Pharynx and Larynx

16

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16.1 Anatomy

The pharynx connects the nasal cavities and mouth with the larynx and oesophagus. It is divided into three functional parts, namely the nasopharynx, the oropharynx, and the hypopharynx (Fig. 16.1).

The *nasopharynx* lies behind the nasal cavities and above the level of the soft palate. The roof and posterior wall relate closely to the skull base and the first cervical vertebra. The lateral wall is an extension of fascia from the skull base called the *pharyngobasilar fascia*. The *Eustachian tube* opens into the lateral wall of the nasopharynx just behind and at approximately the same level as the inferior turbinate. It is lined by respiratory mucosa with accessory mucous glands, particularly numerous around the opening of the Eustachian tube. The slight depression posterior to the opening of the Eustachian tube is called the *fossa of Rosenmüller* (or *pharyngeal recess*). The *oropharynx* extends from the soft palate into the depth of the *vallecula*, the gutter between the posterior tongue and the epiglottis. The *tonsillar fossa* lies in the lateral aspect, between the palatoglossal and palatopharyngeal folds. The *hypopharynx* extends from the upper border of the epiglottis to the lower border of the cricoid cartilage. A narrow recess termed the *piriform fossa* lies on each side of the larynx between the aryepiglottic fold and the thyroid cartilage. Together with the oropharynx, it is lined by stratified squamous epithelium and contains accessory mucous glands (Fig. 16.1).

A ring of lymphoid tissue surrounds the opening of the pharynx, comprising the pharyngeal tonsil (or adenoid), the palatine tonsils, and the lingual tonsil. The adenoid lies on the posterior wall of the nasopharynx in the midline between the posterior edge of the nasal septum and the openings of right and left Eustachian tubes. The palatine tonsils each lie in their tonsillar fossa. This group of lymphoid aggregates is collectively described as *Waldeyer's ring*.

The larynx lies between the posterior one-third of the tongue superiorly and the trachea inferiorly. It is composed of three large midline cartilages—the epiglottis, the thyroid, and the cricoid—with the smaller paired arytenoid cartilages. Other smaller paired cartilages are present, the corniculate and cuneiform cartilages, that are of lesser importance in surgical practice.

The *cricoid cartilage* is the most inferior of the laryngeal cartilages but is the cornerstone of the larynx. It is shaped like a signet ring, with the

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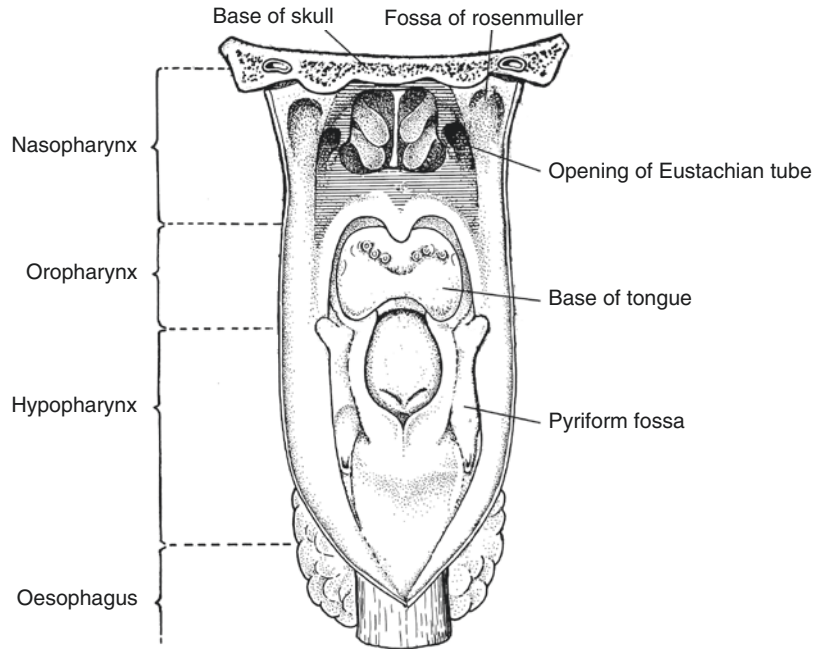

Fig. 16.1 Anatomy of the pharynx. View of pharynx opened from behind to reveal major subdivisions and anatomical landmarks of the pharynx (Used with the permission of the Union for International Cancer Control (UICC), Geneva, Switzerland. The original source for this material is from Wittekind et al. (2005))

broadest part, the lamina, located posteriorly and the narrower arch continuous anteriorly encircling the opening to the trachea. It is connected to the highest tracheal cartilage by the cricotracheal ligament. The *thyroid cartilage* overlaps outside the cricoid cartilage. It is composed of two quadrangular laminae that join in the midline anteriorly (forming the laryngeal prominence or "Adam's apple") and diverge posteriorly, ending as two slender processes, a larger superior cornu and a smaller inferior cornu. It is attached to the cricoid by the cricothyroid membrane and to the hyoid bone above by the thyrohyoid membrane. The *epiglottis* is a thin leaf-shaped cartilage, attached at its inferior aspect to the inner surface of the thyroid cartilage just below where the thyroid laminae join anteriorly and extending superiorly and posteriorly to overhang the inlet to the larynx. The whole assembly is suspended from the hyoid bone by the thyrohyoid and hyoepiglottic membranes (Fig. 16.2).

Right and left *arytenoid cartilages* are smaller than the epiglottis, thyroid, and cricoid cartilages, and are pyramidal in shape. They sit on top of the cricoid lamina, just lateral to the midline and are overlapped outside by the thyroid laminae. They each possess a muscular process (posteriorly and laterally), a vocal process (anteriorly), and an apex (superiorly and posteriorly). Extending anteriorly from the vocal process of each arytenoid to the inner surface of the thyroid cartilage is the vocal ligament. Each vocal ligament forms the basis of the *vocal cord*. A complex arrangement of extrinsic and intrinsic muscles coordinates the movements of the larynx and its constituent cartilages.

The surface anatomy of the endolarynx is defined by three sets of prominent mucosal folds—the aryepiglottic folds, the vestibular folds, and the vocal cords. The *aryepiglottic folds* sweep upward and laterally from the arytenoid cartilages posteriorly to the tip of the epiglottis, encircling the inlet to the larynx and representing the border between larynx and hypopharynx. The *vestibular folds* (or *false cords*) lie just above the vocal cords and run in the horizontal plane parallel to the vocal cords, separated from them by a shallow pouch called the *vestibule* (or *ventricle*). The larynx is divided into three regions—supraglottic, glottic, and subglottic—according to their relationship with the vocal folds. The glottic region corresponds to the region of the vocal cords, while supraglottic and subglottic regions lie above and below, respectively (Fig. 16.3). A number of compartments are present within the larynx that can influence the spread of tumours.

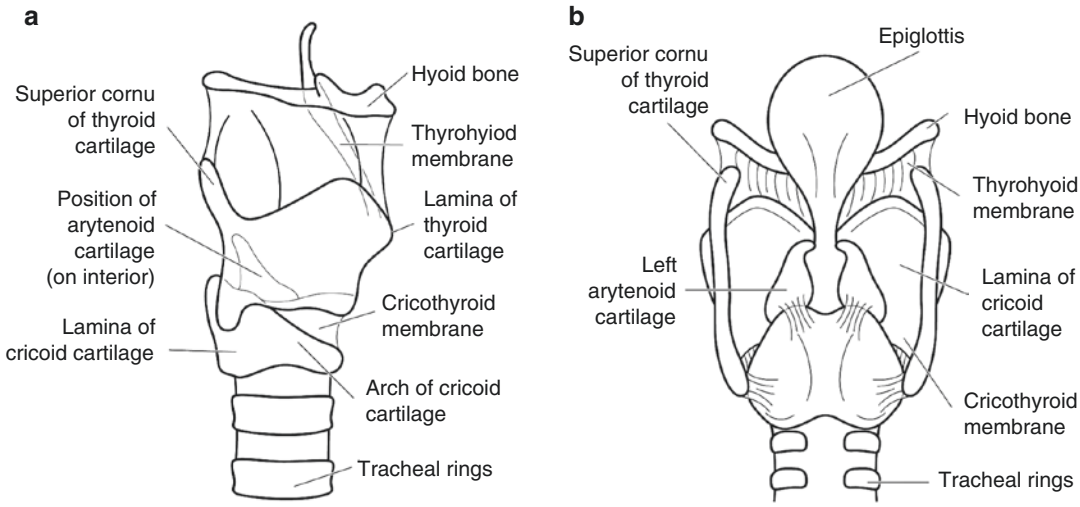

Fig. 16.2 The laryngeal cartilages. (**a**) View from the right lateral aspect; (**b**) view from the posterior aspect (Reproduced, with permission, from Allen and Cameron (2013))

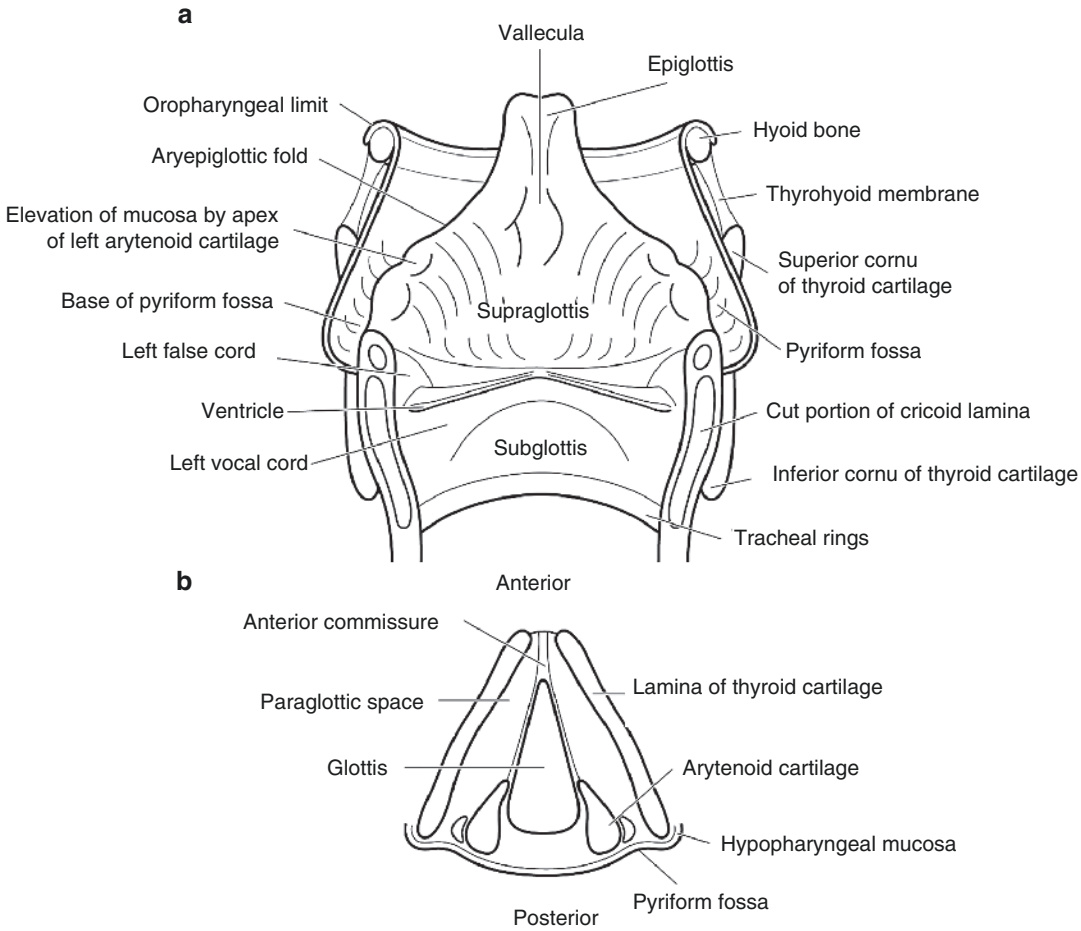

Fig. 16.3 Laryngectomy specimen. (**a**) Idealized view of laryngectomy specimen opened from posterior; (**b**) coronal section through larynx at level of vocal cords (Reproduced, with permission, from Allen and Cameron (2013))

The *pre-epiglottic space* lies outside the larynx between the tongue, the hyoid bone, and the epiglottis, while the *supraglottic space* lies just below the mucosa of the supraglottic larynx from epiglottis to the false cords, these spaces communicating through fenestrations in the epiglottis. The *paraglottic space* lies between the vocal ligament and the lamina of the thyroid cartilage and communicates superiorly with the pre-epiglottic and supraglottic spaces. *Reinke's space* is restricted to the submucosa of the vocal cord, communicating with the paraglottic space and the *subglottic space*, the latter extending submucosally from the vocal cord into the trachea.

The larynx is covered almost entirely by respiratory mucosa with many seromucinous accessory glands in the submucosal tissues, particularly around the epiglottis and the vestibule. In contrast, the vocal cords are covered instead by stratified squamous epithelium with only a minimum of connective tissue around the vocal ligaments in which few (if any) lymphatic channels are found.

Lymphovascular drainage:

Lymph vessels from the nasopharynx, oropharynx, hypopharynx, and the tonsils drain to Level II nodes in the upper deep cervical chain either directly or via the retropharyngeal groups (see Fig. 20.1). Bilateral drainage is common with nasopharyngeal, hypopharyngeal, and laryngeal lesions.

16.2 Clinical Presentation

Disease at any site in the pharynx can present with *dysphagia* (difficulty swallowing), *dysphonia* (change in voice quality), *otalgia* (earache), cranial nerve palsies, or cervical lymphadenopathy. In the nasopharynx, tumours may evoke deafness, middle ear effusion, *epistaxi*s (nose bleeds), nasal obstruction, or palsy of cranial nerves (esp. II—VI, IX, X, XII), while those in the oropharynx usually present with sore throat, dysphagia or earache. Hypopharyngeal masses may cause dysphagia or signs of laryngeal involvement, such as hoarseness or a whistling sound during inspiration (*stridor*).

Patients with laryngeal disease may present with alterations in the voice, particularly hoarseness or stridor.

16.3 Clinical Investigations

- The nasopharynx is usually inspected using rigid or flexible endoscopes. The hypopharynx and larynx can be inspected with a fibre-optic endoscope passed through an anaesthetized nose or indirectly visualized using a laryngeal mirror held against the soft palate. Biopsies can be readily obtained under general anaesthesia using a laryngoscope or operating microscope in malignant disease for staging purposes, or to identify an occult second primary. Endoscopy of the upper aerodigestive tract is performed for neoplasms, and to assess suitability for surgical resection.
- Serological studies for Epstein–Barr virus (EBV) antigens are useful in nasopharyngeal carcinoma both in assessing the effects of therapy and in detecting recurrence. Baseline function of the thyroid gland should be determined prior to radical surgery or radiotherapy to the neck.
- Ultrasonography has proved useful in evaluation of lymphadenopathy and in guidance of needles for FNA and core needle biopsy.
- Contrast studies and direct visualization using an oesophagoscope are performed in cases of dysphagia to assess swallowing function prior to treatment for malignant disease. Chest radiographs may identify a concurrent bronchial or lung lesion. CT and MRI scanning are essential in planning surgery by indicating the depth of the tumour and detecting other changes in the neck. CT has less motion artifact and is good for bone detail, while MRI gives superior soft tissue contrast without dental amalgam artifact or exposure to ionizing radiation. CT is greatly aided by positron emission tomography (PET CT), particularly in cases of metastatic disease in cervical lymph nodes whereby a small and undetected primary tumour might be identified.

- FNA is essential in assessing patients presenting with cervical lymphadenopathy, particularly when there is a high probability of malignant disease.

16.4 Pathological Conditions

16.4.1 Non-neoplastic Conditions

Polyps and nodules: Mucosal polyps are uncommonly detected in the nasopharynx and oropharynx and are likely to represent florid lymphoid proliferations in association with adenoid or tonsillar enlargement.

Localized thickenings of the vocal cords usually arise at the junction of the anterior and middle one-thirds and may be unilateral or bilateral. They are due to trauma or voice abuse (hence the alternative term *singer's node*) but are also associated with smoking. Nodules are broadly based sessile lesions that are usually bilateral and arise in females, while pedunculated polyps are unilateral and predominate in males. Myxoid degeneration of Reinke's space (*Reinke's oedema*) usually arises in older females, affects both cords along their length and is associated with smoking and not voice abuse. All are characterized by mild hyperplasia of the stratified squamous epithelium, accumulation of myxoid matrix in the lamina propria, increased vascularity, and fibrin deposition. Similar lesions may arise in the myxoedema of hypothyroidism. *Contact granuloma* or *contact ulcer* occurs posteriorly between the vocal processes of the arytenoid cartilages and consists of granulation tissue and ulcer slough; voice abuse and recent laryngeal intubation are common causes. *Amyloid* may present with laryngeal nodules or diffuse submucosal thickening but usually affects the ventricle or false cords; only rarely is there associated systemic amyloidosis. *Post-radiation spindle cell nodules* can mimic spindle cell carcinoma.

Cysts: Tonsillar cysts arise in the oropharynx and hypopharynx. They represent accessory tonsillar tissue and are composed of a crypt of stratified squamous epithelium distended by squames and abundant lymphoid tissue in the wall. Laryngeal cysts may contain mucus or air. Mucus-filled cysts are the commonest and usually represent mucous retention cysts of the accessory glands in the supraglottic larynx, usually the ventricle or false cords. They are lined by ductal epithelium. Laryngoceles and saccular cysts are both due to obstruction of the saccule in the laryngeal ventricle, the former containing air and the latter mucus. Both are lined by respiratory epithelium.

Tonsillar enlargement: Tonsillitis is a common disorder of childhood characterized by frequent episodes of sore throat, dysphagia, and otitis media. Although it tends to resolve with age, persistent exacerbations and/or obstructive sleep apnoea may be treated by tonsillectomy with or without concomitant adenoidectomy. Tonsils may be removed in adults for chronic tonsillitis or if a neoplasm is suspected, particularly if there is asymmetrical or unilateral enlargement. Lymphoid follicles with well-formed germinal centres are seen; there may be fibrosis. Actinomyces colonies (*sulphur granules*) may be present within the crypts. Florid tonsillar follicular hyperplasia may occur bilaterally in HIV infection.

16.4.2 Neoplastic Conditions

Benign tumours: Human Papillomavirus-associated squamous papillomas arise in the larynx either in children under 5 years of age with equal gender mix (*juvenile-onset laryngeal papillomatosis*) or in adults over 20 years of age, mostly in males (*adult-onset laryngeal papillomatosis*). The lesions in juvenile-onset laryngeal papillomatosis are multiple and affect the entire laryngeal mucosa. They may require repeated microdebrider de-bulking or laser microsurgery for airway obstruction; resolution usually occurs in adolescence, but a small proportion of cases persists and may even spread into the trachea and bronchi. Adult-onset laryngeal papillomas are fewer in number and relatively easily excised although multiple lesions are more likely to recur. Histologically, hyperplastic stratified squamous epithelium covers well-formed fibrovascular papillary

cores, sometimes with abundant koilocyte-like cells. Cytological atypia is absent or minimal although the epithelium often portrays florid basal cell hyperplasia. Development of malignancy is a rare event; these patients usually have been exposed to other factors known to be associated with laryngeal squamous cell carcinoma (radiation, tobacco use).

Nasopharyngeal (*juvenile*) *angiofibroma*: An uncommon lesion found only in teenage and young adult males. Arises in the lateral wall of the nasal cavity posteriorly and grows into the nasopharynx; presents with unilateral nasal obstruction and epistaxis. A well-circumscribed mass, it has a fibrous cut surface and is characterized by irregular branching dilated vascular channels with partially muscularized walls. Plump spindle cells and mast cells are present in the stroma.

Other benign tumours that arise uncommonly in the pharynx and larynx include salivary gland adenomas (e.g., pleomorphic adenoma), neural tumours (e.g., neurilemmoma, neurofibroma, granular cell tumour), carcinoid tumours, and paraganglioma (from paraganglia in the supraglottic or less often the subglottic larynx).

Malignant tumours: Tobacco and alcohol use are the major risk factors for oropharyngeal, hypopharyngeal, and laryngeal cancers. Their effects are related to dose and duration of use; together they have a multiplicative rather than additive effect. Glottic carcinomas are strongly linked to tobacco use and less associated with alcohol. Post-cricoid carcinoma is associated with Patterson Brown-Kelly syndrome (Plummer–Vinson syndrome—Northern European females, iron-deficiency anaemia, achlorhydria, and upper oesophageal web) and with alcohol. Approximately 10% of patients with Patterson Brown-Kelly syndrome will develop post-cricoid carcinoma. Recent interest has focused on the role of viruses in pharyngeal and laryngeal malignancy. Human Papilloma viruses, particularly the so-called high-risk types, HPV 16 and 18, are detected in an increasing proportion of tumours in patients who are "never-smokers," especially tonsillar squamous cell carcinoma (approximately 70%) and laryngeal carcinoma arising against a background of papillomatosis. Epstein-Barr virus is so strongly associated with nasopharyngeal carcinoma that it is almost a *sine qua non*, although the consumption of dietary nitrosamines and smoking play a role.

Squamous epithelial dysplasia: An uncommon clinical problem on its own—most often seen adjacent to established tumours—although the more hyperplastic and/or keratotic lesions can present because of alterations in voice quality. Strongly associated with tobacco smoking. Characterized histologically by hyperkeratosis, epithelial hyperplasia, and/or atrophy with varying grades of dysplasia. Development of invasive squamous cell carcinoma occurs more frequently with increasing degrees of cytological disturbance (less than 5% for non-dysplastic lesions and mild/low-grade dysplasia; around 15% for high-grade dysplasia) but the effects of treatment are difficult to evaluate. A number of classification systems have been proposed each with slightly differing terminology but all suffer problems of reliability. Identifying high-grade dysplasia highlights the considerable risk of synchronous or metachronous squamous cell carcinoma and often triggers further conservative surgery or ablative therapy (e.g., by laser) to the lesion.

Squamous cell carcinoma: Accounts for approximately 90% of primary malignant tumours in the larynx, oropharynx, and hypopharynx. Males are affected at least five times more often than females and most patients are aged between 40 and 60 years. In the oropharynx, squamous cell carcinoma most commonly arises in the posterior one-third of the tongue and tonsil. Tumours of the posterior tongue tend to be very large at presentation; tonsillar tumours are often occult, presenting with nodal metastasis. Most cases of hypopharyngeal squamous cell carcinoma arise in the pyriform fossa (75%) or the posterior pharyngeal wall (20%).

The commonest site of laryngeal squamous cell carcinoma is the glottis (75%), followed by the supraglottic larynx (15–20%), while subglottic tumours account for less than 5% of cases. Glottic tumours tend to be small and

localized, while supraglottic and subglottic tumours tend to be large with nodal metastasis in over 50% of cases.

Histological and reportedly prognostic variants of squamous cell carcinoma include verrucous carcinoma, papillary squamous cell carcinoma (better than usual type), spindle cell squamous cell carcinoma, adenoid squamous cell carcinoma (same prognosis), basaloid squamous cell carcinoma, and adenosquamous cell carcinoma (worse prognosis).

Nasopharyngeal carcinoma: Has a striking geographic distribution, being commonest in Southern China. Males are affected more often than females, 3:1. Incidence peaks between 40 and 60 years, although occasionally adolescents and young adults may be affected. The fossa of Rosenmüller is the commonest site, although there may be no obvious mucosal abnormality on inspection. All are squamous cell carcinomas, there are a number of histological subtypes: keratinizing; non-keratinizing (the latter being subdivided into differentiated and undifferentiated patterns); and basaloid. Two-thirds of cases will have involved regional lymph nodes at presentation.

Other malignant tumours in the pharynx and larynx include sinonasal transitional cell carcinoma, salivary gland-type adenocarcinoma (especially adenoid cystic carcinoma, mucoepidermoid carcinoma), lymphoma (particularly in the tonsil; diffuse large B-cell type), malignant melanoma, neuroendocrine carcinomas (larynx; moderately and poorly differentiated), chondrosarcoma (larynx), and metastatic tumours.

Prognosis: The precise site within the pharynx and larynx has a major impact on prognosis, probably because of the mass effect and the density of lymphatic channels in the submucosal tissues. Tumour biology has much influence as well as the likely response to therapy eg in the oropharynx, as evidenced by advanced HPV-associated squamous cell carcinomas in the younger "never smoker" patients that respond favourably to chemoradiotherapy. Glottic tumours usually affect the anterior portion of the vocal cords, presenting with hoarseness while still small. In contrast, supraglottic and hypopharyngeal tumours are often very large fungating masses with extensive submucosal spread at presentation. Lymph node metastasis is rare with glottic cancers but up to two-thirds of hypopharyngeal tumours have bilateral nodal disease at presentation. The mucosal/submucosal spread of the tumour affects the ability to achieve surgical clearance but the depth of invasion is probably the most significant factor in determining lymph node metastasis. Lymph node metastasis at presentation halves the chances of survival and doubles the risk of distant metastasis, although HPV-associated oropharyngeal squamous cell carcinoma might be considered the exception to this rule. Extracapsular spread from affected nodes is also an indicator of limited prognosis, with increased risk of recurrence in the neck and of distant spread. The effects of age, tobacco, and alcohol use influence patient's general health; comorbidity from cardiovascular and respiratory disease is a major adverse factor in survival.

Five-year survival with small glottic carcinomas is in excess of 80%, falling to less than 20% for patients with large tumours.

With nasopharyngeal carcinoma, female patients, those aged less than 40 years at presentation and those with undifferentiated carcinoma have improved survival, while patients with cranial nerve involvement, keratinizing squamous cell carcinoma, and positive nodes in the lower neck do less well. Five-year survival with nasopharyngeal carcinoma is approximately 60%, dependent on the response to radiotherapy and chemotherapy.

Early stage oropharyngeal squamous cell carcinomas respond well to surgical excision or radiotherapy (at least 80% 5-year survival) but larger lesions are best treated with cisplatin-based chemoradiotherapy, surgery being reserved for locoregional recurrence (up to 30% of cases). Overall survival is more favourable in cases associated with Human Papilloma virus (80% 3-year survival in HPV-positive cases compared to 60% in HPV-negative cases). The development of a second primary tumour is an ominous event.

16.5 Surgical Pathology Specimens: Clinical Aspects

16.5.1 Biopsy Specimens

Incisional biopsies in the upper aerodigestive tract are usually directed at a specific lesion located either by visualization or by CT or MR imaging. "Blind" biopsies may be taken, particularly from the fossa of Rosenmüller, base of the tongue, pyriform fossa, and palatine tonsil, in the search for an occult primary carcinoma, although pre-operative PET CT is very effective in directing the surgeon. Superficial biopsies of tonsil may miss a small submucosal tumour; bilateral tonsillectomy is preferred. Biopsies of pharyngeal and laryngeal lesions are usually taken at endoscopy with punch or cup forceps. While usually sufficient, it is sometimes difficult to make a histological diagnosis of malignancy as the specimens tend to be superficial and submucosal tumours or the invasive components of well-differentiated squamous carcinoma may not be represented.

16.5.2 Resection Specimens

In general, tonsillectomy specimens are only submitted in cases of unilateral enlargement or where malignancy is suspected; specimens from children for repeated infective episodes or airway obstruction rarely require histological evaluation. In cases of metastatic squamous cell carcinoma to a cervical lymph node, the tonsils are removed when clinical and radiological evaluation fails to locate a primary lesion.

The type of surgical procedure for tumours of oropharynx, hypopharynx, and larynx depends on the precise location of the tumour, its T-stage, the presence of nodal disease, concurrent second primary lesions, and the health of the patient. The surgical clearance possible is limited by the anatomy and is in the region of a few millimeters at best.

In general, T1 and T2 glottic and supraglottic tumours without neck node metastasis can be managed either with radiotherapy or conservative laser micro-surgery in the first instance. Laser resection using the operating microscope is becoming more widely used for glottic and supraglottic lesions. T3 glottic tumours with stridor are often managed with total laryngectomy but radiotherapy is an option if disease is limited and there is no stridor.

Total laryngectomy is the operation of choice in cases of radiotherapy failure, bulky T3 and T4 lesions, subglottic tumours, and where cord immobility and post-radiation perichondritis result in the so-called "crippled larynx". The ipsilateral lobe of thyroid is included when there is a likelihood of extralaryngeal spread in the subglottic region. The larynx will be included in major resections of hypopharynx.

Partial laryngectomy procedures can be divided into supraglottic laryngectomy and vertical hemilaryngectomy. Supraglottic laryngectomy removes the upper part of the larynx to the level of the ventricle, preserving the glottis while vertical hemilaryngectomy removes the vocal cord and false cord on one side. These operations may be indicated for small volume T2 and T3 tumours but usually require precise orientation and stabilization by the clinical team (on slices of cucumber or potato) prior to submission to the laboratory. They can be combined with neck dissection procedures. Intraoperative frozen section analysis is essential to ensure clear margins in these conservative procedures.

T1–T2 oropharyngeal cancers mucosa are resected endoscopically or using transoral robotic surgery (TORS) and may be relatively straightforward (e.g., tonsillectomy) or exhibit complex anatomy requiring tissue reconstruction (e.g., in the soft palate). Pharyngectomy with laryngectomy or pharyngolaryngoesophagectomy are the commonest operations for T2–T4 hypopharyngeal tumours, the defects being repaired by free jejunal transfer and gastric transposition, respectively. T1 hypopharyngeal tumours can be resected endoscopically, especially lesions on the posterior wall. Lesions of the pyriform fossa may require partial pharyngectomy with laryngectomy. The provision by the surgical team of illustrations of the resected tumour and its relationship to anatomical landmarks and margins can greatly aid the pathologist in orientation and sampling—drawings are better than photographs in this regard.

Radiotherapy with or without chemotherapy is the mainstay of nasopharyngeal carcinoma, surgery being reserved for recurrent disease.

16.6 Surgical Pathology Specimens: Laboratory Aspects

16.6.1 Biopsy Specimens

Usually one fragment is present free-floating in formalin although several specimens may be taken simultaneously.

Measure:

- Place in cassette; if very small wrap in moist filter paper.
- Mark for levels.
- Orientate the specimen at the embedding stage to facilitate microscopic assessment.

16.6.2 Resection Specimens

16.6.2.1 Tonsillectomy Specimens

Specimen:
Most tonsillectomy specimens are submitted for exclusion of neoplastic disease in cases of tonsillar asymmetry or cervical lymphadenopathy. Specimens of oropharyngeal mucosa, posterior tongue, or neck dissection may be attached.

Procedure:

Orientate the tonsil(s).
Ink the deep resection margins.
Cut the tonsil into 4-mm-thick slices transversely.

Measurements:

- Dimensions of tonsil (cm) and weight (g)
- Dimensions of oropharyngeal mucosa, if present
- Tumour
  Length × width (cm)
  Maximum depth (cm)
  Distances to closest mucosal and deep surgical margins (cm)
- Mucosal abnormalities

Description:

- Tumour
  Infiltrative/occult: usual type squamous cell carcinoma
- Bulky/fleshy: lymphoma
- Mucosa
  White/thickened: in situ lesions
- Extent
  Confined to tonsil or spread into adjacent soft tissues

Blocks for histology:
The histology should represent the deepest extent of the tumour, the relationship to the surface, mucosal and deep soft tissue margins, and changes in adjacent tonsillar tissue.

NB: If tumour is not seen macroscopically in cases of proven nodal metastasis, submit in total.

At least one block of tumour per centimetre of maximum dimension

- Mucosal and deep surgical margins
- Adjacent uninvolved tonsil

Histopathology report:
Final reports of tonsillectomy specimens should include details on:

- Specimen side
- Type of tumour present
  Squamous cell carcinoma, not otherwise specified (SCC NOS)
  SCC variants include basaloid, adenosquamous, spindle cell, verrucous
  Adenocarcinoma (salivary gland types)
  Neuroendocrine carcinomas
  Lymphoma
- Grade of tumour assessed at the invasive front
- Cohesive or non-cohesive patterns (more metastasis with non-cohesive)
- Extent of local spread
- Distance of tumour from the nearest mucosal margin

- Distance of the tumour from the nearest deep margin
- Presence of intravascular and perineural spread
- Presence or absence of HPV, e.g., p16 immunohistochemistry or ideally by in situ hybridisation

If other specimens are attached as an in-continuity dissection (e.g., oropharyngeal or lingual mucosa, neck dissection), these can be cut separately in the usual fashion.

16.6.2.2 Laryngectomy Specimens

Specimen:

Most laryngectomy procedures are for neoplastic disease in the larynx, although some will be required for hypopharyngeal tumours or because of post-radiation dysfunction. Specimens of neck dissection, hypopharyngeal resection, thyroidectomy, tracheostomy site, or skin from neck may be attached.

Partial laryngectomy specimens are handled in a similar fashion but require orientation by the surgeon; the smaller the specimen, the more critical the orientation.

Procedure:

Paint a vertical line of ink along one side of the larynx from epiglottis to tracheal limit to aid orientation and reconstruction after slicing.

Open the larynx vertically from behind with scissors and identify site of tumour.

Ink only the critical resection margins. This depends on the location and spread of the tumour, e.g., base of tongue and perihyoid soft tissues for anterior supraglottic lesions, lateral pharyngeal wall for lateral supraglottic and pyriform fossa tumours, post-cricoid region for large glottic or post-cricoid tumours, lateral perithyroid region for subglottic tumours.

Dissect off the hyoid bone, strap muscles, thyroid, neck dissection, etc. Look out for extralaryngeal spread of tumour. Supraglottic tumours often spread out of the larynx via the thyrohyoid membrane and subglottic tumours via the cricothyroid membrane. Tumour will permeate directly through ossified cartilages more readily than through cartilage that is not ossified.

Cut the larynx into 4-mm-thick slices in the coronal plane (i.e., in the plane of the vocal cords) to provide "rings" of tissue, working from the lowermost aspect to the base of the epiglottis. This is easiest with a band saw or other heavy-duty slicing device but modern rapid decalcifying systems permit the use of hand-held blades in "real time".

Slice the remaining supraglottic portion parasagittally with a knife to define precisely the upper aspect of supraglottic lesions.

Measurements:

- Length of the larynx superiorly from to the inferior border of the cricoid (cm)
- Length of trachea (cm)
- Dimensions (cm) of mucosal defects and other specimens
- Tumour
  Length × width (cm)
  Maximum depth (from reconstructed mucosal surface (cm))
  Distances to closest mucosal and deep surgical margins (cm)
- Mucosal abnormalities

Description:

- Tumour
  Plaque-like/ulcerated/fungating: usual type SCC
  Warty: well-differentiated SCC, verrucous carcinoma
  Polypoid: spindle cell SCC
- Mucosa
  White/thickened: in situ lesions
- Extent
  Confined to larynx or spread through/between cartilages
- Other
  Tracheostomy, neck dissection, thyroid gland

Blocks for histology:

The histology should represent the deepest extent of the tumour, the relationship to the laryngeal cartilages, mucosal and deep soft tissue margins, and changes in adjacent tissues (Fig. 16.4).

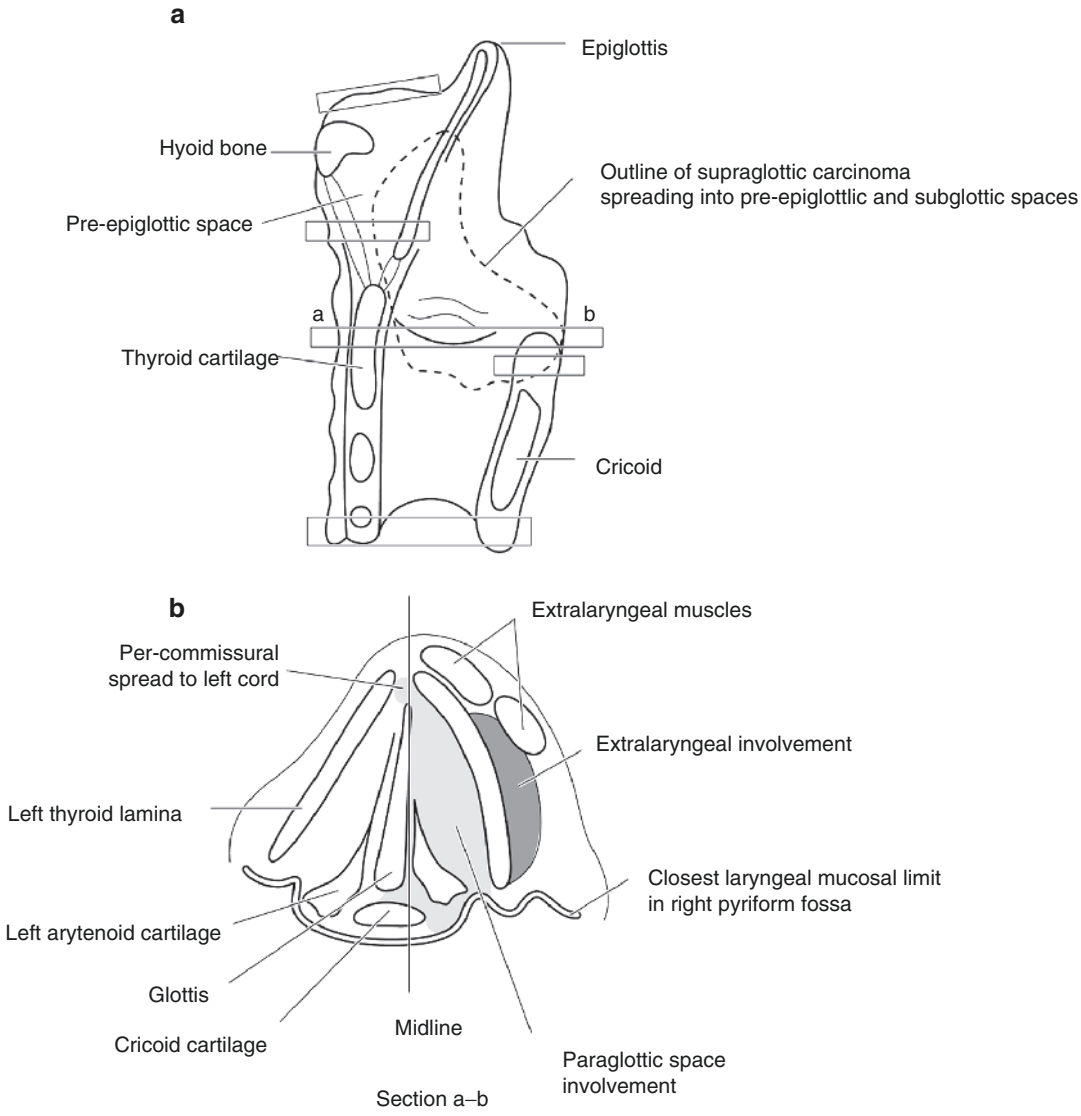

Fig. 16.4 Laryngectomy for supraglottic carcinoma with transglottic and extralaryngeal spread. Suggested siting and orientation of tissue blocks for laryngectomy specimen. (**a**) View from right lateral aspect; (**b**) slice through vocal cords viewed from above (Reproduced, with permission, from Allen and Cameron (2013))

- At least one block of tumour per centimetre of maximum dimension
- Mucosal and deep surgical margins
- Both vocal cords (individually identified) even if normal
- Samples of other lesions, e.g., mucosal white areas
- Tracheostomy site (if present)
- Perilaryngeal lymph nodes not part of the neck dissection

Histopathology report:
Final reports of laryngectomy specimens should include details on:

- Specimen type
- Type of tumour present
  Squamous cell carcinoma NOS
  SCC variants include basaloid, adenosquamous, spindle cell, verrucous
  Adenocarcinoma (salivary gland types)

Neuroendocrine carcinomas
- Grade of tumour assessed at the invasive front
- Cohesive or non-cohesive patterns—(more metastasis with non-cohesive)
- Extent of local spread
- Distance of tumour from the nearest mucosal margin
- Distance of the tumour from the nearest deep margin
- Intravascular and/or perineural spread
- Involvement of perilaryngeal lymph nodes
- Other pathology such as dysplasia or radiation injury.

If other specimens are attached as an in-continuity dissection (e.g., neck dissection, thyroid gland, oesophagus, skin), these can be cut separately in the usual fashion.

16.6.2.3 Pharyngectomy Specimens

Specimen:
Most pharyngectomy procedures are for neoplastic disease in the pharynx, although some will be required for large laryngeal tumours. Specimens of neck dissection, laryngectomy, oesophagectomy, thyroidectomy, tracheostomy site or skin from neck may be attached. Smaller tumours removed by laser will already have been transected by the surgeon—cutting through tumour allows precise assessment of the depth—and will arrive in at least two pieces.

Procedure:

If required, open the pharynx longitudinally with scissors and identify site of tumour.
Ink the external and mucosal resection margins.
Slice into 4-mm-thick slices transversely.

Measurements:

- Length and width of specimen (cm)
- Maximum thickness (cm)
- Dimensions (cm) of mucosal defects and other specimens
- Tumour
  Length × width (cm)
  Maximum depth (from reconstructed mucosal surface (cm))
  Distances to closest mucosal and deep surgical margins (cm)
- Mucosal abnormalities

Description:

- Tumour
  Plaque-like/ulcerated/fungating: usual type SCC
  Warty: well-differentiated SCC, verrucous carcinoma
  Polypoid: spindle cell SCC
- Mucosa
  White/thickened: in situ lesions
- Extent
  Confined to pharynx or spread to adjacent structures
- Other
  Neck dissection, laryngectomy, oesophagectomy, thyroid gland

Blocks for histology:

The histology should represent the deepest extent of the tumour, the relationship to the adjacent structures or organs, mucosal and deep soft tissue margins, and changes in adjacent tissues.
At least one block of tumour per centimetre of maximum dimension
Mucosal and deep surgical margins
Samples of other lesions, e.g., mucosal white areas

Histopathology report:
Final reports of pharyngectomy specimens should include details on:

- Specimen type
- Type of tumour present
  Squamous cell carcinoma NOS
  SCC variants include basaloid, adenosquamous, spindle cell, verrucous
  Adenocarcinoma (salivary gland types)
- Grade of tumour assessed at the invasive front

- Cohesive or non-cohesive patterns (more metastasis with non-cohesive)
- Extent of local spread
- Distance of tumour from the nearest mucosal margin
- Distance of the tumour from the nearest deep margin
- Intravascular and/or perineural spread
- Involvement of peripharyngeal lymph nodes
- Other pathology such as dysplasia or radiation injury

If other specimens are attached as an in-continuity dissection (e.g., neck dissection, thyroid gland, esophagus, skin), these can be cut separately in the usual fashion.

Extent of local tumour spread larynx: TNM 8 for carcinoma

pTis	Carcinoma in situ
pT1[a]	Tumour confined to one subsite[a], normal cord mobility
pT2[a]	Tumour invades more than one subsite[a], impaired cord mobility
pT3	Tumour confined to larynx, fixation of one or two cords
pT4	Tumour through thyroid cartilage and/or extends beyond larynx to, e.g., trachea, soft tissues of neck, thyroid, oesophagus, prevertebral space, mediastinal structures

[a]Exact details depend on whether tumour site is supraglottic, glottic, or subglottic

Regional lymph nodes: cervical—lymphadenectomy is selective or modified/radical including 10 or 15 or more nodes, respectively

pN0	No regional node metastasis
pN1	Metastasis in an ipsilateral single node ≤3 cm without extranodal extension
pN2	Metastasis in
	(a) Ipsilateral single node ≤3 cm with extranodal extension, or, >3–6 cm without extranodal extension
	(b) Ipsilateral multiple nodes ≤6 cm without extranodal extension
	(c) Bilateral or contralateral node(s) ≤6 cm without extranodal extension
pN3	(a) Metastasis in a lymph node >6 cm, or,
	(b) Extranodal extension with any of; >3 cm, multiple ipsilateral, contralateral, bilateral

Extent of local tumour spread pharynx: TNM 8 for carcinoma

Oro-(hypopharynx): oropharyngeal carcinomas are staged differently under TNM 8 according to whether they are HPV-related ie negative or positive for p16 immunohistochemistry (p16 negative carcinoma staging given below).

pT1	Tumour ≤2 cm in greatest dimension (hypopharynx—and limited to one subsite)
pT2	2 cm < tumour ≤4 cm in greatest dimension (hypopharynx—and more than one subsite)
pT3	Tumour >4 cm in greatest dimension (hypopharynx—or with fixation of hemilarynx)
pT4	Tumour invades adjacent structures, e.g., pterygoid muscles, mandible, hard palate, deep muscle of tongue, larynx (hypopharynx—thyroid/cricoid cartilage, carotid artery, soft tissues of neck, pre-vertebral fascia/muscles, thyroid and/or oesophagus)

Nasopharynx

pT1	Tumour confined to nasopharynx, oropharynx, and nasal cavity
pT2	Tumour into parapharyngeal space
pT3	Tumour into bone of skull base and/or nasal sinuses
pT4	Intracranial extension, cranial nerves, hypopharynx, orbit, parotid gland, lateral pterygoid muscle

Regional lymph nodes: cervical—lymphadenectomy is selective or modified/radical including 10 or 15 or more nodes, respectively

Oro- and hypopharynx

pN0	No regional node metastasis
pN1	Metastasis in an ipsilateral single node ≤3 cm without extranodal extension
pN2	Metastasis in:
	(a) Ipsilateral single node ≤3 cm with extranodal extension, or, >3–6 cm without extranodal extension
	(b) Ipsilateral multiple nodes ≤6 cm without extranodal extension
	(c) Bilateral or contralateral node(s) ≤6 cm without extranodal extension
pN3	(a) Metastasis in a lymph node >6 cm, or,
	(b) Extranodal extension with any of; >3 cm, multiple ipsilateral, contralateral, bilateral

Nasopharynx

pN1	Unilateral cervical or uni-/bilateral retropharyngeal nodal metastasis ≤6 cm, above cricoid cartilage
pN2	Bilateral cervical nodal metastasis ≤6 cm, above cricoid cartilage
pN3	Metastasis in cervical node(s) >6 cm, or extension below cricoid cartilage

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