



Chapter 4

Cancer of the Ear

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PEARLS

- The external ear consists of the pinna (auricle), external auditory canal (EAC), tympanic membrane.
- The middle ear contains the auditory ossicles and communicates with the pharynx via the Eustachian tube.
- The inner ear is in the petrous portion of the temporal bone and consists of the bony and membranous labyrinth.
- The University of Florida published a contouring atlas of the middle and inner ear (Pacholke, *Am J Clin Oncol* 2005).
- Primary middle ear and temporal bone tumors are rare, but external ear cutaneous malignancies may involve these structures.
- BCC >> SCC for malignancies of the external ear, but SCC accounts for 85% of EAC, middle ear, and mastoid tumors.
- Nodal metastases occur in <15% with lymphatic drainage to parotid > cervical > postauricular nodes.

WORKUP

- H&P with otoscopy and careful LN exam. CBC, chemistries, BUN/Cr. CT, MRI. Biopsy.
- Audiologic testing includes measuring pure tone threshold with both air and bone conduction, speech reception threshold, word discrimination score, and impedance audiometry.

STAGING

- No site-specific AJCC/UICC staging system exists; may use histology appropriate staging (e.g. skin, Table 4.1).
- Several proposed staging systems for EAC and middle ear; modified University of Pittsburgh system often cited (Hirsch, Arch Otolaryngol Head Neck Surg 2002).

Table 4.1

T-stage	AJCC staging criteria for cutaneous carcinomas	Pittsburgh staging system for temporal bone carcinomas
T1	<2 cm in greatest dimension	Limited to EAC without bony or soft-tissue extension
T2	≥2 cm, <5 cm	Limited (not full thickness) EAC bony erosion or radiographic limited (<0.5 cm) soft-tissue involvement
T3	>5 cm	Eroding osseous EAC (full thickness) with limited (<0.5 cm) soft-tissue involvement or tumor involving middle ear and/or mastoid or p/w facial paralysis
T4	Invading deep extra dermal structures (i.e., cartilage, bone, muscle)	Eroding cochlea, petrous apex, medial wall of middle ear, carotid canal, jugular foramen or dura, or with extensive (> 0.5 cm) soft-tissue involvement

TREATMENT RECOMMENDATIONS

- Tumors of the external ear may be treated with surgery or RT (either EBRT or IS brachytherapy). Surgery is used if the lesion has invaded the cartilage or extends medially into the auditory canal. Advanced lesions or close/+ margins require post-op RT. Treatment of the lymphatics may be indicated for tumors >4 cm or for cartilage invasion.
- Tumors of the middle ear or temporal bone may be treated with surgery or RT. Facial nerve paralysis at presentation is considered a negative prognostic feature. Surgery may

require mastoidectomy or subtotal or total temporal bone resection. Lateral temporal bone resection is often indicated for T1–2 cases and en bloc subtotal or total temporal bone resection for T3–4 tumors. Post-op RT is generally required for close/+ margin or T2–4 disease to increase LRC.

- LC depends on the extent of disease, and ranges from 40 to 100% across multiple small published case series (owing to rarity of condition).
- Preoperative RT or chemo-RT has also been advocated as an alternative to post-op RT for selected cases (Nakagawa, *Otol Neurotol* 2006).

STUDIES

- Madsen (*Head Neck* 2008): 68 primary cancers of EAC and middle ear in Denmark. Five years LRC rates for surgery, RT, or surgery + RT were 55.6%, 47.4%, and 45.3%, respectively. Of 28 recurrences, 24 were purely local.
- Pfreundner (*IJROBP* 1999): 27 primary carcinomas of EAC and middle ear. Five-year OS 61%. Five-year LC 50%. Five-year OS by stage: T1–T2 86%, T3 50%, T4 41%. Complete resection and clear margins were prognostic. All patients with dural invasion died.
- Ogawa (*IJROBP* 2007). 87 pts with EAC SCC, 61% treated with surgery and post-op RT, 39% with RT alone. 5-yr DFS with surgery and post-op RT: T1 75%, T2 75%, T3 46%. 5-yr DFS with RT alone: T1 83%, T2 45%, T3 0%. T-stage and margins prognostic.
- Yin (*Auris Nasus Larynx* 2006). 95 SCC cases of middle ear and EAC. 14% had regional LN metastasis. 5-yr OS: stage I/II 100%, stage III 67%, stage IV 30%. Stage, completeness of resection with negative margin, recurrence, and metastasis influence survival.
- Clark (*J Plastic Reconstr Aesthet Surg* 2008): Meta-analysis of LN metastases from auricular SCC. Metastatic rate is 11.2%, commonly to parotid and upper cervical chain. Usually develops within 12 months and half will die.

RADIATION TECHNIQUES

SIMULATION AND FIELD DESIGN

- Definitive RT (usually considered for early-stage or inoperable advanced-stage pts).
 - Superficial tumors of the pinna may be treated with electrons or orthovoltage photons. For small tumors, 1 cm margins are adequate, but for larger lesions, 2–3 cm margins are required (see Chap. 1).
 - Advanced or unresectable EAC or middle ear tumors may be treated definitively with high energy electrons (energy appropriate for tumor depth) alone or mixed with photons, or with 3DCRT/IMRT if coverage of nodal volumes is desired.
 - GTV: clinical and radiographic gross disease.
 - CTV1: GTV + 0.3–0.5 cm margin; 66–70 Gy at 2.0 Gy per fraction.
 - CTV2: CTV1 + 0.5–0.7 cm margin, including ipsilateral preauricular and postauricular nodes, and upper level II nodes, and parotid gland (if involved); 63 Gy at 1.8 Gy per fraction.
 - CTV3 (considered for more advanced and aggressive tumors): ipsilateral level III and IV, contralateral level II; 56 Gy at 1.6 Gy per fraction.
 - PTV: CTV + 0.3–0.5 cm margin.
- Postoperative treatment.
 - CTV1: original tumor, surgical bed, soft-tissue invasion, areas with possible residual disease; 60–66 Gy at 2 Gy per fraction (62–70 Gy at 2–2.2 Gy per fraction for gross residual disease).
 - CTV2: CTV1 + 0.5–0.7 cm margin, depending on anatomy include ipsilateral level II and parotid; 54–60 Gy at 1.8 Gy per fraction.
 - CTV3: ipsilateral level III and IV ± contralateral level II; 50–54 Gy at 1.6 Gy per fraction.

- PTV: CTV + 0.3–0.5 cm margin.
- Care should be taken to cover the glenoid fossa of the TMJ and periauricular soft tissue as marginal misses have been identified in these locations with IMRT (Chen, IJROBP 2012).
- Immobilization with a thermoplastic mask is necessary.
- Use wax bolus to fill EAC and surrounding concha for pinna tumors to decrease complications and improve homogeneity and superficial dose delivery.
- In carefully selected pts at experienced centers, post-op intracavitary brachy boost may be considered (Badakh, J Cancer Res Ther 2014).

DOSE PRESCRIPTIONS

- Tumors of the pinna may be treated with 1.8–2 Gy per fraction to 50 Gy for small, thin lesions <1.5 cm, 55 Gy for larger tumors, 60 Gy for minimal or suspected cartilage or bone invasion, or 65 Gy for large lesions with bone or cartilage invasion.
- Tumors of the auditory canal or temporal bone: postoperative, 54–66 Gy; definitive, 66–70 Gy, and may consider chemo-RT.

DOSE LIMITATIONS

- Limit temporal bone to ≤ 70 Gy to minimize risk of osteoradionecrosis (~10% for doses >65 Gy) (Fig 4.1).

COMPLICATIONS

- Cartilage necrosis of the pinna and/or temporal bone necrosis is possible if careful planning is not used.
- Neurosensory: hearing compromise or loss.
- Chronic otitis media.
- Xerostomia.

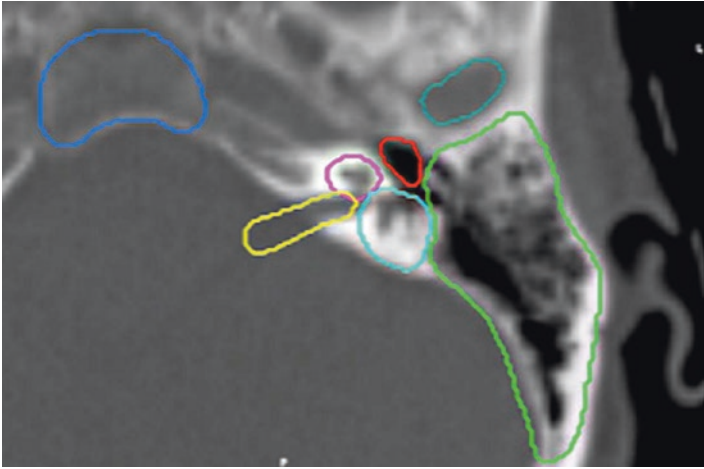


Fig. 4.1 Organs at risk delineated on planning CT: cochlea (*magenta*), vestibular apparatus (*cyan*), middle ear (*red*), CN VIII (*yellow*), clivus (*blue*), temporomandibular joint (*teal*), temporal bone/mastoid air cells (*green*)

FOLLOW-UP

- Frequent H&P with otoscopy every 3–4 months for 1–2 years, then every 6 months for 1–2 years, then annually.

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