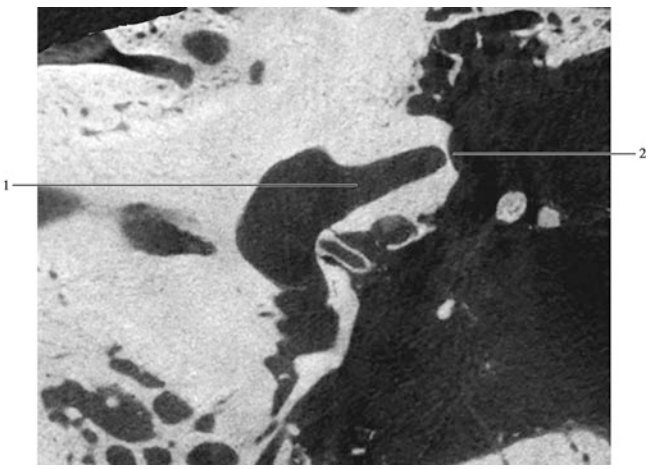

Fig. 8.17 Two-dimensional reconstruction of thinning of lateral semicircular canal on coronal view. (1) Lateral semicircular canal. (2) Local bone thinning of lateral semicircular canal

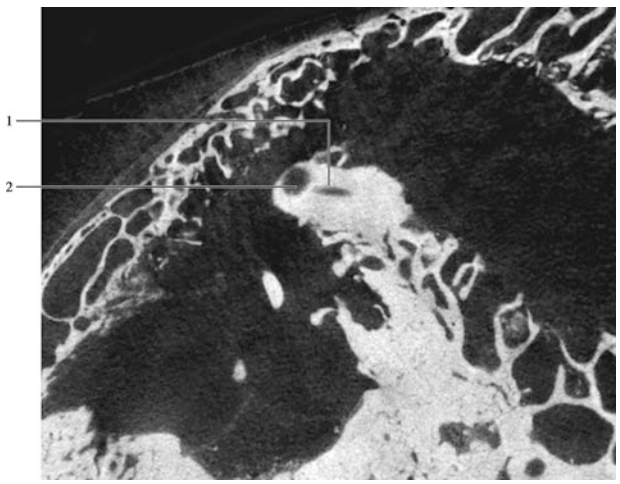

Fig. 8.18 Two-dimensional reconstruction of thinning of lateral semicircular canal on sagittal view. (1) Lateral semicircular canal. (2) Local bone absence of lateral semicircular canal

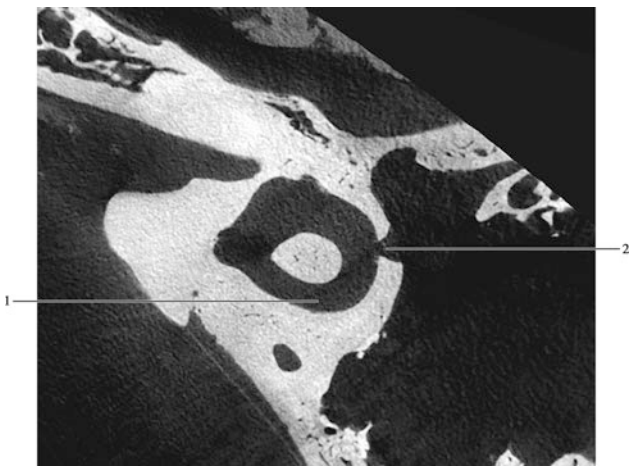

Fig. 8.19 Two-dimensional reconstruction of fenestration on lateral semicircular canal on axial view. (1) Lateral semicircular canal. (2) Local bone absence (hole) of lateral semicircular canal

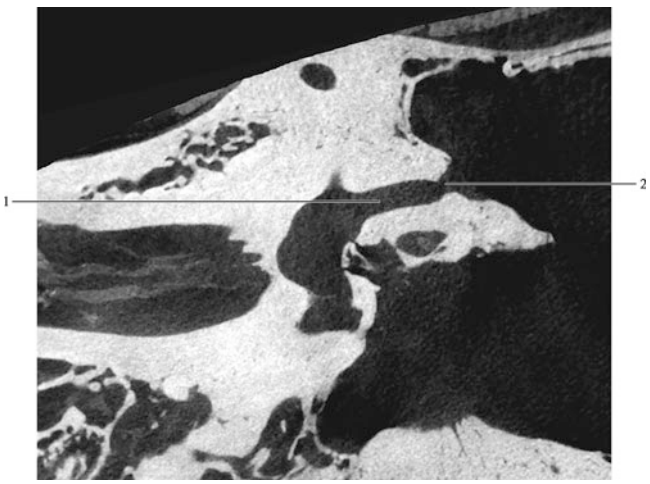

Fig. 8.20 Two-dimensional reconstruction of fenestration on lateral semicircular canal on coronal view. (1) Lateral semicircular canal. (2) Local bone absence (hole) of lateral semicircular canal

Fig. 8.21 Two-dimensional reconstruction of fenestration on lateral semicircular canal on sagittal view. (1) Lateral semicircular canal. (2) Local bone absence of lateral semicircular canal

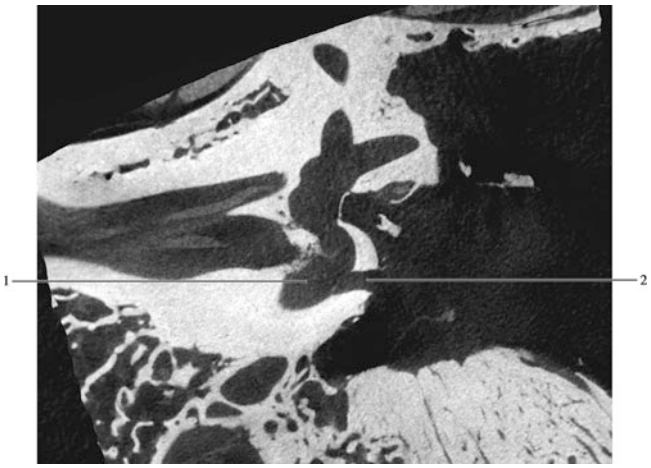

Fig. 8.23 Two-dimensional reconstruction of fenestration of cochlea on coronal view. (1) Cochlear canal. (2) Local bone absence (hole) of cochlea

8.6 Man-Made Tiny Lesion Models on Cochlea

8.6.1 Fenestration of Cochlea

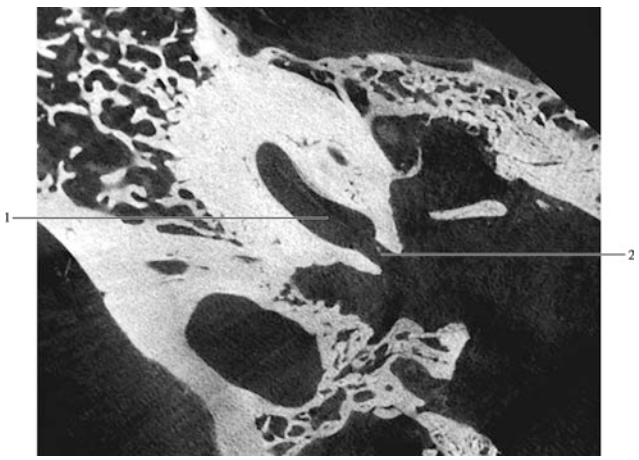

Fig. 8.22 Two-dimensional reconstruction of fenestration of cochlea on axial view. (1) Cochlear canal. (2) Local bone absence (hole) of cochlea

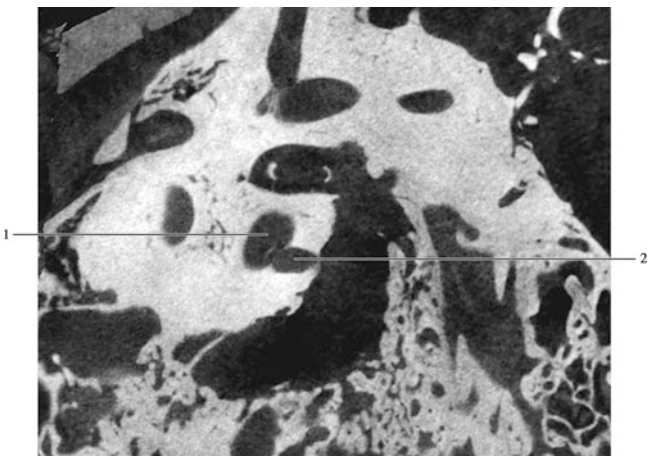

Fig. 8.24 Two-dimensional reconstruction of fenestration of cochlea on sagittal view. (1) Cochlear canal. (2) Local bone absence of cochlea

8.6.2 Fracture of Cochlea

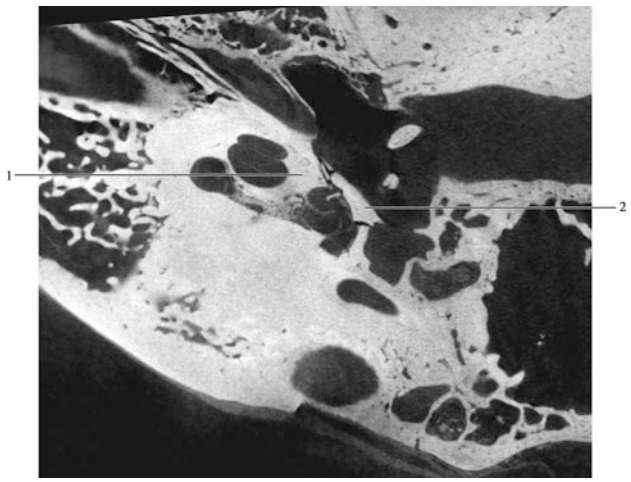

Fig. 8.25 Two-dimensional reconstruction of fracture of cochlea on axial view. (1) Promontory. (2) Fracture fragment of cochlea

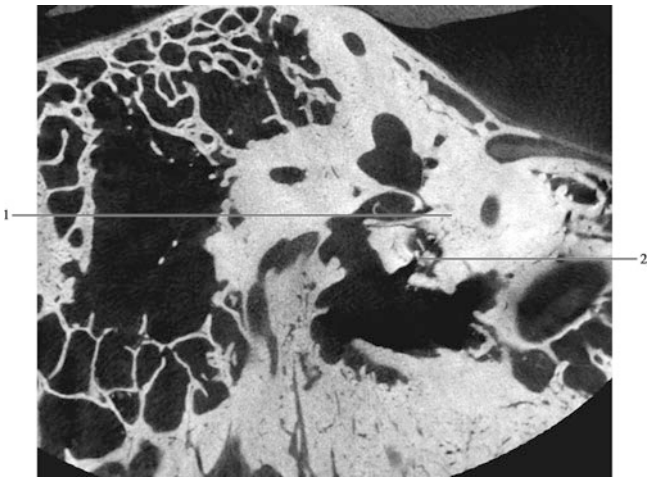

Fig. 8.27 Two-dimensional reconstruction of fracture of cochlea on sagittal view. (1) Promontory. (2) Fracture fragment of cochlea

8.7 Fenestration on Facial Canal

8.7.1 Fenestration on Tympanic Segment of Facial Canal

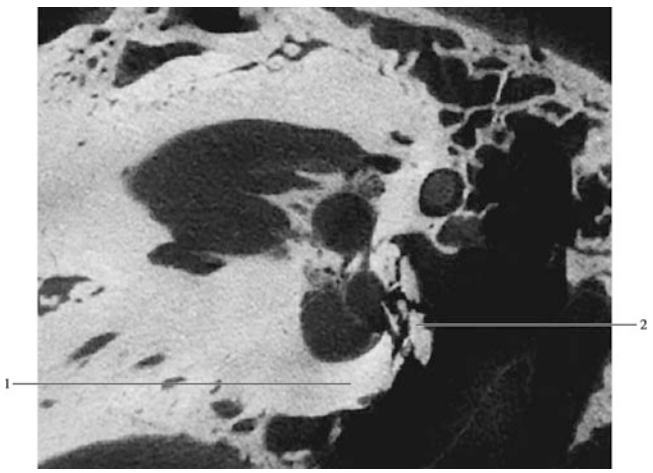

Fig. 8.26 Two-dimensional reconstruction of fracture of cochlea on coronal view. (1) Promontory. (2) Fracture fragment of cochlea

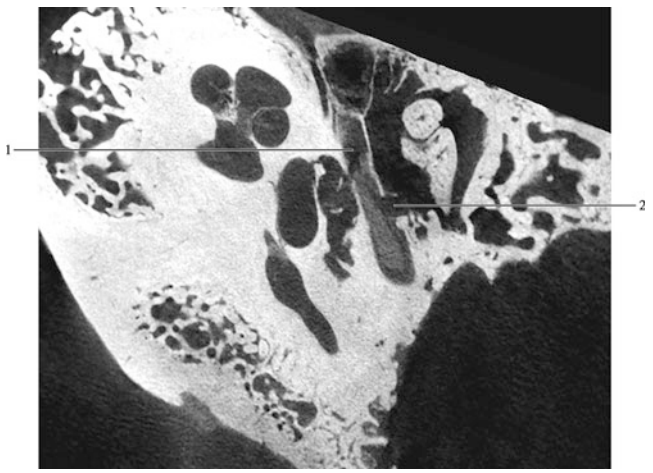

Fig. 8.28 Two-dimensional reconstruction of fenestration on tympanic segment of facial canal on axial view. (1) Facial nerve. (2) Fenestration (dehiscence) on lateral wall of facial canal

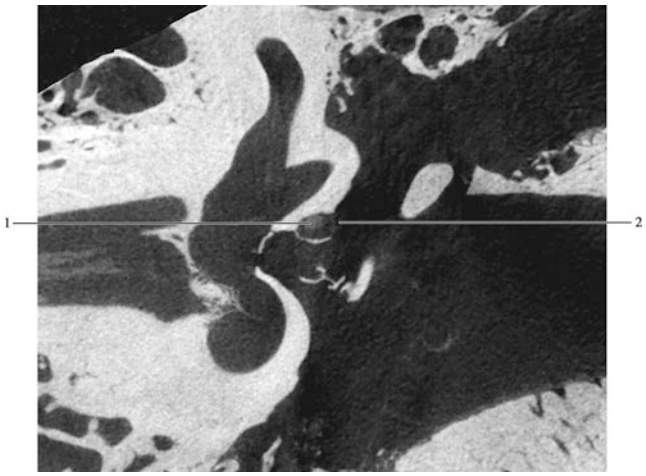

Fig. 8.29 Two-dimensional reconstruction of fenestration on tympanic segment of facial canal on coronal view. (1) Facial nerve. (2) Bone absence (dehiscence) of lateral wall of facial canal

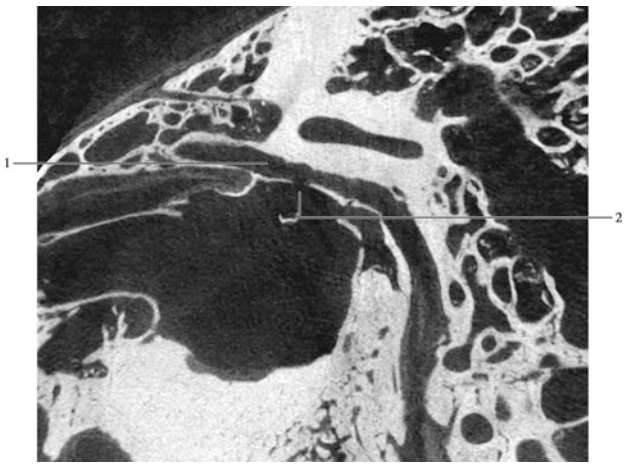

Fig. 8.30 Two-dimensional reconstruction of fenestration on tympanic segment of facial canal on sagittal view. (1) Facial nerve. (2) Bone absence (dehiscence) of inferior wall of facial canal

8.7.2 Fenestration on Second Genu of Facial Canal

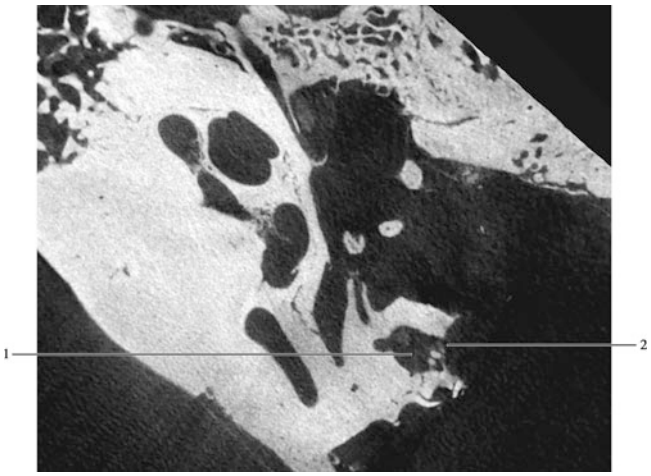

Fig. 8.31 Two-dimensional reconstruction of fenestration on second genu of facial canal on axial view. (1) Facial nerve. (2) Bone absence (dehiscence) of lateral wall of facial canal

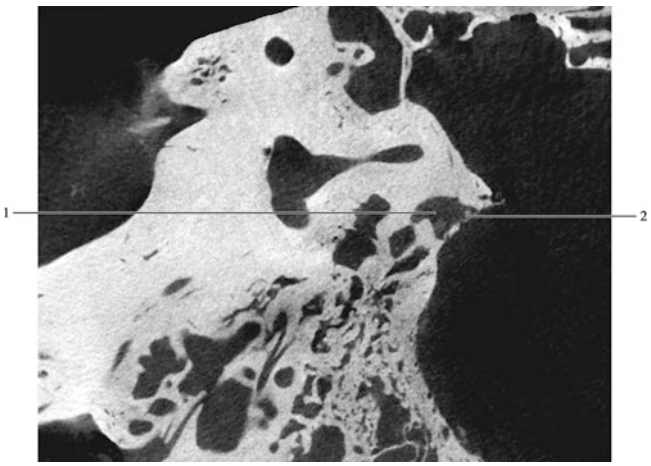

Fig. 8.32 Two-dimensional reconstruction of fenestration on second genu of facial canal on coronal view. (1) Facial nerve. (2) Bone absence (dehiscence) of lateral wall of facial canal

8.7.3 Fenestration on Mastoid Segment of Facial Canal

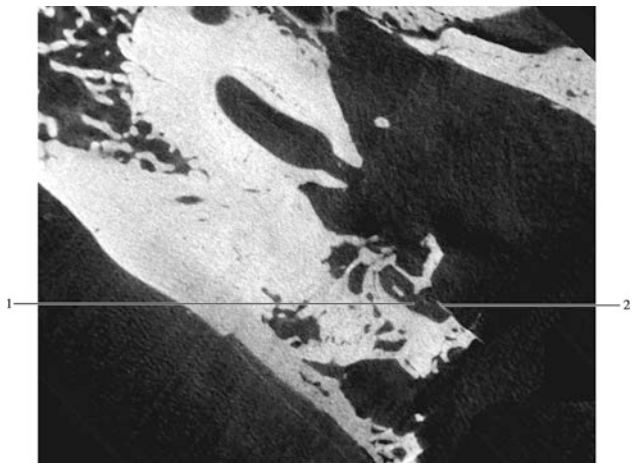

Fig. 8.33 Two-dimensional reconstruction of fenestration on mastoid portion of facial canal on axial view. (1) Facial nerve. (2) Bone absence (dehiscence) of lateral wall of facial canal

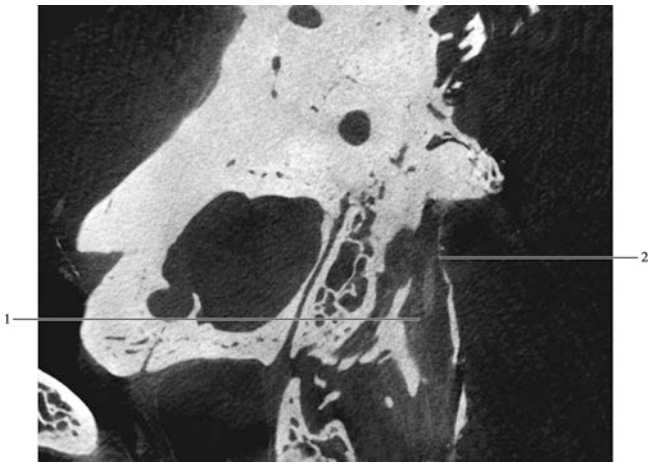

Fig. 8.34 Two-dimensional reconstruction of fenestration on mastoid portion of facial canal on coronal view. (1) Facial nerve. (2) Bone absence (dehiscence) of lateral wall of facial canal

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Hermans R, Marchal G, Feenstra L, Baert AL (1995) Spiral CT of the temporal bone: value of image reconstruction at submillimetric table increments. Neuroradiology 37(2):150–154

9 Three-Dimensional Observation of Man-Made Tiny Lesion Models in Temporal Bone

Zilong Yu, Luo Zhang, and Demin Han

9.1 Introduction

Although the micro-architecture and tiny lesion in temporal bone were difficult to be found by conventional HRCT (see Chap. 10), they have an important clinical significance (see Chap. 5), such as the most frequent length of the facial canal dehiscence in the tympanic segment is less than 1.5 mm (Kozerska et al. 2017), such small structures are hardly visible in clinical HRCT because the resolution capabilities of HRCT are on the order of 1 mm (Kozerska et al. 2017) and the canal has a multiplanar and tortuous route (Yetiser 2012), but micro-CT scan can help us to determine what kind of the dehiscences (their size, shape and location) enhances the risk of the facial nerve destruction (Kozerska et al. 2017).

Three-dimensional reconstruction from micro-CT scan data in the temporal bone can also excellently display the positions, shapes, sizes, and the spatial relationships between those tiny lesions and the adjacent structures (Kozerska et al. 2017; Mukherjee et al. 2011). To some extent, these models can simulate the actual conditions of clinical disease in the body.

Except for the special annotation, all the three-dimensional images were reconstructed from the left temporal bone in this chapter (Figs. 9.1–9.24).

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Z. Yu et al. (eds.), *Micro-CT of Temporal Bone*, https://doi.org/10.1007/978-981-16-0807-0_9

9.2 Dislocation of Incudomalleolar Articulation

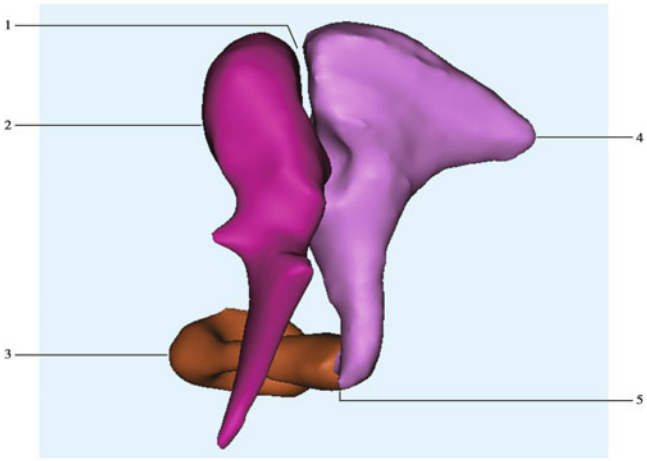

Fig. 9.1. Three-dimensional reconstruction of dislocation of incudomalleolar articulation on lateral view. (1) Enlarged fissure of incudomalleolar articulation. (2) Malleus. (3) Stapes. (4) Incus. (5) Incudostapedial articulation

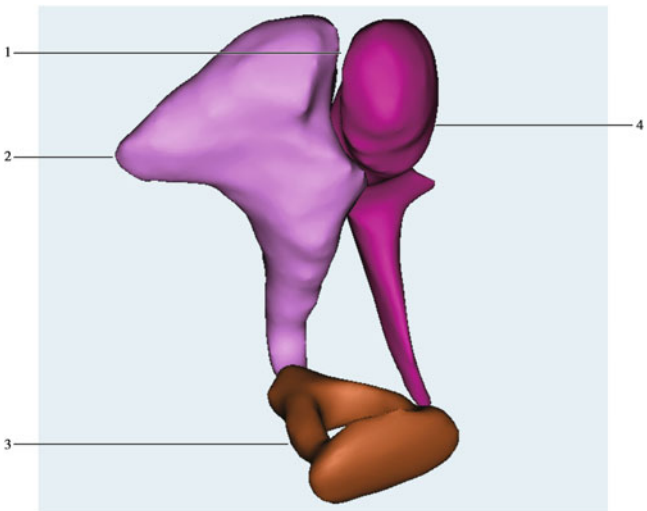

Fig. 9.2 Three-dimensional reconstruction of dislocation of incudomalleolar articulation on medial view. (1) Enlarged fissure of incudomalleolar articulation. (2) Incus. (3) Stapes. (4) Malleus

9.3 Dislocation of Incudostapedial Articulation

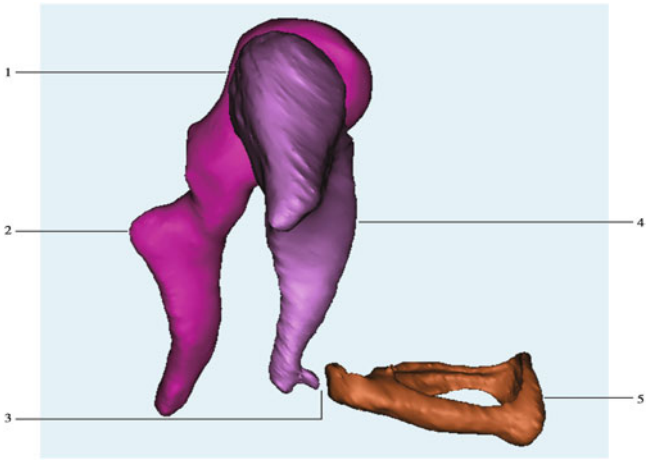

Fig. 9.3 Three-dimensional reconstruction of dislocation of incudostapedial articulation on posterior view. (1) Incudomalleolar articulation. (2) Malleus. (3) Interrupted incudostapedial articulation. (4) Incus. (5) Stapes

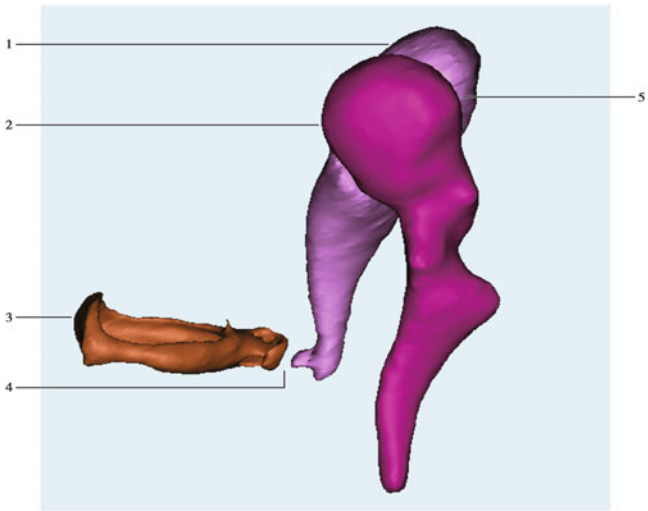

Fig. 9.4 Three-dimensional reconstruction of dislocation of incudostapedial articulation on anterior view. (1) Incus. (2) Malleus. (3) Stapes. (4) Interrupted incudostapedial articulation. (5) Incudomalleolar articulation

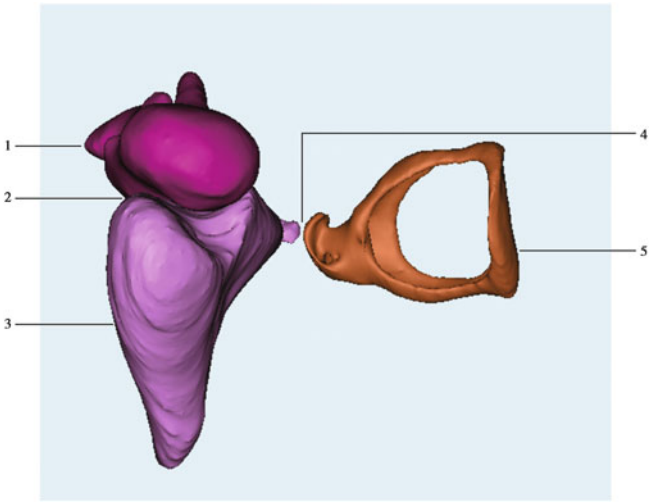

Fig. 9.5 Three-dimensional reconstruction of dislocation of incudostapedial articulation on middle cranial fossa view. (1) Malleus. (2) Incudomalleolar articulation. (3) Incus. (4) Interrupted incudostapedial articulation. (5) Stapes

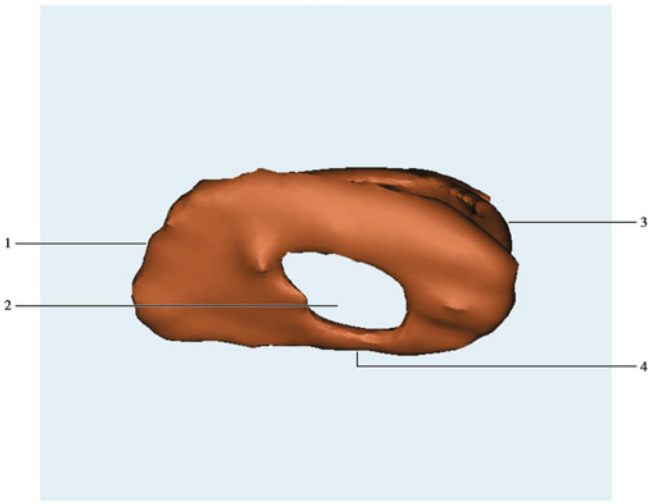

Fig. 9.7 Three-dimensional reconstruction of fenestration on stapedial footplate on medial view. (1) Anterior crus. (2) Bony absence (hole) of footplate. (3) Posterior incus. (4) Inferior edge of footplate

9.4 Man-Made Tiny Lesion Models in Stapes

9.4.1 Fenestration on Stapedial Footplate (Right)

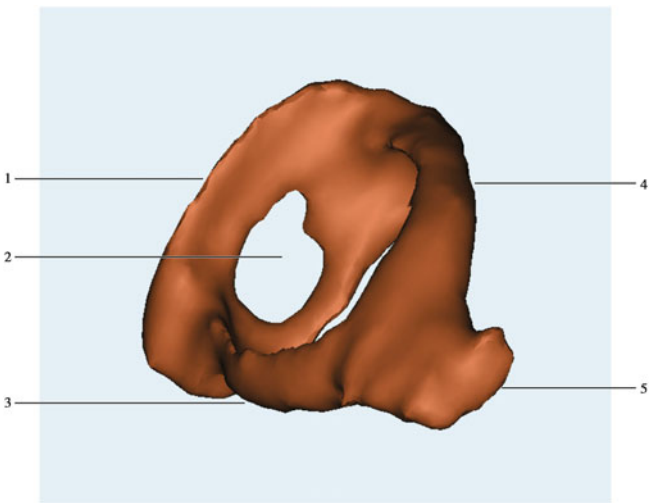

Fig. 9.6 Three-dimensional reconstruction of fenestration on stapedial footplate on posterosuperior view. (1) Superior edge of footplate. (2) Bony absence (hole) of footplate. (3) Posterior incus. (4) Anterior crus. (5) Head of stapes

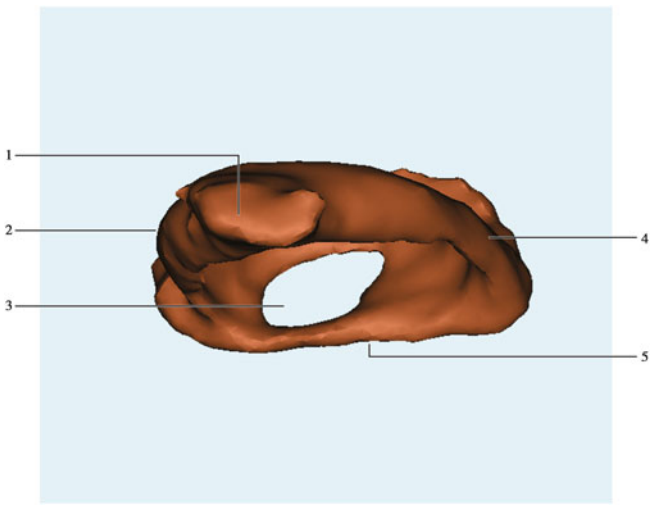

Fig. 9.8 Three-dimensional reconstruction of fenestration on stapedial footplate on inferolateral (promontory) view. (1) Head of stapes. (2) Posterior incus. (3) Bony absence (hole) of footplate. (4) Anterior crus. (5) Inferior edge of footplate

9.4.2 Dislocation of Stapedial Footplate

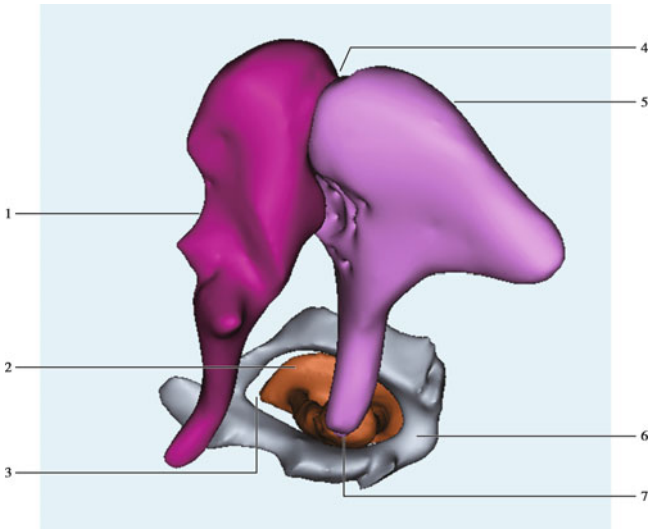

Fig. 9.9 Three-dimensional reconstruction of dislocation on stapedial footplate on lateral view. (1) Malleus. (2) Footplate in vestibule. (3) Vestibular window. (4) Incudomalleolar articulation. (5) Incus. (6) Vestibular window niche. (7) Incudostapedial articulation

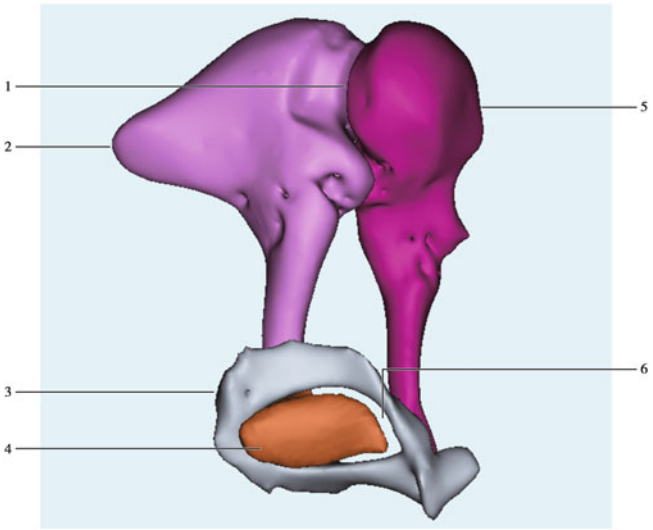

Fig. 9.11 Three-dimensional reconstruction of dislocation on stapedial footplate on medial view. (1) Incus. (2) Incudomalleolar articulation. (3) Vestibular window niche. (4) Footplate in vestibule. (5) Malleus. (6) Vestibular window

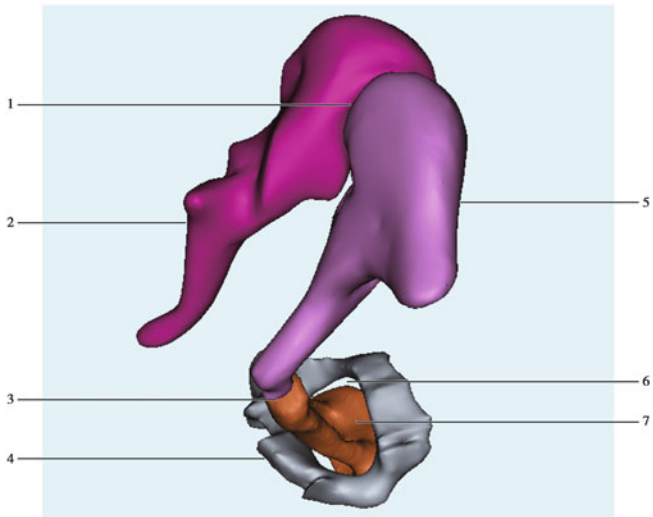

Fig. 9.10 Three-dimensional reconstruction of dislocation on stapedial footplate on posterosuperior view. (1) Incudomalleolar articulation. (2) Malleus. (3) Incudostapedial articulation. (4) Vestibular window niche. (5) Incus. (6) Vestibular window. (7) Footplate in vestibule

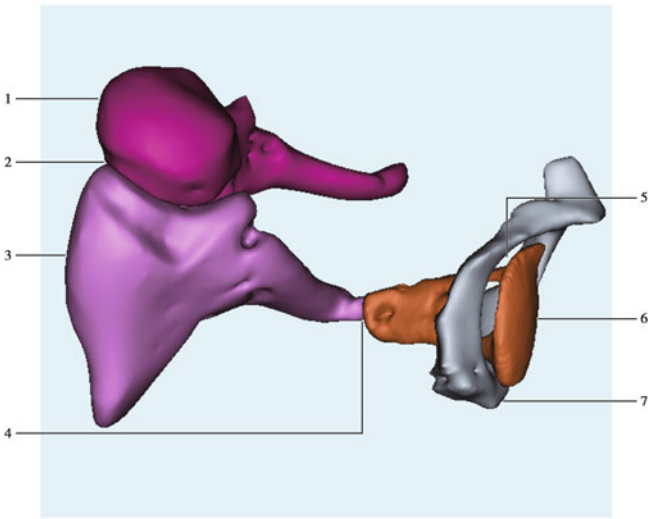

Fig. 9.12 Three-dimensional reconstruction of dislocation on stapedial footplate on middle cranial fossa view. (1) Malleus. (2) Incudomalleolar articulation. (3) Incus. (4) Incudostapedial articulation. (5) Vestibular window. (6) Footplate in vestibule. (7) Vestibular window niche

9.4.3 Fracture of Stapedial Footplate

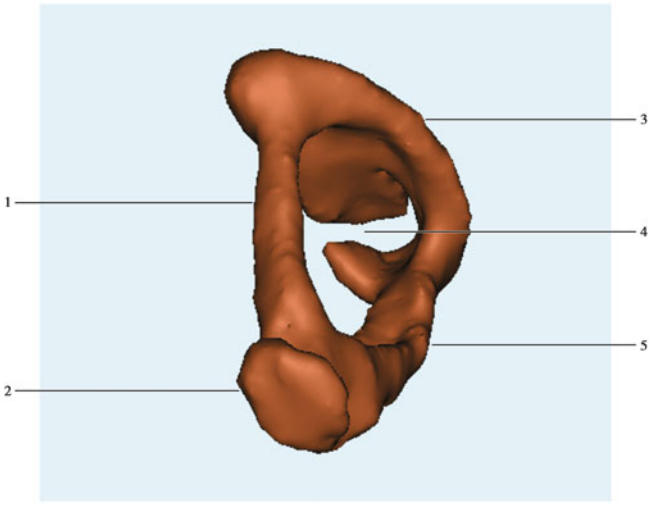

Fig. 9.13 Three-dimensional reconstruction of fracture of stapedial footplate on posterosuperior view. (1) Anterior crus. (2) Head of stapes. (3) Inferior edge of footplate. (4) Fractured footplate. (5) Posterior incus

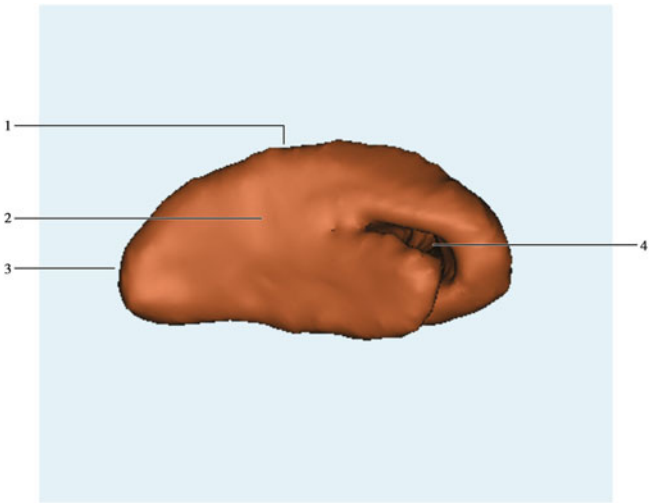

Fig. 9.14 Three-dimensional reconstruction of fracture of stapedial footplate on medial view. (1) Superior edge of footplate. (2) Footplate. (3) Anterior edge of footplate. (4) Fracture fissure of footplate

9.5 Fenestration on Lateral Semicircular Canal

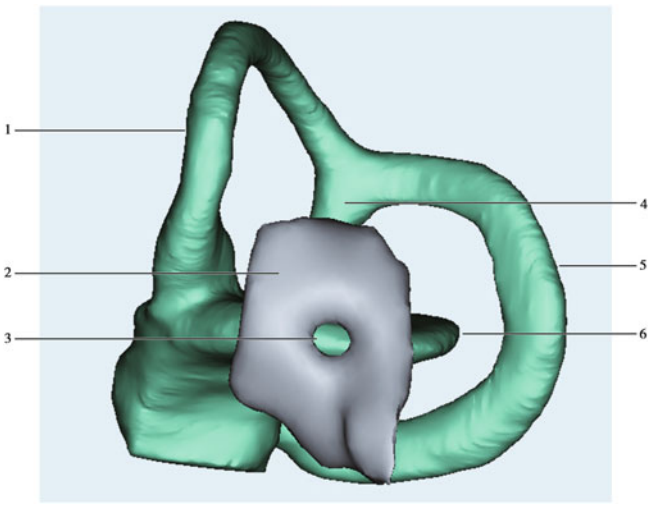

Fig. 9.15 Three-dimensional reconstruction of fenestration on lateral semicircular canal on lateral view. (1) Anterior semicircular canal. (2) Bony lateral semicircular canal. (3) Fenestration on lateral semicircular canal. (4) Common crus. (5) Posterior semicircular canal. (6) Lateral semicircular canal

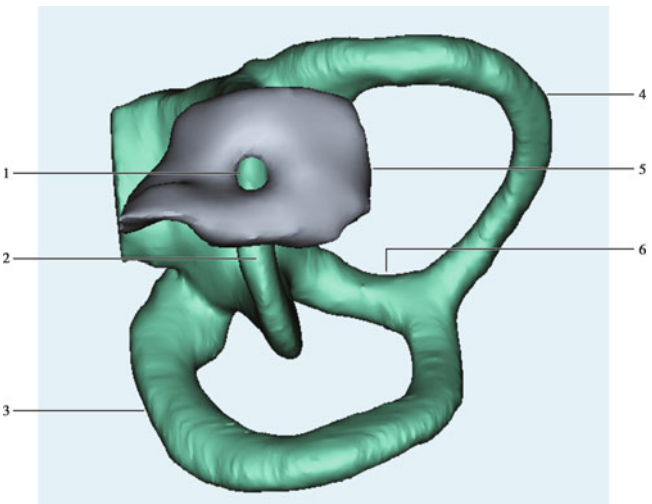

Fig. 9.16 Three-dimensional reconstruction of fenestration on lateral semicircular canal on posterior view. (1) Fenestration on lateral semicircular canal. (2) Lateral semicircular canal. (3) Posterior semicircular canal. (4) Anterior semicircular canal. (5) Bony lateral semicircular canal. (6) Common crus

9.6 Man-Made Tiny Lesion Models on Cochlea

9.6.1 Fenestration of Cochlea

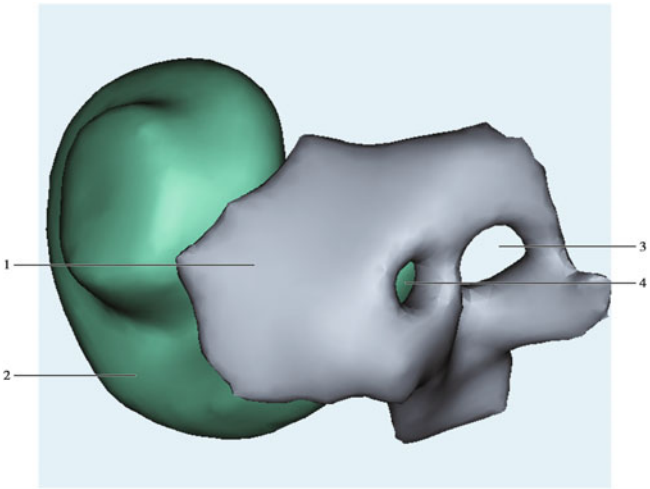

Fig. 9.17 Three-dimensional reconstruction of fenestration of cochlea on posterolateral view. (1) Promontory. (2) Cochlea. (3) Cochlear window. (4) Fenestration on cochlea

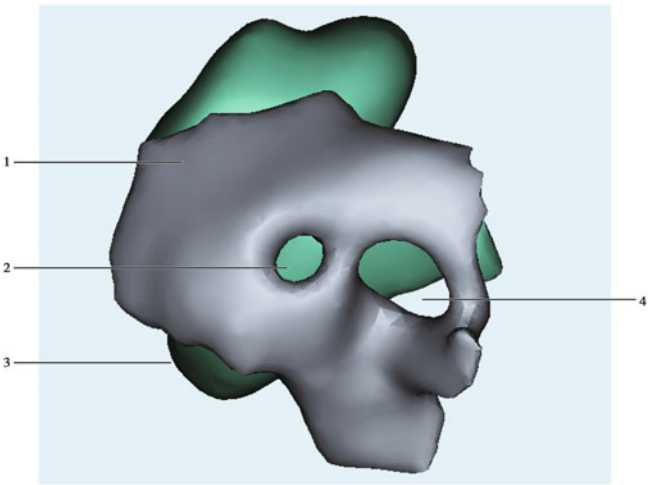

Fig. 9.18 Three-dimensional reconstruction of fenestration of cochlea on posterosuperior view. (1) Promontory. (2) Fenestration on cochlea. (3) Cochlea. (4) Cochlear window

9.6.2 Fracture of Cochlea

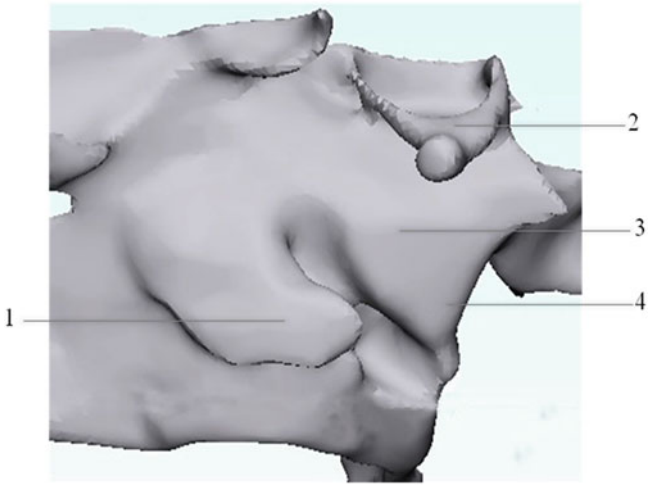

Fig. 9.19 Three-dimensional reconstruction of fracture of cochlea on lateral view. (1) Fragmented bone. (2) Stapes. (3) Promontory. (4) Anterior edge of cochlear window niche

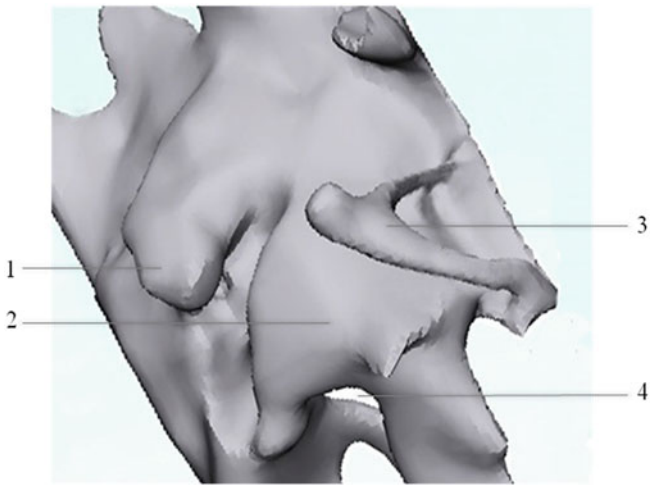

Fig. 9.20 Three-dimensional reconstruction of fracture of cochlea on posterosuperior view. (1) Fragmented bone. (2) Promontory. (3) Stapes. (4) Cochlear window

9.7 Fenestration on Facial Canal

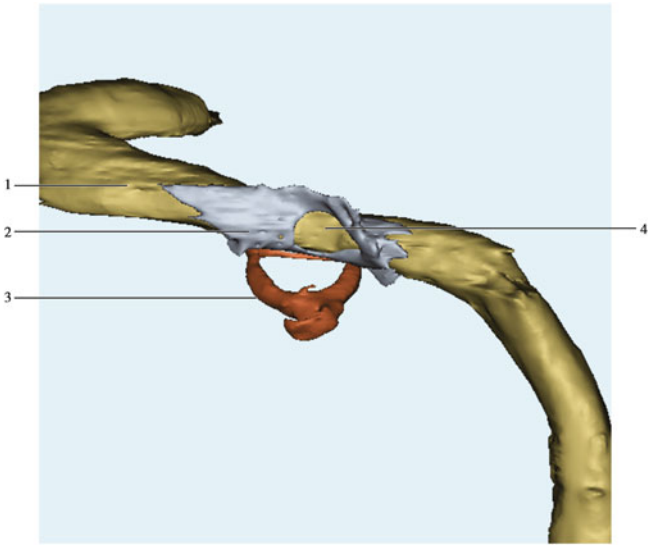

Fig. 9.21 Three-dimensional reconstruction of fenestration of facial canal on lateral view. (1) Tympanic portion of facial nerve. (2) Facial canal. (3) Stapes.(4) Bone absence (dehiscence) of facial canal

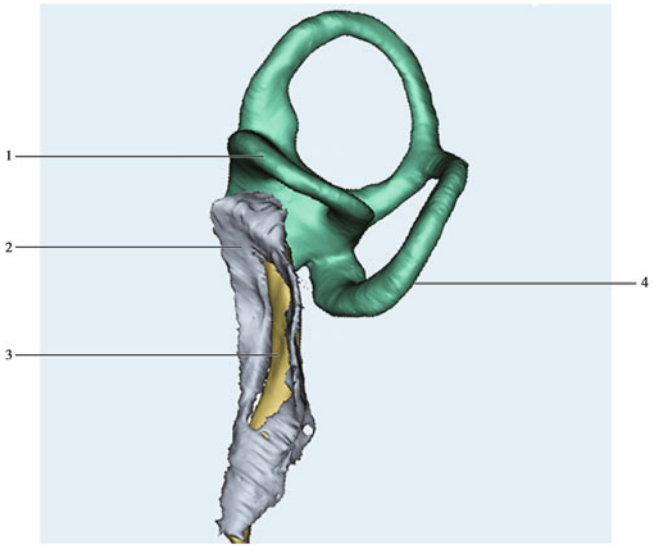

Fig. 9.23 Three-dimensional reconstruction of fenestration of facial canal on posterolateral view. (1) Lateral semicircular canal. (2) Facial canal. (3) Bone absence (dehiscence) of second and mastoid portions of facial canal. (4) Posterior semicircular canal

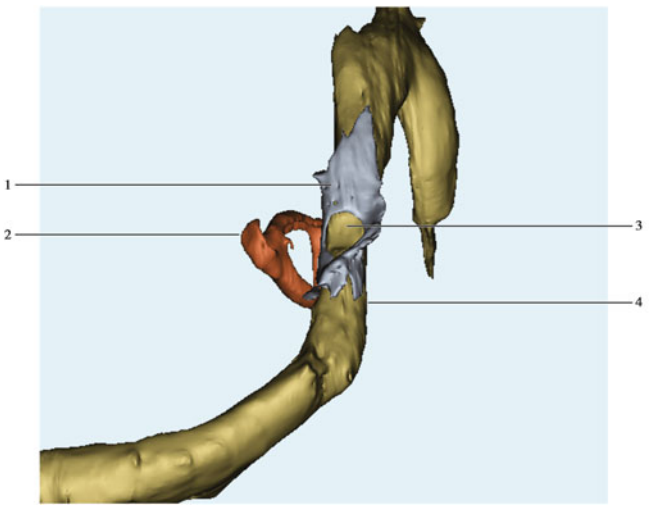

Fig. 9.22 Three-dimensional reconstruction of fenestration of facial canal on posterosuperior view. (1) Facial canal. (2) Stapes. (3) Bone absence (dehiscence) of facial canal. (4) Tympanic portion of facial nerve

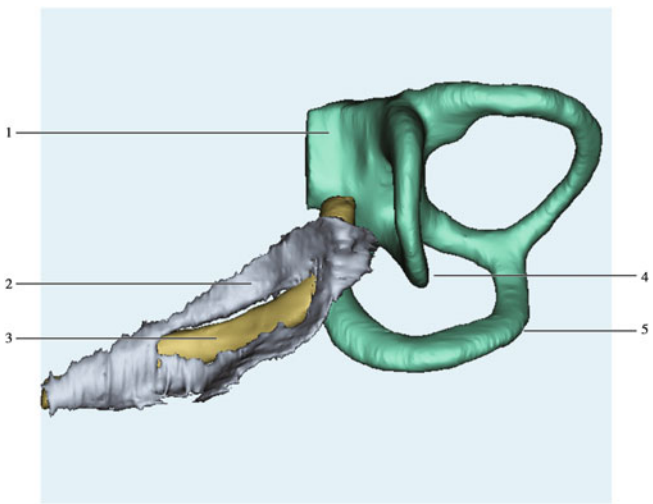

Fig. 9.24 Three-dimensional reconstruction of fenestration of facial canal on posterosuperior view. (1) Vestibule. (2) Facial canal. (3) Bone absence (dehiscence) of second and mastoid portions of facial canal. (4) Lateral semicircular canal. (5) Posterior semicircular canal

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Comparison Between Micro-CT and High-Resolution CT Scan of Temporal Bone

10

Zilong Yu, Luo Zhang, and Demin Han

The two-dimensional images of the temporal bone scanned by HRCT and micro-CT, respectively, are contrasted in this chapter, the differences are also described as follows:

10.1 Comparison of Two-Dimensional Image Between Micro-CT and High-Resolution CT Scan of Temporal Bone

Micro-CT scan demonstrates excellent resolution, almost all micro-architectures can be identified by micro-CT, but the same structure may be difficult to be judged by HRCT scan because of its low resolution. All the images are taken from the right temporal bone (Figs. 10.1–10.18).

10.1.1 Two-Dimensional Image on Axial View

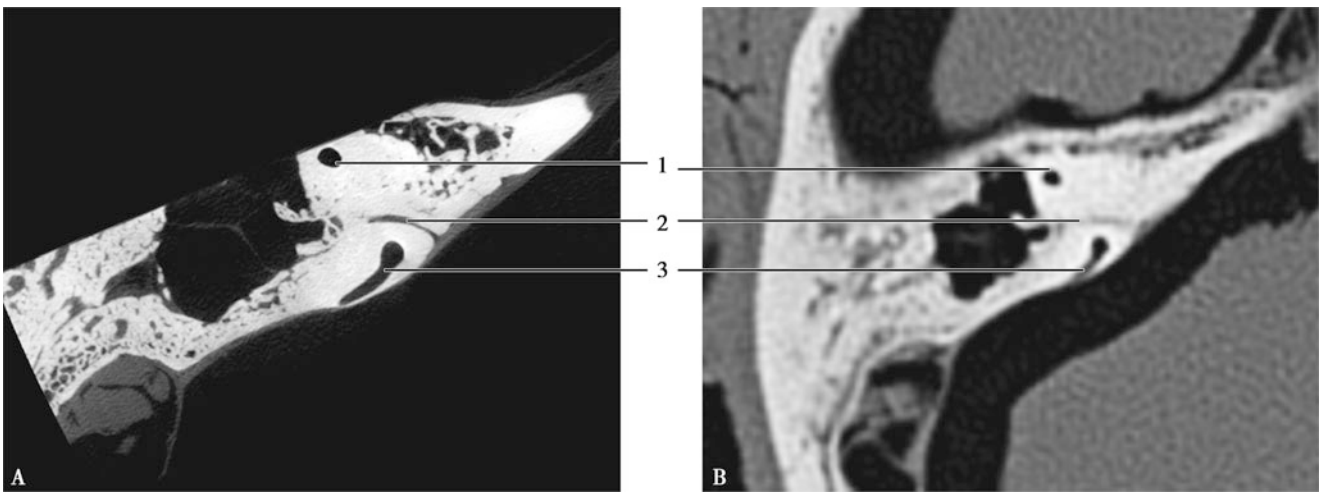

Fig. 10.1 Two-dimensional image contrast of anterior-posterior semicircular canal on axial view. (A) Micro-CT. (B) HRCT. (1) Anterior semicircular canal. (2) Petromastoid canal (subarcuate artery. (3) Posterior semicircular canal. Note:Suspicious dehiscence of posterior semicircular canal on HRCT image

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Z. Yu et al. (eds.), *Micro-CT of Temporal Bone*, https://doi.org/10.1007/978-981-16-0807-0_10

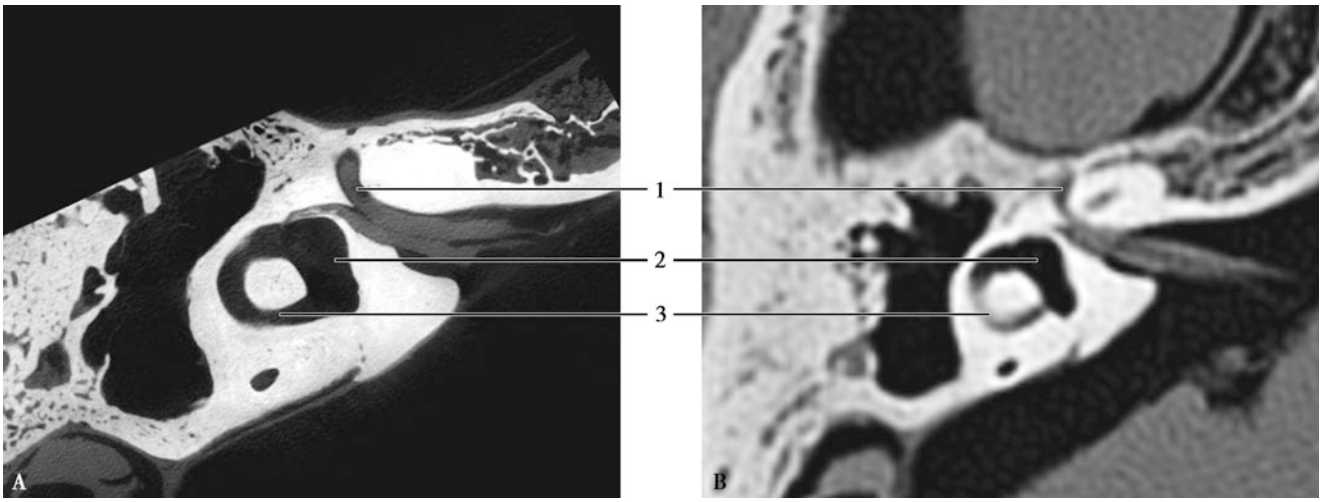

Fig. 10.2 Two-dimensional image contrast of lateral semicircular canal on axial view. (A) Micro-CT. (B) HRCT. (1) Labyrinthine portion of facial nerve. (2) Vestibule. (3) Lateral semicircular canal

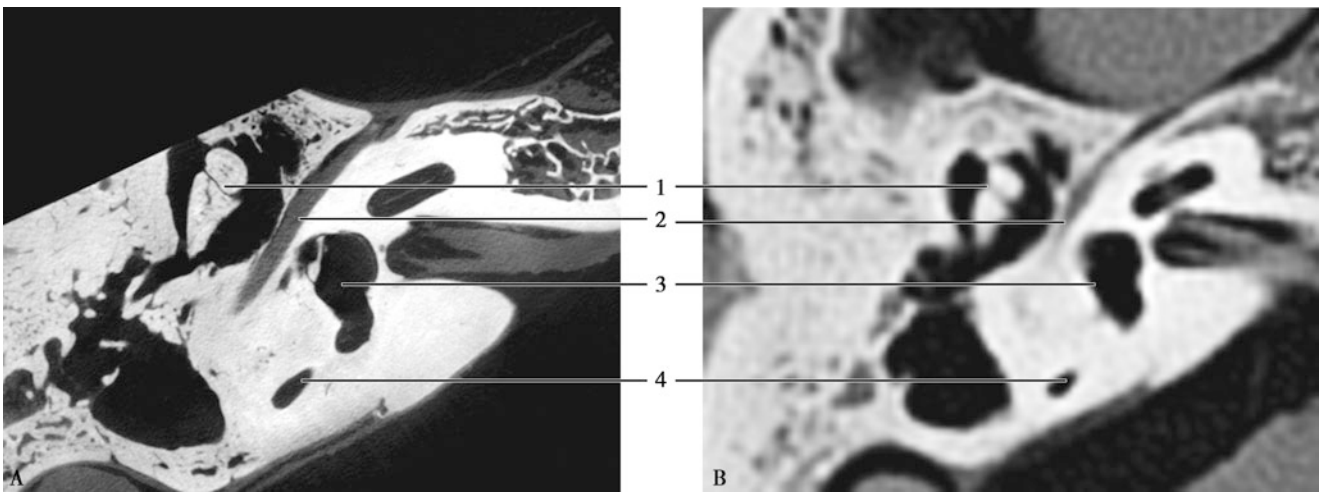

Fig. 10.3 Two-dimensional image contrast of tympanic portion of facial nerve on axial view. (A) Micro-CT. (B) HRCT. (1) Incudomalleolar articulation. (2) Tympanic portion of facial nerve. (3) Vestibule. (4) Posterior semicircular canal

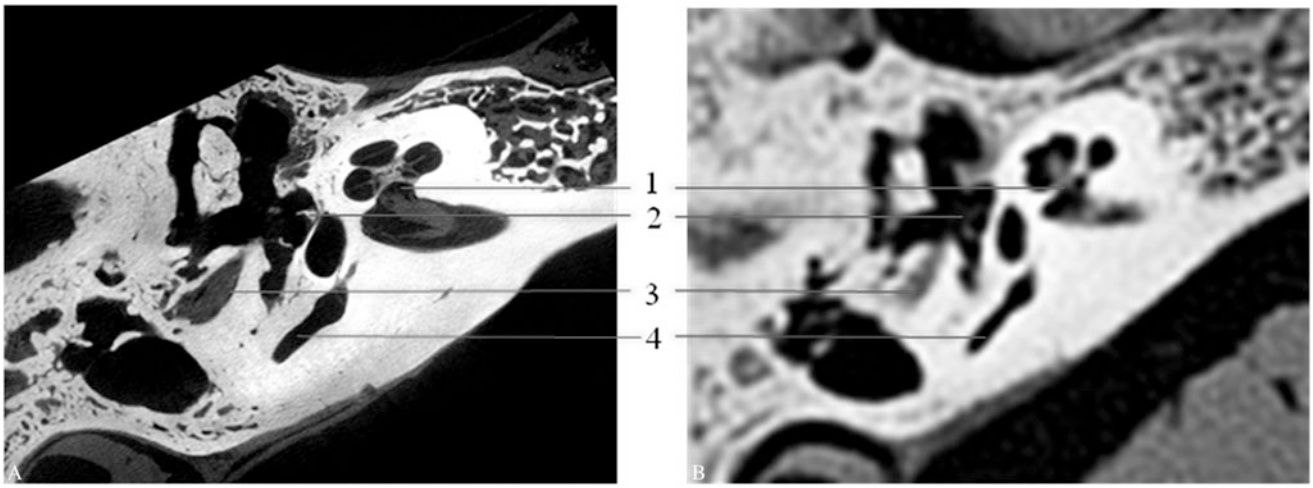

Fig. 10.4 Two-dimensional image contrast of modiolus on axial view. (A) Micro-CT. (B) HRCT. (1) Modiolus. (2) Stapes. (3) Second genu of facial nerve. (4) Posterior semicircular canal. Note: Stapedial crura and cochlear nerve in modiolus can be clearly presented on micro-CT image

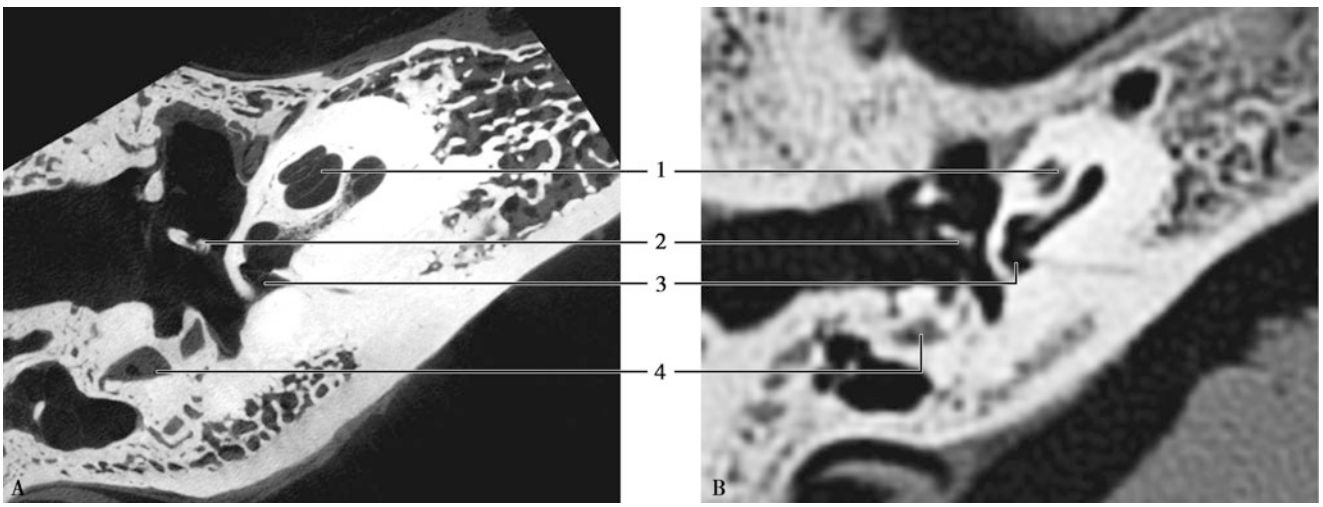

Fig. 10.5 Two-dimensional image contrast of incudostapedial articulation on axial view. (A) Micro-CT. (B) HRCT. (1) Cochlea. (2) Incudostapedial articulation. (3) Cochlear window niche. (4) Second genu of facial nerve. Note: Incudostapedial articulation can be clearly presented on micro-CT image

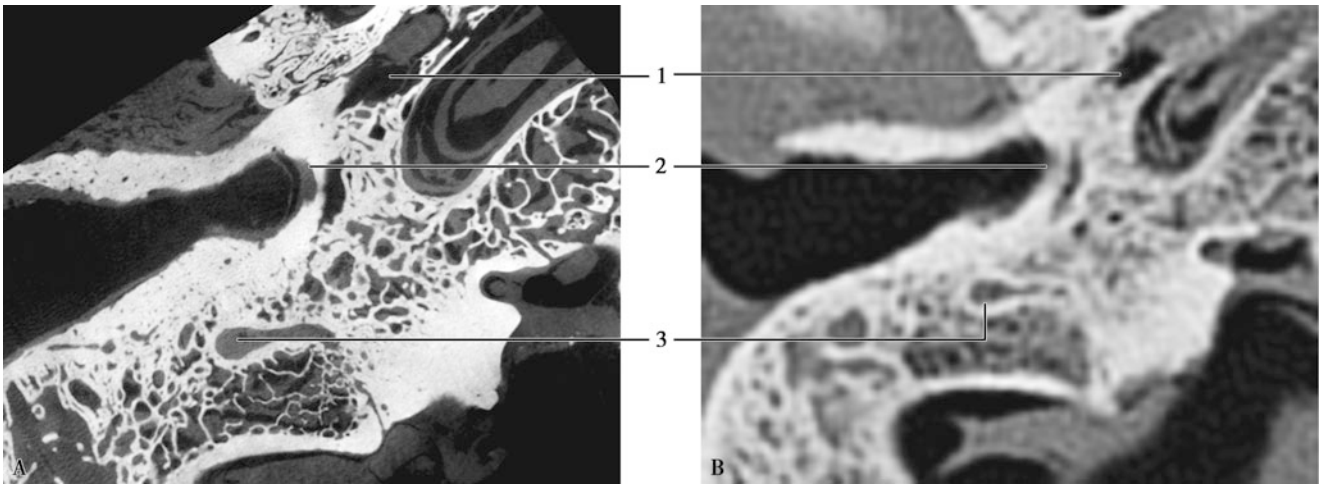

Fig. 10.6 Two-dimensional image contrast of tympanic sulcus on axial view. (A) Micro-CT. (B) HRCT. (1) Eustachian tube. (2) Tympanic sulcus. (3) Mastoid portion of facial nerve

10.1.2 Two-Dimensional Image on Coronal View

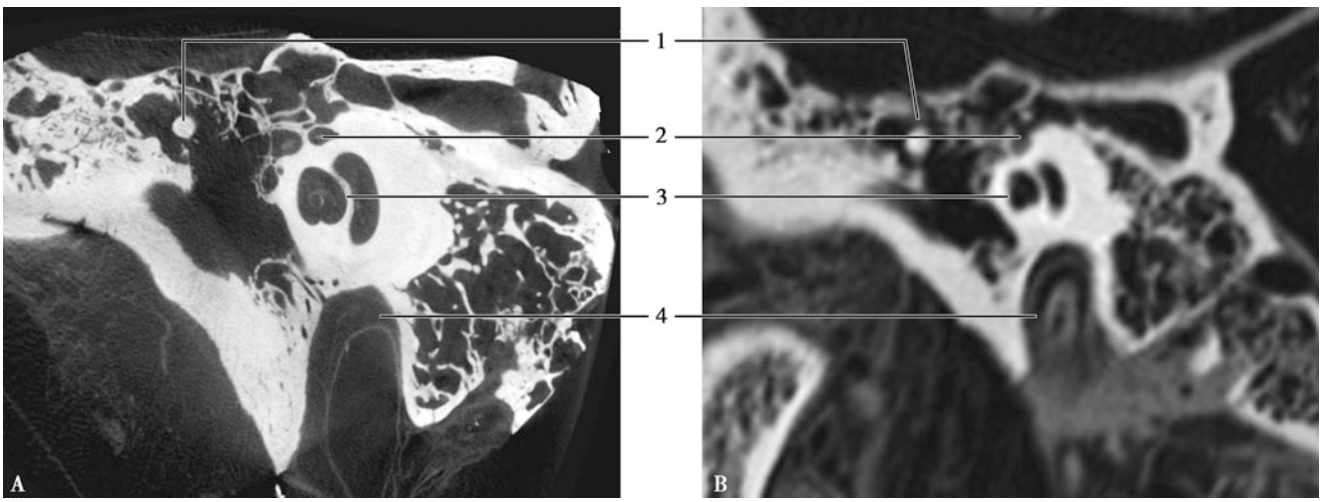

Fig. 10.7 Two-dimensional image contrast of head of malleus and cochlea on coronal view. (A) Micro-CT. (B) HRCT. (1) Head of malleus. (2) Labyrinthine portion of facial nerve. (3) Cochlea. (4) Internal carotid artery

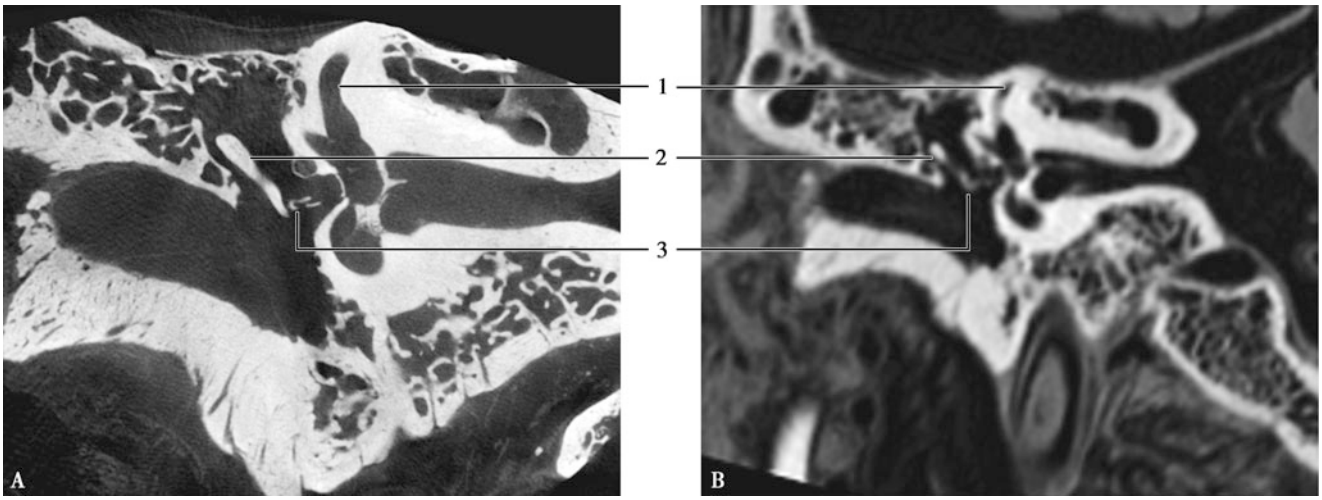

Fig. 10.8 Two-dimensional image contrast of incudostapedial articulation on coronal view. (A) Micro-CT. (B) HRCT. (1) Anterior semicircular canal. (2) incus. (3) Incudostapedial articulation. Note: Incudostapedial articulation can be clearly presented on micro-CT image

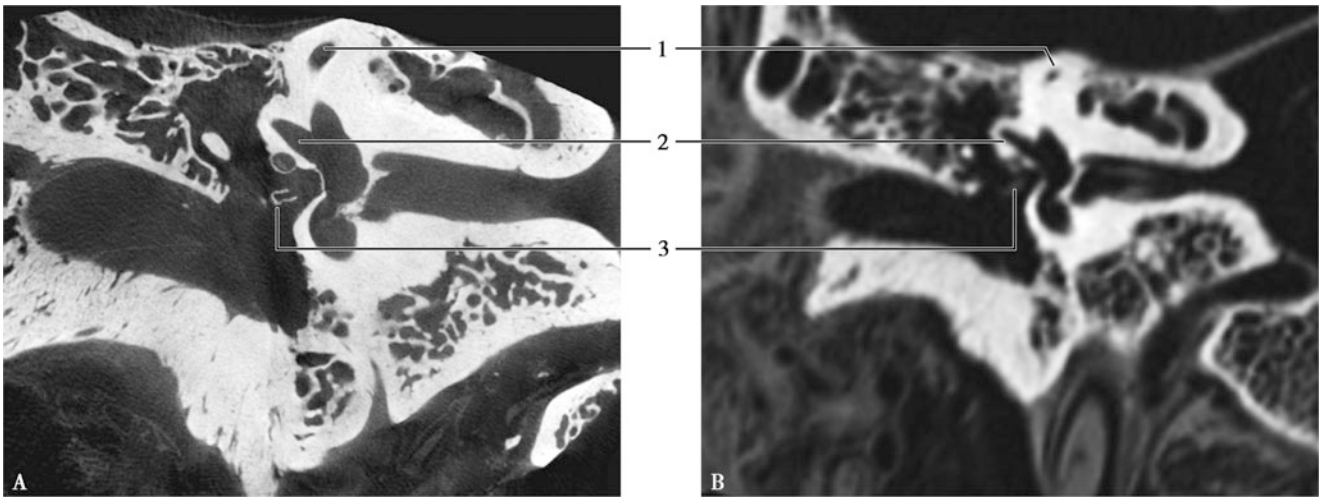

Fig. 10.9 Two-dimensional image contrast of stapes on coronal view. (A) Micro-CT. (B) HRCT. (1) Anterior semicircular canal. (2) Lateral semicircular canal. (3) Stapes. Note: Neck of stapes can be clearly presented on micro-CT image

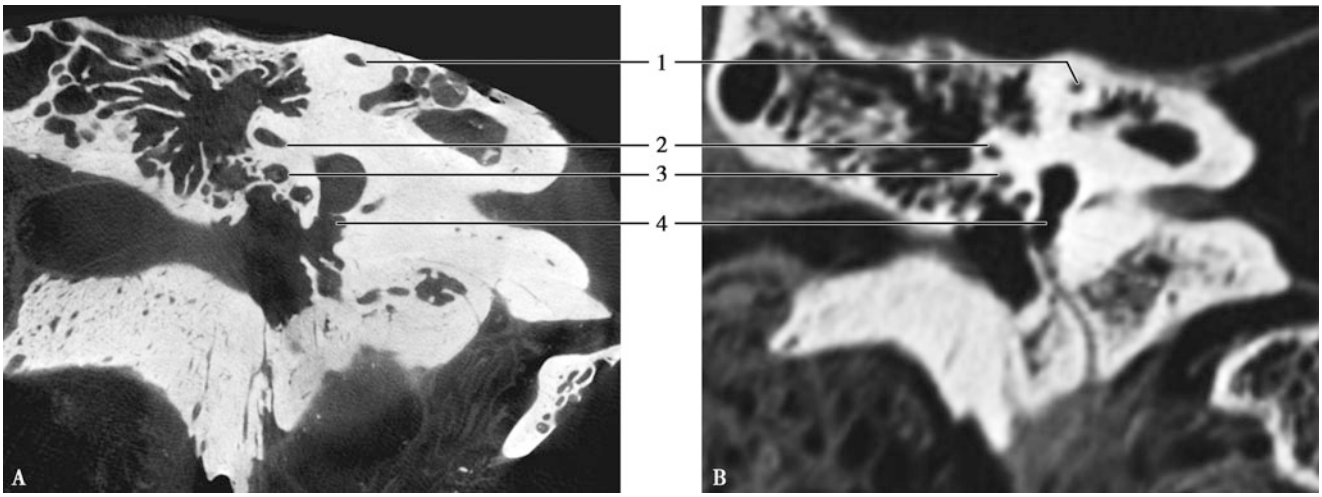

Fig. 10.10 Two-dimensional image contrast of cochlear window niche on coronal view. (A) Micro-CT. (B) HRCT. (1) Anterior semicircular canal. (2) Lateral semicircular canal. (3) Facial nerve. (4) Cochlear window niche

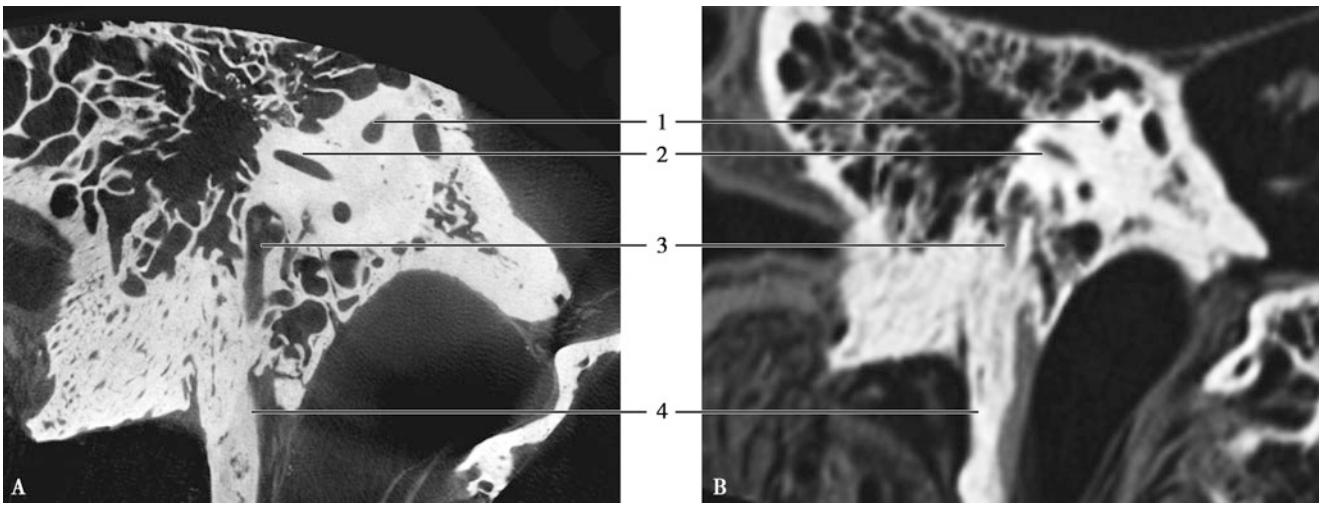

Fig. 10.11 Two-dimensional image contrast of mastoid portion of facial nerve on coronal view. (A) Micro-CT. (B) HRCT. (1) Anterior semicircular canal. (2) Lateral semicircular canal. (3) Mastoid portion of facial nerve. (4) Styloid process

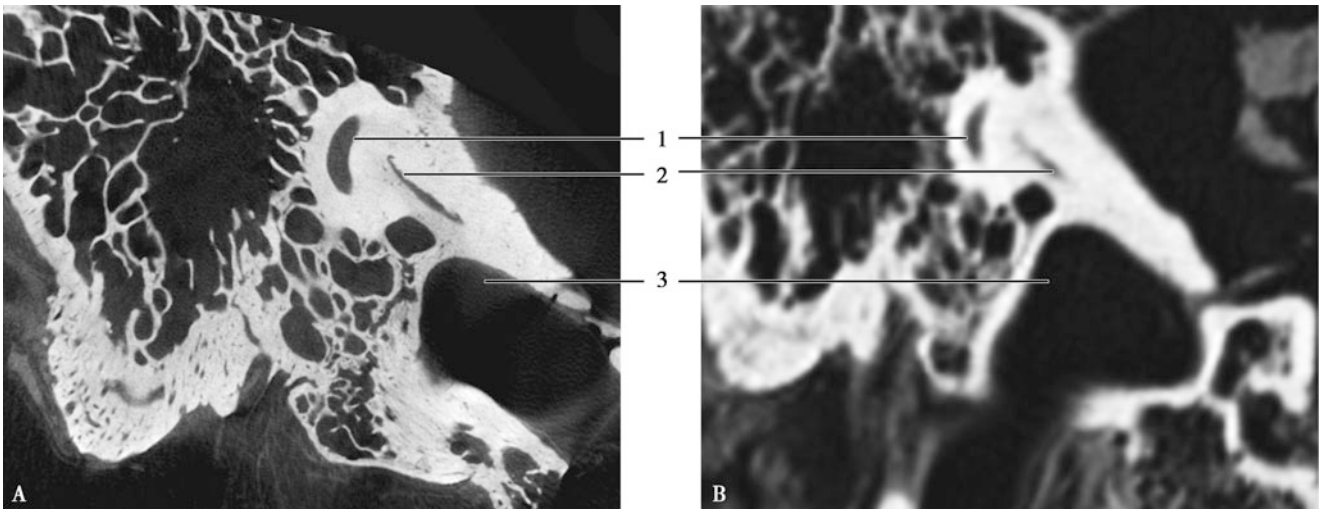

Fig. 10.12 Two-dimensional image contrast of posterior semicircular canal on coronal view. (A) Micro-CT. (B) HRCT. (1) Posterior semicircular canal. (2) Endolymphatic sac. (3) Jugular bulb

10.1.3 Two-Dimensional Image on Sagittal View

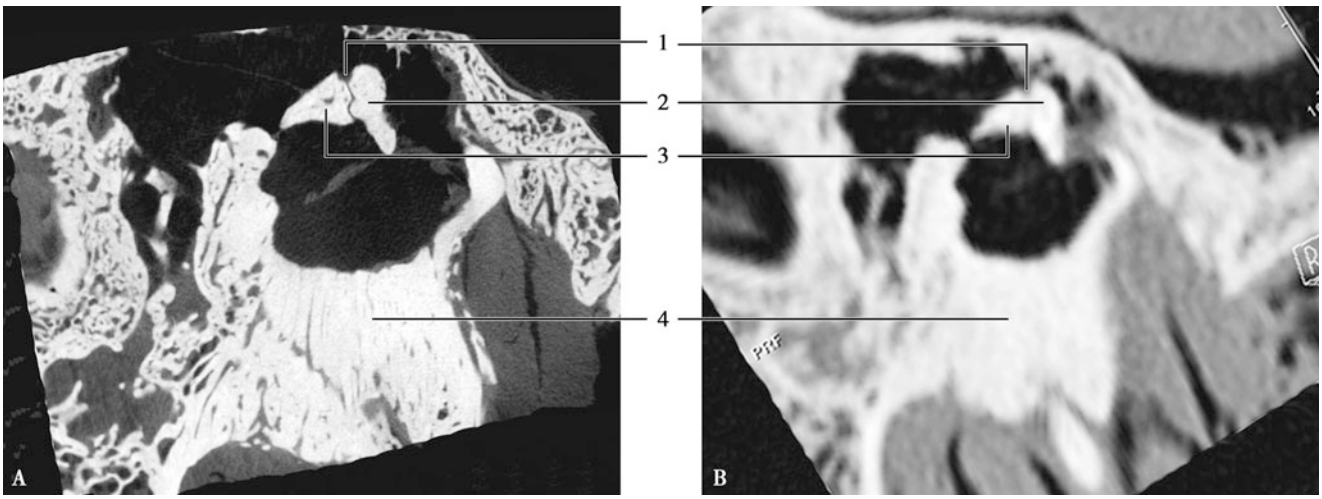

Fig. 10.13 Two-dimensional image contrast of incudomalleolar articulation on sagittal view. (A) Micro-CT. (B) HRCT. (1) Incudomalleolar articulation. (2) Malleus. (3) Incus. (4) Tympanic portion of temporal bone (basal wall of external auditory canal). Note: Incudomalleolar articulation can be clearly presented on micro-CT image

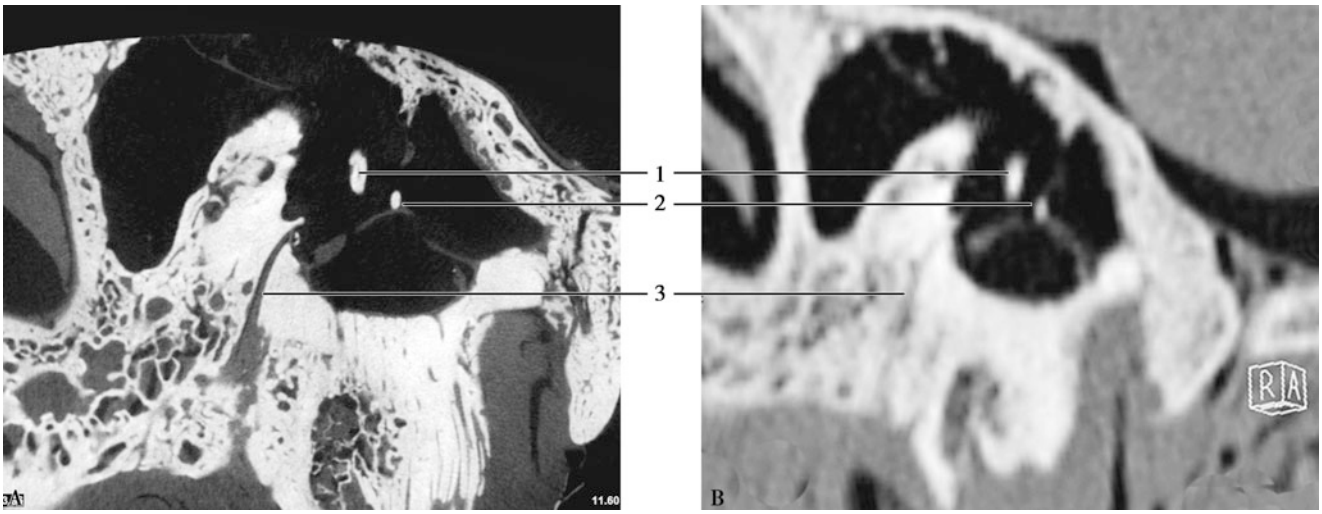

Fig. 10.14 Two-dimensional image contrast of chorda tympani nerve on sagittal view. (A) Micro-CT. (B) HRCT. (1) Long crus of incus. (2) Manubrium. (3) Chorda tympani nerve

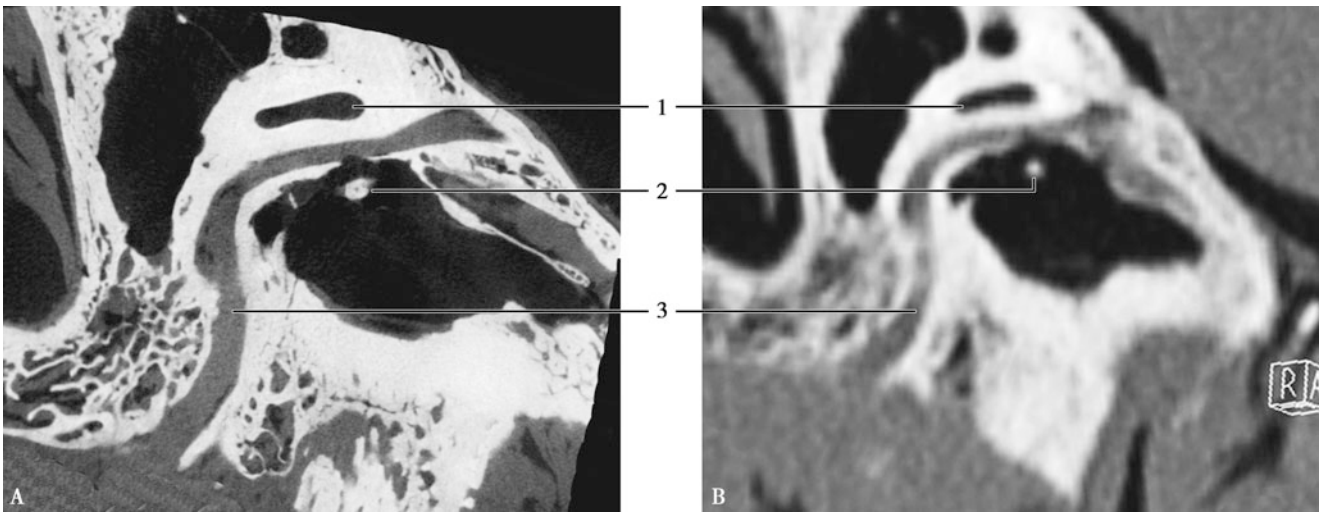

Fig. 10.15 Two-dimensional image contrast of head of stapes and facial nerve on sagittal view. (A) Micro-CT. (B) HRCT. (1) Lateral semicircular canal. (2) Head of stapes. (3) Facial nerve

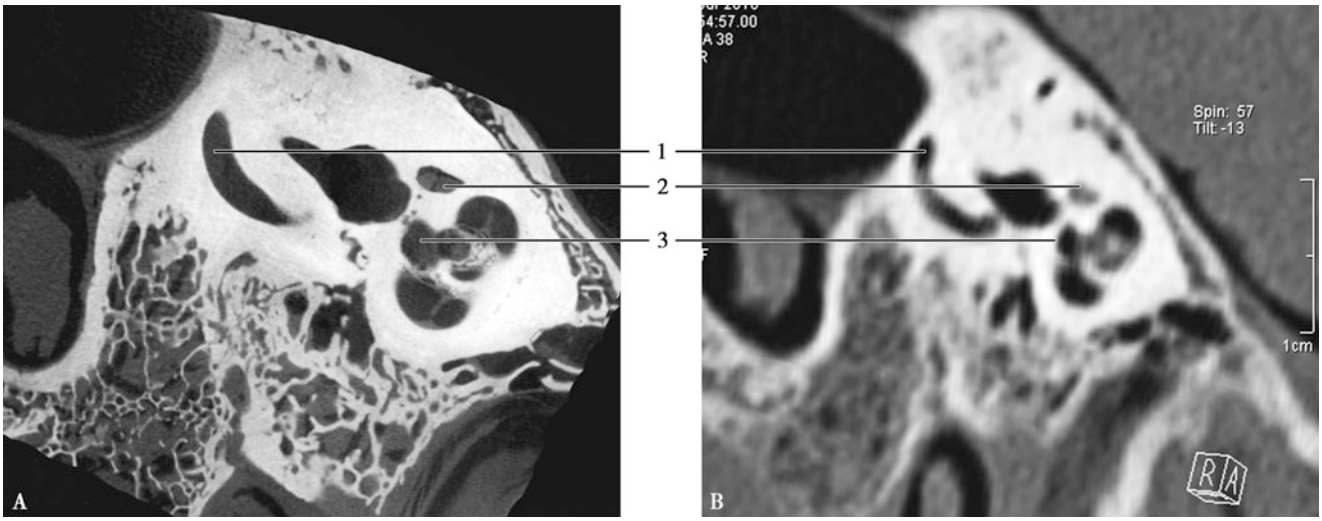

Fig. 10.16 Two-dimensional image contrast of cochlear nerve and fundus of internal auditory canal on sagittal view. (A) Micro-CT. (B) HRCT. (1) Posterior semicircular canal. (2) Superior part of fundus of internal auditory canal. (3) Cochlear nerve canal

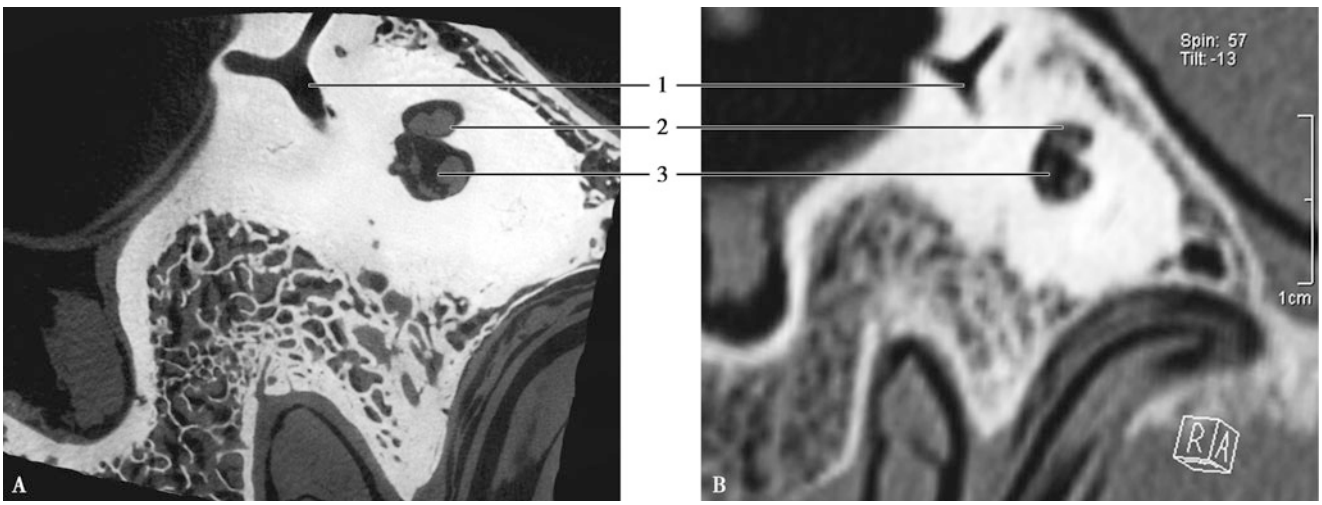

Fig. 10.17 Two-dimensional image contrast of fundus of internal auditory canal on sagittal view. (A) Micro-CT. (B) HRCT. (1) Common crus. (2) Superior part of fundus of internal auditory canal. (3) Inferior part of fundus of internal auditory canal. Note: Suspicious dehiscence of posterior semicircular canal on HRCT image

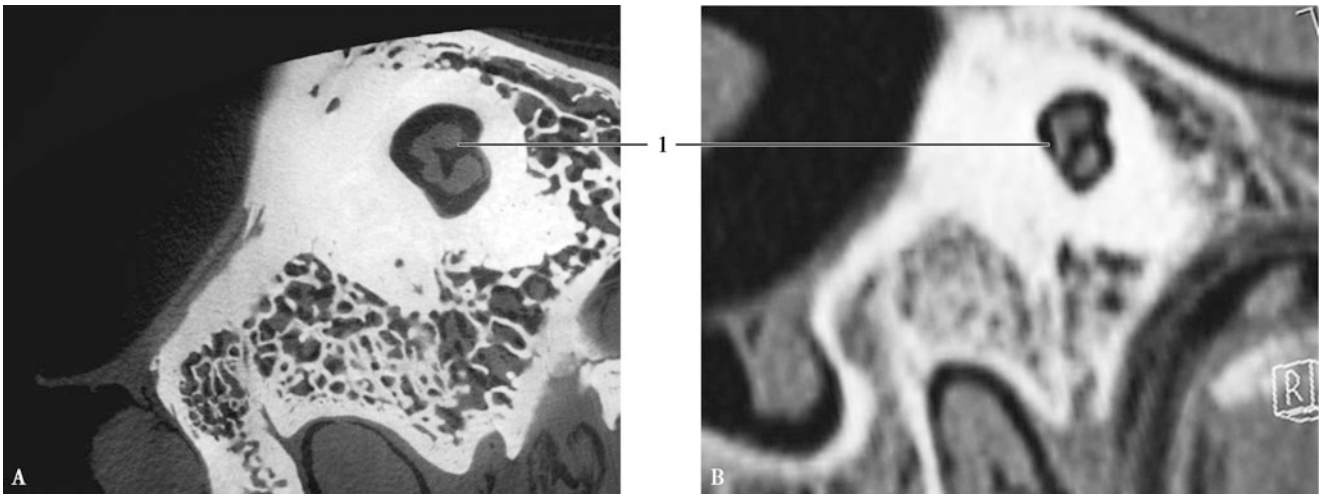

Fig. 10.18 Two-dimensional image contrast of internal auditory canal on sagittal view. (A) Micro-CT. (B) HRCT. (1) fundus of internal auditory canal

10.2 Comparison of Man-Made Tiny Lesion Models in Temporal Bone Scanned by Micro-CT and High-Resolution CT

The tiny lesions in the temporal bone were scanned by micro-CT and HRCT, respectively, Micro-CT can accurately show the position and scale of tiny lesion in temporal bone. The same lesions with HRCT scan are usually blurred and indistinct on image. All the images are taken from the left temporal bone except the special annotation (Figs. 10.19–10.27).

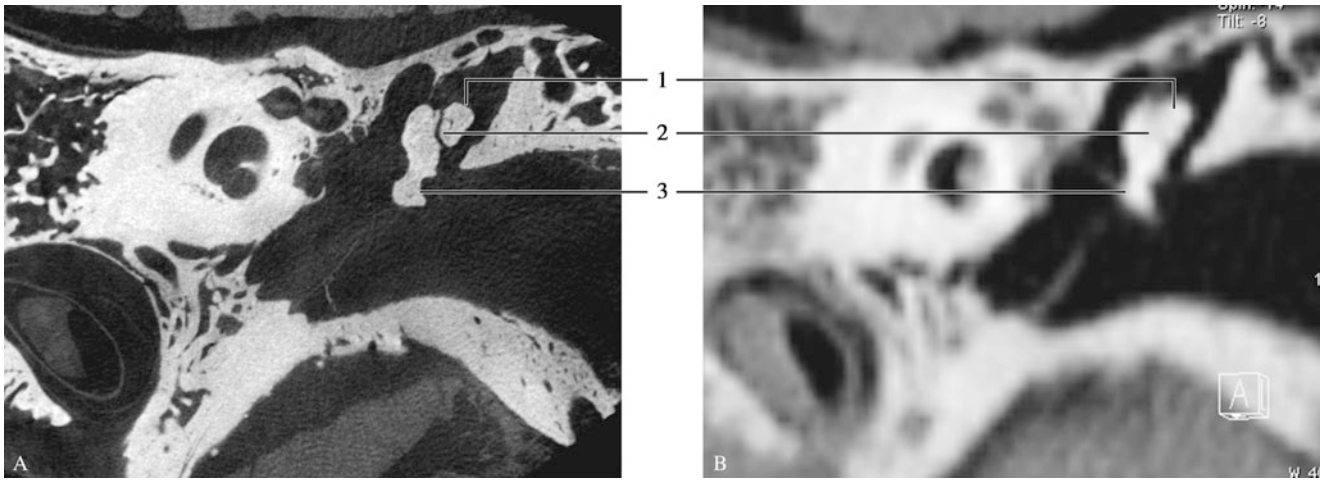

Fig. 10.19 Two-dimensional image contrast on dislocation of incudomalleolar articulation on coronal view. (A) Micro-CT. (B) HRCT. (1) Body of incus. (2) Incudomalleolar articulation. (3) Malleus. Note: The enlarged fissure of Incudomalleolar articulation can be seen clearly on micro-CT image

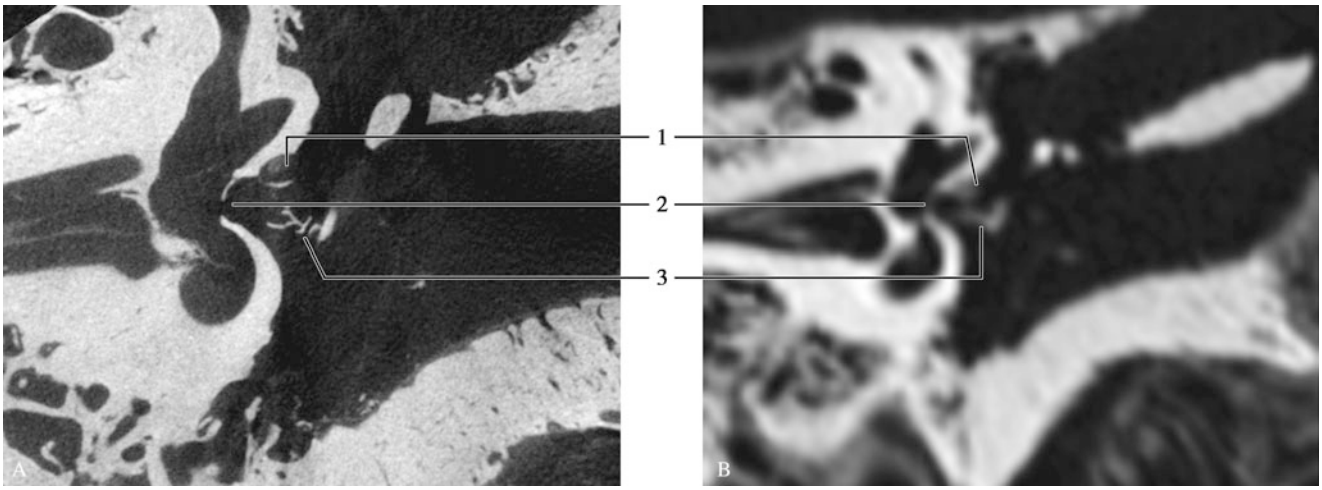

Fig. 10.20 Two-dimensional image contrast on fenestration of footplate and facial canal & dislocation of Incudomalleolar articulation on coronal view. (A) Micro-CT. (B) HRCT. (1) Fenestration (dehiscence) of facial canal on tympanic portion. (2) Fenestration of footplate. (3) Dislocation of incudostapedial articulation. Note: These three tiny lesions can be seen clearly on micro-CT image

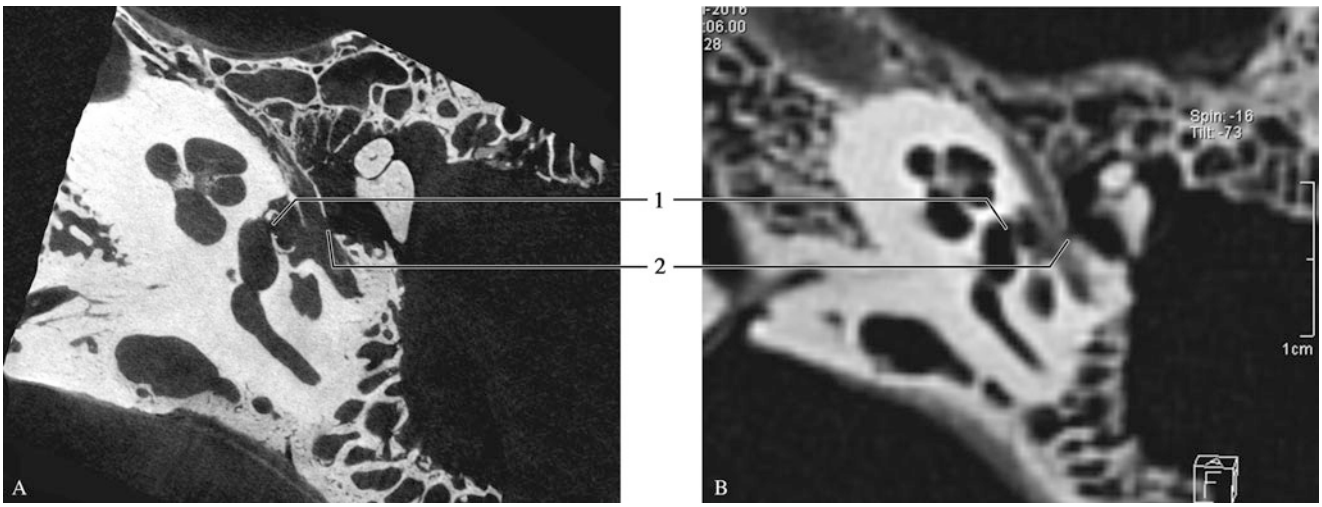

Fig. 10.21 Two-dimensional image contrast on fenestration of footplate and facial canal on axial view. (A) Micro-CT. (B) HRCT. (1) Fenestration of facial canal on tympanic portion. (2) Fenestration of footplate. Note: These two tiny lesions can be seen clearly on micro-CT image

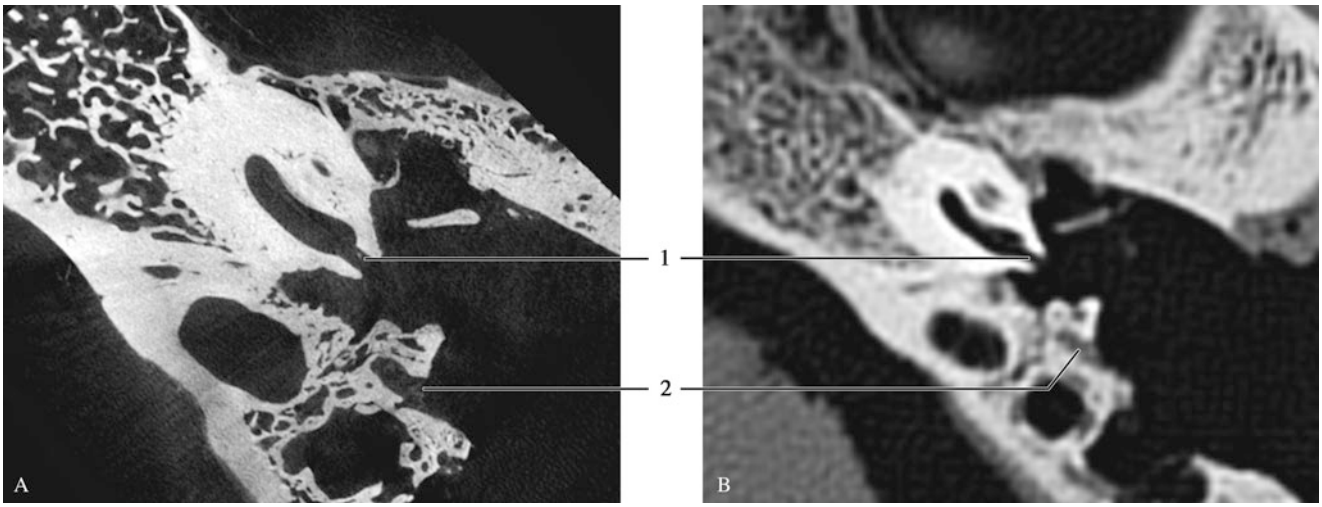

Fig. 10.22 Two-dimensional image contrast on fenestration of cochlea and mastoid portion of facial canal on axial view. (A) Micro-CT. (B) HRCT. (1) Fenestration of cochlea. (2) Fenestration of facial canal on mastoid portion

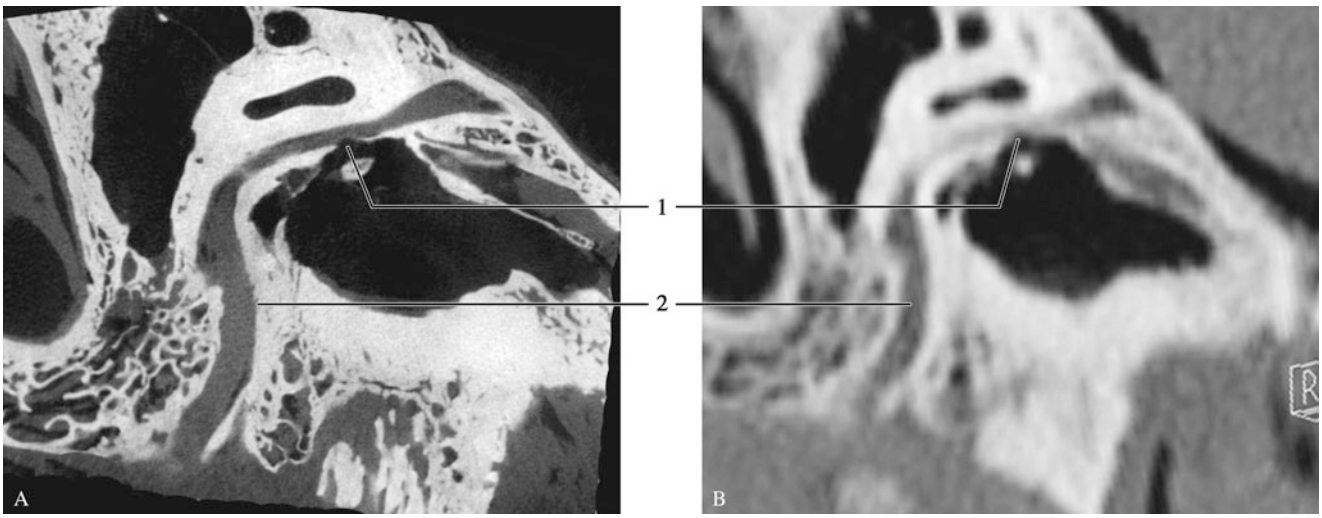

Fig. 10.23 Two-dimensional image contrast on fenestration of facial canal on sagittal view. (A) Micro-CT. (B) HRCT. (1) Bony absence (dehiscence) of facial canal on inferior wall. (2) Facial canal. Note: The bony absence of facial canal can be seen clearly on micro-CT image

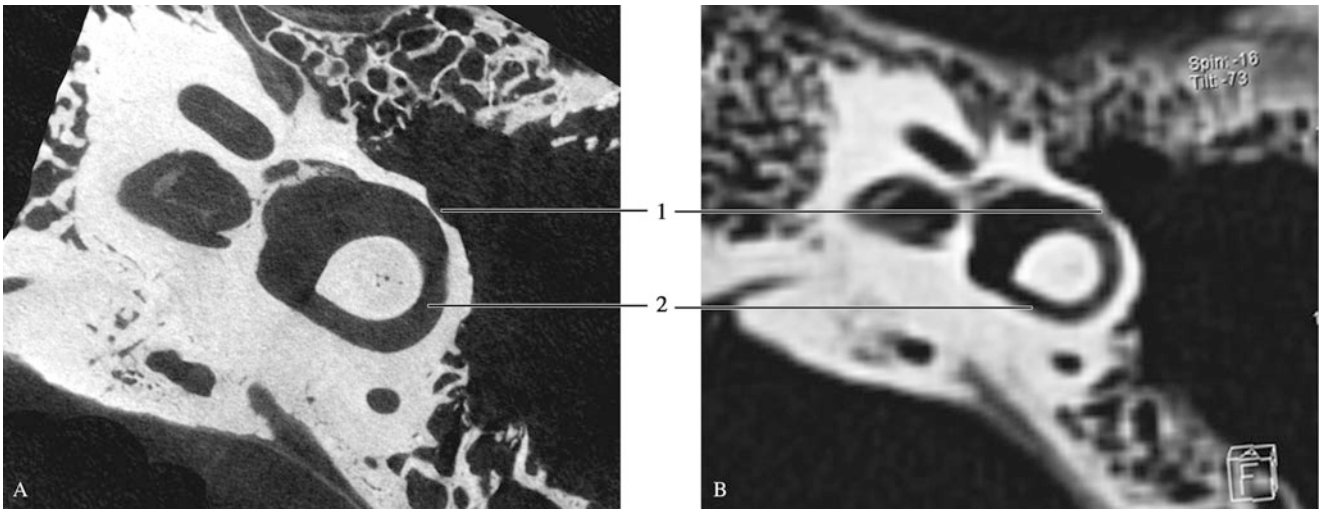

Fig. 10.24 Two-dimensional image contrast on bone thinning of lateral semicircular canal on axial view. (A) Micro-CT. (B) HRCT. (1) Bony absence of lateral semicircular canal. (2) Lateral semicircular canal. Note: Bony wall thinning not perforation of lateral semicircular canal can be seen clearly on micro-CT image

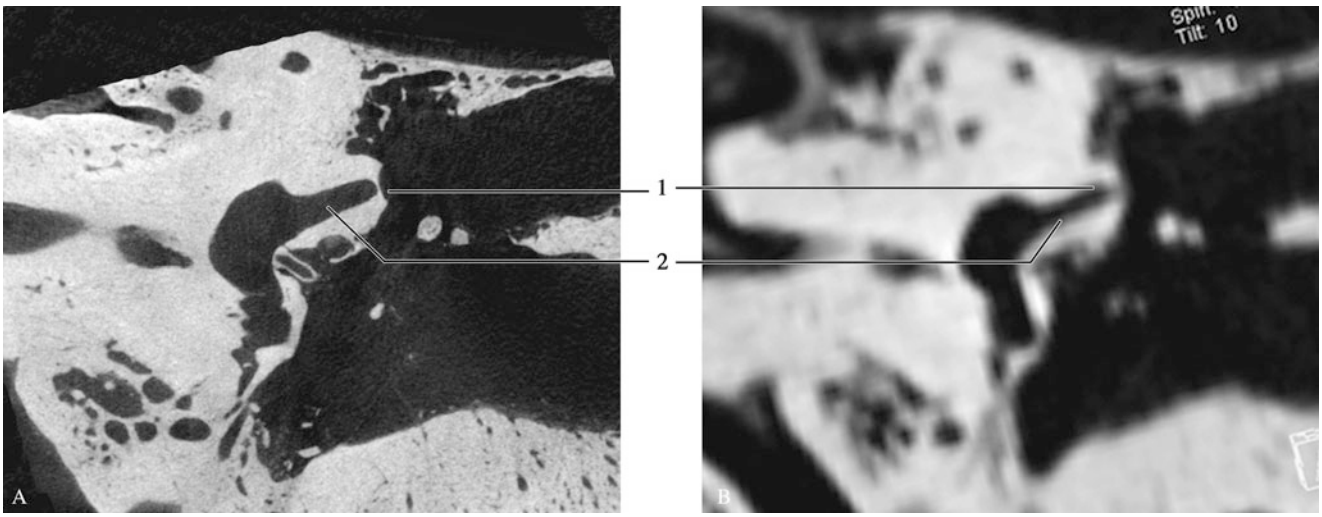

Fig. 10.25 Two-dimensional image contrast on bone thinning of lateral semicircular canal on coronal view. (A) Micro-CT. (B) HRCT. (1) Bony absence of lateral semicircular canal. (2) Lateral semicircular canal. Note: Bony wall thinning not perforation of lateral semicircular canal can be seen clearly on micro-CT image

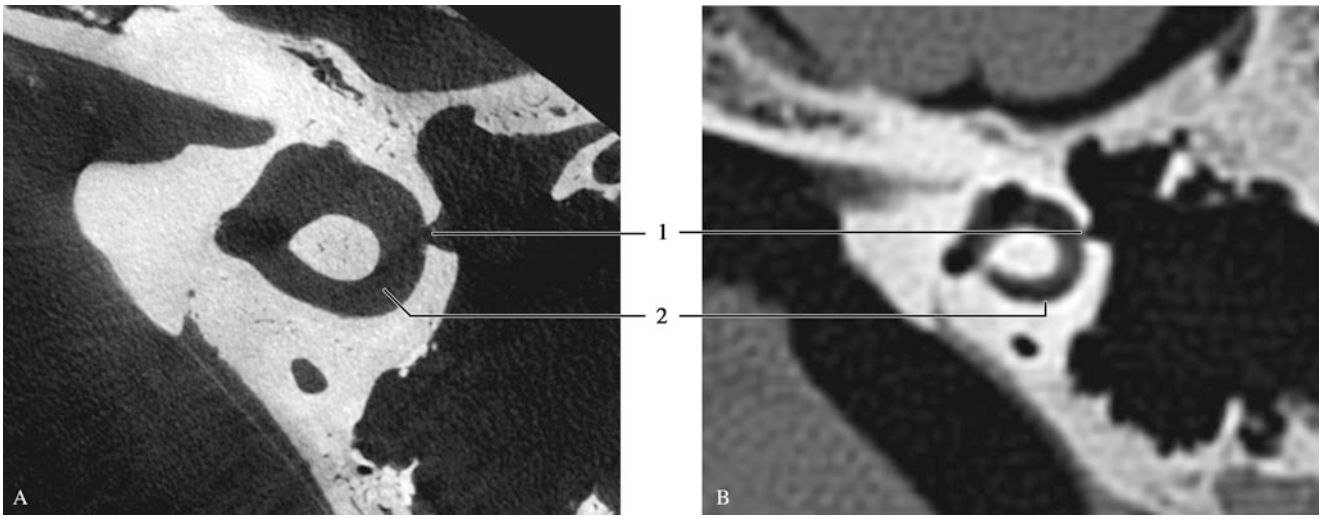

Fig. 10.26 Two-dimensional image contrast on fenestration of lateral semicircular canal on axial view. (A) Micro-CT. (B) HRCT. (1) Bony absence (ho1e) of lateral semicircular canal. (2) Lateral semicircular canal

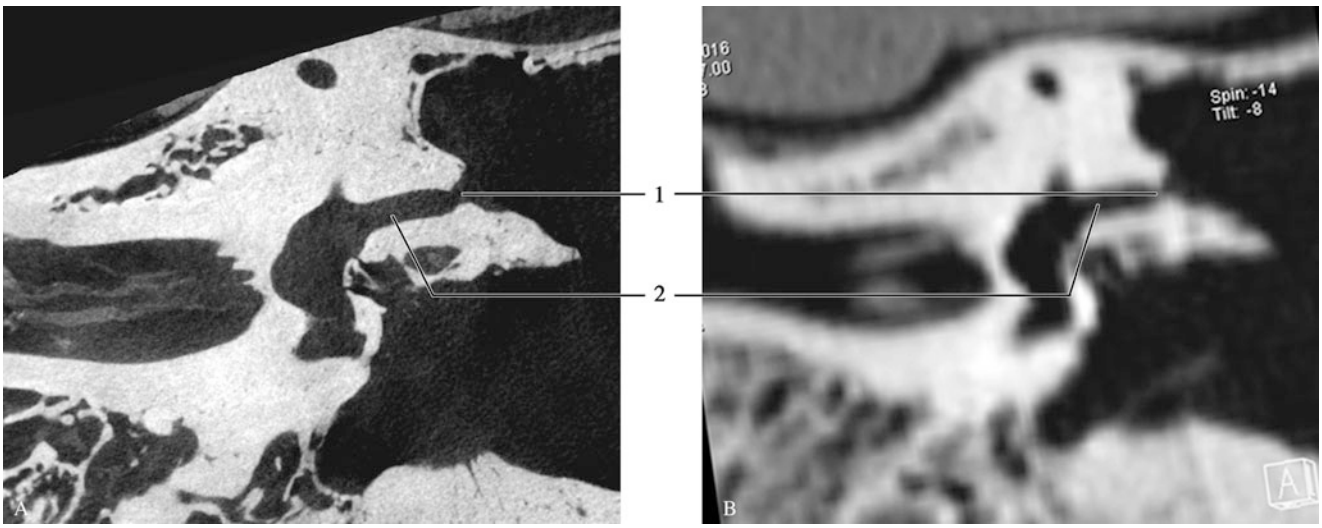

Fig. 10.27 Two-dimensional image contrast on fenestration of lateral semicircular canal on coronal view. (A) Micro-CT. (B) HRCT. (1) Bony absence (ho1e) of lateral semicircular canal. (2) Lateral semicircular canal

10.3 Advantage and Shortcoming of Micro-CT Scan

The micro-CT scan as a non-destructive method owns excellent spatial resolution and can exhibit the micro-architecture without destroying the sample, and the same sample can later be prepared for histological analysis (Irie et al. 2018). Certainly, the extra-high resolution of micro-CT is at the expense of small volume of the sample and high radiation doses. This shortcoming can be minimized using novel contrast agents, and up-to date low-dose micro-CT with newer, more sensitive detectors and intelligent scanning protocols (Schambach et al. 2010).

The temporal bone is regarded as one of the most complex bones in human body, which houses the end organ of hearing and equilibrium in a small bone block, micro-CT scan is an adequate technique for it in the scientific study. We believe that a long-term increase in the use of micro-CT in preclinical research of temporal bone can be expected (Fig. 10.28).

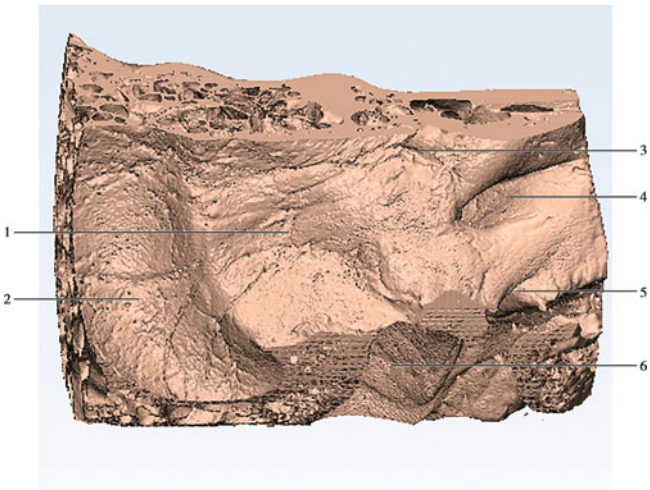

Fig. 10.28 Three-dimensional reconstruction of temporal bone. (1) Fissure of endolymphatic sac. (2) Sigmoid sinus. (3) Outer orifice of petromastoid canal (subarcuate artery). (4) Internal acoustic porus. (5) Nerve portion of jugular foramen. (6) Vascular portion of jugular foramen

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