The Throat: Part I

30

Michael Perry

30.1 Applied Anatomy

The pharynx (often referred to as the throat) is a musculofascial tube, which is incomplete anteriorly and continuous with the nose, mouth and larynx. It extends from the base of the skull to the level of the C6 vertebra, i.e. at the lower border of the cricoid cartilage, where it becomes continuous with the oesophagus. The pharynx thus acts as a common entrance to both the respiratory and alimentary tracts, making this an important functional region. The term 'throat' is an imprecise word, but is generally taken to mean the area behind the mouth which passes down to the oesophagus. More precisely this is the oropharynx and hypopharynx. The larynx may also be included as part of the throat, but for the purposes of this chapter, this is discussed in the chapter on the neck. Sitting above the throat (oropharynx) is the nasopharynx, a small area just behind the nasal cavity. This houses the openings of the eustachian tubes. Hence some diseases of the throat may cause symptoms in, or extend to directly involve the middle ear.

30.1.1 Overview

The pharyngeal wall is made up of mucosa, submucosa, muscle. There are three main muscles (the superior, middle and inferior pharyngeal constrictors), which are arranged like stacked plastic cups placed one inside the other, but which are deficient anteriorly. These open into the nasal, oral and laryngeal cavities respectively. The overlapping of these muscles is incomplete posterolaterally, resulting in four natural 'gaps' through which various structures can enter and leave the pharynx.

Each constrictor muscle is attached anteriorly to the side-wall of its respective nasal, oral and laryngeal cavity and fans out to insert into a midline raphe, which

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passes down the posterior aspect of the pharynx. Collectively, the pharyngeal constrictors have a strong internal fascial lining (the pharyngobasilar fascia) and a thin external lining (the buccopharyngeal fascia). The buccopharyngeal fascia blends inferiorly with the pretracheal layer of the deep cervical fascia. All three constrictors are supplied by the pharyngeal plexus of nerves. This is made up from branches of the vagus and glossopharyngeal nerves, together with sympathetic branches from the superior cervical ganglion. This plexus lies on the lateral wall of the pharynx. Several internally sited longitudinal muscles (palatopharyngeus, stylopharyngeus and salpingopharyngeus) elevate the larynx and thus shorten the pharynx during swallowing and speaking (Figs. 30.1, 30.2, and 30.3).

30.1.2 Oropharynx

The oropharynx communicates anteriorly with the mouth. Many of its structures can therefore be visualised during examination of the oral cavity. It extends from the level of the hard palate, down to the hyoid bone. Each of its lateral walls are composed of two palatal arches, between which lay the palatine tonsils. Anterior to these

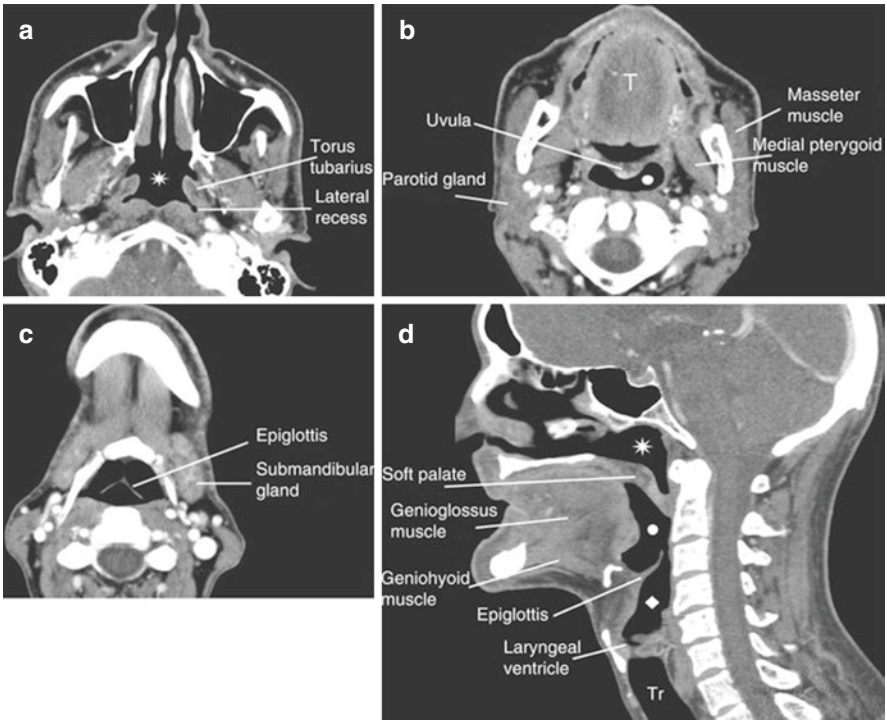

Fig. 30.1 Nasopharynx and oropharynx CT. Axial scan (**a–c**) and sagittal reconstruction (**d**). Nasopharynx *(asterisk),* hypopharynx *(rhombus),* tongue *(T),* oropharynx *(circle),* trachea *(Tr)*

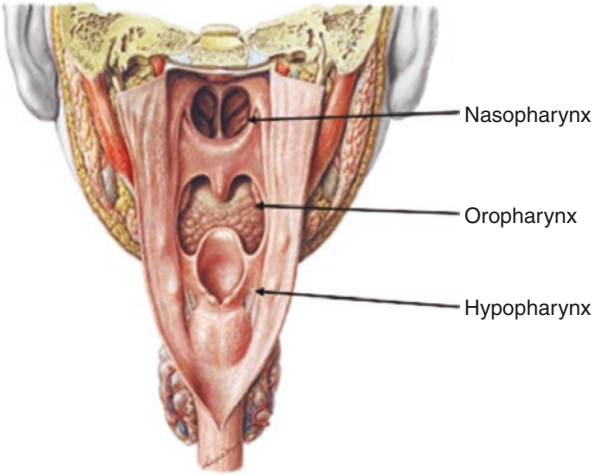

Fig. 30.2 Subdivisions of the pharynx I

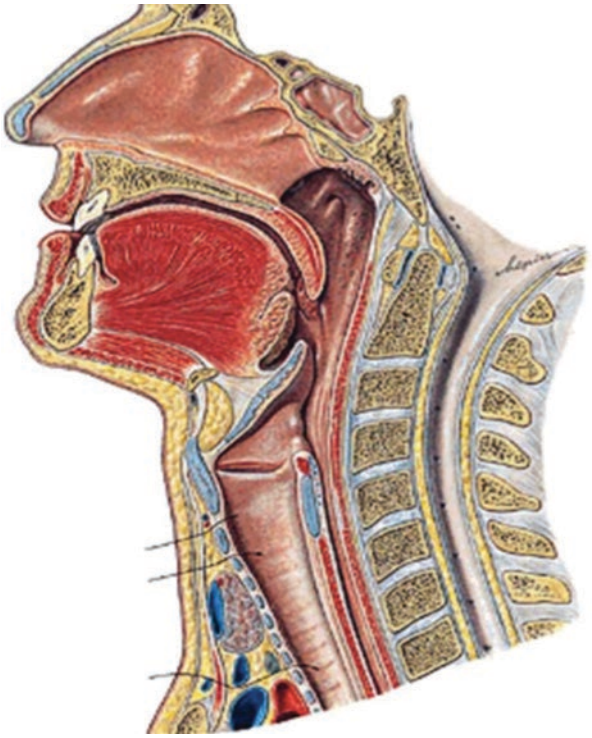

Fig. 30.3 Subdivisions of the pharynx II

arches is the mouth (oral cavity proper). The oropharynx can be divided into (1) the palatine arch (consisting of the soft palate, uvula and the anterior faucial pillar), and (2) the oropharynx proper. The lower part of the anterior wall of the oropharynx is formed by the posterior third (the base) of the tongue. This is demarcated from the

anterior two thirds of the tongue by a v-shaped line of circumvallate papillae. Numerous lymphatic aggregates give the base of the tongue a nodular appearance. This is a normal feature but may cause confusion and concern to the inexperienced. The lymphatics from this region drain into the upper deep cervical chain (level II nodes). The jugulodigastric lymph node is therefore often the first node to be palpable when involved by metastatic tumour. Midline tumours often metastasise to both sides.

The lateral walls of the oropharynx contains the tonsils, the tonsillar fossae, the faucial pillars (palatal arches) and the lateral pharyngeal wall, which blends with the posterior wall. Immediately lateral to the lateral pharyngeal wall lies the parapharyngeal space. This contains several important structures, notably the carotid artery, internal jugular vein, sympathetic chain and cranial nerves IX through XII. Infiltration of this space by infection or tumour can therefore result in significant complications including carotid involvement and cranial nerve deficits. Penetrating trauma here (commonly seen in children) also needs careful assessment.

The palatine tonsils lay in the tonsillar fossa between the anterior and posterior faucial pillars. These are the largest aggregation of lymphoid tissue in 'Waldeyer's ring', described later. The anterior faucial pillar, (formed by the palatoglossal muscle), forms the boundary between the mouth and the oropharynx. This fuses with the lateral wall of the tongue. The posterior pillar, (formed by the palatopharyngeal muscle), blends with the lateral wall of the pharynx. The tonsils are roughly symmetric, and slightly mobility. Crypts and crevasses are often visible. These can become filled with epithelial debris—tonsilloliths, appearing as yellow/white pale spots. The tonsils also have a rich lymphatic network which drains directly into the upper deep cervical (jugulodigastric) nodes. The venous drainage of the tonsils is to the pharyngeal plexus. The paratonsillar vein, is nearly always divided in tonsillectomy and this may result in troublesome haemorrhage.

The posterior pharyngeal wall extends from Passavant's ridge superiorly, (at the level of the hard palate) to the level of the hyoid bone inferiorly. Here it becomes continuous with the hypopharynx. The roof of the oropharynx is formed by the soft palate (the velum) and uvula. The soft palate itself extends posteriorly from the posterior edge of the hard palate to which is it attached. It has a thick aponeurotic part anteriorly, which becomes thinner and more muscular posteriorly. Laterally, the soft palate is continuous with the lateral wall of the oropharynx and is joined to the tongue and pharynx by the palatoglossal and palatopharyngeal arches respectively. Five muscles attach to the soft palate. These arise from the base of the skull. The veins of the palate drain into the pterygoid venous plexus. In a significant number of patients the mucosa may appear dusky red compared to the surrounding tissues. This can extend into the tonsillar fossae. These regions have a richer blood supply than the surrounding tissues and may be associated with Waldeyer's ring. Although these changes are normal, this appearance is often misdiagnosed as a "sore throat" or 'thrush' (Fig. 30.4).

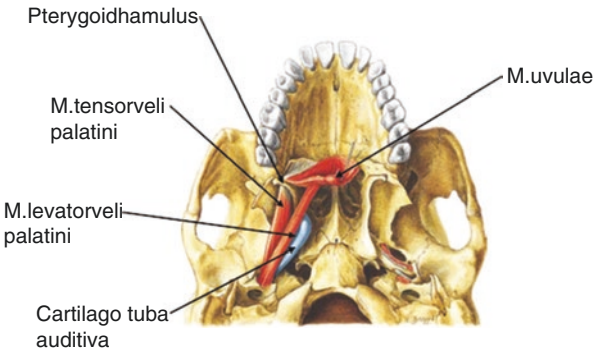

Fig. 30.4 Muscles of the soft palate

Fig. 30.5 A view of the oropharynx in a patient with a peritonsillar abscess. From: Flint, Paul W. Throat disorders. In: Goldman L, Schafer AI (eds). Goodman-Cecil Medicine, 25th edition. Elsevier, Inc. 2016, with permission

30.1.2.1 Peritonsillar Space

This space lays lateral to the palatine tonsil. It is bound medially by the capsule of the tonsil and laterally by the superior constrictor. The anterior and posterior borders are formed by the anterior and posterior tonsillar pillars. This is a potential space and contains no important contents. Nevertheless it is an important space in which peritonsillar abscesses can rapidly develop. These are one of the most common deep neck space abscesses and occur following infection of the tonsil. It has been suggested that inflammation of 'Weber's minor salivary glands', found in this region, may be an important underlying cause. Nearby is the masticator space. Inflammation here results in trismus. Infections in this area can thus quickly spread in different directions and result in significant symptoms (Fig. 30.5).

30.1.3 Nasopharynx

The nasopharynx (nasal part of the pharynx) is a relatively small space which lies in front of the first cervical vertebra. It is often said to be about the size of the patient's thumb. It is the uppermost part of the pharynx, which extends from the base of the

skull to the upper surface of the soft palate. This cavity differs from the rest of the pharynx in that it is composed of semi rigid walls and is therefore always patent. When elevated, the soft palate seals the nasopharynx off from the rest of the pharynx during swallowing, thereby preventing regurgitation of food into the nose. Anteriorly the nasopharynx communicates via the choanae with the nasal cavities. These are separated from each other by the vomer. Two important structures lie within the nasopharynx.

1 The nasopharyngeal tonsil ('adenoids')—this is a collection of lymphatic tissue deep to the epithelium in the roof and posterior wall of the nasopharynx. This is usually prominent in children but undergoes atrophy after puberty. When chronically inflamed the adenoids can almost fill the nasopharynx, resulting in mouth-breathing. They may also block the eustachian tube, resulting in middle ear problems and loss of hearing (see the chapter on the Ear).
2 Laterally, the pharyngotympanic (Eustachian) tubes open into the nasopharynx. The torus tubarius marks the posterior boundary of this orifice. Behind this is a deep recess, the pharyngeal recess (fossa of Rosenmüller). This a common site for nasopharyngeal malignancy.

Diseases of the throat, may therefore involve the ear. The Eustachian tube provides a pathway for sepsis from the pharynx to enter the middle ear. Pain can also be referred to the ear from the pharynx. If required, the middle ear can be intubated through a catheter passed via the Eustachian tube. There are also a number of benign embryological and developmental lesions that can develop in the nasopharynx.

1. Rathke's pouch develops when remnants of the mucosal invagination that forms the anterior lobe of the pituitary gland persist.
2. Craniopharyngioma is a tumour that arises from these remnants.
3. The Pharyngeal Bursa of Luschka. This is a soft swelling that projects into the midline of the nasopharynx between the longus capitis muscles. It is seen in 7% of the population as an incidental, asymptomatic finding. If the bursa becomes infected from inflammation or trauma, it is called a "Thornwaldt cyst" (Pharyngeal Bursitis). The bursa is believed to develop when the endodermal attachment to the pharyngeal end of the notochord persists (Figs. 30.6, 30.7, and 30.8).

30.1.4 Hypopharynx

The hypopharynx (laryngopharynx) is bounded above and anteriorly by the sloping laryngeal inlet. It lies below the epiglottis, passing downwards to diverge into the larynx and oesophagus. Its lower margin is the lower border of the cricoid cartilage. Below this level the oesophagus lays posterior to the airway. The hypopharynx is divided into three areas (the piriform sinus, post-cricoid area and the posterior pharyngeal wall).

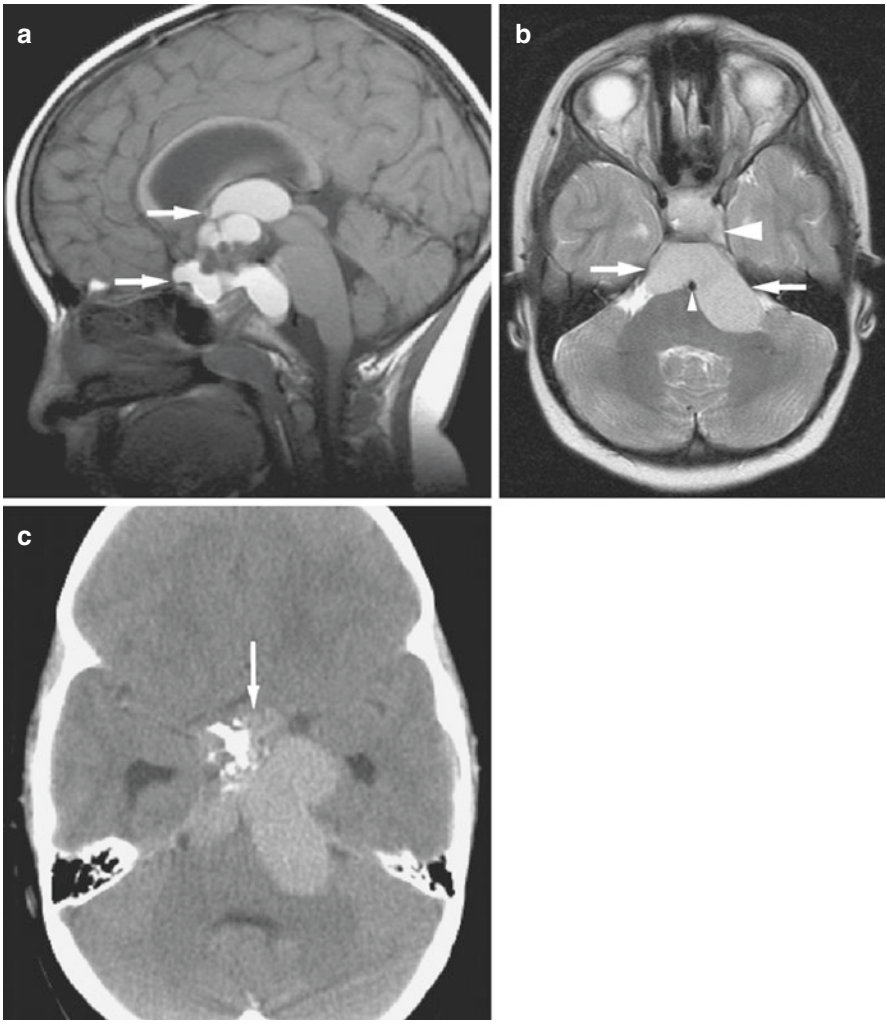

Fig. 30.6 Craniopharyngioma; 7-year-old female with history of longstanding headache. (**a**) Sagittal T1-weighed MR shows a large tabulated sellar/suprasellar mass extending upwards to third ventricle and posteriorly into prepontine cistern (arrows). Most cysts show hyperintensity. (**b**) Axal T2-wetgnted MR shows extension into cerebellopontine angles more to left (arrows) with left parasellar extension (*arrowhead*) and encasement of basillar artery (*small arrowhead*). (**c**) Axial CT shows eccentrically located calcification within a hyperdense iobulated mass at suprasellar region (*arrow*)

Fig. 30.7 Craniopharyngioma

As with the superior and middle constrictors, the inferior constrictor muscles are attached posteriorly to the pharyngeal raphe. However each constrictor consists of two parts. The upper part runs forwards and downwards to the oblique line on the thyroid cartilage. This is thyropharyngeus. Its upper edge covers the inferior part of the middle constrictor. The lower part of the constrictor muscle is attached to the side of the cricoid cartilage as the cricopharyngeus muscle. This is sometimes regarded as a separate muscle. It is continuous inferiorly with the circular fibres of the oesophagus. Posteriorly, there is a potential gap between these two muscles—Killian's dehiscence. Pharyngeal pouch (Oesophageal diverticulum) may arise following herniation of the mucosa through the muscular wall of the hypopharyx. In this region there are three well known areas of natural weakness.

1. Killian's Triangle. This is located inferior to the cricopharyngeal muscle and superior to the cricothyroid muscles
2. Killian-Jamieson Space: This is seen laterally, between cricopharyngeal and oesophagus muscle
3. Laimer-Haeckermann Space: This is found between the cricopharyngeus superiorly and the circular fibres inferiorly

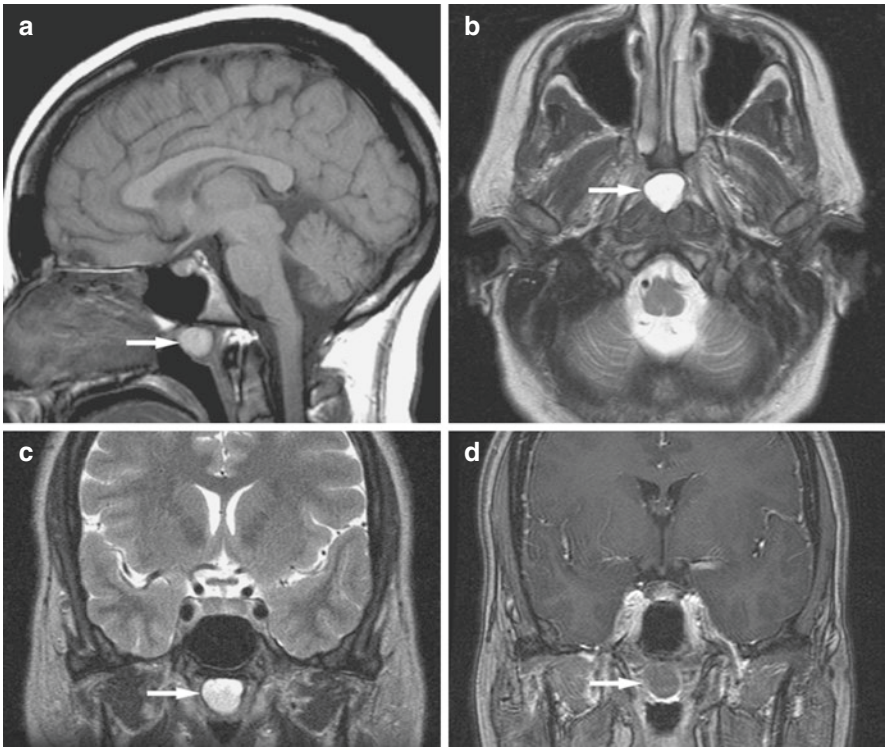

Fig. 30.8 Tornwaldt's cyst, large; incidental findings in 30-year-old. (**a**) Sagittal T1-weighted MRI shows low-signal cyst (*arrow*) in posterior nasopharynx. (**b**) Axial T2-weighted MRI shows bright signal cyst (*arrow*). (**c**) Coronal T1-weighted MRI shows bright signal cyst (*arrow*). (**d**) Coronal T1-weighted post-Gd MRI shows no enhancement of the cyst (*arrow*)

30.1.4.1 Zenker's Diverticulum

This is a pulsion diverticulum which arises following elevated intraluminal pressure at Killian's triangle. It is seen typically in the elderly, who present with slowly progressive dysphagia, spontaneous regurgitation of undigested food, halitosis and aspiration. The diverticulum initially protrudes posteriorly, but this is limited by the prevertebral fascia. As it continues to enlarge it therefore begins to project to one side of the pharynx, usually the left. With further enlargement, the pouch displaces the oesophagus and lays directly in line with the pharynx. Food can then passes into the pouch and collect. Overspill of the contents into the larynx can then result in aspiration. Diagnosis requires an oesophagogram and endoscopy. Symptomatic and large diverticulum (>1.5 cm) may require surgical excision or repair (diverticulectomy with cricopharyngeal myotomy, or diverticulopexy). Alternatively, endoscopic stapling of the pouch may be possible. Botulinum toxin injected into the cricopharyngeal muscle may also help. Untreated pouches can lead to complications like diverticulitis, fistula formation, perforation, and rarely malignancy within the pouch itself.

30.1.5 Waldeyer's Ring

This refers to a ring-like collection of lymphatic tissue found in the nasopharynx and oropharynx. It is composed of

1. Pharyngeal tonsils (adenoids). This develops from an aggregation of lymphoid tissue in the posterosuperior wall of the nasopharynx.
2. Tubal tonsil (a collection of lymphoid tissue in the submucosa around the opening of the Eustachian tube).
3. Palatine tonsils (tonsils). These develop from the endodermal lining of the second pharyngeal pouch and underlying mesenchyme.
4. Lingual tonsils (on the dorsolateral aspect of the posterior tongue. This develops from an aggregation of lymphoid tissue on dorsum of the posterior one-third of the tongue.

It is also common to see discrete, yellowish-pink nodules on the posterior wall of the oropharynx and oral mucosa. These are small clumps of lymphatic tissue that supplement Waldeyer's ring.

This tissue gradually increases in size from birth and attains a relatively larger size at around 4 years of age. It is believed that since it is sited at the entry to both the respiratory and digestive tracts, it is constantly exposed to antigens. Waldeyer's ring is thus an important part of the mucosa-associated lymphoid tissues (MALT), which process antigens and present them to T helper and B cells. During early childhood these tissues undergo significant growth as a result of repeated exposures to antigenic stimuli. The tonsil has an exceptionally good blood supply from the facial artery and a plexus of paratonsillar veins, which may be the source of significant bleeding following tonsillectomy.

30.1.5.1 Reactive Lymphoid Hyperplasia

The lingual tonsil is one of the largest lymphoid aggregates in Waldeyer's ring. It is typically surrounded by crypts and frequently becomes inflamed and enlarged. Enlargement is usually bilateral, but if it is unilateral is can easily be mistaken for a tumour. Similar reactive hyperplasia can occur in the other lymphoid aggregates presenting as firm nodular submucosal masses. Castleman's disease is a rare disorder characterised by multiple benign growths within the lymph nodes throughout the body. This often involves the chest, stomach, and/or neck. The abnormal enlargement is secondary to lymphoid hamartoma. Three types have been described. Whilst some patients remain symptom free, others may develop fever, weight loss, skin rash, haemolytic anaemia or hypergammaglobulinaemia. The exact cause of Castleman's disease is not known, but it has been suggested that increased production of interleukin-6 (IL-6) may be involved.

Lymphoepithelial cysts can also develop within these lymphoid aggregates. These present as movable, painless submucosal nodules with a yellow/yellow-white appearance. Superficial cysts may rupture to release a foul-tasting, cheesy, material. No treatment is necessary unless its location is such that it is constantly being

traumatised. These crypts may become obstructed by keratin and other debris following inflammation.

30.1.5.2 Tangier Disease

This is a familial high-density lipoprotein deficiency (a rare autosomal recessive condition) that affects children and adults. Patients develop startling orange or yellowish grey discolourations and swelling in the tonsils, pharyngeal mucosa and gingivae. This is associated with hypocholestrolaemia and enlargement of the spleen, liver and lymph nodes. Xanthomas are also frequently seen.

30.1.5.3 Accessory Tonsillar Tissue

This may be found in various locations throughout the oropharynx, including the floor of the mouth, ventral surface of the tongue, soft palate and the posterior pharyngeal wall. Some patients seem to have an abundance of lymphoid tissue. Clinically this is seen as multiple small, smooth, glossy, yellowish-pink nodules.

30.1.5.4 Tonsilloliths

In some patients, food and mucous secretions can collect and stagnate in the deep tonsillar crypts, usually in the upper pole of the tonsil. These can thicken and form into a nidus which can then become colonised by local flora. Repeated episodes of inflammation may produce fibrosis at the openings of the crypts. Bacterial and epithelial debris then accumulates and contributes to the formation of retention cysts. Over time dystrophic calcification occurs following deposition of inorganic salts derived from saliva. Most tonsilloliths are composed primarily of calcium carbonate and calcium phosphate but other minerals such as magnesium, sodium, silica, potassium, copper, aluminium, iron, ammonia radicals have been isolated. Mineralisation may occur to such an extent that the calcified mass may be seen on routine imaging (OPG) as a single or multiple opacities. Large tonislloliths are relatively uncommon although small concretions are a common finding in tonsillectomy specimens. Tonsilloliths are relatively common in clinical practice, although most patients are symptom free. Some however may complain of a foreign body sensation in the throat or halitosis. Larger tonsilloliths can mimic abscesses or neoplasms and can produce misleading symptoms including irritable cough, dysphagia, otalgia, and tonsil swelling. With gentle pressure they can express white debris (tonsilloliths). Treatment is usually conservative (aggressive mouth care, which includes irrigation or cleaning with cotton swab, hydrogen peroxide gargles, antiseptic mouth rinse etc). Tonsillectomy may be considered in recurrently symptomatic cases (Fig. 30.9).

30.1.6 Retromolar Trigone (RMT)

This is the triangular area of mucosa just behind the upper and lower third molars (wisdom teeth), covering the anterior edge of the ascending ramus of the mandible. It is an important junction between the oral cavity and the oropharynx. Although technically within the oral cavity, this is noted here as symptoms are often

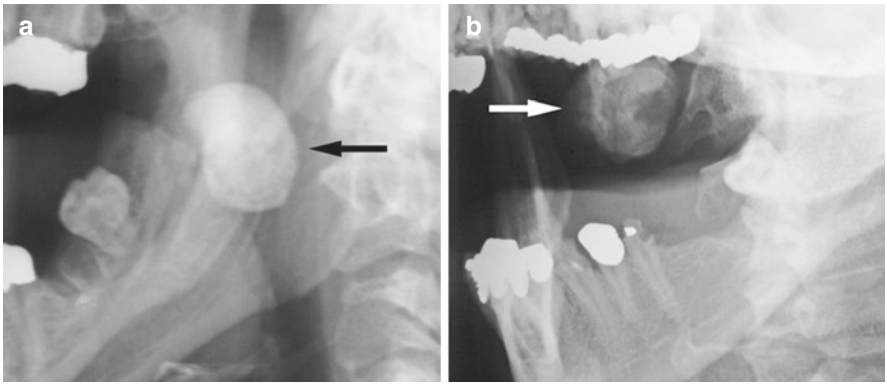

Fig. 30.9 Calcification in palatine tonsil; 31-year-old female with prominent, hard mass in right tonsil region. (**a**) Lateral view shows large calcification (*arrow*). (**b**) Oblique lateral view snows calcification freely projected from skeleton (*arrow*) (**a** reproduced with permission from Aspestrand and Kolbenstved: 1987)

Fig. 30.10 Cancer of the retromolar trigone

attributable to the throat. Cancers in this site are easily overlooked. The pterygomandibular raphe (ligament) is a thick fascial band that passes between the hamulus of the medial pterygoid plate and the posterior border of the mylohyoid ridge of the mandible. This forms a line of attachment for the buccinator and superior pharyngeal constrictor muscles—the junction between the oral cavity and oropharynx. It has been postulated that cancers in the retromolar trigone can extend along this raphe undetected. Tumours can thus pass from the palate to the posterior floor of the mouth and tongue (Fig. 30.10).

30.1.7 Parapharyngeal Space

This is an important potential space, which lies lateral to the pharynx. It extends from the base of the skull to the superior mediastinum and contains the carotid vessels, internal jugular vein, deep cervical lymph nodes, last four cranial nerves and

the cervical sympathetic trunk. This is an important "pathological pathway". Infection of the lymph nodes in the parapharyngeal space commonly occurs as a result of infections of the tonsils or teeth (particularly the third lower molar tooth). This may then spread up to the skull base or down to the paraoesophageal region and superior mediastinum.

30.1.8 Retropharyngeal Space

This is another potential space which lies behind the pharynx. It is bounded anteriorly by the posterior pharyngeal wall and posteriorly by the cervical vertebrae and their covering muscles and fascia. It contains the retropharyngeal lymph nodes.

These are more developed in infancy and young children. If they become severely inflamed they can affect swallowing and respiration. Bleeding into this space can occur following fractures or ligamentous injuries to the cervical spine, which may be visible through the open mouth (Fig. 30.11).

30.1.9 Nerve Supply

Pharyngeal branches of CN IX and CN X make up the main sensory and motor supply to most of the pharynx. The maxillary division of CN V provides sensory innervation to the nasopharynx. The sensory nerves to the palate come from the maxillary nerve (from the pterygopalatine ganglion). The lesser palatine nerves supply the soft palate.

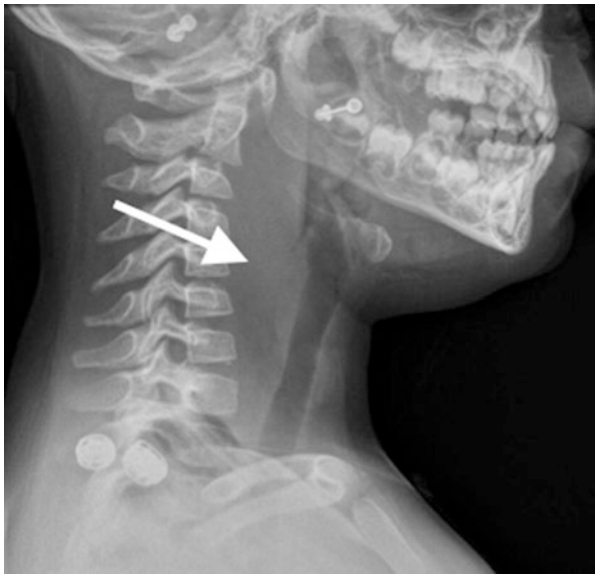

Fig. 30.11 Lateral neck X-ray revealing widened retropharyngeal space

30.1.9.1 The Glossopharyngeal Nerve (CN IX)

From a clinical point of view, the glossopharyngeal nerve is largely unimportant except for its role in the gag reflex. Its main function is to provide sensation to the oropharynx and posterior part of the tongue. The nerve emerges from the lateral aspect of the medulla and passes anterolaterally to leave the skull through the jugular foramen. At this foramen are the superior and inferior ganglia, which contain the cell bodies for the sensory components of the nerve. The nerve follows the stylopharyngeus muscle (derived from the third pharyngeal arch—the only muscle that it supplies), passing between the superior and middle constrictor muscles to reach the oropharynx and tongue. It provides sensory fibres to the pharyngeal plexus of nerves. Parasympathetic fibres are also provided to the otic ganglion, which innervates the parotid gland. General sensory branches of CN IX are

1. The tympanic nerve.
2. The carotid sinus nerve (the sinus monitors changes in blood pressure, oxygen and carbon dioxide levels).
3. The pharyngeal, tonsillar and lingual nerves to the mucosa of the oropharynx, palatine tonsil, soft palate and posterior third of the tongue.

Taste fibres are conveyed from the posterior third of the tongue to the superior and inferior ganglia of CN IX. Embryologically, the glossopharyngeal nerve is the nerve of the third branchial arch. This gives rise to the lower part of the hyoid bone and the stylopharyngeus muscle. The arterial components of the third arch eventually form part of the common and internal carotid arteries, thereby explaining the carotid sinus innervation.

30.1.9.2 Glossopharyngeal Neuralgia

This is a condition of unknown cause, although neural ischaemia has been suggested. It is not as common as trigeminal neuralgia, but the pain may be as severe and in some patients can be excruciating. Pain is similar to that of trigeminal neuralgia but arises in the sensory distribution of the glossopharyngeal nerve. It presents in middle-aged and elderly patients as a sharp, shooting pain in the ear, pharynx, nasopharynx, tonsil or posterior third of the tongue. It is almost invariably unilateral. Patients may experience numerous mild attacks or occasional severe ones. There is usually a ‘trigger zone’ somewhere in the pharynx or tonsillar fossa. Because of this location simple actions such as swallowing, talking, yawning or coughing can bring on the pain. Treatment is very difficult and in extreme cases may involve resection of the extracranial portion of the nerve or intracranial division.

30.1.9.3 Vagus Nerve

The vagus nerve (CN X) has the longest course and the most varied distribution of all the cranial nerves. Many of its branches supply structures below the collarbones. It arises from the medulla and leaves the skull through the jugular foramen. It has a superior ganglion in the jugular foramen which is mostly concerned with the

general sensory component of the nerve. Just below the foramen is the inferior ganglion which is concerned with the visceral sensory components of the nerve. The nerve continues downwards in the carotid sheath, towards the root of the neck, supplying branches to the palate, pharynx and larynx. The courses of the right and left vagi are asymmetrical in the thorax (as a result of the rotation of the midgut during embryonic development).

The vagus nerve supplies motor fibres to the voluntary muscles of the larynx, pharynx, palatoglossus and upper oesophagus. It also supplies sensory fibres to the lower pharynx and larynx. Taste and somatic sensation are conveyed from the root of the tongue and taste buds on the epiglottis. The pharyngeal branch of the vagus passes forwards between the internal and external carotid arteries to the middle constrictor where it joins the pharyngeal plexus. From this plexus motor fibres pass to the muscles of the pharynx and soft palate. In the neck, two important branches are

1. The superior laryngeal nerve—this descends on the side of the pharynx deep to the internal carotid artery and divides into internal and external laryngeal nerves. The internal laryngeal nerve pierces the thyrohyoid membrane to supply sensation to the pharynx around the laryngeal inlet and the mucosa of the larynx as far down as the vocal folds. The external laryngeal nerve runs downwards on the inferior constrictor to supply the cricothyroid muscle.
2. The recurrent laryngeal nerve—this is the lowest branch of the vagus which innervates structures in the neck. Its course differs between the two sides. In the neck, the returning nerve enters the larynx deep to the lower border of the inferior constrictor. It supplies all the muscles of the larynx, except cricothyroid and the laryngeal mucosa below the vocal folds. It also innervates the mucosa and muscles of the oesophagus and trachea.

The vagus nerve then continues downwards into the chest and abdomen carrying parasympathetic and visceral fibres. Superior and inferior cardiac branches pass into the thorax to join the cardiac plexuses. These convey the parasympathetic innervation of the heart.

30.1.10 Gag Reflex

This is a protective reflex, which prevents soiling of the airway. In many patients it is possible to touch the anterior part of the tongue without inducing a feeling of discomfort. However, when the posterior part of the tongue is touched many patients gag. Sensory branches from the glossopharyngeal nerve provide the stimulus of this reflex. Both the glossopharyngeal and the vagus are responsible for the profound muscular contraction and retching that then occurs. The gag reflex is thus a useful clinical test to assess function in both the glossopharyngeal (afferent limb) and the vagus (efferent limb) nerves. It is an important part of the cranial nerve examination.

30.1.11 Swallowing (Deglutition)

This is also noted in the chapter on the front of the neck. However, some overlap between these two sites is inevitable. Swallowing or deglutition is a series events that propels the contents of the oral cavity through the pharynx and oesophagus into the stomach, whilst avoiding entry into the respiratory tract. In addition it also removes mucus contaminated with dust and bacteria. During swallowing, the Eustachian tube is also opened, thereby equalising pressures either side of the tympanic membrane.

To perform these functions requires a complex sequence of actions and reflexes. Swallowing is initiated voluntarily, but once underway is completed by involuntary actions in the pharynx. If the throat is damaged or diseased, this process may be severely disrupted, resulting in loss of weight, choking and aspiration. For descriptive purposes, swallowing is usually divided into three phases, although these run in continuity. They are (1) The oral phase (subdivided into an oral preparatory phase and an oral phase), (2) the pharyngeal phase and (3) the oesophageal phase. Altogether, the main steps are.

1. Food is crushed by mastication and lubricated with saliva. It is then pushed back into oropharynx by elevating the floor of the mouth and the tongue against the palate. At the same time the nasopharynx is closed by elevation of the soft palate.
2. Contraction of the palatoglossi muscles narrows the space between the anterior faucial pillars. This gap is closed by the dorsum of the tongue which wedges into it, thereby protecting the larynx (which is also elevated and pulled forward).
3. Breathing is temporarily suspended to prevent inhalation of debris. The true cords, vocal folds and the aryepiglottic folds constrict.
4. The epiglottis then guides the food bolus away from the laryngeal entrance by covering the laryngeal inlet—"laryngeal lid".
5. The cricopharyngeus then relaxes, allowing the bolus to pass through the pharyngo-oesophageal junction.

This entire process takes about one second. Semi-solid or solid material is propelled by peristalsis, with an oesophageal transit time of about 15 s. Gravity has no effect on this. Difficulties in swallowing (dysphagia), may arise from mechanical obstruction of the pharynx or oesophagus or from disorders of the nervous system affecting neuromuscular coordination (cranial nerves and central nuclei). This is discussed later in this chapter.

30.2 Important Considerations When Taking a History

Since the throat is a conduit for both the respiratory and alimentary tracts it is not surprising that some diseases and injuries can result in symptoms that are referable to either or both systems. These tend to be either mechanical in nature (such as a large tumour, swelling or haematoma) or neurological (for example disorders in swallowing may result in aspiration). Acute problems arising within the throat tend

to present with varying combinations of pain, dysphagia, ulceration or swelling. The general approach to a patient with a sore throat is to identify and treat infections of group A β-hemolytic streptococcal pharyngitis ("strep throat") in order to prevent acute rheumatic fever (ARF), peritonsillar, parapharyngeal and retropharyngeal abscesses. Pain can occasionally be referred to the ear, which is why every patient who presents with 'earache' should have their throat examined. In the absence of an obvious cause this symptom should be viewed with suspicion. Injuries to the throat are rare, but usually self evident from the history. These require careful evaluation if the mucosa has been lacerated as penetrating injuries to the throat and soft palate can involve the carotid arteries. Common problems that can affect the throat include infections, foreign bodies, gastroesophageal reflux, diffuse oesophageal spasm, obstructive sleep apnea and malignancy. The history should therefore include.

A timeline and progression of the main and associated symptoms

- Presence of dysphagia
- Change in voice
- Difficulty breathing or choking episodes
- Nocturnal coughing
- Postnasal drip
- Weight loss
- Vomiting/Regurgitation
- Associated chest symptoms
- Fever/chills/headache/photophobia/neck stiffness
- Predisposing factors (obesity, pregnancy, alcohol, smoking)

These should cover all but the very unusual or rare conditions. Sore throats are most commonly caused by a bacterial or viral illness. Review of the systems should therefore also enquire about associated symptoms, such as a runny nose, cough, and difficulty swallowing, speaking, or breathing. Any preceding weakness and malaise (suggesting mononucleosis) should be noted, which can recur. The social history should inquire about close contact with people with previous sore throats and if appropriate, risk factors for gonorrhea transmission (eg, recent oral-genital sexual contact) and risk factors for HIV (eg, unprotected intercourse, multiple sex partners, IV drug abuse). Throat discomfort can also be associated with throat masses, including thyroid hypertrophy or malignancies, foreign objects in the throat, and other causes. Hoarseness may be caused by overuse of the voice (prolonged periods of shouting or loud speech), but it can also be an indication of gastroesophageal reflux, malignancies, neuromuscular disorders, or other health problems. Smoking and alcohol consumption are risk factors for many of these diseases.

30.3 Examining the Throat and Associated Structures

Thorough clinical examination of the throat requires good lighting, a tongue depressor and a mirror. Ideally it also includes flexible fibreoptic laryngoscopy, but this requires training and accurate interpretation requires experience. Detailed

examination is therefore often carried out by otolaryngologists. In the emergency department, head light examination using a tongue depressor and mirror may be limited but nevertheless may still reveal useful signs. Examination is more than an assessment of the back of the mouth. In particular, it is important to also examine the lateral border of the tongue, floor of mouth, soft palate and tonsillar area. These are common sites for many diseases, including cancers. They should be both inspected and whenever possible palpated (especially the base of the tongue). Any unilateral, asymmetrically enlarged tonsil should be regarded as a potential tumour. However, a normal sized tonsil can also be pushed towards the midline by a parapharyngeal mass (commonly a large deep lobe tumour of the parotid gland).

Ask the patient to remove any dentures. Note their voice and articulation, presence of mouth breathing and ask them to swallow. Then ask the patient to open their mouth, protrude their tongue and move it from side to side. Note any trismus. Limitation of tongue movement can occur as a result of either throat and oral disease. Look at the anterior and posterior fauces and the tonsils for cysts, debris, ulcers and signs of infection. Generally, the tonsils protrude just beyond the palatoglossal arch, but they can project much further, or remain hidden. In streptococcal disease the patient may have a 'strawberry tongue'. In cases of infectious mononucleosis there may be petechiae on the palate. Look for any areas of ulceration or necrosis.

Ask the patient to say "Ahhh" and watch the movement of the uvula and palate. This should be painless and symmetrical. If there is any discharge or loosely adherent plaques or slough, try to gently wipe them off for microbiology or pathology. A laryngeal mirror is then used to look at the tongue base and the lateral walls of the oropharynx. If the patient can cope, press down on the tongue with a tongue depressor and using the mirror look at its posterior surface. Then gently push the tongue to each side. This will allow you to see the floor of the mouth, importantly the retromolar trigone and 'coffin corner' (the area of tissue lingual to and below the lower wisdom tooth, passing down the throat) (Fig. 30.12).

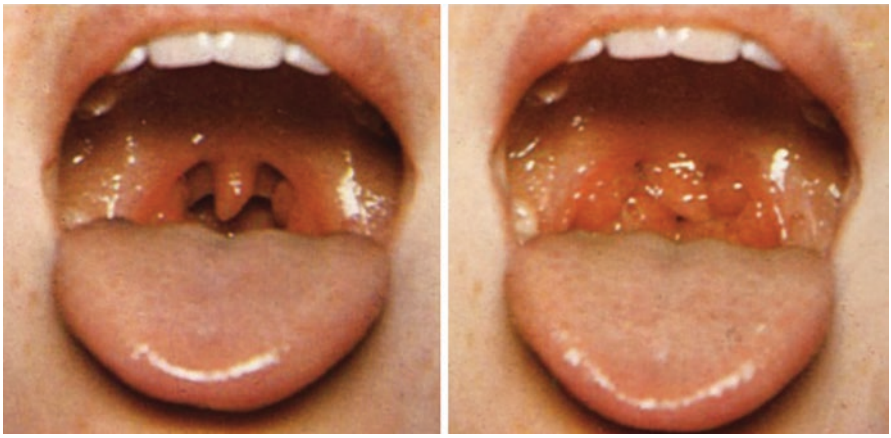

Fig. 30.12 Normal tonsills on the *right side,* kissing tonsills on *the left* side

It is important to remember that examination of the mouth and throat is not just a case of looking. If possible (without causing excessive gagging) always palpate suspicious areas. Tumours can be easily missed if this is not routinely undertaken. If one of the tonsils is displaced medially examine the associated parotid—tumours of the deep lobe can displace a normal tonsil. Not all tumours are obvious to the naked eye.

Finally examine the nasopharynx and larynx with a mirror or, if experienced, a flexible fibreoptic nasendoscope. The location of the nasopharynx makes it very difficult to access and examine easily. If endoscopy is not available the only way to examine the nasopharynx is posterior rhinoscopy. A small angled mirror is placed at the back of the pharynx. A strong head light is then directed on to the mirror. This is reflected upwards, showing the posterior nasal cavity. This is a difficult technique, as both the tongue and uvula can obstruct the view. Endoscopic techniques have now considerably improved visualisation. This may be performed transorally or transnasally and usually provide excellent views. If necessary, flexible oesophagoscopy can be performed under local anaesthesia. This is generally tolerated well. Rigid oesophagoscopy requires general anaesthesia and is indicated when looking for foreign bodies, or for visualising the pyriform fossa and postcricoid region (Fig. 30.13).

If the patient has a sore throat it may also be necessary to examine the trunk for a rash—the rash of scarlet fever generally starts on the chest and spreads to the neck and face. The rash associated with infectious mononucleosis tends to be

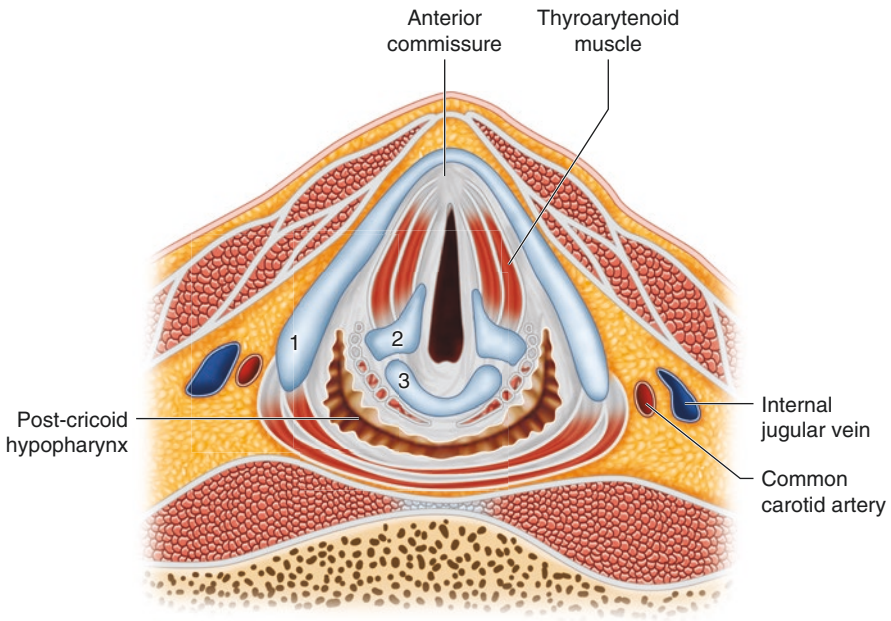

Fig. 30.13 Anatomy of the glottis, axial section. Thyroid curtilage (*1*), arytenoid curtilage *(2),* cricoid curtilage *(3)*

generalised. Examine also the neck for cervical lymphadenopathy (see the chapter on the front of the neck).

30.4 Investigating Symptoms and Signs

30.4.1 Laboratory Tests

A complete blood count including differential count is required for most infective symptoms of the throat. A very high CRP should raise suspicion of a deep seated abscess, such as retropharyngeal. Monospot or Paul Bunnel test and liver function Tests should be requested if glandular fever is suspected. Subclinical hepatitis (raised levels of alanine aminotransferase) has been reported to occur in approximately 75% of patients and in some cases overt hepatitis. Specific tests include gonococci, syphilis, chlamydia, diphtheria. Throat swabs can be sent for rapid strep-test (Rapid Antigen Detection Test—RADT) if a streptococcal sore throat is suspected. Most of the rapid antigen detection tests that are currently in use today have a specificity of greater than 95% and a sensitivity of at least 90%. Owing to the high specificity of these tests, a positive rapid antigen detection test is generally accepted as adequate for the diagnosis of GABHS pharyngitis.

Throat swabs should also be sent for culture if there has been no clinical response to first line antibiotics. In vitro testing for diphtheria toxin production (modified Elek test) can be done to differentiate toxigenic from nontoxigenic strains. PCR testing for the diphtheria toxin gene is also available.

Tests for Helicobacter pylori infection may be indicted in patients with suspected GORD. Serum ferritin levels and iron profile are important in Plummer Vinson syndrome. Antioxidants such as selenium (Se), zinc (Zn), copper (Cu) may be measured in chronic throat infections.

30.4.2 Plain Films

Plain film radiographs have become largely obsolete today in the investigation of diseases of the pharynx. However, lateral radiographs of the neck may show soft tissue abnormalities. Of particular importance is the width and outline of the prevertebral soft tissue shadow (retropharyngeal abscess) and a swollen epiglottis. This may be preferable to nasendoscopy or CT in an irritable child. The outline of the laryngotracheal airway can also be a useful guide to the presence of disease involving the pharynx and larynx. On the lateral view there should be no air within the upper oesophagus or gas in the tissues. If this is seen, endoscopy may be indicated. Radio-opaque foreign bodies may also be seen in the pharynx, larynx or upper oesophagus. Contrast swallow is still occasionally undertaken in the investigation of some oesophageal disorders (diverticula, tumours, stenoses, and disorders of motility). Contrast media include Barium, Gastrografin, Ultravist, Isovist. If there is a

Fig. 30.14 Native planar X-ray detects an osteophyte *(arrow)* causing swallowing disorders and globus nervous

risk or suspicion of a perforation or aspiration, barium should not be used (Fig. 30.14).

30.4.3 CT/MRI/PET

Cross sectional imaging with CT and MRI is useful in the diagnosis of pharyngeal tumours/masses, foreign bodies, inflammation and abscess. These can provide information about submucosal tumour extension and cartilage involvement. The origin and extent of such lesions is often difficult to determine based on the clinical examination. Penetrating throat injuries require careful assessment, due to their risk of carotid injury and deep cervical infections.

Positron emission tomography (PET) is a recent imaging technique which provides quantitative data on tumour metabolism before and after chemotherapy. In trauma CT will be required following penetrating injuries to the throat. With contrast this can visualise the nearby vessels.

30.4.4 Video-Flouroscopy and Assessment of Swallowing

A video fluoroscopic swallowing exam (VFSE) uses a form of real-time imaging (fluoroscopy) to evaluate a patient's ability to swallow safely and effectively. The exam is typically well tolerated, noninvasive, and can help identify the consistencies of liquid and food that a patient can most safely consume. This is used mainly to assess swallowing disorders, using high-speed cineradiography. This technique evaluates the different phases of swallowing with high speed image resolution (approximately 50 images per second). It allows imaging of anatomical structures in real-time and allows the interpret ion of any limited function. Modified Barium Swallow (MBS) is a videofluoroscopic study that visualises oral and pharyngeal phases of swallowing. Oesophageal webs in Plummer Vinson syndrome can be detected by barium swallow or videofluoroscopy. Other investigations for swallowing disorders are detailed in the chapter on the front to the neck. Manometry measures the duration, amplitude, and velocity of peristaltic waves.

30.4.5 Laryngoscopy and Oesophagoscopy

This is indicated if there is suspicion of malignancy, to remove foreign bodies, and to biopsy a mass or lesion.