52 T_h e pharynx, larynx and neck

- Peripheral nerve tumours
- Pharyngeal pouch
- Phonation speech
- Quinsy
- SUMMARY
- Secondary carcinoma
- Sideropenic dysphagia
- Stridor in children
- TRACHEOSTOMY AND OTHER EMERGENCY AIRWA Y MEASURES
- TRAUMA TO THE NECK
- Thoracic duct injury
- Thyroglossal duct cysts Embryology
- Tracheostomy tubes
- Transtracheal ventilation
- Treatment
- Tuberculous adenitis
- Tumours of the larynx
- Tumours of the nasopharynx
- Tumours of the oropharynx
- VOICE DISORDERS Vocal nodules
- Vagal body tumours
- Vocal fold palsy
- Vocal fold polyps
- Voice rehabilitation
- Wounds above the hyoid bone
- Wounds of the thyroid and cricoid cartilage

Acute epiglottitis

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In children acute epiglottitis is of rapid onset. It tends to occur in children of 2 years of age and over. Stridor is usually associated with drooling of saliva. The condition is caused by Haemophilus influenzae infection, which initially causes a severe pharyngitis that extends to involve the laryngeal inlet, causing inflamma tion and oedema. Further progression involves the whole of the supraglottic larynx, with severe oedema of the aryepig folds and epiglottis being the most notable component, hence the commonly used term ‘acute epiglottitis’. These children frequently require intensive management with emergency intubation or tracheostomy followed by oxy genation, humidification, continuous oximetry and antibiot ics. There may be associated septicaemia, so blood cultures should be obtained. Attempted examination with a spatula into the mouth may precipitate a respiratory ar rest and should be avoided. The incidence of acute epiglottitis has plummeted where H. influenzae vaccination programmes are in place. Acute epiglottitis

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Acute laryngitis

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This often occurs as part of an upper respiratory tract infection in association with a cough and pharyngitis. Usually viral, it may be localised to the larynx and it settles quickly if the voice is rested during the acute inflammation. Steam inhalations are soothing along with mild analgesia, but antibiotics are unnecessary . Summary box 52.13 Warning /uni25CF

Hoarseness lasting for 3–4 weeks should always be referred for an ENT opinion

Chronic laryngitis may be specific and can be caused by myco bacteria, syphilis and fungi. Treatment is directed towards the causative organism. Non-specific laryngitis is common, the main predisposing factors being smoking, chronic upper and lower respiratory sepsis and voice ab use. Gastro-oesophageal reflux has been implicated as a factor in laryngitis, vocal fold nodules and polyps, but the evidence is controversial. However, antireflux medication and proton pump inhibitors are commonly prescribed. Diagnosis of chronic laryngitis should not be made unless the larynx has been fully evaluated by a laryngologist. Acute laryngitis

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Adenoidectomy

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Adenoid tissue can be removed alone or in conjunction with a tonsillectomy . The indications for adenoidectomy are: /uni25CF OSA associated with postnasal obstruction; /uni25CF recurrent acute otitis media or prolonged serous otitis me - dia, usually longer than 3 months’ duration; /uni25CF recurrent rhinosinusitis*; /uni25CF postnasal discharge*. Operative technique With the patient placed in a supine position with the neck in a neutral position, the adenoid tissue is removed with a guarded curette pressed against the roof of the nasopharynx before sweeping downwards to deliver the excised adenoid into the oropharynx (Figures 52.18 and 52.19). A postnasal swab is placed into the nasopharynx until all haemorrhage has ceased. A mirror can be used to guide the direction of the adenoid curette. Alternatively , suction monopolar diathermy or a coblator may be used to remove adenoid tissue. Reactionary or secondary haemorrhage during the recov - ery period may require a nasopharyngeal pack under a further anaesthetic. This can occasionally cause respiratory depression is required while in children and adults, and strict observation the pack is in place.

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Figure 52.18 St Clair Thomson adenoid curette. Figure 52.19 Curettage of the adenoid.

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Anatomical relationships of the pharynx

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Some of these are illustrated in Figure 52.5 . Parapharyngeal space This potential space lies lateral to the pharynx and is shaped like an inverted pyramid with its base at the base of the skull - and its apex at the level of hyoid. It is divided into a prestyloid space, which contains the deep lobe of the parotid gland, blood vessels, lymph nodes and fat tissue, and a poststyloid space (also known as carotid space), which contains cranial nerves IX–XII, the carotid artery , internal jugular vein, deep cervical lymph nodes and cervical sympathetic trunk. - Infection and necrosis of the cervical lymph nodes in the parapharyngeal space most commonly occur from infections of the tonsils or teeth (particularly the third lower molar tooth). - As the parapharyngeal space is not anatomically divided, infection may therefore spread from the skull base cranially to the superior mediastinum caudally and consequently often presents a sur gical challenge. Retropharyngeal space This potential space lies posterior to the pharynx, bounded anteriorly by the constrictor muscles and the covering buccopharyngeal fascia and posteriorly by the prevertebral musculature and its overlying prevertebral fascia. It contains the retropharyngeal lymph nodes, which are usually paired lateral nodes but which are separated by a tough midline fibrous condensation that connects the prevertebral and buccopharyngeal fascia. As with the lymphoid tissue of Waldeyer’s ring, these nodes are more active in infancy and young children, and it is at this age that they are most likely to be involved in infl ammatory pr ocesses, which, if severe, may a ff ect swallowing and respira tion as a consequence of gross swelling and suppuration of the retropharyngeal space.

Tonsil Mandible Hyoid bone Thyroid cartilage Cricoid cartilage Figure 52.5 Sagittal diagram of the upper aerodigestive tract.

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Angiography or digital subtraction vascular imagin

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These techniques may be indicated if a vascular lesion such as a carotid body tumour is suspected. Angiography may have a therapeutic role to play by facilitating embolisation of vascu - lar tumours prior to planned surgical procedures. Magnetic resonance angiography (MRA) o ff ers excellent resolution of vascular anatomy and is less invasive.

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Barium swallow and videofluoroscopy

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Barium (or water-soluble contrast if a pharyngeal or oesoph - ageal perforation is suspected) is used to perform dynamic videofluoroscopic studies, which record the movement of a small quantity of radio-opaque food of various textures and allow detailed ev aluation of the oral and pharyngeal phases of swallowing (Figure 52.12).

Figure 52.10 Plain lateral radiograph showing normal anatomy. Figure 52.11 Plain radiograph demonstrating a coin in the oesoph agus.

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Branchial cyst

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A branchial cyst (Figure 52.63) develops from the vestigial remnants of the second branchial cleft, is lined by squamous epithelium and contains thick, turbid fluid. The cyst usually presents in the upper neck in early or middle adulthood and is found at the junction of the upper third and middle third of the sternomastoid muscle at its anterior border. It is a fluctuant swelling that may transilluminate and is often soft in its early stages so that it may be di ffi cult to palpate. Summary box 52.15 Diagnosis of a lump in the neck /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF If the cyst becomes infected, it becomes erythematous and tender and the di ff erential diagnosis is broadened. Ultrasound and fine-needle aspiration both aid diagnosis and treatment is by complete excision, which is best undertaken when the lesion is quiescent. It passes superficial to the hypoglossal and glossopharyngeal nerves, but deep to the posterior belly of the digastric. These structures and the spinal accessory nerve must be positively identified to avoid damage. In patients over 35 years of age, a high index of suspicion for a necrotic metastatic lymph node should exist and malignancy should be excluded before excision.

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Branchial fistula

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A branchial fistula (Figure 52.64) may be unilateral or bilateral and is thought to represent a persistent second branchial cleft. The external orifice is nearly always situated in the lower third of the neck near the anterior border of the sternoclei domastoid muscle, while the internal orifice is located on the anterior aspect of the posterior faucial pillar just behind the tonsil. Although the anterior aspect of the tract is easy to dissect, it may pass backwards and upwards through the bifurcation of the common carotid artery as far as the pharyngeal constrictors. The internal aspect of the tract may , however, end blindly at or close to the lateral pharyngeal wall, constituting a sinus rather than a fistula. The tract is lined by ciliated columnar epithe - lium and, as such, there may be a small amount of recurrent mucopurulent discharge onto the neck. The tract follows the same path as a branchial cyst and requir es complete excision to avoid recurrence.

(b) Figure 52.63 Right branchial cyst: anterior (a) and oblique (b) views.

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CLINICAL ANATOMY AND PHYSIOLOGY The pharynx

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The pharynx is a fibromuscular tube forming the upper part of the respiratory and digestive passages. It extends from the base of the skull to the level of the sixth cervical vertebra at the lower border of the cricoid cartilage, where it becomes continuous with the oesophagus. It is divided into three parts: the nasopharynx, oropharynx and hypopharynx (Figure 52.1 Nasopharynx The nasopharynx lies anterior to the first cervical vertebra. The adenoids, which constitute the superior component of Waldeyer’s ring, are situated at the junction of the roof and posterior wall of the nasopharynx. Waldeyer’s ring is a ring of lymphoid tissue comprising, in addition to the adenoids, the palatine and lingual tonsils of the oropharynx. It is situated at the entry to the air and food passages and is constantly exposed to new inspired or ingested antigenic stimuli. Accordingly , it is an important part of the mucosa-associated lymphoid tissue (MALT), which processes antigens and presents them to T-helper cells and B cells (Figure 52.2), thereby facilitating a first-line immune response mechanism, which is particularly important in childhood. The tissue of Waldeyer’s ring under goes physiological hypertrophy during early childhood as the child is exposed to increasing amounts of antigenic stimuli, and there is often a similar hypertrophy of the cervical lymph nodes. The Eustachian tubes, leading fr om the middle ear cleft, open into the posterosuperior aspect of the lateral wall. Dorsal and superior to the openings, bounded anteriorly by a ridge Heinrich Wilhelm Gottfried Waldeyer-Hartz , 1836–1921, Professor of Pathological Anatomy , Berlin, Germany . Bartolomeo Eustachio (Eustachius) , 1513–1574, appointed physician to the Pope in 1547, and Professor of Anatomy , Rome, Italy , in 1549. Johann Christian Rosenmüller , 1771–1820, Professor of Anatomy and Surgery , Leipzig, Germany .). formed by the salpingopharyngeus muscle, are the fossae of Rosenmüller, a common site for the development of naso - pharyngeal carcinoma (Figure 52.3). Oropharynx - This is bounded superiorly by the soft palate, inferiorly by the lingual surface of the epiglottis and anteriorly by the anterior faucial pillars and the circumvallate papillae of the tongue. The palatine tonsils are situated in the lateral wall between the anterior and posterior pillars of the fauces. The lateral wall, and in particular the tonsil, takes its blood supply from the facial artery , which may be closely related to the lower pole,

The aetiology, natural history and management of • squamous cell carcinoma of the upper aerodigestive tract Nasopharynx Oropharynx Hypopharynx Figure 52.1 The component parts of the pharynx.

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Adenoids Lymphoid tissu around the Tonsillar Eustachian tube lymph nodes Glands of the jugular chain Faucial tonsils Lingual tonsil Submaxillary lymph nodes Submental lymph nodes Figure 52.2 Waldeyer’s ring. Figure 52.3 Endoscopic view of the left nasopharynx. ET, Eustachian tube; FOR, fossa of Rosenmüller.

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CLINICAL EXAMINATION Pharynx and larynx

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Before examination of the pharynx, the oral cavity should be examined with the aid of a good light and tongue depressors. Historically , a reflecting mirror on the head was used as a source of examination light. However, a headband-mounted fibreoptic light source is widely available and more commonly used. Either option permits the use of both hands to hold instruments. Inspection should include the buccal mucosa and lips, the palate, the tongue and floor of the mouth, all surfaces of the teeth and gums, the salivary ductal orifices, opening and closing of the mouth and dental occlusion. Patients should be asked to elevate the tongue to the roof of the mouth - and protrude the tongue towards both the right and the left. Grasping the protruded tongue with a gauze aids the exam - ination. Intraoral palpation may be required gently using one Level II Level III Level IV Level V Level VI I

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combined with extraoral bimanual palpation of the submental and submandibular lymph nodes and salivary glands to aid the characterisation and/or localisation of any swelling detected. Following examination of the oral cavity , the oropharynx is then inspected with the tongue depressor placed firmly onto the tongue base to depress it inferiorly . Care must be taken to, if possible, avoid pr ovoking a gag reflex. The anterior and pos terior faucial pillars, the tonsil, retromolar trigone and poste rior pharyngeal wall should all be inspected for colour changes, ulceration, mass lesions, mucopus, foreign bodies and swell ings. Pain and trismus as a consequence of pharyngolaryngeal or neck pathology may add to the di ffi culty of the examination but are significant clinical findings in their own right. While angled mirrors and a headlight may be used in expert hands, moder n flexible fibreoptic endoscopes passed through the nose, with or without topical anaesthesia, allow high- quality examination of the entire nasopharynx, oropharynx, larynx and often the hypopharynx in almost every patient. Moreover, a camera attached to the endoscope permits the taking of high-quality photographs to record and present pertinent clinical findings. A rigid 0° fibreoptic endoscope (Hopkins’ rod) is often used in preference to inspect the nasal cavities and nasopharynx. CLINICAL EXAMINATION Pharynx and larynx

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Chronic retropharyngeal abscess

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This condition is now rare and is most commonly the result of an extension of tuberculosis (TB) of the cervical spine, which has spread through the anterior longitudinal ligament to reach the prevertebral space. In addition to the pharyngeal

Figure 52.29 Axial computed tomography scan of the neck demon

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swelling seen intraorally , there may be fullness behind the sternocleidomastoid muscle on one side. In contrast to an acute retropharyngeal abscess, this condition occurs almost solely in adults. Radiology usually shows evidence of bone destruction and loss of the normal curvature of the cervical spine. The spine may be quite unstable and undue manipulation may precipitate a neurological event. In contrast to an acute abscess, a chronic retropharyngeal abscess must not be opened into the mouth, as such a proce dure may lead to secondary infection. Drainage of the abscess may not be necessar y if suitable treatment of the underlying TB disease is instituted. If it is necessary , drainage should be carried out through a cervical incision anterior to the sterno cleidomastoid muscle with an approac h anterior and medial to the carotid sheath to enter the retropharyngeal space. The cavity is opened and suctioned dry after taking biopsy material. Occasionally , surgery is requir ed to decompress or stabilise the spinal cord if there is a progressive neurological deficit.

Figure 52.30 Infectious mononucleosis.

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Chronic tonsillitis

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Chronic tonsillitis usually results from repeated attacks of acute tonsillitis in which the tonsils become progressively damaged by inflammatory processes and provide a reservoir for infective organisms. Tonsillectomy The indications for a tonsillectomy are either diagnostic, ther apeutic or for surgical access. Recurrent acute tonsillitis is the most common relative indication for tonsillectomy in children and adolescents, although it is important that these attacks are well documented, frequent and do not simply constitute a minor viral sor e throat. Chronic tonsillitis more frequently a ff ects young adults, in whom it is important to establish that chronic mouth breathing secondary to nasal obstruction is not the main problem rather than the tonsils themselves. Tonsillectomies are occasionally performed as a means to gain surgical access to the parapharyngeal space laterally in the oropharynx or to access an elongated styloid process. Absolute indications for tonsillectomy are when the size of the tonsils is contributing to airway obstruction or a malignancy of the tonsils is suspected (Table 52.1). Ideally , the procedure should be undertaken when the ton sils are not acutely infected, and it is important to discuss fac tors that may increase the tendency to bleed. Blood transfusion is rarely required, but it is normal practice to type and screen blood for cross-match in children under 15 /uni00A0 kg in weight. /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF β - Dissection tonsillectomy is carried out under general anaes - thesia. The mucosa of the anterior faucial pillar is incised and the tonsil capsule identified. Using blunt dissection, the tonsil is separated from its bed until only a small inferior pedicle is left (Figure 52.27). It is then separated from the lingual tonsil. A - tonsil swab is placed in the tonsillar bed and pressure applied for some minutes, following w hich bleeding points may be controlled by ligature or by bipolar diathermy . (Coblation and laser dissection is commonly used in the resource-rich world in an attempt to reduce postoperative pain and bleeding.) Following surgery , the patient is kept under close obser - vation for any systemic or local evidence of bleeding, with regular pulse and blood pressure measurements and observa - tion to monitor whether the patient is swallowing excessively (Figure 52.28). Postopera tively , patients are encouraged to eat normally and take regular oral analgesics. Patients are allowed home on the same or following day and are warned that they may experience otalgia as a result of referred pain from the glossopharyngeal nerve and that secondary haemorrhage may occur up to 10 days following the surgery . - Haemorrhage is the most common complication in the - immediate postoperative period. Local pressure may help in mild cases, but reactionary haemorrhage usually requires return to theatre f or definitive treatment, particularly in

Absolute Sleep apnoea, chronic respiratory tract obstruction, cor pulmonale Suspected tonsillar malignancy Relative Documented recurrent acute tonsillitis Chronic tonsillitis Peritonsillar abscess (quinsy) Tonsillar asymmetry Tonsillitis resulting in febrile convulsions Diphtheria carriers Systemic disease caused by -haemolytic Streptococcus (nephritis, rheumatic fever) Figure 52.27 Removal of the tonsils.

younger patients. Under general anaesthesia, it may be possible to identify a bleeding spot, but often a more generalised ooze is observed and suturing of the tonsil bed combined with the application of haemostatic gauze and bipolar diathermy is often more successful than attempted placement of ligatures. Late haemorrhage is sometimes secondary to infection and patients are usually started on broad-spectrum intrave nous antibiotics. Any residual clot in the tonsil fossa should be removed and regular gargling with a dilute solution of h ydrogen peroxide may be beneficial. Significant or persistent bleeding may requir e a further general anaesthetic and hae mostasis, which may require diathermy and/or undersewing of the granulating, sloughy tonsil fossa. Postoperative tonsillar haemorrhage is still a serious and life-thr eatening complication and should not be underestimated, particularly in the younger patient. Summary box 52.6 Complications of tonsillectomy /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Figure 52.28 Positioning of the patient after tonsillectomy. Haemorrhage (immediate or late) Infection Pain/otalgia Postoperative airway obstruction Velopharyngeal insuf /f_i ciency Injury to oral cavity and oropharyngeal structures

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Clinical features

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The cysts almost always arise in the midline but, when they are adjacent to the thyroid cartilage, they may lie slightly to one side of the midline. Classically , the cyst moves upwards on swallowing and with tongue protrusion, but this can also occur with other midline cysts such as dermoid cysts, as it merely - indicates attachment to the hyoid bone. Thyroglossal cysts may become infected and rupture onto the skin of the neck, presenting as a discharging sinus. Although they often occur in children, they may also present in adults, even as late as the sixth or sev enth decade of life (Figure 52.66). Clinical features

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Complications of tracheostomy

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The intraoperative, early and late postoperative complications of tracheostomy are listed in Table 52.2 . /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF - /uni25CF /uni25CF -

TABLE 52.2 Tracheostomy: complications. Intraoperative Haemorrhage complications Injury to paratracheal structures, particularly the carotid artery, recurrent laryngeal nerve and oesophagus Damage to the trachea Early Apnoea caused by a fall in the P CO 2 postoperative Haemorrhage complications Subcutaneous emphysema, pneumomediastinum and pneumothorax Accidental extubation, anterior displacement of the tube, obstruction of the tube lumen and tip occlusion against the tracheal wall Infection Swallowing dysfunction Late Dif /f_i cult decannulation postoperative Tracheocutaneous /f_i stula complications Tracheo-oesophageal /f_i stula, tracheoinnominate artery /f_i stula with severe haemorrhage Tracheal stenosis P CO , partial pressure of carbon dioxide. 2

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Computed tomography scanning

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Computed tomography (CT) scanning provides high- resolution imaging of disease in the pharynx, larynx and neck. Intravenous contrast given at the same time as the CT scan (dynamic scanning) further improves the demonstration of disease in these areas (Figure 52.13).

Figure 52.12 Static image grab from a video /f_l uoroscopy sequence showing liquid barium in the upper pharynx in a normal swallow. Figure 52.13 Axial computed tomography scan through the neck and larynx at the level of the glottis.

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Cricothyroidotomy

Cricothyroidotomy

Cricothyroidotomy has the advantages of speed and ease, requiring minimal equipment and surgical expertise, and has great value in the emergency setting when conditions are not optimal to perform a tracheostomy . Cricothyroidotomy is performed through the cricothyroid membrane, which is a fibroelastic condensation connecting the thyroid cartilage to the cricoid cartilage. The cricothyroid artery and vein, the pyramidal lobe of the thyr oid gland and lymph nodes may overlie the membrane. The membrane should be identified precisely before undertaking the proce - dure to avoid injury to adjacent structures; the patient's neck is extended and the area between the prominence of the thyroid cartilage and the cricoid cartilage below is palpated with the index finger of the free hand and, if necessary , the 'laryngeal handshake technique' can be used to define the membrane - (Figure 52.49). Cricothyroidotomy can be performed using the scalpel or cannulae. The scalpel–bougie tube technique is the fastest and most reliable method of securing the airway; a number 10 blade, a bougie and a 6-mm cu ff ed endotracheal tube are needed to perform this, with the patient r eceiving 100% oxy - device, gen and full neuromuscular blockade. A vertical skin incision is recommended with dissection rapidly carried down to the cricothyroid membrane. A 1-cm transverse incision is made through the membrane immedia tely above the cricoid carti - lage and the scalpel twisted through a right angle to gain access to the airway . If available, an artery forceps, bougie, dilator or tracheal hook will improv e the aperture and insertion of an -).

Figure 52.48 Transtracheal needle introduction.

available tube (Figures 52.50 and 52.51). The endotracheal tube allows ventilation using conventional low-pressure equip ment. Cannula cricothyroidotomy can be performed with a narrow-bore (internal diameter ≤ 2 /uni00A0 mm) or wide-bore (internal diameter ≥ 4 /uni00A0 mm) cannula to facilitate oxygenation. Specialist equipment is available f or this, but both techniques are asso ciated with kinking of the cannula and complications, such as device displacement and barotrauma. As soon as practicably possible, the cricothyroidotomy should be converted to a tracheostomy . Although there is debate about the frequency of subglottic stenosis following this procedure, there is general agr eement that it is much increased if any long-term ventilation is undertaken via even a modestly size tracheostomy tube through the cricothyroid membrane.

Figure 52.49 Laryngeal handshake technique as described in the Dif /f_i cult Airway Society (DAS) 2015 guidelines. grasp the top of the larynx (the greater cornu of the hyoid bone) and roll it from side to side. The bony and cartilaginous cage of the larynx is a cone, which connects to the trachea. (b) The /f_i ngers and thumb slide down over the thyroid laminae. cricoid cartilage, with the index /f_i nger palpating the cricothyroid membrane. (Reproduced with permission from Dr handshake technique in locating the cricothyroid membrane: a non-randomised comparative study. Figure 52.50 Incision in a cricothyroidotomy. (a) The index /f_i nger and thumb (c) The middle /f_i

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Cystic hygroma

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Cystic hygromas (Figure 52.65) usually present in the neonate or in early infancy , and occasionally may present at birth and be so large as to obstruct labour. The cysts are filled with clear lymph and lined by a single layer of epithelium with a mosaic appearance. Swelling usually occurs in the neck and may involve the face, submandibular region, tongue and floor of the mouth. The swelling may be bilateral and is soft and partially compressible, visibly increasing in size when the child coughs or cries. The characteristic that distinguishes it from all other neck swellings is that it is brilliantly transilluminant. The cheek, axilla, groin and mediastinum are other less frequent sites for a cystic hygroma. The behaviour of cystic hygromas during infancy is unpre dictable. Sometimes the cyst expands rapidly and occasionally respiratory di ffi culty ensues, requiring immediate aspiration and even occasionally a tracheostomy . The cyst may become infected. Definitiv e treatment involving complete excision of the cyst at an early stage is best if possible. Injection of a sclerosing agent is an alternative strategy and may reduce the size of the cyst; however, they are commonly multicystic and therefore complete resolution is a challenge.

(b) (c) Figure 52.64 (a) Plain radiograph with radio-opaque dye in the /f_i stula tract. (b) Probing of the /f_i stula tract. (c) Excision of the /f_i stula tract. Figure 52.65 Cystic hygroma.

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DISEASES OF THE LARYNX EMERGENCIES Stridor

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Stridor means noisy breathing. It may be inspiratory or expira tory or occur in both phases of respiration. Inspiratory stridor is usually due to an obstruction at or above the vocal folds is most commonly the result of an inhaled foreign body or acute infections such as epiglottitis. Expiratory stridor is usually from the lower respiratory tract and gives rise to a prolonged expiratory wheeze. It is most commonly associated with acute asthma or acute infective tracheobronchitis. Biphasic stridor is usually due to obstruction or disease of the tracheobronchial airway and distal lungs. Summary box 52.8 Stridor /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Inspiratory Foreign body or epiglottitis Expiratory Acute asthma or infective tracheobronchitis Biphasic Obstruction, disease of tracheobronchial airway or distal lungs

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Direct pharyngoscopy and laryngoscopy

Direct pharyngoscopy and laryngoscopy

Examination of the pharynx, larynx and neck under general anaesthesia may be required to assess the stage and resectabil - ity of the primary site, or in instances where comprehensive examination has not been possible; such scenarios include an inadequate clinical examination caused by trismus from pain, poor patient compliance or large obstructive pharyngeal or laryngeal pathology . These examinations may be further aided by the use of an operating microscope or rigid straight and angled (30° and 70°) endoscopes (Hopkins’ rods) (Figure 52.15). The advantages and disadvantages of laryngeal examina - tion techniques are given in Summary box 52.3 . Summary box 52.3 - Advantages and disadvantages of larynx and pharynx examination techniques /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Flexible nasolaryngoscopy Well-tolerated examination Can also examine nasal passages and postnasal space Need /f_i breoptic light source Rigid endoscopy Can be used with stroboscope for evaluation of voice High-de /f_i nition view Needs /f_i breoptic light source Bulky and dif /f_i cult if prominent gag re /f_l ex present Laryngeal mirror Does not need /f_i breoptic light source No record of examination Low-resolution image Dif /f_i cult if prominent gag re /f_l ex present

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Division of the trachea

Division of the trachea

Wounds of the trachea are rare. They should all be formally explored and, to obtain adequate exposure, it is usually neces - sary to divide and ligate the thyroid isthmus. A small trache - ostomy below the wound followed by repair of the trachea with a limited number of submucosal sutures is appropriate. In self-inflicted wounds, the recurrent laryngeal nerves, which lie protected in the tracheo-oesophageal g rooves, are rarely injured. Primary repair of the nerve is rarely possible but may be undertaken at the time of formal exploration of a major neck wound. Division of the trachea

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Elective tracheostomy

Elective tracheostomy

The advantage of an elective surgical procedure is that there is complete airway control at all times, unhurried dissection and careful placement of an appropriate tube. Close cooperation between the surgeon, anaesthetist and scrub nurse is essential, and attention to detail will markedly reduce possible compli cations and morbidity from the procedure. Following induction of general anaesthesia and endotra cheal intubation, the patient is positioned with a combination of head extension and placement of an appropriate sandbag under the shoulders (Figure 52.41). There should be no rota tion of the head. Children’s heads should not be overextended, as it is possible to enter the trachea in the fifth and sixth rings in these circumstances. A transverse incision may be used in the elective situation (Figure 52.42). The thyroid isthmus is divided carefully and o versewn and tension sutures placed either side of the tracheal fenestration in children (Figure 52.43). A Bjork flap may be used in adults (Figures 52.44 and 52.45). The advantages of a Bjork flap outweigh the potential dis advantages, as performed correctly it is safe and allows rein troduction of a displaced tube with the minimum of di ffi culty , reducing the risk of replacing the displaced tube in a false track anterior to the trachea into the superior mediastinum. Although not routinely used, this is described here for com pletion. The inferiorly based flap is created by starting with an inci sion into the trachea betw een the first and second or second and third tracheal rings. In order to reduce the risk of subglot tic stenosis, damage to the first tracheal ring should be avoided at all costs. A stay suture is inserted ar ound the cartilage at the free edge of the flap. Lateral incisions are made in a caudal direction extending through two tracheal rings to crea Viking Olaf Bjork , 1918–2009, cardiac surgeon, Karolinska Sjukset, Stockholm, Sweden. flap. One option is to leave the stay suture attached and taped to the chest wall to allow retraction of the flap to obliterate the pretracheal space when replacing a displaced tube. An alter - native is to suture the free edge of the flap to the edge of the inferior transverse skin incision. In a paediatric patient a vertical incision is made between - the second and third tracheal rings. No tracheal tissue is removed. A cu ff of anterior neck subcutaneous fat pad may be - r emoved in children for adequate access . Prior to incision of the trachea, vertical stay sutures are placed lateral to the mid - line through the tracheal rings and left in place. These can pro - - vide traction for the trachea and allow for rapid tracheostomy tube reinsertion if accidental decannulation occurs prior to the establishment of the tract. Some surgeons will suture skin flaps to the trachea for additional safety (maturation sutures). It is essential to stick to the midline during dissection as more la teral dissection risks a pneumothorax, as the cupula of the cervical pleura extends into the neck on either side of the trachea. - - - - - te the

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Figure 52.40 An incision in the trachea in an emergency tracheos

tomy. Figure 52.41 Position of the patient for elective tracheostomy.

Figure 52.42 Position of the skin incision in an elective tracheostomy. Figure 52.43 Tracheal fenestration in an elective tracheostomy.

Elective tracheostomy

The advantage of an elective surgical procedure is that there is complete airway control at all times, unhurried dissection and careful placement of an appropriate tube. Close cooperation between the surgeon, anaesthetist and scrub nurse is essential, and attention to detail will markedly reduce possible compli cations and morbidity from the procedure. Following induction of general anaesthesia and endotra cheal intubation, the patient is positioned with a combination of head extension and placement of an appropriate sandbag under the shoulders (Figure 52.41). There should be no rota tion of the head. Children’s heads should not be overextended, as it is possible to enter the trachea in the fifth and sixth rings in these circumstances. A transverse incision may be used in the elective situation (Figure 52.42). The thyroid isthmus is divided carefully and o versewn and tension sutures placed either side of the tracheal fenestration in children (Figure 52.43). A Bjork flap may be used in adults (Figures 52.44 and 52.45). The advantages of a Bjork flap outweigh the potential dis advantages, as performed correctly it is safe and allows rein troduction of a displaced tube with the minimum of di ffi culty , reducing the risk of replacing the displaced tube in a false track anterior to the trachea into the superior mediastinum. Although not routinely used, this is described here for com pletion. The inferiorly based flap is created by starting with an inci sion into the trachea betw een the first and second or second and third tracheal rings. In order to reduce the risk of subglot tic stenosis, damage to the first tracheal ring should be avoided at all costs. A stay suture is inserted ar ound the cartilage at the free edge of the flap. Lateral incisions are made in a caudal direction extending through two tracheal rings to crea Viking Olaf Bjork , 1918–2009, cardiac surgeon, Karolinska Sjukset, Stockholm, Sweden. flap. One option is to leave the stay suture attached and taped to the chest wall to allow retraction of the flap to obliterate the pretracheal space when replacing a displaced tube. An alter - native is to suture the free edge of the flap to the edge of the inferior transverse skin incision. In a paediatric patient a vertical incision is made between - the second and third tracheal rings. No tracheal tissue is removed. A cu ff of anterior neck subcutaneous fat pad may be - r emoved in children for adequate access . Prior to incision of the trachea, vertical stay sutures are placed lateral to the mid - line through the tracheal rings and left in place. These can pro - - vide traction for the trachea and allow for rapid tracheostomy tube reinsertion if accidental decannulation occurs prior to the establishment of the tract. Some surgeons will suture skin flaps to the trachea for additional safety (maturation sutures). It is essential to stick to the midline during dissection as more la teral dissection risks a pneumothorax, as the cupula of the cervical pleura extends into the neck on either side of the trachea. - - - - - te the

Figure 52.40 An incision in the trachea in an emergency tracheos

tomy. Figure 52.41 Position of the patient for elective tracheostomy.

Figure 52.42 Position of the skin incision in an elective tracheostomy. Figure 52.43 Tracheal fenestration in an elective tracheostomy.

Emergency tracheostomy

Emergency tracheostomy

If a skilled anaesthetist is unavailable, local anaesthesia is employed, but in desperate cases when the patient is uncon scious, none is required. In patients who have su ff ered severe head and neck trauma and who may have an unstable cervical spine fracture, cricothyr oidotomy may be more suitable. If it is possible, the patient should be laid supine with padding placed under the shoulders and the extended neck kept as steady as possible in the midline. This aids palpation of the thyroid and cricoid cartilage between the thumb and index finger of the free hand. The movements of the fingers of the free hand are important in this technique. The operation is more di ffi cult in small children and thick-necked adults as the landmarks are di ffi cult to palpate (Figures 52.39 and 52.40). - Indications for tracheostomy /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF A vertical midline incision is made from the inferior aspect of the thyroid cartilage to the suprasternal notch and con - tinued down between the infrahyoid muscles. There may be heavy bleeding from the wound at this point, particularly if the neck is congested as a result of the pa tient’s e ff orts to breathe around an acute upper airway obstruction. No steps should be - taken to control this haemorrhage, although an assistant and suction are valuable. The operator should feel carefully for the cricoid cartilage using the index finger of the free hand while retracting the skin edges by pressure applied by the thumb and middle finger. If the situation is one of extreme urgency , a further vertical incision straight into the trachea at the level of the second, third and fourth rings should be made immediately without regard to the presence of the thyroid isthmus. The knife blade is rotated through 90°, thus opening the trachea. At this point the patient may cough violently as blood enters the airway . The operator should be aware of this possibility - and avoid losing the position of the scalpel in the open trachea. Any form of available tube should be inserted into the trachea as soon as possible and blood and secretion sucked out. Once to an airway has been established, haemostasis is then secured. - With the emergency under control, the tracheostomy should - be refashioned as soon as possible. Should additional equipment and more time be available once the cricoid cartilage has been identified, blunt finger dis - section inferiorly can be used to mobilise the thyroid isthmus, which should be clipped and divided, clearing the trachea before making a vertical incision through the second to the - fourth rings. A tracheal dilator is inserted thr ough the tracheal incision and the edges of the tracheal wound are separa ted gently . This is likely to induce coughing and so, particularly in cases where there is a suspected infection risk, as far as possible care should be taken to minimise the risk of contaminating the operator(s). A tracheostomy tube is inserted into the trachea and the dilator removed. It is important that the surgeon/assis - tant keeps a finger on the tube while it is secured with sutures to the neck skin. Additional securing of the tube is achieved by means of tapes attached to the flange of the de vice passed behind the neck and secured to the opposite side with the neck in a neutral position.

Acute upper airway obstruction For example, an inhaled foreign body, a large pharyngolaryngeal tumour or acute pharyngolaryngeal infections in children Potential upper airway obstruction For

example, after or prior to major surgery involving the oral cavity, pharynx, larynx or neck Protection of the lower airway For example, protection against aspiration of saliva in unconscious patients as a consequence of head injuries, maxillofacial injuries, comas, bulbar poliomyelitis or tetanus Patients requiring prolonged arti /f_i cial respiration Best performed within 10 days of ventilation

Figure 52.39 Position of the skin incision in an emergency tracheos tomy.

Emergency tracheostomy

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FURTHER READING

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Fibreoptic endotracheal intubation

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In most emergency situations, endotracheal intubation is the most direct and satisfactory method of securing the airway . Nasotracheal ‘awake’ intubation in expert hands is also a well-established technique and is particularly useful if the patient has trismus, severe mandibular injuries, cervical spine rigidity or an obstructing mass within the oral cavity or lower down in the upper aerodigestive tract. This is facilitated by passing a fibreoptic endoscope through the centre of an endo - tracheal tube, hence guiding it into the larynx and trachea under direct vision.

Figure 52.47 A laryngeal mask airway being inserted.

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Fine-needle aspiration cytology and core biopsy

Fine-needle aspiration cytology and core biopsy

This is the investigation of choice when attempting to determine the nature of a neck or thyroid mass. Fine-needle Michael Anthony Epstein , b. 1921, formerly Professor of Pathology , University of Bristol, Bristol, UK. Yvonne Barr , 1931–2016, virologist who emigrated to Australia. Epstein and Barr discovered this virus in 1964. for deep-seated lesions) to the extent that ultrasound-guided FNAC or core biopsy is now the standard of care in many units around the world. Core biopsy is the prefer red technique in investigating a neck node as immunohistochemistry tests can be performed on the tissue samples to determine positivity to human papillomavirus (HPV) or Epstein–Barr virus (EBV) in current-day practice. The technique is safe and well tolerated and has high diagnostic sensitivity and specificity , especially when diagnosing cervical lymph node enlargement. Fine-needle aspiration cytology and core biopsy

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Foreign bodies

Foreign bodies

Both children and adults may inhale foreign bodies. Y oung children will attempt to swallow a wide variety of objects, but coins, beads and parts of toys are particularly common. In adults, the aspiration is usually food, particularly inadequately chewed bones and meat. This is more common in elderly Henry Jay Heimlich , 1920–2016, thoracic surgeon, Xavier University , Cincinnati, OH, USA. inhaled, particularly in association with road tra ffi c accidents. Clinical features The history is paramount and a history of foreign body inges - tion or inhalation in a child, even though the pain, dysphagia, coughing, etc. may have settled, should always be taken seriously . Adults usually have a clear recall, which facilitates diag - nosis. Fish bones may lodge in the tonsils or base of tongue with minimal symptoms, but small fish bones may give rise to delayed para- and retropharyngeal abscess formation. Examination Examination may be prevented by trismus, pain and anxiety , but the presence of a foreign body may be suspected by salivary pooling within the piriform fossa or adjacent oedema and erythema of the pharyngolaryngeal mucosa. Radiology Radiology may be helpful but is not critical. Fish bones are often invisible on plain radiographs and a normal plain radio - graph does not exclude a foreign body within the pharynx, larynx, oesophagus or lungs. Specialised studies may help in cases of doubt, using a CT - scan or a contrast swallow in the case of a suspected oesoph - ageal foreign body . lottic Treatment In the case of an inhaled foreign body causing severe stridor in a neonate or infant, it may be removed either by hooking - it from the pharynx with a finger or by inverting the child - carefully by the ankles and slapping their back. In a larger child, it may be more appropriate to bend the child over your knee with the child’s head hanging down and again strike the child firmly between the shoulders. In the case of adults, an impacted laryngeal foreign body may be coughed out using abdominal thrusts (often referred to as a Heimlich manoeuvre). This involves standing behind the patient, clasping the arms around the lower thorax, such that the knuckles of the clasped hands come into contact with the patient’s xiphisternum, and then a brief, firm compression of the lower thorax may aid instant expiration of the foreign body . If none of these immediate emergency measures removes the foreign body and the patient is cyanosed and severely stridulous, an immediate cricothyroidotomy or tracheostomy may be necessary . In less - urgent cases, and when a foreign body is strongly suspected, endoscopy under general anaesthesia may be indicated. Foreign bodies

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Glandular fever (infectious mononucleosis)

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This systemic condition is usually caused by EBV , but similar features can be caused by cytomegalovirus or toxoplasmosis. The tonsils are typically erythematous with a creamy grey exudate and appear almost confluent, usually symmetrical (Figure 52.30). In addition to the discomfort and dysphagia, patients may drool saliva and have respiratory di ffi culty , particularly on inspiration. They commonly have a high temperature and gross general malaise with marked cervical or generalised lymphadenopathy . Occasionally , an enlarged spleen or liver may be detected. The condition is most frequent in teenagers and young adults. The diagnosis can be confirmed by serological testing for EBV , which has now commonly replaced Paul–Bunnell testing, an absolute and relative lymphocytosis, and the presence of atypical monocytes in the peripheral blood. John Rodman Paul , 1893–1971, Professor of Preventative Medicine, Yale University , New Haven, CT , USA. Walls Willard Bunnell , 1902–1966, American physician. Paul and Bunnell described this test in 1932. Moritz Kaposi , 1837–1902, Professor of Dermatology , Vienna, Austria, described pigmented sarcoma of Analgesia and maintenance of fluid intake are important. A small number of patients require admission to hospital if the airway is compromised or if oral intake of fluids is not possible, and a short course of steroids may be helpful. Antibiotics are of little value and ampicillin is contraindicated because of the frequent appearance of a widespread skin rash. Rarely , if the airway is severely compromised, an elective tracheostomy under local anaesthesia is safer and less traumatic than an emergency intubation. Emergency tonsillectomy is contra - indicated because of the generalised pharyngeal oedema and compromised airway . Glandular fever (infectious mononucleosis)

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HYPOPHARYNX Tumours of the hypopharynx

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Benign Benign tumours of the hypopharynx are very rare, the most common being the fibroma and the leiomyoma. They show a smooth, submucosal mass lying in the lumen of the hypophar ynx or oesophagus. Malignant Malignant tumours of the hypopharynx are almost exclusively squamous cell carcinomas and typically behave aggressively . The tumours are usually classified according to their probable anatomical site of origin from the piriform fossa, postcricoid region or posterior pharyngeal wall. Marked di ff erences in the incidence of these tumours occur globally because of factors such as iron deficiency anaemia (see Sideropenic dysphagia). They may be associated with marked submucosal spread, which further complicates evaluation. Tumours arising from the piriform fossa and posterior pharyngeal wall may spread to upper or lower cervical nodes. Tumours arising in the postcricoid area typically metastasise to paratracheal and paraoesophageal nodes, which may not be palpable. As with other non-HPV head and neck cancers, alcohol and tobacco are two principal carcinogens. Postcricoid carcinoma, though rare, is more common in women than in men. Thomas Hodgkin , 1798–1866, Curator of the Museum and Demonstrator of Morbid Anatomy , Guy’s Hospital, London, UK, described lymphadenoma in 1832. - considered in all patients presenting with dysphagia, hoarse - ness or referred otalgia, particularly if they have a history of smoking or significant alcohol consumption. Fibreoptic endoscopic examina tion in the clinic may show only subtle signs such as oedema or pooling of saliva unilater - ally in the piriform fossa. Note should also be made that this region is not well seen on flexible gastroscopy . The pr eferred investigation is with direct rigid phar yngoscopy and oesopha - goscopy with biopsy under a general anaesthetic. All regions of the neck must be assessed in a systematic manner. Fine-needle aspiration is advocated for suspicious nodes. Radiological examination As for other head and neck cancers, a suspected primary tumour requires an MRI or CT scan of the neck together with a CT scan of the thorax and upper abdomen. Treatment Squamous cell carcinoma of the hypopharynx commonly presents late and carries a poor prognosis. Early lesions may be treated with radiotherapy or transoral robotic or transoral laser microsurgical resection and a neck dissection plus postopera - tive radiotherapy . Non-surgical strategies, designed to preserve function, rely on chemoradiotherapy . Major open excisional surgery is generally used for recurrence after radiotherapy or as primary excision in advanced disease . Total laryngectomy and either partial or total pharyngectomy followed by pharyngeal reconstruction involving myocutaneous or free flap reconstruc - tion (e.g. jejunum or anterolateral thigh) or gastric transposition is commonly required (Figure 52.38). Swallowing and voice -

Figure 52.38 Total pharyngolaryngectomy specimen showing hypopharyngeal carcinoma (hypopharynx opened from the posterior aspect of the resection).

surgery if they are to adjust and maintain some quality of life. Summary box 52.7 Tumours of the hypopharynx /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Variable symptoms – discomfort, pain, dysphagia, hoarseness Incidence increased by history of smoking and alcohol Expert examination with nasendoscopy Late presentation Referral to multidisciplinary team for detailed assessment and treatment – radiotherapy with/without chemotherapy, transoral or open surgery

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Human immunodeficiency virus (HIV)

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Acquired immunodeficiency syndrome (AIDS) can a ff ect the ear, nose and throat (ENT) system at any point during the disease. The initial seroconversion may present with the symptoms of glandular fever; this is followed by an asymp - tomatic period of variable length. In the pre-AIDS period, before the full-blown symptoms of the AIDS-related complex, many patients have minor upper respiratory tract symptoms that are often o verlooked, such as otitis externa, rhinosinusitis and a non-specific pharyngitis. As the patient moves into the full-blown AIDS-related complex, a persistent, generalised lymphadenopathy is frequently found a ff ecting the cervical - nodes, which is usually due to follicular hyperplasia. However, patients may also develop tumours such as Kaposi’s sarcoma, sometimes seen in the oral cavity , and high-grade malignant B-cell lymphoma a ff ecting the cervical lymph nodes and - nasopharynx. In addition, multiple ulcers may be found in the oral cavity or pharynx associated with herpesvirus infection. Severe Candida may a ff ect the oral cavity , pharynx, oesophagus or even larynx, and a hairy leukoplakia may a ff ect the tongue (Figure 52.31). the skin in 1872.

Figure 52.31 Intraoral view showing a hairy tongue in a human immu

node /f_i ciency virus-positive patient.

A wide variety of patients experience the feeling of a lump in the throat (from the Latin globus = lump). The symptom most commonly a ff ects adults between 30 and 60 years of age. This feeling is not true dysphagia as there is no di ffi culty in swallowing. Most patients notice the symptom more if they swallow their own saliva (i.e. a forced, dry swallow) rather than when they eat or drink. The aetiology of this common symptom is unknown, but some patients may have gastro-oesophageal reflux or spasm of their cricopharyngeus muscle. Radiological and endoscopic investigation may be necessary to e xclude an underlying cause and/or for patient reassurance.
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Acquired immunodeficiency syndrome (AIDS) can a ff ect the ear, nose and throat (ENT) system at any point during the disease. The initial seroconversion may present with the symptoms of glandular fever; this is followed by an asymp - tomatic period of variable length. In the pre-AIDS period, before the full-blown symptoms of the AIDS-related complex, many patients have minor upper respiratory tract symptoms that are often o verlooked, such as otitis externa, rhinosinusitis and a non-specific pharyngitis. As the patient moves into the full-blown AIDS-related complex, a persistent, generalised lymphadenopathy is frequently found a ff ecting the cervical - nodes, which is usually due to follicular hyperplasia. However, patients may also develop tumours such as Kaposi's sarcoma, sometimes seen in the oral cavity , and high-grade malignant B-cell lymphoma a ff ecting the cervical lymph nodes and - nasopharynx. In addition, multiple ulcers may be found in the oral cavity or pharynx associated with herpesvirus infection. Severe Candida may a ff ect the oral cavity , pharynx, oesophagus or even larynx, and a hairy leukoplakia may a ff ect the tongue (Figure 52.31). the skin in 1872.

Figure 52.31 Intraoral view showing a hairy tongue in a human immu

node /f_i ciency virus-positive patient.

A wide variety of patients experience the feeling of a lump in the throat (from the Latin globus = lump). The symptom most commonly a ff ects adults between 30 and 60 years of age. This feeling is not true dysphagia as there is no di ffi culty in swallowing. Most patients notice the symptom more if they swallow their own saliva (i.e. a forced, dry swallow) rather than when they eat or drink. The aetiology of this common symptom is unknown, but some patients may have gastro-oesophageal reflux or spasm of their cricopharyngeus muscle. Radiological and endoscopic investigation may be necessary to e xclude an underlying cause and/or for patient reassurance.

Hypopharynx

Hypopharynx

The superior border of the hypopharynx is at the level of the laryngeal inlet. Its inferior border is the lower border of the cricoid cartilage where it continues into the oesophagus. The hypopharynx is commonly divided into three areas: the right and left piriform fossae, the posterior pharyngeal wall and the postcricoid region. The mucosa of these areas is, however, continuous so disease processes, such as squamous cell carci nomas, often involve more than one area as a result of overt or submucosal spread. The multifaceted complex process of swallowing, which consists of the oral, pharyngeal and oesophageal phases (Figure 52.4), is mediated via a ff er ent fibres passing to the medulla oblongata through the second division of the trigem inal nerve (V), glossopharyngeal nerve (IX) and vagus nerve (X). The e ff erent pathway is from the nucleus ambiguus and is mediated via the glossopharyngeal (IX), vagus (X) and hypo glossal (XII) nerves. Damage to these major cranial nerves at an y point along their pathway , by trauma or disease, may cause dysphagia and/or aspiration. Videofluoroscopy , in which the passage of a bolus of radio- opaque f ood of di ff erent textures from the point at which it enters the oral cavity down to its passage within the stomach is examined radiologically , is the investig ation of choice when investigating swallowing (dys)function. (b)

e Oral Pharyngeal Oesophageal Superior pharyngeal constrictor muscle Middle pharyngeal constrictor muscle Inferior pharyngeal constrictor muscle Cricopharyngeus muscle Oesophagus Figure 52.4 The three phases of swallowing (a) and the muscles (b) .

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INFLAMMATORY CONDITIONS OF THE NECK Ludwig’s angin

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Ludwig described a clinical entity characterised by a brawny swelling of the submandibular region combined with inflam matory oedema of the mouth. These clinical features, as well as accompanying putrid halitosis, define the condition. The infection is often caused by a virulent streptococcal infection associated with anaerobic organisms. There may also be an underlying oral cavity cancer . The infection tracks deep to the mylohyoid m uscle, causing oedema and inflammation such that the tongue is displaced upwards and backwards, giv ing rise to dysphagia and subsequently to painful obstruction of the airway . Unless treated, cellulitis may extend beneath the dee p fascial layers of the neck to involve the larynx, causing glottic oedema and further airway compromise. Antibiotic therapy should be instituted as soon as possible using intravenous broad-spectrum antibiotics, with anaero bic cover. If the swelling does not subside rapidly with such treatment, or in advanced cases wher e pus is evident, a curved submental incision may be used to drain both submandibular triangles. The mylohyoid muscle ma y be incised to decompress the floor of the mouth and corrugated drains placed in the wound, which is then lightly sutured. Although this operation may be conducted under local anaesthetic, a general anaes thetic approach is preferred as it provides a more controlled setting, allowing for optimal exposure and drainage without undue stress to the patient. Rarely , a tracheostomy may be necessary .

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INVESTIGATION OF THE PHARYNX, LARYNX AND NECK Plai

INVESTIGATION OF THE PHARYNX, LARYNX AND NECK Plain lateral radiographs

Plain lateral radiographs of the neck and cervical spine may show soft-tissue abnormalities, although their sensitivity and specificity is low; of particular importance is the depth and Harold Horace Hopkins , 1918–1994, Professor of Applied Optics, University of Reading, Reading, UK, invented the rigid rod endoscope (Hopkins’ rod, 1954) and contributed to the development of the fibres for flexible endoscopes. Key points of history and examination /uni25CF /uni25CF - /uni25CF - /uni25CF /uni25CF - /uni25CF outline of the prevertebral soft-tissue shadow on sagittal section as an indication of retropharyngeal pathology . The outline of the laryngotracheal airway may be a useful guide to the presence of disease in the pharynx and larynx. There should be no air within the upper oesophagus. If air is seen, endoscopy is advised. Radio-opaque foreign bodies may be seen impacted in the pharynx, larynx or upper oesophagus on these radiographs (Figures 52.10 and 52.11).

Mouth Adequate light source and two spatulas to examine the mouth Examine Lips Teeth, gums, gingival sulci Buccal mucosa, opening of parotid ducts Floor of mouth and opening of submandibular salivary ducts Hard and soft palate Retromolar trigone region Anterior and posterior faucial pillars, tonsils Posterior pharyngeal wall Tongue (observe full movements) Palpate Salivary glands/ducts Any mass lesions or ulcers in the mouth Larynx, oropharynx and hypopharynx Indirect laryngoscopy Mirror and headlight Flexible /f_i breoptic pharyngolaryngoscopy Nasopharynx Rigid Hopkins’ rod endoscopy Flexible /f_i breoptic nasendoscopy Neck Inspection Tongue protrusion Observe swallowing Palpation If a mass is palpable, evaluate for size, site, shape, consistency, super /f_i cial and deep /f_i xation, /f_l uctuation, transillumination, auscultation

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Introduction

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LARYNGEAL DISEASE CAUSING

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LUMP IN THE NECK

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Laryngeal mask airway

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The laryngeal mask airway (LMA) is a wide-bore airway with an inflatable cu ff at the distal end, which forms a seal in the pharynx around the laryngeal inlet. Provided the laryngotra cheal airway is clear, the LMA provides a clear and secure airway . The technique can easily be learnt by non-anaesthetists and secures an airway in most cases. It comes in a range of sizes covering infants to large adults. It is particular ly useful in cases of di ffi cult intubation where mouth opening is unimpeded ® (Figure 52.47). A newer variation of this is the i-gel which replaces the inflatable cu ff with a rim that conforms to the anatomical shape around the laryngeal inlet. Laryngeal mask airway

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Laryngeal papillomata

Laryngeal papillomata

These are rare benign tumours occurring mainly in children but can also present in adults. They are most commonly found on the vocal folds but may spread throughout the larynx and tracheobronchial airway (although this is less likely in adults) (Figure 52.54). They are caused by papillomaviruses (most frequently HPV 6 and 11) and need repeated removal usually by laser microsurgery or microdebrider to maintain a reasonable voice and airway . These patients are best managed in specialist centres, with the appropriate expertise. The evidence to date is mixed with regard to antiviral use, and existing data are insu ffi cient to support the regular use of antiviral agents such as cidofovir in the management of laryngeal papillomatosis. Vaccination against papilloma has shown some therapeutic benefit in reducing the recurrence of the disease. There is a greater appreciation of the role that gastro-oesophageal reflux may play in this setting and many centres opt to place patients on proton pump inhibitors or H blockers. 2 Laryngeal papillomata

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Laryngotracheobronchitis (croup)

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Croup is usually of slower onset than acute epiglottitis and occurs most commonly in children under 2 years of age. It is usually viral in origin and the cases often occur in clusters. The children have biphasic stridor and are often hoarse with a typical barking cough. Airway intervention is required less often, but admission to hospital with oxygenation and humidi fication, coupled with antibiotics, may be necessary if there are signs of secondary infection. Laryngotracheobronchitis (croup)

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Larynx

Larynx

It is important to appreciate that the main function of the larynx is not the production of voice but the protection of the tracheobronchial airway and lungs. In order to achieve this, the larynx, together with the base of the tongue, forms the protec tive sphincter that closes o ff the airway during swallowing. It is only an evolutionary by-product that, in humans and some other mammals, the larynx is responsible for the production of sound. The larynx comprises a cartilaginous framework (tha ossify in later life), which consists of the hyoid bone above, the thyroid and cricoid cartilages and the intricate arytenoid cartilages posteriorly . The cricoid cartilage is the only complete ring in the entire airwa y and bounds the subglottis, which is the narrowest point of the airway in children. This is the most common site for damage from an endotrac heal tube used for intensive care unit ventilation in seriously ill patients. A purely anatomical description of the larynx divides it into the supraglottis, glottis and subglottis (Figure 52.6). The true - - t may

Nasal cavity Hard palate Nasopharynx Soft palate Oropharynx Tongue Epiglottis Laryngopharynx Vocal cords Oesophagus Trachea Epiglottis Hyoid Thyrohyoid ligament Thyroid Arytenoid cartilage cartilage Cricothyroid Cricoid ligament cartilage Cricoid cartilage Trachea Epiglottis Hyoid Supraglottis S upr Pre-epiglottic space Ventricular fold Glottis (false cor d) Laryngeal ventricle Subglottis Vocal fold (true cord) Cricothyr oid space Tracheal cartilage Figure 52.6 Anatomy of the larynx.

vocal folds (often incorrectly called the vocal cords) are nor mally white, in contrast to the pink mucosa of the rest of the larynx and airway . The true vocal folds meet anteriorly at the midlevel of the thyroid cartilage, whereas posteriorly the separate and attached to an arytenoid cartilage. This arrange ment produces the ‘V’ shape of the glottis (Figure 52.7

Posterior pharyngeal wall Trachea Arytenoid cartilage Aryepiglottic fold Vocal fold Epiglottis Base of tongue (b) Figure 52.7 (a) Flexible nasendoscopy view of the larynx with the vocal folds abducted. (b) Flexible nasendoscopy view of the larynx with the vocal folds adducted.

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Learning objectives

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To understand: The relevant anatomy, physiology, disease processes and • investigations of the pharynx, the larynx and the neck The diagnosis and emergency treatment of airway • obstruction
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Malignant

Malignant

The most important epithelial tumour is squamous cell carci noma, which constitutes approximately 90% of all epithelial tumours in the upper aerodigestive tract (Figures 52.35 and 52.36). In the oropharynx, the proportion is less (70%) because of the higher incidence of lymphoma (25%) and ary gland tumours (5%). Because of the rich lymphatic saliv drainage of the oropharynx, cervical node metastases are common. They may be the only presenting feature with a primary pharyngeal tumour often being unsuspected and missed in the tonsil or tongue base. Aetiology While it has been long established that oropharyngeal squamous cell carcinoma (OPSCC) is strongly associated with cigarette smoking and consumption of alcohol, over recent decades there has been a near epidemic increase in HPV-associated OPSCC (HPV+OPSCC) in the resource-rich world, with prevalences of up to 70% being commonly reported in the USA, UK and northern Europe. That HPV+OPSCC constitutes a separate disease entity is undoubted, as these patients are typically younger with less or - no history of alcohol and tobacco use. The presenting features of HPV+OPSCC include multiple large cystic cervical lymph nodes with a small primary; these are usually associated with better outcomes after treatment. Treatment Treatment varies with facilities around the world, but early- stage tumours may be cured by transoral laser surgery , transoral robotic surgery or radiotherapy . Intermediate- or late-stage disease is usually managed with concurrent chemo - radiotherapy or based on institutional choices, with open surgery and reconstruction using myocutaneous pedicles or free flaps. Recurrent disease following radiotherapy with/ without chemotherapy is a surgical challenge; smaller tumours can be treated by transoral robotic surgery (Figure 52.37), but larger recurrences require open surgery and reconstruction. Neck dissection is required in most cases where surgery is the

(b) Figure 52.37 (a) Recurrent cancer of the soft palate and tonsil set up for transoral robotic resection. (b) Completed resection of the cancer. Note prevertebral

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geal fat.

who have only partially responded following chemoradio therapy . Postoperative dysphagia with aspiration as a result of interference in the complex neuromuscular control of the second phase of swallowing is a particular problem in these patients. The advent of HPV+OPSCC has created a clinical need to define novel de-intensified treatments that maintain current advantageous survival rates while reducing the late morbidity of treatment. Management of such tumours should be multidisciplinary and is best carried out at tertiary centres undertaking this work on a regular basis. Lymphoma of the head and neck Lymphomas of the head and neck may arise in nodal or extranodal sites and both Hodgkin's disease and non-Hodgkin's lymphoma commonly present as lymph node enlargement in the neck. Hodgkin's disease is rare in the oropharynx, but non-Hodgkin's lymphoma accounts for 15–20% of tumours at this site in some countries. Most are of the B-cell type and have features in common with other MALT tumours. Further evaluation with CT scanning of the thorax and abdomen and bone marrow evaluation are essential. Core biopsy , or, often, excision biopsy to improve tissue yield, is frequently required to establish a firm diagnosis and aid in the classification of lymphomas. Radiotherapy is the treatment of choice for localised non-Hodgkin's lymphoma; for widespread non-Hodgkin's lymphoma, systemic treatment is needed. Malignant

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NASOPHARYNX Enlarged adenoid

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The most common cause of an enlarged adenoid (there is only one nasopharyngeal adenoid, despite the common use of the term ‘adenoids’) is physiological hypertrophy in childhood. The size of the adenoid alone is not an indication for removal. Of more importance is the consequence of hypertrophy (e.g. nasal obstruction). Adenoid hypertrophy (Figure 52.16 is often associated with hypertrophy of the other lymphoid tissues of Waldeyer’s ring. Of particular note, if excessive adenoidal hypertrophy causes blockage of the nasopharynx in association with tonsil hypertrophy , the upper airway may become compromised during sleep causing, obstructive sleep apnoea (OSA).

Figure 52.16 Adenoid hypertrophy.

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Figure 52.16 Adenoid hypertrophy.

Neck

Neck

- The neck is divided into anterior and posterior triangles by). the sternocleidomastoid muscle. The anterior triangle extends from the inferior border of the mandible to the sternum below and is bounded by the midline and the posterior border of the sternocleidomastoid muscle. The posterior triangle extends backwards to the anterior border of the trapezius muscle and inferiorly to the clavicle. The upper part of the anterior trian - gle, above the hyoid bone, is commonly subdivided into the submandibular triangle above the digastric muscle bellies, and the submental triangle anteriorly , between the anterior digas - tric bellies of each side. The lympha tic drainage of the head and neck is of considerable clinical importance (Figure 52.8). The most important chain of nodes are the jugular nodes, which run adjacent to the internal jugular vein. The other main groups are the submental, submandibular, pre- and postauricular, occipital and posterior triangle nodes. A system of levels is used to describe the location of these neck nodes (Figure 52.9). Of particular note are the jugular nodal levels, which include levels II, III and IV; these relate to the upper, middle and inferior third of the carotid sheath, respectively . The level II nodes, which contain the large jugu lodigastric node, drain the naso- and oropharynx, including the tonsils, posterolateral aspects of the oral cavity and the Level I Level VI the most common sites of enlargement and ma y be palpated along the anterior border of the sternocleidomastoid muscle. Metastatic spread of squamous cell carcinoma (80% of head and neck cancers) most commonly occurs from tumours arising in the upper aer odigestive tract mucosa, which com - prises the following sites: oral cavity , nasopharynx, orophar - ynx, larynx and hypopharynx. When an enlarged neck node is detected and malignant disease is suspected, these sites must be carefully examined.

nodes Jugulodigastric nodes Submental nodes Upper deep cervical nodes Submandibular Jugulo-omohyoid nodes node Supraclavicular nodes Figure 52.8 Distribution of cervical lymph nodes. Figure 52.9 The level system for describing the location of lymph nodes in the neck. Level I, submental and submandibular group; level II, upper jugular group; level III, middle jugular group; level IV, lower jugular group; level V, posterior triangle group; level VI, anterior compartment group; level VII, superior mediastinal nodes. (Reproduced with permission from Watkinson JC, Gilbert RW. surgery and oncology , 5th edn. Boca Raton, FL: Hodder Arnold/CRC Press, 2012.)

Neck

The patient should be examined in the sitting position with the whole neck exposed so that both clavicles are clearly seen. The neck is inspected from the front and the patient asked to swallow , preferably with the aid of a sip of water. Movements of the larynx and any swellings in the neck are noted. The patient should be asked to protrude the tongue if there is a midline neck swelling, as a thyroglossal duct cyst will move upwards with the tongue protrusion. The neck is then examined

from behind, one side at a time, with the chin flexed slightly downwards and the neck tilted to the same side being palpated to remove any undue tension in the strap muscles, platysma and sternocleidomastoids. On examining for a lump in the neck, it is often helpful to ask the patient to point to the lump first. Ask if the lump is tender. All five palpable neck node levels (I–V) should be examined systematically . If malignancy is suspected (hard, irregular or fixed to ov erlying skin or to deep structures), inspection of the upper aerodigestive tract mucosa, as described above, is mandatory . Neck

- The neck is divided into anterior and posterior triangles by). the sternocleidomastoid muscle. The anterior triangle extends from the inferior border of the mandible to the sternum below and is bounded by the midline and the posterior border of the sternocleidomastoid muscle. The posterior triangle extends backwards to the anterior border of the trapezius muscle and inferiorly to the clavicle. The upper part of the anterior trian - gle, above the hyoid bone, is commonly subdivided into the submandibular triangle above the digastric muscle bellies, and the submental triangle anteriorly , between the anterior digas - tric bellies of each side. The lympha tic drainage of the head and neck is of considerable clinical importance (Figure 52.8). The most important chain of nodes are the jugular nodes, which run adjacent to the internal jugular vein. The other main groups are the submental, submandibular, pre- and postauricular, occipital and posterior triangle nodes. A system of levels is used to describe the location of these neck nodes (Figure 52.9). Of particular note are the jugular nodal levels, which include levels II, III and IV; these relate to the upper, middle and inferior third of the carotid sheath, respectively . The level II nodes, which contain the large jugu lodigastric node, drain the naso- and oropharynx, including the tonsils, posterolateral aspects of the oral cavity and the Level I Level VI the most common sites of enlargement and ma y be palpated along the anterior border of the sternocleidomastoid muscle. Metastatic spread of squamous cell carcinoma (80% of head and neck cancers) most commonly occurs from tumours arising in the upper aer odigestive tract mucosa, which com - prises the following sites: oral cavity , nasopharynx, orophar - ynx, larynx and hypopharynx. When an enlarged neck node is detected and malignant disease is suspected, these sites must be carefully examined.

nodes Jugulodigastric nodes Submental nodes Upper deep cervical nodes Submandibular Jugulo-omohyoid nodes node Supraclavicular nodes Figure 52.8 Distribution of cervical lymph nodes. Figure 52.9 The level system for describing the location of lymph nodes in the neck. Level I, submental and submandibular group; level II, upper jugular group; level III, middle jugular group; level IV, lower jugular group; level V, posterior triangle group; level VI, anterior compartment group; level VII, superior mediastinal nodes. (Reproduced with permission from Watkinson JC, Gilbert RW. surgery and oncology , 5th edn. Boca Raton, FL: Hodder Arnold/CRC Press, 2012.)

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Nerve supply

Nerve supply

The sensory nerve supply to the larynx above the true vocal folds is from the internal branch of the superior laryngeal nerve and, below , it is from the recurrent laryngeal nerve. Both these nerves are branches of the vagus nerve (X). The motor nerve supply to the larynx is from the recurrent laryngeal nerve, which supplies all intrinsic muscles except the cricothyroid, which is supplied by the external branch of the superior laryngeal nerve. Only one of these intrinsic muscles, the posterior cricoarytenoid, abducts the vocal folds during respiration. All other intrinsic or vagus nerve above the recurrent laryngeal nerve branch will cause paralysis of the vocal fold on the side of the damage. er studies have described the ‘human Additionally , cada v communicating nerve’, which is an anastomosis between the external branch of the superior laryngeal nerve and the recurrent laryngeal nerve, seen in 70% of human larynges. This nerve provides the sensory supply to the subglottis and motor innervation to the thyroarytenoid muscle. Nerve supply

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Neurovascular injury

Neurovascular injury

Penetrating wounds of the neck may involve the common - carotid or the external or internal carotid arteries. Major haemorrhagic shock may occur. V enous air embolism may occur because of damage to one of the major veins, most commonly the internal jugular. Compression, resuscitation and exploration under general anaesthetic, with control of vessels above and below the injury and primary repair, should be undertaken. All cervical nerves are vulnerable to injury , particularly the vagus and recurrent laryngeal nerves and cervical sympathetic chain. Neurovascular injury

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OROPHARYNX Acute tonsillitis

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This common condition is characterised by a sore throat, fever, general malaise, dysphagia, enlarged upper cervical nodes and sometimes referred otalgia. Approximately half the cases are bacterial, the most common cause being a pyogenic group A Streptococcus . The remainder are viral and a wide variety of viruses have been implicated, in particular infectious mononu - cleosis (glandular fever), which may be mistaken for bacterial tonsillitis. On examination, the tonsils are swollen and erythema - tous, and yellow or white pustules may be seen on the palatine tonsils, hence the name ‘follicular tonsillitis’ (Figure 52.24). A throat swab should be taken at the time of examination as well as blood for EBV testing to confirm or refute the diagnosis of ver. glandular fe Treatment Paracetamol and/or other analgesia may be administered to relieve pain and saline gargles are soothing. The condition is frequently sensitive to benzyl- or phenoxymethylpenicillin (penicillin V) and these are given until antibiotic sensitivities are established. Ampicillin is avoided as it may precipitate a rash in patients with infectious mononucleosis. Most cases resolve in a few days. OROPHARYNX Acute tonsillitis

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OTHER EMERGENCY AIRWAY PROCEDURES

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Obstructive sleep apnoea

Obstructive sleep apnoea

This condition is becoming increasingly diagnosed in children and is important because it can cause sleep deprivation and secondary cardiac complications. It has been implicated in some cases of sudden infant death syndrome. The most common symptom is snoring, which is typically irregular, with the child ceasing respiration (apnoea) and then restarting with a loud inspiratory snort. The child is often restless and may take up strange sleep positions as he or she tries to improve the pharyngeal airway . Surgical removal of the tonsils and adenoid is curative, but it is important to avoid sedative premedications and opiate analgesics postoperatively because they may further depress the child’s respiratory drive. OSA may also occur in adults, where the obstruction may result from nasal deformity , a hypertrophic soft palate associated with an altered nasopharyngeal isthmus, obesity and general narrowing of the phar yngeal airway , or supraglottic laryngeal pathology . The initial investigation may include a sleep study ,) during which measurements of the patient’s sleep pattern and arterial oxygenation are undertaken. Continuous positive air - way pressure devices may ameliorate OSA by splinting the obstruction open. Surgery may also be indicated, depending on the level(s) of the obstruction. Hypertrophy of adenoid tissue most commonly occurs between the ages of 4 and 10, but the adenoid tissue usually ophy during puberty , although undergoes spontaneous atr some remnants may persist into adult life (Figure 52.17). The relationship of adenoid enlargement to recurrent secretory otitis media or recurrent acute otitis media is not entirely clear.

Figure 52.17 Plain lateral radiograph showing a large pad of adenoid tissue (arrow) in the postnasal space.

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Other causes of acute pharyngolaryngeal oedema

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Angioneurotic oedema, radiotherapy and laryngeal trauma associated with road tra ffi c accidents, corrosives, scalds and smoke ingestion may all cause significant pharyngolaryn - geal oedema, in addition to the acute infective conditions along with dysphagia prior to the increase in dyspnoea. If flex ible laryngoscopic examination is possible, marked oedema of the supraglottis and pharynx can be seen. Humidified oxygen, adrenaline (epinephrine) nebulisers, systemic antihistamines and steroids may be valuable . Opioids should not be given as they may cause respiratory depression and respiratory arrest. If the dyspnoea progresses, intubation or tracheostomy will be necessary .
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Other imaging

Other imaging

Magnetic resonance imaging (MRI) gives better soft-tissue definition and is preferred for primary tumour staging except for paranasal sinus cancers. Drawbacks of this approach include a reduction in image quality as a result of movement artefact, poorer definition of bony and cartilaginous structures and upstaging of tumours as a result of oversensitivity (Figure 52.14). Ultrasound scanning can be useful in di ff erentiating solid lesions (e.g. malignant lymph nodes) from cystic lesions such as a branchial cyst and is particularly helpful when fine-needle aspiration is needed to establish the diagnosis; this modality is also invaluable for salivary gland pathology . If a head and neck malignancy is suspected, then CT imag - ing of the thorax should also be performed to detect distant

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metastases and synchronous primary bronchogenic tumours (approximately 5%), as the presence of these diagnoses will change treatment options. Positron emission tomography (PET)-CT scans are per formed during a single examination, in which the cross- sectional anatomical detail of a CT is fused with the metabolic information available from using a radiotracer. 18-Fluorodeoxyglucose (FDG) is the most commonly used radiotracer , with molecules similar to glucose; it accumulates in areas of high metabolic activity , which may represent tumour or inflammation. PET-CT is particularly used in patients being investigated for carcinoma of unknown primary to help identify the primary site of tumour, to look for distant metastases and to assess response to cancer treatment.

Figure 52.14 An axial magnetic resonance imaging scan at the same level as Figure 52.13 . Figure 52.15 A rigid Hopkins’ rod or endoscope.

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PRIMARY TUMOURS OF THE NECK Neurogenic tumours

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Paraganglioma (carotid body tumour) This is a rare tumour that has a higher incidence in areas where people live at high altitudes because of chronic hypoxia leading to carotid body hyperplasia. The tumours most commonly present in the fifth decade. Approximately 10% of patients have a family history , with familial cases caused by mutations in the genes for succinate dehydrogenase (SDH) enzyme. There is an association with phaeochromocytoma in familial cases, and thus appropriate tests should be undertaken to rule out synchronous catecholamine-secreting tumours during the Charles Mantoux , 1877–1947, physician, Le Cannet, Alpes Maritimes, France, described the intradermal tuberculin skin test in 1908. Albert Leon Charles Calmette , 1863–1933, and Jean-Marie Camille Guérin the bacille Calmette–Guérin in 1908. ® -TB - - - work-up. The tumours arise from the chemoreceptor cells on the medial side of the carotid bulb and, at this point, the tumour is adherent to the carotid wall. These tumours are usually benign with only a small number of cases producing proven metastases (Figures 52.67 and 52.68). Clinical features There is often a long history of a slowly enlarging, painless lump at the carotid bifurcation. About one-third of patients present with a pharyngeal mass that pushes the tonsil medially and anteriorly . The mass is firm, rubbery , pulsatile, mobile from side to side but not up and down and can sometimes be emptied by firm pressure, after which it slowly refills in a pulsatile manner. A bruit may also be present. Swellings in the parapharyngeal space, which often displace the tonsil medially , should not be biopsied from within the mouth. Investigations When a paraganglioma is suspected, a carotid angiogram can be carried out to demonstrate the carotid bifurcation, which is usually splayed, and a blush, which outlines the tumour vessels. MRI scanning also provides excellent detail in most cases. This tumour must not be biopsied and fine-needle aspiration is also contraindicated. , 1872–1961, microbiologists at the Institute Pasteur, Lille, France, introduced

Ganglion nodosum Glomus jugulare Internal Glossopharyngeal jugular nerve vein Carotid bodies Vagus nerve Aorticopulmonary bodies Pulmonary artery Figure 52.67 Sites for chemodectomas.

Treatment The Shamblin classification is used to determine the surgical resectability of these tumours. Type I tumours are localised and do not involve more than 180° of the carotid vessels; type II tumours surround the vessel by over 180°; and type III tumours completely encase the vessels and are more challeng ing to resect with higher complications and a possible need for vessel reconstruction. Because these tumours rarely metastasise and their overall rate of growth is slow , the need for surgical r emoval must be considered carefully as complications of surgery are poten tially serious. The operation is best avoided in elderly patients. Radiotherapy will not cure the tumour but can prevent further growth. In some cases it may be possible to dissect the tumour away from the carotid bifurcation b ut, at times, when the tumour is large, it may not be separable

from the vessels and resection will be necessary , such that all appropriate facilities should be available to establish a bypass while a vein autograft is inserted to restore arterial continuity in the carotid system.

Figure 52.68 Axial view computed tomography angiogram (a) and magnetic resonance imaging

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Figure 52.68 Axial view computed tomography angiogram (a) and magnetic resonance imaging

Parapharyngeal abscess

Parapharyngeal abscess

Parapharyngeal abscess may be confused with a peritonsillar abscess, but the maximal swelling is behind the posterior faucial pillar and there may be little or no oedema of the soft palate. The patient is usually a young child and there may be a severe general malaise and obvious neck swelling. A large parapharyngeal abscess may compromise both the airway and swallowing. MRI or CT scanning of the head and neck is often an invaluable aid to diagnosis and management as it allows assessment of the extent of the abscess and facilitates planning of the optimal surgical approach. In early cases, admission to hospital and the institution of fluid replacements coupled with intravenous antibiotics may produce resolution. However, when a collection is evident, transcervical drainage is required under general anaesthesia, which usually requires the expertise of a senior anaesthetist. In instances where an obvious abscess points into the oropharynx, drainage may be carried out with a blunt instrument (Figure 52.29). This is the result of suppuration of the retropharyngeal lymph nodes and, again, is most commonly seen in children, with most cases occurring under the age of 1 year. It is associated with infection of the upper aerodigestive tract and is frequently accompanied by severe general malaise, neck rigidity , dyspha - gia, drooling, a croupy cough, an altered cry and marked dyspnoea. Dyspnoea may be the prominent symptom and may also be accompanied by febrile convulsions and vomiting. These children should always be carefully examined by the most senior clinicians av ailable. Inspection of the posterior wall of the phar ynx may show gross swelling and an abscess pointing beneath the thinned mucosa. In countries where diphtheria still occurs, an acute retro- pharyngeal abscess may be confused with this, but the presence of the greyish-gr een membrane aids di ff erentiation. Occasion - - ally , a foreign body , most commonly a fish bone that has per - forated the posterior pharyngeal mucosa, will give rise to a retropharyngeal abscess in older children and young adults. Intravenous antibiotics are commenced immediately but sur - - gical drainage of the abscess is often necessary . It requires an e xperienced anaesthetist because, on induction, care must be taken to avoid rupturing the abscess. The airway is protected by placing the child in a head-down position while a pair of dressing force ps, guided by the finger, may be thrust into an obvious abscess in the posterior wall and the contents evac - uated. On other occasions, an approach anterior and medial to the carotid sheath via a cervical incision may be preferable. Parapharyngeal abscess

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Percutaneous tracheostomy

Percutaneous tracheostomy

As an alternative to open tracheostomy , a percutaneous trache ostomy is commonly performed in the critical care setting in an intubated patient. A transverse skin incision is made at the level of the first and second tracheal rings; blunt dissection of the midline is then performed. A 22-gauge needle is inserted between the second and third tracheal rings. When air is aspi rated into the syringe, the guidewire is introduced. Sequentially larger dilators are then inserted over the guidewire to create a suitable-sized tracheostome. Finally , the tracheotomy tube is introduced along the guidewir e and dilator. The guidewire and dilator are removed, the cu ff of the tracheotomy tube is inflated and the breathing circuit is connected. The endotracheal tube can then be removed. Patients must have appropriate anatomy and no limitation of neck movement. If any doubt arises as to the suitability of a patient for percutaneous tracheostomy , a surgical approach should be adopted. P ercutaneous tracheostomy is rarely per formed in children.

Figure 52.44 Bjork /f_l ap. Figure 52.45 Fenestration in a Bjork /f_l ap.

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Peripheral nerve tumours

Peripheral nerve tumours

Schwannomas are solitary and encapsulated tumours attached to or surrounded by nerve, although paralysis of the associated nerve is unusual. The vagus nerve is the most common site. Neurofibromas also arise from the Schwann cell and may be - part of von Recklinghausen’s syndrome of multiple neuro - fibromatosis. Multiple neurofibromatosis is an autosomal dominant, hereditary disease; the neurofibromas may be present at birth and are often multiple. Diagnosis requires CT or MRI scanning to di ff erentiate them from other parapharyngeal tumours b ut, on occasions, the diagnosis must wait until excision (Figure 52.6 9). Peripheral nerve tumours

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Pharyngeal pouch

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A pharyngeal pouch is a protrusion of mucosa though Killian’s dehiscence, a weak area of the posterior pharyngeal wall between the oblique fibres of the thyropharyngeus and the transverse fibres of cricopharyngeus at the lower end of the inferior constrictor muscle (Figure 52.32). These fibres, along with the circular fibres of the upper oesophagus, form the physiological upper oesophageal sphincter mechanism. Videofluoroscopic and manometric studies have been unable to elucidate the cause of the pouch. Many patients with pharyngeal pouches have been demonstrated to have normal relaxation of the upper oesophageal sphincter mechanism in relation to swallowing, but others have been shown to have incomplete pharyngeal relaxation, early cricopharyngeal contraction and abnormalities of the pharyngeal contraction wave. When enlarged, the pouch almost invariably deviates to the left side of the neck. Clinical features Patients with this condition are commonly more than 60 years of age and it is more common in men than in women. As the diverticulum enlarges, patients may experience regurgitation of undigested food, sometimes hours after a meal, particularly if they are bending down or turning over in bed at night. They sometimes wake at night with a feeling of tightness in the throat and a fit of coughing. Occasionally , they may pres ent with recurrent, unexplained chest infections as a result of aspiration of the contents of the pouch. As the pouch increases in size, patients may notice gurgling noises from the neck on swallowing and the pouch may become large enough to form a visible swelling in the neck. Dysphagia may also be a presenting symptom. Radiological examination A thin emulsion of barium is given to the patient as a barium swallow (Figure 52.33) or ideally as part of a videofluoroscopic swallowing study . Care should be exercised in patients who cough on swallowing, indicating they may have aspiration. A small volume of barium is su ffi cient to outline the pharynx, pouch and upper oesophagus. The videofluoroscopic study Gustav Killian , 1860–1921, Professor of Laryngology at Freiburg, and later at Berlin, Germany . gives additional information about the pharyngeal contraction waves and the performance of the upper oesophageal sphincter. Treatment Surgery is indicated when the pouch is associated with - progressive symptoms and particularly when a prominent crico pharyngeal bar of muscle is associated with abnormality of the upper oesophageal sphincter mechanism and causes considerable dysphagia. In elderly patients, a decision to oper - ate may be influenced by their general condition. However, surgical intervention is mandated in all but the most poorly patients as, in most cases, it is the pouch that is contributing significantly to the underlying debilitation. Of particular importance is the risk of recurr ent pneumonia from aspiration and overspill of pouch contents, as well as increasing dysphagia as the pouch opening becomes larger than the oesophageal opening and the enlarged pouch exerts extramural pressure on the oesophagus. Accordingly , preoperative chest physiotherapy and attention to the respiratory , cardiovascular and nutritional aspects of the patient are important.

Figure 52.32 A pharyngeal pouch. Figure 52.33 Pharyngeal pouch on barium swallow.

The surgical technique typically used is endoscopic sta pling of the diverticular wall. A double-bladed rigid endoscope (diverticuloscope) is passed, with one blade in the diverticulum and one blade positioned in the oesophagus (Figure 52.34 Opening of the bivalve scope reveals the pathognomonic ‘bar’ formed by the cricophar yngeus muscle and overlying mucosa, which forms the boundary between the posterior wall of the oesophagus and the anterior wall of the pouch. At this stage the pouch should be emptied of food content and the mucosa should be inspected for the rare occurrence of carcinoma in the pouch. An endoscopic linear stapler is then introduced to sit astride the ‘bar’. One jaw of the stapler is placed in the oesophagus, the other in the pouch. The stapler is fired, divid ing the wall separating the two. The process should be repeated until the bottom of the pouch is reached. This has the e ff ect of opening the pouch, incor porating it as part of the oesophageal wall and dividing the cricopharyngeus muscle. If the patient is symptom free after the procedure, they may start graded oral intake and be discharged early . Division of the ‘bar’ using a carbon dioxide laser, as an alternative to stapling, is gaining popularity in some centres. Flexible endoscopic division of the cricopharyngeal bar is a new technique popularised over the last decade, with equally good results, and can be used in patients who have poor access with rigid endoscopes. In instances where endoscopic access is di ffi cult or for very large pouches, an open excision of the pouch becomes neces sary . In the classic external operation, the opening to the pouch is first identified using a pharyngoscope and a nasogastric tube placed into the oesophageal lumen f or postoperative nutrition. This initial endoscopy is often di ffi cult because the nor oesophageal opening is small compared with the lumen of the pouch, but it may be better visualised using a Dohlman’s rigid endoscope. The pouch may be packed with ribbon gauze to further aid identification of its neck. Gösta Dohlman , 1890–1983, Swedish physician and professor. Henry Stanley Plummer , 1874–1937, physician, The Mayo Clinic, Rochester, MN, USA, described this syndrome in 1912. Porter Paisley Vinson , 1890–1959, physician, The Mayo Clinic, Rochester, MN, who later practised in Richmond, V A, USA. Donald Rose Paterson , 1863–1939, surgeon, The Ear, Nose and Throat Department, The Royal Infirmary , Cardi ff , UK. Adam Brown Kelly , 1865–1941, surgeon, The Ear, Nose and Throat Department, The Royal Victoria Infirmary , Glasgow , UK. Vinson, Paterson and Kelly all described this syndrome independently in 1919. sternocleidomastoid muscle, or a transverse crease incision, is used and the muscle and carotid sheath are retracted laterally and the trachea and larynx medially . The pouc h is found medi - ally behind the lower pharynx and is carefully isolated and dissected back to its origin at Killian’s dehiscence. It is then excised and the pharynx closed in two layers or , if it is small, the pouch may be invaginated into the pharyngeal lumen before closing the muscle layers. Care must be taken to protect the recurrent laryngeal nerve during the procedure. In all cases, a myotomy dividing the fibres of the cricopharyngeus muscle and the upper oesophageal circular muscle fibres must be per - formed. The wound is usually closed with drainage and the patient fed through a nasogastric tube for 3–7 days. A water- based swallow test is performed on day 5 to ascertain that there is no leak prior to commencing oral feeds. The av erage operating time with an endoscopic proce - dure is 20–30 minutes compared with 60–90 minutes with an external procedure. Inpatient stay is also decreased for pa tients - undergoing an endoscopic procedure. The endoscopic tech - nique is associated with a high symptomatic success rate and a low morbidity , which is particularly important in the elderly .). Complications The classic operation has been associated with wound infec - tion, mediastinitis, pharyngeal fistula formation, recurrent laryngeal nerve palsy and stenosis of the upper oesophagus. Endoscopic division is associated with the same risks but at much lower rates. The recurrence rates between the two proce - dures appears to be equal; longer term follow-up will establish this. Endoscopic stapling will also allow for safe reoperation if -

necessary . It must be noted that contrast swallows will demon - strate the pouch in patients who have under gone stapling and are an inappropriate modality to evaluate recurrences.

Oesophagus Pouch Figure 52.34 Endoscopic view of a pharyngeal pouch.

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Phonation speech

Phonation/speech

The larynx functions by closing the vocal fold against the air being exhaled from the lungs, but the rise in subglottic pres - sure forces the vocal folds apart slightly for an instant of time, resulting in an accompanying sinusoidal wave-like vibration of the vocal fold epithelium. The human vocal folds have a specialised tissue morphology with r esultant biomechanical properties that allow phonation. The opening and closing occurs in rapid sequence to produce a vibrating column of air, which is the source of sound that can be articulated by the structure of the oral cavity to produce speech. Paralysis or disease of the vocal folds or closely associated laryngeal structures will give rise to disturbance of the sound, producing hoarseness. The functions of the larynx are given in Summary box 52.1 . Summary box 52.1 Functions of the larynx /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF - y are

Protection of the lower respiratory tract by: Closure of the laryngeal inlet Closure of the false cords Closure of the glottis Cessation of respiration Cough re /f_l ex Phonation Vocal folds produce sound by quasiperiodic vibration Respiration Control of pressure Fixation of chest Aids lifting, straining and climbing

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Quinsy

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This is an abscess in the peritonsillar region that causes severe pain and trismus (Figure 52.25). The trismus, which is caused by spasm induced in the pterygoid muscles, may make examination di ffi cult but may be overcome by instillation of local anaesthesia into the posterior nasal cavity (anaesthetising the sphenopalatine ganglion) and the oropharynx. Inspection reveals a di ff use swelling of the soft palate just superior or lateral to the involved tonsil, displacing the uvula medially . In more advanced cases, pus may be seen pointing underneath the thin mucosa. Treatment In the early stages, intravenous broad-spectrum antibiotics may produce resolution. However, if there is frank abscess formation, incision and drainage of the pus can be carried out under local anaesthesia. A small scalpel is best modified by winding a strip of adhesive tape around the blade so that only 1 /uni00A0 cm of the blade projects. In teenagers and young adults, the patient sits upright and an incision is made approximately midway between the base of the uvula and the third upper molar tooth (Figure 52.26). This may produce immediate release of pus, but, if not, a dressing forceps is pushed firmly through the incision and, on opening, pus may then be encoun tered. Needle aspiration of the pus, with or without ultrasound guidance, is an alternative treatment. In small children, general anaesthesia is required.

Incision Figure 52.26 Site of incision in a peritonsillar abscess.

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SUMMARY

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The anatomical and physiological performance of the pharyn - golarynx is involved in the important mechanisms of breath - ing, coughing, voice production and swallowing. A variety of congenital, traumatic, infectious and neoplastic conditions disturb these functions, giving rise to the common symptoms of pain, swelling, hoarseness, dyspnoea and dysphagia. Squamous cell carcinomas are the most common malig - nancies, accounting for appr oximately 80% of all head and around the world, but they are mainly caused by the prevent able aetiological agents of smoking and alcohol, although nasopharyngeal and oropharyngeal squamous cell carcinomas have additional genetic and environmental factors. All head and neck cancers have a high morbidity and mortality and require expert tr eatment. SUMMARY

The anatomical and physiological performance of the pharyn - golarynx is involved in the important mechanisms of breath - ing, coughing, voice production and swallowing. A variety of congenital, traumatic, infectious and neoplastic conditions disturb these functions, giving rise to the common symptoms of pain, swelling, hoarseness, dyspnoea and dysphagia. Squamous cell carcinomas are the most common malig - nancies, accounting for appr oximately 80% of all head and around the world, but they are mainly caused by the prevent able aetiological agents of smoking and alcohol, although nasopharyngeal and oropharyngeal squamous cell carcinomas have additional genetic and environmental factors. All head and neck cancers have a high morbidity and mortality and require expert tr eatment.

Secondary carcinoma

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Metastatic spread of squamous cell carcinoma to the cervical lymph nodes is a common occurrence from head and neck primary cancers; occasionally , this may be the sole presenting feature of the disease (Figure 52.70). The upper aerodiges - tive tract mucosa must be carefully examined for a primary site before considering surgery to the neck nodes. When a primary site is not seen on clinical examination, they are most often found in the orophar ynx. Appropriate radiological investigations (MRI, PET-CT) must be undertaken to define subclinical primaries, as management will be dictated by this. If radiological assessment shows no primaries, tonsillectomy and robot-assisted tongue base mucosectomy are performed as a diagnostic procedure because the oropharynx is the most common site for a clinically and radiologically unknown primary cancer. Management The management of malignant cervical lymph nodes depends on the overall treatment regime: /uni25CF if surgery is being used to treat the primary disease and the cervical nodes are palpable and <3 /uni00A0 cm, they may be excised with the primary lesion as part of a neck dissection; /uni25CF if radiotherapy or chemoradiotherapy is used initially with resolution of the primary tumour, but there is subsequent residual or recurrent nodal disease, then this situation will require cervical lymph node dissection. Type of neck dissection Classical radical neck dissection (Crile) The classic operation involves resection of the cervical lymph nodes (levels I–V) and those structures closely associated: the internal jugular vein, the accessory nerve, the submandibular gland and the sternocleidomastoid muscle. These structures are all removed en bloc and in continuity with the primary disease if possible. The main disability that follows the operation is weakness and drooping of the shoulder due to paralysis of the trapezius muscle as a consequence of excision of the accessory nerve. Bulky nodal disease may dictate the need for a radical neck dissection, but this operation is less commonly performed owing to a better understanding of the lymphatic drainage of George Washington Crile , 1864–1943, Professor of Surgery , The Western Reserve University , and one of the founders of the Cleveland Clinic, Cleveland, OH, USA. the primary sites and as most patients with advanced disease need adjuvant radiation. Modified radical neck dissection This term denotes a procedure in which one or more of the non-lymphatic structures are preserved (the accessory nerve, the sternocleidomastoid muscle or the internal jugular vein) with clearance of all nodal levels (I–V). Selective neck dissection In this type of dissection, one or more of the major lymph node groups is preserved along with the sternocleidomastoid muscle, accessory nerve and internal jugular vein. In these circumstances, the exact groups of nodes excised must be documented. It must be noted that, when neck dissections are performed for residual disease after (chemo)radiation therapy , the neck is often fibrotic and scarred and the opera tion may not fall into any of the above categories. For instance, lymph nodes in levels II and III may be removed, along with the sternomastoid mus - cle for access; thus, meticulous annotation of the procedure is more important than ascribing a name to the operation.

Figure 52.69 Magnetic resonance imaging scan demonstrating a large parapharyngeal tumour. The imaging characteristics of the tumour suggested a paraganglioma or a schwannoma. Resection con

/f_i rmed the latter. Figure 52.70 Axial computed tomography scan demonstrating a large cystic metastatic node from an unknown primary. Core biopsy con /f_i rmed a squamous cell cancer.

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Sideropenic dysphagia

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Prolonged iron deficiency anaemia may lead to dysphagia, particularly in middle-aged women. In addition, they may have koilonychia, cheilosis and angular stomatitis together with lassitude and poor exercise tolerance. The dysphagia is caused by a postcricoid or upper oesophageal web and these patients have a higher incidence of postcricoid malignancy . The syndrome is associated with the names of Plummer and - Vinson, Paterson and Brown Kelly . Sideropenic dysphagia

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Stridor in children

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Infants and children presenting with stridor need careful assessment with a full history and examination as appropriate. If, on presentation, a child is cyanosed and severely unwell, the airway must be secured as soon as possible, but a brief history with important pointers can often be obtained from the parents. History In infants in the first year of life, it is important to establish if the stridor is associated with particular activities such congenital laryngomalacia or subglottic stenosis. If the stridor is exacerbated by feeding, particularly in the first 4 weeks of life, this suggests a vascular ring compressing the oesophagus or tracheo-oesophageal fistula. If the cry is weak or abnormal, this suggests a vocal fold palsy . If the problem only occurs in association with an upper respiratory tract infection and, in particular, is biphasic, this suggests congenital subglottic steno - sis. In a young child, inspiratory stridor and drooling suggest acute epiglottitis, whereas biphasic stridor without drooling suggests laryngotracheobronchitis or croup. Examination It is important, when possible, to observe the child carefully at rest. Once a baby starts to cry , it may be impossible to study its resting respiratory pattern for some time. Ask the mother, not a nurse or a colleague, to move a baby or young child into di ff erent positions, such as face down and supine, and watch for changes in respiratory pattern and level of distress. Observe any drooling and, with neonates and infants, always try to watch the child being fed, listening to the trachea and chest with a stethoscope if possible. Always examine the whole child, looking for any evidence of congenital abnormalities before attempting any examination of the throat. - and Summary box 52.9 Acute paediatric stridor /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF If a child is stridulous and drooling, do not attempt to lay them down and do not attempt to look inside the mouth. These manoeuvres are potentially life-threatening as the child may aspirate a large quantity of thick saliva contained within the oral cavity . It is particularly important in acute e piglottitis as the aspiration of thick saliva may be associated with further laryngeal spasm and a respiratory arrest. Restlessness, increas - ing tachycardia and cyanosis are important signs of hypoxia. If the child is not distressed and drooling, and not markedly stridulous, they may be cooperative enough that it is possible to look inside the mouth and check the palate, tongue and

Congenital Laryngomalacia Laryngeal web Subglottic stenosis Acquired In /f_l ammatory Angioneurotic oedema Traumatic Impacted foreign body, laryngeal fracture Infective Epiglottitis, laryngotracheobronchitis Neurological Vocal fold palsy Neoplasia Benign laryngeal papillomatosis

infants, a transcutaneous oximeter is invaluable. A resuscitation trolley with the necessary equipment for emergency intubation or tracheostomy should be close at hand before commencing examination. Investigation Plain lateral radiographs of the neck and a chest radiograph can be obtained but only if the child’s condition permits. If a child is severely stridulous, they should not be sent to a radiography department without access to medical sta ff or resuscitation equipment. Examination under anaesthesia is essential in all children whose diagnosis remains in doubt. This

requires a high level of anaesthetic and surgical skill, with appropriate selection of rigid laryngoscopes, br onchoscopes and telescopes. Equipment for an urgent tracheostomy should also be readily available at all times. Stridor in children

Infants and children presenting with stridor need careful assessment with a full history and examination as appropriate. If, on presentation, a child is cyanosed and severely unwell, the airway must be secured as soon as possible, but a brief history with important pointers can often be obtained from the parents. History In infants in the first year of life, it is important to establish if the stridor is associated with particular activities such congenital laryngomalacia or subglottic stenosis. If the stridor is exacerbated by feeding, particularly in the first 4 weeks of life, this suggests a vascular ring compressing the oesophagus or tracheo-oesophageal fistula. If the cry is weak or abnormal, this suggests a vocal fold palsy . If the problem only occurs in association with an upper respiratory tract infection and, in particular, is biphasic, this suggests congenital subglottic steno - sis. In a young child, inspiratory stridor and drooling suggest acute epiglottitis, whereas biphasic stridor without drooling suggests laryngotracheobronchitis or croup. Examination It is important, when possible, to observe the child carefully at rest. Once a baby starts to cry , it may be impossible to study its resting respiratory pattern for some time. Ask the mother, not a nurse or a colleague, to move a baby or young child into di ff erent positions, such as face down and supine, and watch for changes in respiratory pattern and level of distress. Observe any drooling and, with neonates and infants, always try to watch the child being fed, listening to the trachea and chest with a stethoscope if possible. Always examine the whole child, looking for any evidence of congenital abnormalities before attempting any examination of the throat. - and Summary box 52.9 Acute paediatric stridor /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF If a child is stridulous and drooling, do not attempt to lay them down and do not attempt to look inside the mouth. These manoeuvres are potentially life-threatening as the child may aspirate a large quantity of thick saliva contained within the oral cavity . It is particularly important in acute e piglottitis as the aspiration of thick saliva may be associated with further laryngeal spasm and a respiratory arrest. Restlessness, increas - ing tachycardia and cyanosis are important signs of hypoxia. If the child is not distressed and drooling, and not markedly stridulous, they may be cooperative enough that it is possible to look inside the mouth and check the palate, tongue and

Congenital Laryngomalacia Laryngeal web Subglottic stenosis Acquired In /f_l ammatory Angioneurotic oedema Traumatic Impacted foreign body, laryngeal fracture Infective Epiglottitis, laryngotracheobronchitis Neurological Vocal fold palsy Neoplasia Benign laryngeal papillomatosis

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TRACHEOSTOMY AND OTHER EMERGENCY AIRWA Y MEASURES

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This procedure relieves airway obstruction or protects the airway by fashioning a direct entrance into the trachea through the skin of the neck. Tracheostomy may be carried out as an emergency for acute airway obstruction when the larynx cannot be intubated, but it is not always an easy procedure, particularly in an obese patient. An easier alternative for the inexperienced is insertion of a large intravenous cannula or a small tube into the cricothyroid membrane, which lies in the midline immediately below the thyroid cartilage. The time to do a tracheostomy is when you first think it may be necessary . If time allows, the following should be undertaken: /uni25CF inspection and palpation of the neck to assess the laryngo tracheal anatomy in the individual patient; /uni25CF indirect or direct laryngoscopy; /uni25CF assessment of pulmonary function by auscultation. Whenever possible, the procedure should be adequately explained to the patient beforehand, with particular emphasis on the inability to speak immediately following the operation. Ample reassurance is required that they will not have ‘lost’ their voice permanently . The indications for tracheostomy are shown in Summary box 52.10 . Within the theatre or intensive care setting, the ‘can’t intu bate, can’t oxygenate’ situation occurs after attempts to secure the airway by a facemask, a supraglottic airway device and an endotracheal tube have failed. Only a narrow window exists avoid profound hypoxia and its consequences and local proto cols should be agreed upon to manage these situations before hand using appropriate emergency front of neck access options (cricothyroidotomy or tracheostomy). TRACHEOSTOMY AND OTHER EMERGENCY AIRWA Y MEASURES

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TRAUMA TO THE NECK

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The management of penetrating neck trauma depends on the structures that have been injured. The neck is classified into three zones for this purpose (Table 52.3). (Note: this is di ff erent from the levels used to describe cervical lymphadenopathy .) The majority of injuries occur commonly in zone 2. Critical clinical assessment coupled with appropriate imaging such as a CT scan or CT angiogram is crucial in managing these patients. TRAUMA TO THE NECK

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Thoracic duct injury

Thoracic duct injury

Wounds to the thoracic duct are usually iatrogenic and usually left sided, occurring when lymph node level IV is dissected during a neck dissection. When damage to the duct is not leak from the wound in amounts up to 2 /uni00A0 L/day with profound e ff ects on nutrition. Should the damage be recognised during an operation, the proximal end of the duct must be ligated. Ligation of the duct is not harmful because there are a number of anastomotic chan nels betw een the lymphatic and venous systems in the lower neck. If undetected, chyle usually starts to discharge from the neck wound within 24 hours of the operation. Low-flow chyle leaks (less than 500 /uni00A0 mL/day) can be managed conserv atively with a low-fat diet and systemic octreotide. The patient’s fluid and electrolyte balance must be closely monitored. Total par enteral nutrition and surgical re-exploration may be warranted in high-output leaks. Thoracic duct injury

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Thyroglossal duct cysts Embryology

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The thyroid gland descends early in fetal life from the base of the tongue towards its position in the lower neck with the isthmus lying over the second and third tracheal rings. At the time of its descent, the hyoid bone has not been formed and the track of the descent of the thyroid gland is variable, passing in front, through or behind the eventual position of the hyoid body . Thyroglossal duct cysts represent a persistence of this track and may therefore be found anywhere in or adjacent to the midline from the tongue base to the thyroid isthmus. Rarely , what appears to be a thyroglossal cyst is an incompletely migrated thyroid gland that contains the only functioning thyroid tissue in the body . Ultrasound neck imaging is used to conï¬rm a cyst and the presence of a thyroid gland in the normal location. Thyroglossal duct cysts Embryology

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Tracheostomy tubes

Tracheostomy tubes

- Most modern tracheostomy tubes are made of plastic (Figure 52.46). Tubes of various sizes with varying curves, angles, cu ff s, inner tubes and speaking valves are available. After a newly fashioned tracheostomy is created, a cu ff ed tube is used initially to protect the airway from secretions or bleeding. - This may be changed after 3–4 days to a non-cu ff ed tube. The pressure within the tube cu ff should be carefully monitored and should be low enough so as not to occlude circulation in the mucosal capillaries, which promotes scar tissue formation and subglottic stenosis. When in position, the tube should be retained by double tapes threaded through the flanges and passed around the patient's neck. It is important that the patient's head is flexed when the tapes are tied, otherwise they may become slack when the patient is moved from the position of extension, thereby resulting in a possible displacement of the tube if the patient coughs. Alternatively , the flanges of the - plastic tube may be stitched directly to the underlying neck skin. A removable inner tube, which is easily cleaned, should always be used to prevent lumen occlusion by thickened, dried secretions from the trachea. All forms of tracheostomy and cricothyroidotomy bypass the upper airway and have the following advantages: /uni25CF the anatomical dead space is reduced by approximately 50%; /uni25CF the work of breathing is reduced; /uni25CF alveolar ventilation is increased; /uni25CF the level of sedation needed for patient comfort is decreased and, unlike endotracheal intubation, the patient may be able to talk and eat with a tube in place. However, there are several disadvantages: /uni25CF loss of heat and moisture exchange in the upper respira tory tract; /uni25CF desiccation of tracheal epithelium, loss of ciliated cells and metaplasia; /uni25CF the presence of a foreign body in the trachea stimulates production of mucus; where no cilia are present, the mu cociliary stream is therefore impeded; /uni25CF the increased mucus is more viscid and thick crusts may form and block the tube; /uni25CF although many patients with a tracheostomy can feed sat isfactorily , there is some splinting of the larynx, which may prevent normal swallowing and lead to aspiration; this aspiration may be silent. Postoperativ e treatment is designed to counteract these e ff ects and frequent suction and humidification are most important. A trolley must be placed by the bed containing a tracheal dilator, duplica te tubes and introducers, retractors and dressings. Oxygen is at hand and, in the initial period, a nurse must be in constant attendance. Humidification will render the secretions less viscid and a sucker with a catheter attached should be on hand to keep the tracheobronchial tree free from secretions. Tracheostomy: postoperative management /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Figure 52.46 Modern plastic tracheostomy tube with the introducer, low-pressure cuff and inner cannula. Suction – ef /f_i cient, sterile and as often as required Humidi /f_i cation (with or without oxygen) A warm, well-ventilated room Position of the tube and patient Spare tube, introducer,

tapes, tracheal dilator Change of tube, inner tube, possible speaking valve Physiotherapy Initiation of local decannulation protocols where indicated

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Transtracheal ventilation

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This technique is simple and e ff ective and allows ventilation for periods in excess of 1 hour, providing time to allow for more elective intubation. The cricothyroid membrane is located as discussed above, and a 14- or 16-gauge plastic sheathed intra vascular needle attached to a 10-mL syringe containing a few millilitres of lidocaine is introduced in the midline and directed downwards and backwards into the tracheal lumen. The needle is advanced steadily and negative pressure is placed on the syringe until bubbles of air are clearly seen (Figure 52.48 The tissues of the neck may be infiltrated with the anaesthetic if desired and the tracheal mucosa likewise partly anaesthetised by the introduction of 1–2 /uni00A0 mL of lidocaine after gaining the lumen. The needle is removed and the plastic sheath cannula left in the tracheal lumen; it must be carefully held and fixed in place by the operator so that it does not come out of the lumen into the soft tissues of the neck. It is attached by means of a Luer connection to the high-pressure oxygen supply . V entilation may be undertaken in a controlled manner with a jetting device, with the chest being observed for appropriate movements. If there is severe obstruction of the laryngopharynx by the foreign body or tumour, the exhaled outflow of gases can Hermann Adolph Wülfing-Lüer , 1836–1909, German instrument maker who was working in Paris, France, at the end of the nineteenth century . exhalation ports. This procedur e gains extremely rapid control of ventilation and requires a minimum of tec hnical expertise. Its only notable complication is surgical emphysema of the neck tissues if the cannula dislodges from the tracheal lumen. Transtracheal ventilation

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Treatment

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Treatment must include excision of the whole thyroglossal tract, which involves removal of the body of the hyoid bone and the suprahyoid tract through the tongue base to the vallecula at the site of the primitive foramen caecum, together with a core of tissue on either side. This operation is known as Sistrunkâ€™s operation and minimises recurrence, most notably from small side branches of the thyroglossal tract.

Figure 52.66 A patient with a thyroglossal /f_i stula from a cyst in the midline of the neck.

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Tuberculous adenitis

Tuberculous adenitis

This condition most commonly a ff ects children or young adults but can occur at any age. The deep upper cervical nodes are most commonly a ff ected, but there may be a widespread cervical lymphadenitis with matted nodes. In most cases, the tubercular bacilli gain entrance through the ipsilateral tonsil. - In approximately 80% of patients, the tuberculous process is limited to the clinically a ff ected group of lymph nodes, but a primary focus in the lungs must always be suspected. Rarely , the patient may develop a natural resistance to the infection and the nodes may be detected at a later date, as evi - denced by calcification on radiography . This can also be seen after appropriate general treatment of TB adenitis. If treat - ment is not instituted, the caseated node may liquefy and break down with the formation of a cold abscess in the neck. The pus is initially confined by the deep cervical fascia, but after weeks or months this may become eroded at one point and the pus flows through the small opening into the space beneath the superficial fascia. T he process has now reached the well-known stage of a ‘collar-stud’ abscess. The superficial abscess enlarges steadily and, unless suitably treated, a discharging sinus results. Fine-needle aspirate taken from neck nodes with a suspicion of TB should be tested for the presence of acid-fast bacilli. Systemic investigation should not be neglected, with a chest radiograph and tuberculin skin test (Mantoux) useful as first-line investigations. The drawback of the Mantoux test is the poor sensitivity in immunocompromised patients and low specificity in patients with prior bacille Calmette–Guérin (BCG) vaccination. The interferon- γ release assay (QuantiFERON Gold In-Tube; QFT-GIT; Cellestis, Carnegie, Australia) with ® T-SPOT . TB (Oxford Immunotec, Abingdon, UK), in con trast, is more specific than a Mantoux test as the results are not confounded by previous BCG vaccination. This blood test measures the cellular immune response to antigens derived from Mycobacterium tuberculosis . Although active or latent infec tion cannot be specifically di ff erentiated with this test, a pos itive test in a patient with negative clinical and radiological evidence of TB indicates latent TB infection. Depending on the country of origin, where TB is diagnosed or suspected, the coexistence of other infectious diseases such as HIV and malaria should not be ov erlooked. Treatment The patient should be treated using appropriate chemotherapy , dependent on the sensitivities derived from the abscess contents. If an abscess fails to resolve despite appropriate chemotherapy and general measures, occasionally excision of the abscess and its surrounding fibrous capsule is necessary , together with the relevant lymph nodes. If there is active TB of another system, for example pulmonary TB, then removal of tuberculous lymph nodes in the neck is inappropriate. The matted nodes are associated with significant fibrosis, making surgery di ffi cult to the extent that the sacrifice of adjacent structures such as the internal jugular vein or sternocleidomastoid muscle may be necessary . The resected nodes should be sent for both histology and microbiology . Tuberculous adenitis

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Tumours of the larynx

Tumours of the larynx

Benign tumours of the larynx are extremely rare. Squamous cell carcinoma is the most common malignant tumour, being responsible for more than 90% of tumours within the larynx. It is the second most common head and neck cancer (oral cavity is more common) and previously usually occurred in elderly male smokers. However, over the past decades, the incidence among women has risen because of increased smoking. The incidence of laryngeal cancer in the three subsites – supraglottis, glottis and subglottis – varies around the world. Clinical features Patients typically present with voice change. Other symptoms include dysphagia, odynophagia and neck lumps. Advanced tumours can present with airway compromise, usually as inspiratory stridor (Figure 52.56). Investigations Direct laryngoscopy , followed by a general anaesthetic assessment, together with angled (30° and 70°) Hopkins' rod examination, allows precise determination of the extent of the tumour and biopsy confirms the histology . CT and MRI give further details of the extent of larger tumours, demonstrating spread outside the larynx and suspicious nodal involvement within the neck, which may not be obvious clinically . Treatment Early laryngeal cancer (T1 and T2) Early-stage supraglottic and glottic tumours can be treated with a single modality: radiotherapy or endoscopic surgical resection, with the aim of preservation of function. Although both modalities are associated with similar survival rates (approximately 95% local control), transoral laser resection is commonly used as it usually involves day case surgery and more therapeutic options are available for the small number of patients who have local recurrence (Figure 52.57). Advanced laryngeal cancer (T3 and T4) Organ preservation should be a priority when treating locally advanced cancer without extralaryngeal spread and/ or laryngeal dysfunction. The non-surgical standard of care is concurrent chemoradiotherapy; while a variety of open partial laryngectomy procedures are also available, these are best undertaken in specialist centres. Laryngeal cancer with gross extralaryngeal extension is usually best treated with total laryngectomy and adjuvant post operative radiotherapy or chemoradiotherapy (Figure 52.56 After the larynx has been removed, the remaining trachea is brought out onto the lower neck as a permanent tracheal stoma and the hypopharynx, which is opened at the time of the operation, is closed to restore continuity for swallowing (Figur e 52.58). Thus, the upper aero- and digestive tracts are permanently disconnected. Part or all of the thyroid gland and associated parathyroid glands may also be removed, depend ing on the extent of the disease. -).

Figure 52.56 A total laryngectomy specimen with a transglottic tumour. Figure 52.57 Flexible nasendoscopy demonstrating a laryngeal tumour seen involving the entire length of the right vocal fold. Figure 52.58 Transverse closure of the pharynx with an endotracheal tube in the end tracheostome.

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Tumours of the nasopharynx

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Benign There are two main types of benign tumours of the nasophar ynx: the angiofibroma and the antrochoanal polyp. Both are rare. Angiofibroma This tumour is confined to young male patients most commonly between the ages of 8 and 20 years. It usually causes progressive nasal obstruction, recurrent severe epistaxis, purulent rhinorrhoea and occasionally loss of vision because of compression of the optic nerve by superior extension of the tumour through the skull base. Although the tumour is rare, these symptoms in a young male patient should always arouse suspicion. The tumour is more common in northern India, although the reasons for this are unknown. Clinical examina tion typically shows a mass in the nasal cavity or nasopharynx, but CT scanning best demonstrates the extent of the tumour and any associated bony erosion. MRI scanning defines the soft-tissue extent and, with these two modalities, combined with the history and clinical e xamination, a diagnosis can safely be arrived at. Angiography and embolisation are usually performed 24–48 hours prior to surgery to minimise intra- operative bleeding. Biopsy should be avoided unless clinical and radiological examinations are not diagnostic because of the risk of bleeding. Surgical resection requires adequate exposure through either a midfacial degloving approach or lateral rhinotomy (Figures 52.20 and 52.21). Both allow ligation of the feeding maxillary artery . More r ecently , endoscopic resection has been used for smaller lesions. Sir St Clair Thomson , 1859–1943, British surgeon and professor of laryngology . George Walter Caldwell , 1834–1918, otolaryngologist, who practised successively in New Y ork, San Francisco and Los Angeles, USA, devised this operation for treating suppuration in the maxillary antrum in 1893. Henri Luc , 1855–1925, otolaryngologist, Paris, France, described his operation in 1889. - Antrochoanal polyp This relatively uncommon lesion is a benign mucosal polyp - that arises in the maxillary antrum and prolapses into the nasal cavity , where it expands backwards into the nasopharynx and occasionally into the oropharynx (Figures 52.22 and 52.23). It may mimic an angiofibroma, from which it is distinguished by its avascularity and pale colour, as well as its site of origin, which is determined on endoscopic examination and imaging. It requires complete removal via an endoscopic approach through the middle meatus of the maxillary sinus or, rarely , via an open Caldwell–Luc approach. Malignant Nasopharyngeal carcinoma Nasopharyngeal carcinoma has a marked geographically variable incidence. There is classically a tumour involving the nasopharynx that may extend into the nasal cavity , oral

Figure 52.20 Intraoperative photograph showing exposure during a midfacial degloving approach.
Figure 52.21 Intraoperative photograph showing an incision in lateral rhinotomy.

cavity , parapharyngeal space, bones and sinuses or brain. It has a male-to-female ratio of 3:1. In most parts of the world, it is rare with an annual incidence of 1 case per 100 /uni00A0 000 population; however, among southern Chinese populations the rate is 30–50 cases per 100 /uni00A0 000 population. The aetiol ogy of nasopharyngeal carcinoma is multifactorial. Genetic susceptibility , tobacco smoking, early infection by EBV and consumption of traditional diets,

particularly salted fish, are known to contribute. Aetiological factors in nasopharyngeal carcinoma /uni25CF /uni25CF /uni25CF /uni25CF The majority of nasopharyngeal tumours are undi ff er - entiated with a characteristic morphology , constituting over 90% of nasopharyngeal malignancy in endemic areas. Rare epithelial tumours are adenocarcinoma and adenoid cystic carcinoma, which arise from minor salivary glands. B- and T -cell lymphomas also occur in the nasopharynx and should not be confused with the more common undi ff erentiated carci - noma. Nasopharyngeal carcinoma has a bimodal distribution with an increased incidence in teenagers and young adults and then again in the 50- to 60-year-old age group . Symptoms are closely related to the position of the tumour in the nasopharynx and the degree of regional and/or distant spread. Early symptoms are often minimal and ma y be ignored by both patient and doctor. Approximately 50% of patients will present with a malignant node or nodes in the neck, indicating an advanced tumour. While investigation of the lymph node will involve fine-needle aspiration or a biopsy , such a clinical presentation mandates an immediate thorough examination of the nasopharynx. In about 5% of patients, the nasopharynx may look normal or minimally asymmetrical but contains submucosal nasopharyngeal carcinoma. MRI or CT of the head and neck should be performed as part of the diagnostic work-up; even if a nasopharyngeal mass is not iden - tified clinically or radiologically , a biopsy of the nasopharynx, targeting the fossa of Rosenmüller, will reveal the site of the primary tumour in patients with a malignant neck lump that shows EBV positivity . In contrast, nasal complaints (obstruc - tion with/without rhinorrhoea) occur in one-thir d of patients and aural symptoms of unilateral deafness as a consequence of Eustachian tube obstruction and secretory otitis media occur in approximately 20% of patients. Neurological complications with cranial nerve palsies as a result of disease in the skull base occur rela tively late in the disease, but are a poor prognostic sign, as is trismus resulting from tumour involvement of the pterygoid musculature. Summary box 52.5 Nasopharyngeal carcinoma: main presenting com - plaints /uni25CF /uni25CF /uni25CF - /uni25CF /uni25CF /uni25CF /uni25CF

Figure 52.22 Intraoral view showing a /f_l eshy polyp hanging in the oropharynx. Figure 52.23 Axial computed tomogram of an antrochoanal polyp (as seen in Figure 52.22), with an opaque maxillary antrum and a mass in the nasal cavity and nasopharynx. Genetic (e.g. Cantonese population) Infective (e.g. EBV) Environmental (e.g. salted /f_i sh) Tobacco smoking Clinical features. Regional Cervical lymphadenopathy Local Hearing loss (unilateral serous otitis media), otalgia Nasal obstruction, bloody discharge, epistaxis Cranial nerve palsies, especially III–VI then IX–XII Trismus

rigid nasendoscope and biopsy under topical or general anaes thesia. Serological investigation for EBV-associated antigenic markers in combination with the clinical and histological examination is valuable for the early detection of disease. Highly sensitive assays for antiviral antibodies together with virus-associated serological marker s are useful in early detec tion and in post-treatment surveillance. Immunoglobulin (Ig) A antiviral capsid antigen antibody and early antigen antibody have been evaluated in mass surveys in southern China and have been found to be an e xcellent screening method for early detection of nasopharyngeal carcinoma in high-risk groups. This is essential for staging and to determine the extent of disease. The imaging of choice is MRI, which allows for assessment of brain parenchyma, cavernous sin us and the closely associated cranial foramina and for treatment planning. CT or PET-CT of the head, neck and chest has a major role in planning radiotherapy and assessing the response to treatment, diagnosing recurrence and detecting complications. The primary treatment of nasopharyngeal carcinoma is non-surgical as it is highly radiosensitive and depends on the stage of the disease. Intensity-modulated and cisplatin-

based chemotherapy with concurrent radiation - therapy for stages III and IV . Surgery is reserved for local recur - rence that would require a nasopharyngectomy , which can be performed either transorally with a robot, transnasally with a in rigid telescope or via an open approach; regional recurrence the neck is managed by a neck dissection. Given the complexity - of the anatomy and proximity of vital neurovascular struc - tures, ongoing trials with proton beam therapy at selected centres around the world have demonstrated promising results or early disease, 5-year disease-free with lesser adverse e ff ects. F survival rates of more than 75% are common; however, in advanced disease the results are less good, with 5-year disease- free survival rates of 30–50%.

Imaging. Treatment. Figure 52.24 Acute follicular tonsillitis. Figure 52.25 Quinsy (peritonsillar abscess).

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VOICE DISORDERS Vocal nodules

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These are fibrous thickenings of the vocal folds at the junction - of the middle and anterior thirds (Figure 52.52) and result from vocal abuse; they are known as singers’ nodules in adults and screamers’ nodules in children. Speech therapy is therefore the preferred treatment and the lesions will resolve spontaneously in most cases. Occasionally , the nodules will need to be surgi - cally removed using modern microlaryngoscopic dissection or laser techniques, but speech therapy will still be required for postoperative voice rehabilitation.

Figure 52.52 Vocal fold nodules. Figure 52.53 A vocal fold polyp.

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Vagal body tumours

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Vagal paragangliomas arise from nests of paraganglionic tissue of the vagus nerve just below the base of the skull near the jugular foramen. They may also be found at various sites along the nerve down to the level of the carotid artery bifurcation. They also present as slowly growing and painless masses in the anterolateral aspect of the neck, and may also have a long history , commonly of 2–3 years, before diagnosis. They may William R Shamblin , Mayo Graduate School of Medicine (University of Minnesota), Rochester, MN, USA, described this classification in 1971. Friedrich Theodor Schwann , 1810–1882, Professor of Anatomy and Physiology , successively at Louvain (1839–1848) and Liège (1848–1880), Belgium, described the neurilemma in 1839. Friedrich Daniel von Recklinghausen , 1833–1910, Professor of Pathology , Strasbourg, France, described generalised neurofibromatosis in 1882. spread into the cranial cavity . Diagnosis is confirmed by CT and MRI scanning and additional MRA or arteriography if necessary . Treatment is surgical excision following appropriate consent of resulting hoarseness . -

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Vocal fold palsy

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This may be unilateral or bilateral (Figure 52.55). Unilateral cord palsy is most commonly idiopathic. In non-idiopathic cases, left vocal fold palsy is most common because of the long intrathoracic course of the left recurrent laryngeal nerve, which arches around the aorta and may be commonly involved in inflammatory and neoplastic conditions involving the left hilum or lung apex. Lung cancer should be considered the cause of a left vocal fold palsy until proved otherwise. Tumours of the nasopharynx, larynx, thyroid gland or oesophagus may also cause vocal fold palsy . Bilateral vocal fold paralysis is uncommon and tends to occur after thyroid surgery or head injuries. Summary box 52.14 Causes of vocal fold palsy /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Clinical features Unilateral recurrent laryngeal nerve palsy of sudden onset produces hoarseness, di ffi culty in swallowing liquids and a weakened cough. These symptoms may be short-lived and the voice may return to normal within a few weeks as the muscles in the opposite vocal fold compensate and move it across the midline to meet the paralysed vocal fold, which usually lies in the paramedian position. Bilateral recurrent laryngeal - nerve palsy is an occasional and serious complication of total thyroidectomy . On anaesthetic reversal, acute dyspnoea occurs as a result of the paramedian position of both vocal folds, which reduce the airway to 2–3 /uni00A0 mm and which tend to get sucked together on inspiration. This can be temporarily relieved by positive pressure mask ventilation, but, in severe cases, tracheostomy or intubation is necessary immediately , otherwise death occurs from asphyxia. Investigation of vocal fold paralysis is by a CT scan from the skull base (including posterior fossa) to the diaphragm. Approximately 20–25% of vocal fold paralysis occurs without kno wn pathology and spontaneous recovery may occur. When compensation does not occur, a unilateral paralysed fold may be medialised by injection or external thyroplasty . In bilateral vocal fold palsy , surgery may be carried out to divide the posterior aspect of one vocal fold (cordotomy) or a portion of one arytenoid cartilage (arytenoidectomy). These procedures are most easily performed endoscopically with a carbon dioxide laser. T hey increase the size of the posterior glottic airway , allowing the patient to be decannulated or even avoid an initial tracheostomy .

Congenital (infants) Acquired Traumatic Direct to neck Post surgery (e.g. thyroidectomy) Infective Viral (rare) Neoplastic Carcinoma of the lung involving the left hilum Carcinoma of the nasopharynx, larynx, thyroid and oesophagus Vascular Aortic aneurysm Neurological Lower motor neurone disease Figure 52.55 Vocal fold positions: (a) normal; (b) unilateral vocal fold palsy.

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Vocal fold polyps

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These are usually unilateral and may be associated with an acute infective episode, cigarette smoking or vocal abuse (Figure 52.53). Speech therapy is again indicated, but they do usually require removal by microdissection or laser surgery . Summary box 52.12 Causes of hoarseness /uni25CF /uni25CF /uni25CF /uni25CF

Mucosal disease (e.g. vocal nodule, polyps or laryngeal papillomatosis, acute or chronic laryngitis) Neurological disease (e.g. vocal fold palsy) Neoplasia (e.g. laryngeal tumours) Non-speci /f_i c voice disorders, functional dysphonia Figure 52.54 Laryngeal papillomas.

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Voice rehabilitation

Voice rehabilitation

The loss of the larynx as a generator of sound does not prevent patients speaking as long as an alternative source of sound can be created by vibration in the pharynx. This can be achieved - in one of three ways: 1 A small one-way valve may be inserted through the back wall of the tracheal stoma into the pharynx (Figure 52.59 This allows air from the trachea to pass into the pharynx, but does not allow food and liquid to pass into the airway . These valves must not be confused with tracheostomy tubes. Like all foreign bodies, the speaking valves are asso ciated with minor complications, such as the formation of granulations, bleeding or leakage of pharyngeal contents, and have an ongoing financial cost because of the need for regular replacement (Figure 52.60). Mark I Singer , contemporary , head and neck surgeon, San Francisco, CA, USA. Eric D Blom , contemporary , speech pathologist and medical device inventor, Carmel, IN, USA. 2 An external battery-powered vibrating device that when). applied to the soft tissues of the neck produces sound, which is turned into speech by the vocal tract compris - ing the tongue, pharynx, oral cavity , lips, teeth and nasal sinuses (Figure 52.61). - 3 Oesophageal speech, when air is swallowed into the phar - ynx and upper oesophagus. On regurgitating the air, a segment of the pharyngo-oesophageal mucosa vibrates to produce sound, which is modified by the vocal tract into speech (Figure 52.62).

Figure 52.59 A Blom–Singer valve within a surgically fashioned tracheo-oesophageal /f_i stula and an outer stoma valve. Figure 52.60 Provox voice valve prosthesis viewed in rear wall of trachea. Figure 52.61 Electrolarynx. Figure 52.62 Production of oesophageal speech.

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Wounds above the hyoid bone

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Wounds of the thyroid and cricoid cartilage

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Blunt crushing injuries or severe laceration injuries to the laryngeal skeleton can cause marked haematoma formation or swelling and rapid loss of the airway . There may be significant disruption of the laryngeal skeleton. These patients should not have an endotracheal intubation for any length of time, even if this is the initial emergency way of protecting the airway . The larynx is a delicate three-tiered sphincter and the presence of Walter Ellis Sistrunk Jr , 1880–1933, Professor of Clinical Surgery , Baylor University College of Medicine, Dallas, TX, USA. a foreign body in its lumen after severe disruption gives rise to major fibrosis and loss of laryngeal function. These injuries frequently require a low tracheostomy , following which the larynx can be carefully explored, damaged cartilages reposi - tioned and sutured or plated and the paraglottic space drained. An indwelling stent of soft sponge shaped to fit the laryn - geal lumen and held by a nylon retaining suture through the neck may be left in place for 5–10 days to minimise webbing. This stent can be removed endoscopically after cutting the retaining suture and, as the laryngeal damage heals, the patient may then be decannulated.

contained within. Zone Boundary Structures within Trachea, oesophagus, innominate 1 From clavicle/ artery, arch of aorta, brachial sternal notch to plexus, thoracic duct, carotid artery cricoid cartilage Larynx, hypopharynx, carotid artery 2 From cricoid (common/internal/external), internal cartilage to angle jugular vein, sympathetic plexus, of mandible recurrent laryngeal nerve Facial nerve, carotid artery 3 From angle of (internal/branches of external), mandible to skull jugular vein base

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