

CHAPTER

# 9 Tumors of the Upper Respiratory Tract

The upper respiratory system includes the nasal cavity and paranasal sinuses, pharynx and larynx. This system allows the passage of both air and food to their respective destinations (an aerodigestive system). The main function of the larynx, besides producing voice, is to prevent the entry of food into the trachea and lung through multiple sphincter mechanisms.

Tumors of the aerodigestive tract are grouped together because of their common etiologic factors, histologic profile and lines of treatment. As a group, they constitute about 55% of head and neck cancer (pharynx 25%, larynx 25% and sinonasal structures 5%).

## GENERAL CONSIDERATIONS

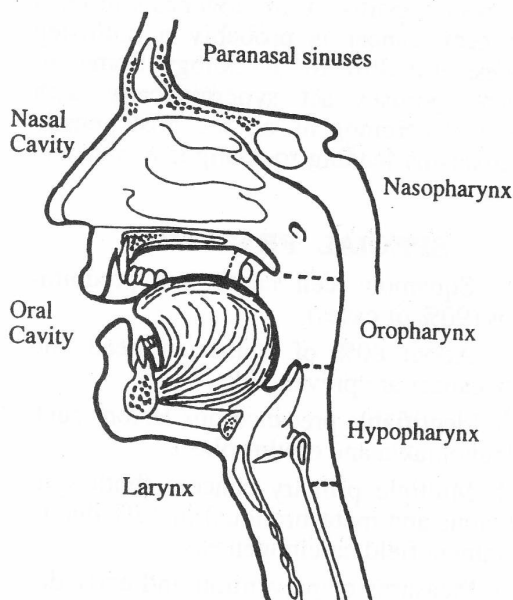
### Anatomic Landmarks

The sinonasal structures include the nasal cavity and the paranasal sinuses. The nasal cavity

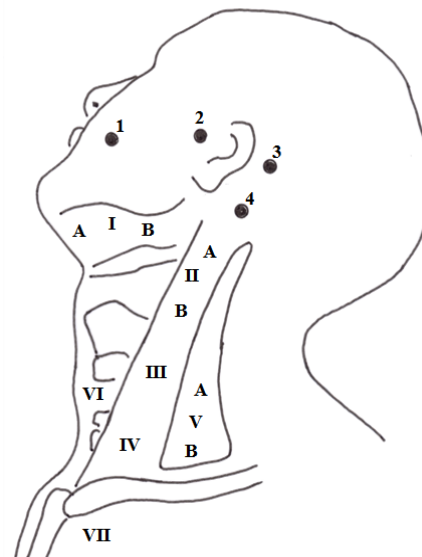
extends from the nose anteriorly to about the end of hard palate posteriorly where it communicates with nasopharynx through the choanae (Fig 9-1). The landmarks of the three main regions of the pharynx are demonstrated in (Fig 9-1). The nasopharynx (postnasal space or epipharynx) lies above the soft palate which forms its floor. The oropharynx (mesopharynx) extends from the lower border of soft palate to the lingual surface of epiglottis. On each side of the glossoepiglottic fold lies the vallecula. The hypopharynx (laryngopharynx) extends from the tip of epiglottis to the lower border of cricoid cartilage opposite the body of the sixth cervical vertebra where the esophagus begins.

### Lymph Nodes of Head and Neck

The regional lymph nodes of the head include 4 main groups, namely: the buccal, parotid, occipital and retropharyngeal (Fig 9-2). The latter group is commonly forgotten due to its hidden impalpable condition.



**Fig 9-1** Anatomic landmarks of the three components of upper respiratory system: the sinonasal structures, pharynx and larynx.



**Fig 9-2** Regional lymph nodes of head and neck. Head: (1) buccal, (2) parotid (3) occipital and (4) retropharyngeal. Neck lymph nodes: IA submental IB submandibular, II upper jugular, III midjugular, IV lower jugular, V posterior triangle, (A) upper and (B) lower, VI anterior central, and VII upper mediastinal.

Cervical lymph nodes are classified into 7 locations or levels (Fig 9-2). This classification was originally suggested by Suen and Goepfert in 1987 and later endorsed by UICC (Edge, 2010). Cervical lymph node groups or levels have the following specific anatomic boundaries:

*Level I:* extends from the mandible to the hyoid bone and is divided into two sublevels: IA, the submental group located anteriorly between the anterior bellies of digastric muscle and IB, two submandibular groups located between the anterior and posterior bellies of digastric muscle.

*Level II (the upper jugular group):* includes lymph nodes around the upper third of internal jugular vein and extends from the base of skull to hyoid bone. It is divided into two levels: II A, located anterior or medial to the spinal accessory nerve and II B, located posterior or lateral to the spinal accessory nerve.

*Level III (the middle jugular group):* includes lymph nodes around the middle third of internal jugular vein and extends from the inferior border of hyoid bone (above) to the inferior border of the cricoid cartilage (below).

*Level IV (the lower jugular group):* includes lymph nodes around the lower third of internal jugular vein and it extends from the lower border of cricoid cartilage (above) to the clavicle (below).

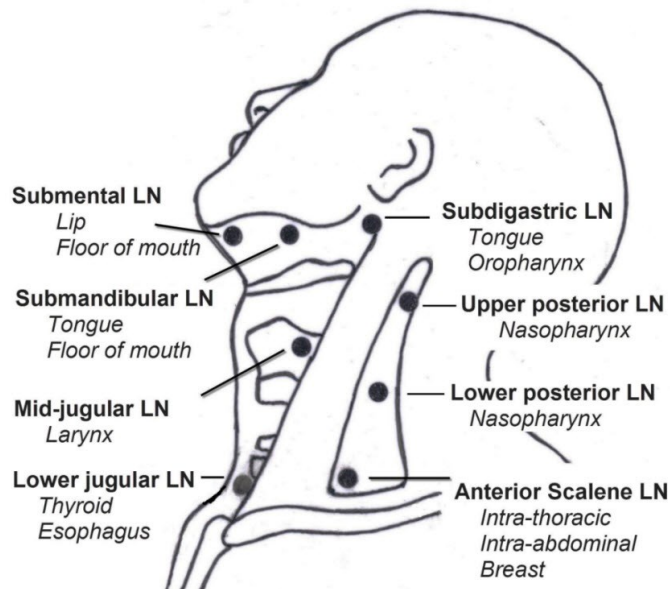
Virchow lymph node on left side (which drains thoracic and abdominal organs) belongs to this group.

*Level V (the posterior triangle groups):* the area bounded by the sternomastoid, trapezius and clavicle. It is divided by cricoid cartilage into two sublevels: VA an upper level including nodes around spinal accessory nerve and VB a lower level including supraclavicular lymph nodes.

*Level VI (the anterior or central group):* it extends from the hyoid bone superiorly, to the suprasternal notch inferiorly and carotid arteries laterally. It includes the precricoid (Delphian) node, perithyroidal nodes, pre and paratracheal nodes.

*Level VII (superior mediastinal group):* it extends from the suprasternal notch above to the innominate artery below.

The rationale for grouping lymph nodes by levels is that lymph flow of head and neck follows a predictable course. This has important diagnostic and therapeutic importance. First, the anatomic site of cervical lymphadenopathy usually suggests the site of primary cancer (Fig 9-3 and Table 9-1). Second, the treatment of head and neck cancer (whether by surgical node dissection or radiotherapy) can be tailored to the high-risk areas of metastasis.



**Fig 9-3** Sites of cervical lymphadenopathy diagnostic of primary origin of carcinomas. About 80% of cervical metastases are of head and neck origin.

**Table 9-1 Location of a Primary Tumor From the Level of its Cervical Lymph Node Metastases**

Lymph node level	Location of primary
IA	Lower lip, alveolar margin, anterior tongue
IB	Mid face, nasal cavity, oral cavity
II	Nasal, oral cavity, pharynx, larynx, parotid
III	Oral cavity, pharynx, larynx
IV	Hypopharynx, cervical esophagus
V	Nasopharynx, oropharynx
VI	Thyroid, larynx, pyriform sinus, cervical esophagus

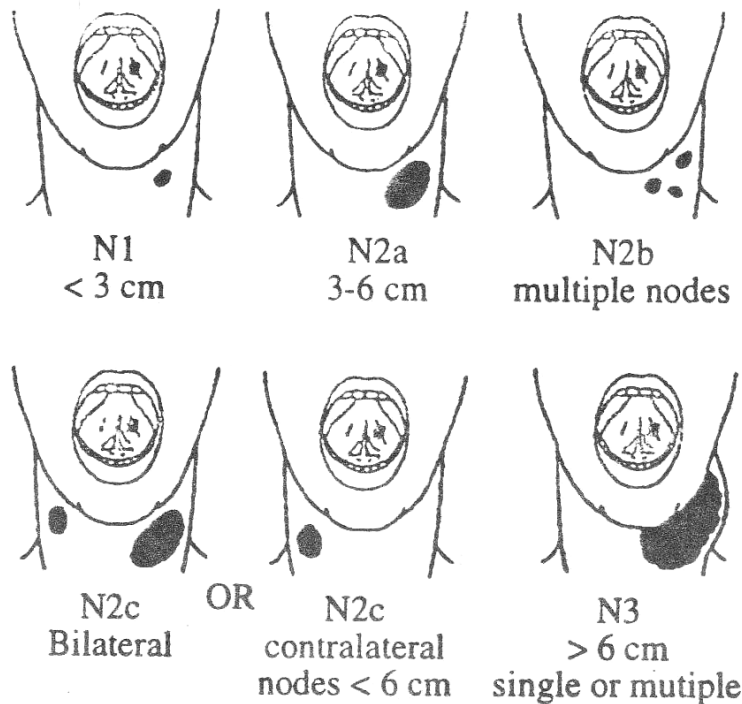
(Edge et al, 2010)

**TNM staging**

The TNM staging system proposed by the American Joint Committee (AJC) on cancer and the International Union Against Cancer (UICC) is recommended for staging (Edge, 2010). In this system, (T) describes the primary tumor, (N) the regional lymph node involvement and (M) distant metastases. The criteria of defining T categories varies in different sites of head and neck (surface dimensions of tumor is used in oral cavity and oropharynx, but, invasion of adjacent sites in tumors of nasopharynx, oropharynx and larynx).

Classification of nodal (N) and distant metastases (M) are similar for all sites of head and neck (Fig 9-4), other than the nasopharynx. The distribution and prognostic impact of regional lymph node spread from nasopharyngeal carcinoma are different from those of head and neck mucosal cancers and justify the use of a different (N) classification scheme (N1 <6 cm, N3 >6 cm, supraclavicular node metastases is classified as stage IV B).

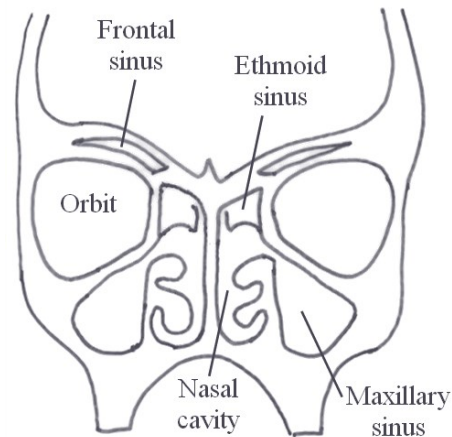
The stage of carcinoma is reached by combining TNM categories (Fig 9-5). Tumor stage is used clinically to guide therapy and predict prognosis.



**Fig 9-4** Lymph node staging (N categories) applicable for all head and neck carcinomas except nasopharynx.

	T <sub>is</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	M <sub>1</sub>
N <sub>0</sub>	O	I	II			
N <sub>1</sub>				III		
N <sub>2</sub>						
N <sub>3</sub>						IV

**Fig 9-5** TNM stage grouping for head and neck cancers (except nasopharynx).



**Fig 9-6** Anatomic relations of the nasal cavity and its accessory paranasal air sinuses.

## SPECIAL CONSIDERATIONS

### TUMORS OF NASAL AND PARANASAL SINUSES

#### Anatomy

The nasal cavity extends from the nose anteriorly to about the end of hard palate posteriorly where it communicates through choanae with the nasopharynx. The nasal cavity is divided in the midline by the nasal septum (bony and cartilaginous components). On the lateral wall are the superior, middle and inferior turbinate, as well as, openings (ostea) of paranasal sinuses. The hard palate forms the floor of nasal cavity and its roof is formed by the cribriform plate which transmits the filaments of olfactory nerve.

Four accessory air sinuses are related to the nasal cavity, namely: frontal, ethmoid, maxillary and sphenoid sinus (Fig 9-6). These paranasal sinuses are so named for the bones in which they are located. An imaginary line (Ohngren's line) drawn from the medial canthus to the angle of the mandible divides the paranasal sinuses into an infrastructure and suprastructure (Fig 9-7). The epithelial lining of sinonasal structures (Schneiderian epithelium) is derived from ectoderm, and is uniquely different from epithelium of the rest of upper respiratory tract which is derived

from endoderm. Schneiderian epithelium is a pseudostratified columnar epithelium that simulates transitional epithelium of the urinary system.

#### Epidemiology

Sinonasal carcinoma affects mainly adults (> 60 years) with male predominance (sex ratio 2:1). Human papilloma virus (HPV) is etiologically related to Schneiderian papilloma and carcinoma. Moreover, industrial exposure to inhalation of wood and textile dust, as well as, nickel, chromium and radium plays a strong carcinogenic role.

#### Classification

The unique histology of sinonasal system is reflected on the histogenesis of a complex variety of tumors with a wide range of biologic behavior (Table 9-2). Classically, they are divided into: benign, recurring but non-metastasizing and malignant (primary or metastatic). Pigmented neuroectodermal tumor of infancy (P 9-1) and osteoma (P 9-2) are rare benign tumors which may arise in paranasal sinuses. This location is also the seat of ectopic intracranial tumors such as meningioma or pituitary adenoma.

Inverted papilloma (contrary to the benign exophytic papilloma) is a high risk tumor with a 35% recurrence rate and 13% associated invasive malignancy (P 9-3). Ossifying fibroma is another locally aggressive and recurrent tumor almost

**Table 9-2 Classification of Sinonasal Tumors**

<b>Benign Tumors</b>
Schneiderian exophytic papilloma
Pigmented neuroectodermal tumor
Extracranial meningioma
Osteoma
<b>Recurring tumors</b>
Inverted papilloma
Ameloblastoma
Angiofibroma
Ossifying fibroma
Myxoma
<b>Carcinomas</b>
Squamous cell carcinoma
Schneiderian (transitional)
Adenocarcinoma
Salivary gland type
Intestinal type
Non-intestinal type
Undifferentiated carcinoma
<b>Neuroectodermal</b>
Melanoma, neuroblastoma
<b>Lymphomas</b>
NK/T lymphoma, Burkitt, plasmacytoma
<b>Sarcomas</b>
Rhabdomyosarcoma, chondrosarcoma, osteosarcoma, fibrous histiocytoma
<b>Metastases</b>
From kidney, lung, breast

(Barnes et al, 2005)

restricted to jaw bones (P 9-4). Myxoma of maxilla (odontogenic in origin) belongs to the same family of locally recurrent tumors (P 9-5).

In the carcinoma group, keratinizing squamous carcinoma predominates, but non-keratinizing transitional type may also be observed (P 9-6). The three main subtypes of adenocarcinomas are: salivary gland type (P 9-7), intestinal type (P 9-8) or non-intestinal type (Stelow et al, 2010). Sinonasal undifferentiated carcinoma is a highly anaplastic tumor associated with the worst prognosis.

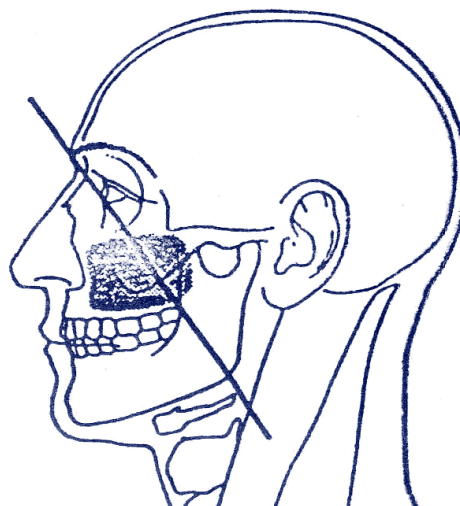
The nasal cavity is among the common sites of primary extracutaneous melanoma (P 9-9), as well as, neuroblastoma (P 9-10), both are of neuroecto-

dermal origin. Olfactory neuroblastoma is graded into 4 grades based on anaplasia, mitosis, fibrillary stroma, type of rosettes and necrosis (Hyams et al, 2000). High grade tumors (grade 3 and 4) lack fibrillary stroma, shows active mitosis, true rosettes and focal necrosis.

The three most common non-Hodgkin lymphomas (NHL) which affect this site are: NK/T cell lymphoma nasal type (P 9-11), Burkitt lymphoma and plasmacytoma. Important soft tissue sarcomas which may arise from this location are rhabdomyosarcoma (P 9-12), chondrosarcoma (P 9-13), osteosarcoma and malignant fibrous histiocytoma (MFH).

### Malignant maxilla

The maxillary sinus (antrum of Highmore) is the largest of the accessory sinuses of the nose. It is pyramidal in shape, with its base related to the lateral wall of nasal cavity, apex related to the zygomatic process and roof related to the orbit. An imaginary line (Ohngren's line) drawn from the medial canthus to the angle, of the mandible divides the paranasal sinuses into an infrastructure and suprastructure (Fig 9-8). In general, sinus tumors of the suprastructure are more common,

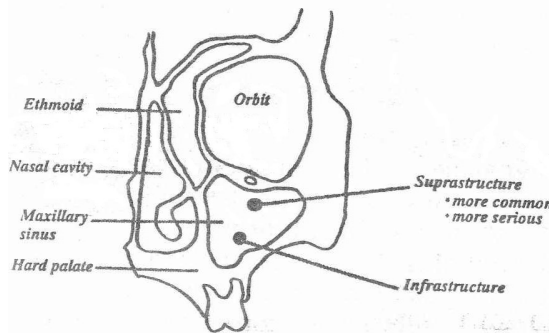


**Fig 9-7** Ohngren's line (extending from inner canthus to angle of mandible) divides paranasal sinuses into suprastructure and infrastructure.



less amenable to surgical excision, more close to vital structures and hence carry a more unfavorable prognosis.

The *maxillary sinus* is the most common sinus affected by malignancy, The median age is the 6th decade and males predominate with a ratio of 2:1. The etiology is related to industrial exposure to nickel, wood dust, chromium, thorotrast or chronic sinusitis. Histologically Table 9-2), squamous cell carcinoma predominates (75%).



**Fig 9-8** Anatomic relations of maxillary antrum and its division to suprastructure and infrastructure.

**Table 9-3** TNM Staging and Survival of Maxillary Carcinoma

Stage	5-year survival	
0	Carcinoma in situ (noninvasive)	
I	Tumor confined within maxillary sinus, no bone invasion	60%
II	Bone invasion (except posterior wall of maxilla)	
III	Bone invasion (posterior wall of maxilla, orbit or ethmoid), soft tissue invasion, L. node <3 cm	30%
IV A	Invasion of anterior orbit, pterygoid, infratemporal fossa, sphenoid or frontal sinus, or positive nodes 3 - 6 cm	
IV B	Brain invasion or positive nodes >6 cm	
IV C	Any T or N with distant metastases	

(Edge et al, 2010)

*Spread* of maxillary carcinoma occurs by the following routes: (1) *local spread*, downwards to the hard palate forming an antro-oral fistula; superior spread to orbit and ethmoid sinus; anterolateral spread to cheek; or posterior spread to nasopharynx, pterygoid muscle (trismus) and invasion of branches of trigeminal nerve in infratemporal fossa (maxillary, lingual and inferior dental branches), (2) *lymph node spread* occurs in 15% of cases and the most common nodes affected are level I, and (3) *hematogenous spread* occurs in advanced cases.

The *TNM staging* and 5-year survival for maxillary carcinoma is presented in (Table 9-3). In operable cases, it is important to distinguish tumors confined to maxilla (stages I and II) from those with extramaxillary spread (stage III), since survival rates drops from 60% to 30% in these two groups respectively. Relapse is usual within 2 years, but recent cisplatinium based chemoradiotherapy is effective to control the disease.

### Differential diagnosis

Giant cell granuloma (better called giant cell lesion) is an obscure giant cell reactive process (P 9-14) which should not be misdiagnosed as giant cell tumor. Wegener's granulomatosis is another idiopathic possibly autoimmune disease (P 9-15) must be distinguished from NK/T cell lymphoma. Finally, the so called nasal glioma (P 9-16) is not a true neoplasm, but, just ectopic normal glial tissue in the nasal cavity. Rhinoscleroma (P 9-17) must not be misdiagnosed as clear cell carcinoma

## TUMORS OF NASOPHARYNX

### Anatomy

The nasopharynx is the transitional area between the nasal cavity and oropharynx, located above the soft palate and measuring only 3 x 3 cm in dimensions. Its lateral wall contains the auditory (Eustachian) tube, with the fossa of Rosenmuller located behind and medial to it (Fig 9-9). The nasopharynx contains also a collection of lymphoid tissue, namely, the adenoids or nasopharyngeal tonsil.

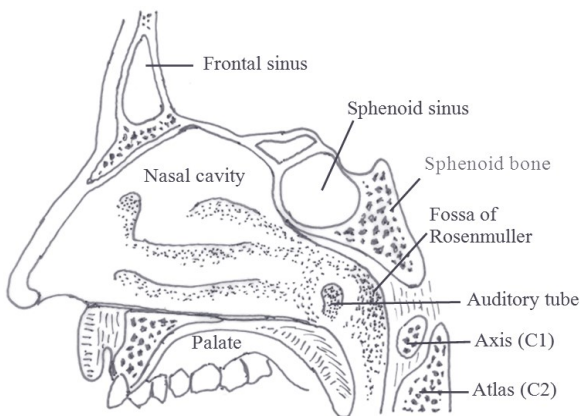
The fascial spaces around the nasopharynx contain important nerves and structures. Thus, the retropharyngeal space contains the lymph node of Ranvier, and the parapharyngeal space contains the maxillary artery and nerve, as well as the carot-

id sheath. The nasopharynx is also related to several cranial nerves, namely: nerves III to V in cavernous sinus, and nerves VIII to XII as they emerge from the base of skull (Fig 9-10). Clinical manifestations of nerve palsies are important for staging of the tumor.

The epithelial lining of nasopharynx is stratified squamous epithelium, but, the superior and lateral wall contain ciliated transitional epithelium which explains the development of Schneiderian type of carcinoma in some cases.

### Epidemiology

Nasopharyngeal carcinoma is most common in China (18% of all cancers) and North Africa, as compared to western countries (only 0.25% in



**Fig 9-9** Surface anatomy of nasopharynx. The fossa of Rosenmuller, the most common site of carcinoma, is closely related to the opening of auditory tube and openings of nasal cavity. (deafness and nasal obstruction are early symptoms).

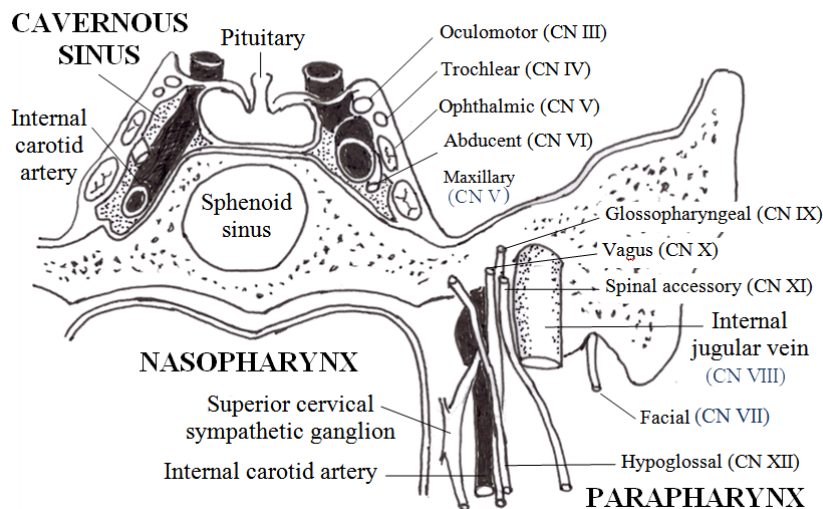
USA). Association with Epstein-Bar virus (EBV) infection is most striking especially in endemic areas (viral antibodies detected in 93% of cases and viral DNA in 80%). Other contributing etiologic factors in endemic areas include the high consumption of salted fish rich in nitrosamines and inhaling formaldehyde chemical fumes.

### Molecular Oncogenesis

Tumor initiation requires EBV expression and EBV-LMP1 appears to be the principal oncogene. Important early events include: (a) inactivation of p16 (due to deletion of 9p21) resulting in cell cycle dysregulation, (b) Bcl-2 overexpression (anti-apoptosis) and (c) telomerase overexpression (increased cell survival). Additional late mutations will lead to tumor progression and development of metastases.

### Pathology

The WHO classified nasopharyngeal carcinomas into keratinizing and non-keratinizing. The latter is further subdivided into differentiated (transitional) and undifferentiated (Table 9-4). keratinizing squamous carcinoma shows obvious keratin formation, the differentiated subtype simulates urothelial carcinoma, and the undifferentiated carcinoma is characterized by large vesicular nuclei, prominent nucleoli and indistinct cytoplasm (P 9-18). Other tumors which are not uncommon in nasopharynx include: nasopharyngeal angiofibroma (P 9-19), large cell NHL (P 9-20)



**Fig 9-10** Relation of nasopharynx to cranial nerves. A carcinoma may invade cranial nerves III to VI in cavernous sinus (paralysis of ocular movement) or cranial nerves IX to XII at base of skull (paralysis of tongue movement).

**Table 9-4 WHO Histological Classification of Nasopharyngeal Carcinoma**

	<b>Keratinizing</b>	<b>Non keratinizing</b>	<b>Undifferentiated</b>
<b>Frequency</b>			
Endemic (China)	1%	7%	92%
Non-endemic (USA)	25%	15%	60%
<b>Age</b>	Adults	Adults	Young adults and children
<b>EBV association</b>	Weak	Strong	Strongest
<b>Radiation response</b>	Resistant	Sensitive	Sensitive
<b>5-Year survival</b>	20-40%	65%	65%

(Barnes et al, 2005/ Thompson, 2006)

and chordoma of basiocciput bone (P 9-21).

**Spread**

The spread of carcinoma is by the following three routes: (1) *local spread*: lateral to pterygoid muscle (trismus) or Eustachian tube; anterior spread to the nasal cavity, upward spread behind the sphenoid to the base of skull (paralysis of cranial nerves II to IV) or along the hypoglossal foramen (cranial nerves XI and XII), jugular and carotid vessel invasion, (2) *lymph node metastases* occur in 85 to 95% of cases, bilateral in 53%, with affection of all levels especially level V and the retropharyngeal node of Ranvier, and (3) *hematogenous spread* in 20% of cases to distant locations.

**Staging**

The staging and survival of nasopharyngeal carcinoma is presented in (Table 9-5). The TNM system for this tumor is different from other head and neck tumors especially the N categories. Thus, the critical size of node enlargement is 6 cm not 3 cm. Moreover, metastases in supraclavicular lymph nodes is classified as stage IV.

**Table 9-5 Staging and Survival of Nasopharyngeal Carcinoma**

Stage		5 year survival
0	Carcinoma in situ (noninvasive)	
I	Tumor confined to nasopharynx (T1)	61%
IIA	Invasion of nasal cavity or oropharynx (N0M0)	
IIB	Invasion of parapharyngeal soft tissue, unilateral positive nodes < 6 cm (N1)	56%
III	Invasion of paranasal sinuses or bony structures, bilateral nodes < 6 cm (N2)	56%
IVA	Intracranial spread, nerve palsy	34%
IVB	Positive nodes > 6 cm, positive supraclavicular nodes	
IVC	Any T or N with distant metastases (M1)	

(Edge et al, 2010)

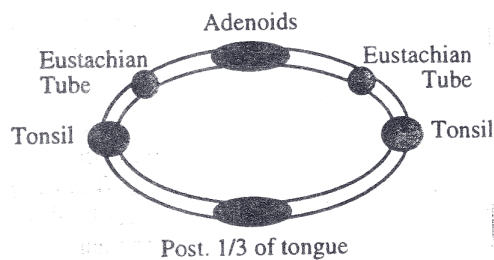


## CANCER OF OROPHARYNX

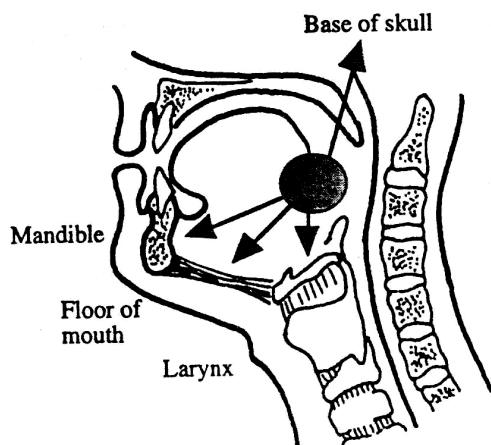
It accounts for 10% of all head and neck malignancies. The tumor may arise from posterior third of tongue, tonsils or its pillars, soft palate, lateral or posterior pharyngeal wall. The median age is 60 years and male predominance is 2:1. The etiology is related to smoking and alcohol abuse, as well as, HPV infection.

The oropharynx also contains Waldeyer ring of lymphoid tissue (Fig 9-11) which is considered a nodal rather than extranodal site. The lymphoma which arises from this tissue is usually high-grade aggressive NHL (non-MALT type), and is usually difficult to distinguish from undifferentiated carcinoma. Immunohistochemistry is needed for recognition (LCA).

The spread of oropharyngeal cancer is (1) *local*, upward to base of skull, downward to larynx, floor of mouth and mandible (Fig 9-12), (2) *lymph nodes* in 75% of cases to level I and (3) *hematogenous*.



**Fig 9-11** Waldeyer's ring of lymphoid tissue in oropharynx. It is considered nodal and not mucosa-associated lymphoid tissue (MALT).



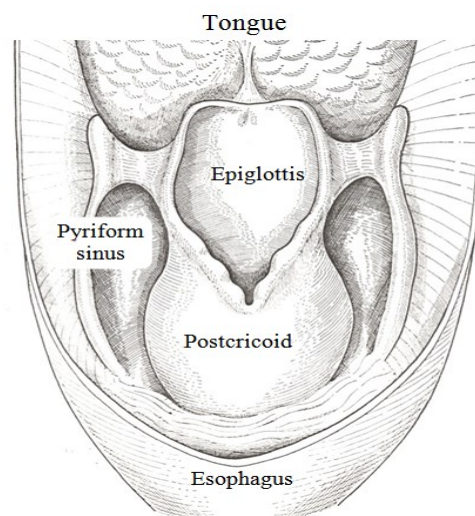
**Fig 9-12** Local spread of carcinoma of oropharynx.

## CANCER OF HYPOPHARYNX

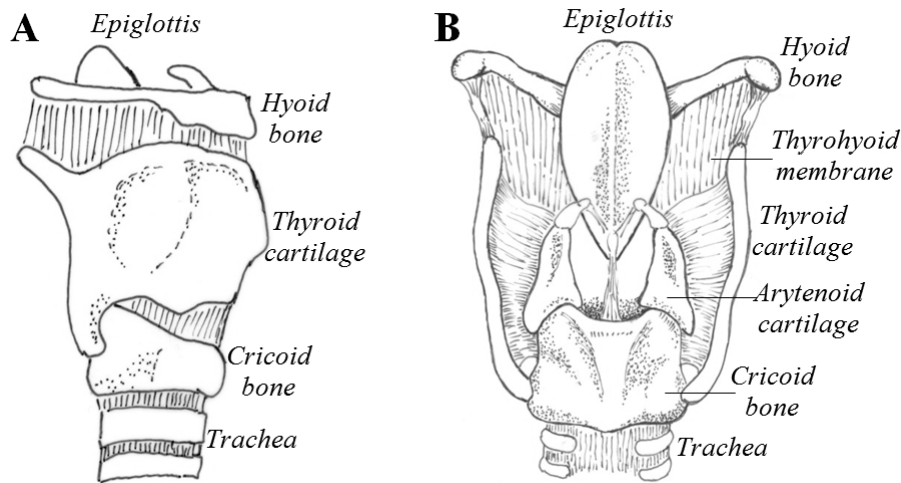
It accounts for 5% of head and neck cancer. The median age is 55 years. Carcinoma of upper hypopharynx or pyriform sinus (Fig 9-13), is common in males and related to smoking. Conversely, carcinoma of lower hypopharynx (postcricoid) is common in females and is related to malnutrition particularly vitamin B12 and iron deficiency (Plummer-Vinson syndrome) characterized by iron deficiency anemia, dysphagia, hypochlorohydrria and glossitis.

The carcinoma occurs most commonly at the pyriform sinus (70%) in total series (P 9-22) and the histology is commonly squamous carcinoma (95%) with field cancerization in 15% of cases.

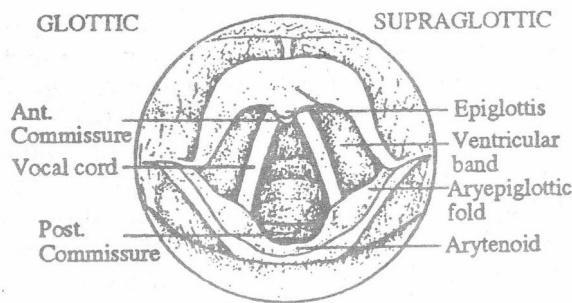
The carcinoma spreads by three routes, namely: (1) *local*: from pyriform sinus upward to the base of skull and anteriorly to invade thyroid cartilage (50%) and recurrent laryngeal nerve, postcricoid carcinoma spreads down to esophagus, (2) *lymphatic* spread to levels II and III nodes, paratracheal and retropharyngeal; the risk of metastases is 80% in pyriform sinus, 60% in posterior tumors and 40% in postcricoid region, and (3) *distant metastases* occur in 24% of cases. Hypopharyngeal carcinoma is histologically aggressive tumor with 5-year survival as low as 25%.



**Fig 9-13** Surface anatomy of anterior wall of hypopharynx showing the sites of pyriform sinus and postcricoid regions.



**Fig 9-14** Cartilagenous skeleton of larynx includes 3 unpaired cartilages (epiglottis, thyroid and cricoid) and 3 paired cartilages (arytenoids, corniculate and cuneiform), all are attached by fibrous ligaments and membranes. A. side view and B. posterior view.



**Fig 9-15** Surface anatomy of larynx as seen by laryngoscopy showing glottis and supraglottic structures.

## TUMORS OF LARYNX

### Anatomy

The laryngeal skeleton is composed of 9 cartilages (Fig 9-14), 3 single (epiglottis, thyroid and cricoid) and 3 paired (arytenoid, corniculate and cuneiform). The hyoid bone is not included in the laryngeal skeleton. Anatomically, and for the purpose of TNM staging, the larynx is divided into three sites or regions, namely: supraglottic, glottis and infraglottic (Fig 9-15).

*Supraglottic region:* includes epiglottis, aryepiglottic folds, arytenoids, ventricular folds (false cords) and ventricles which are two sinuses between the false and true cords.

*Glottic region:* includes the true vocal folds (cords) which extend from the arytenoids to the thyroid cartilage and they meet close together anteriorly at the thyroid cartilage (anterior com-

missure), but are separated posteriorly (posterior commissure), producing the V-shape of glottis (Fig 9-15).

*Subglottic region:* This is the area between the vocal cord and lower border of cricoid. It is related anteriorly to the thyroid cartilage, cricothyroid ligament and cricoid.

The larynx in adults is lined by squamous epithelium. The true cord is identified histologically by the presence of vocalis muscle in the lamina propria, whereas, the false cord contains abundant seromucinous minor salivary glands in the lamina propria.

### Epidemiology

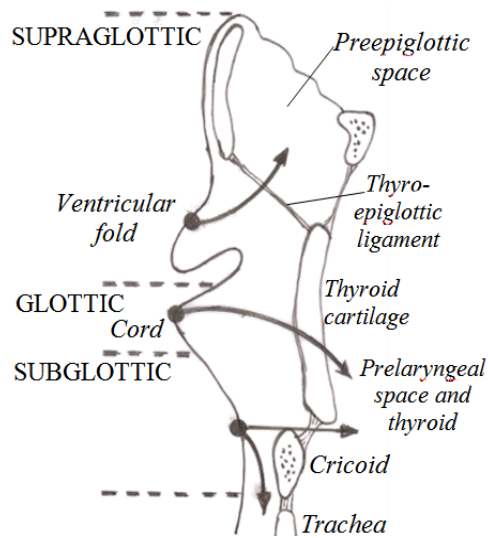
Carcinoma of the larynx constitutes 1.5% of all cancers and 25% of head and neck cancer. The median age is 60 years and males predominate with a ratio of 4.5: 1. The carcinoma is etiologically related to tobacco smoking, alcohol overuse, nutritional deficiency and human papilloma virus infection.

### Macroscopy

The carcinoma presents grossly as a nodular mass or ulcer (P 9-22 and P 9-23). The most common site is glottis (65%), followed by supraglottic (34%) and infraglottic (1%).

### Histopathology

Precursor lesions include the HPV-related squamous papilloma (P 9-24), squamous dysplasia



**Fig 9-16** Local spread of laryngeal carcinoma. Supraglottic carcinoma invades the thyroepiglottic ligament to reach the preepiglottic space. Glottic carcinoma invades the thyroid cartilage (50% of cases) to reach the prelaryngeal space. Infraglottic carcinoma may invade the prelaryngeal space or trachea (Micheau et al, 1976).

or leukoplakia (P 9-25) and carcinoma in situ (P 9-26). Invasive squamous carcinoma may be microinvasive or conventional invasive carcinoma (P 9-27). Verrucous and papillary variants of squamous carcinoma may also occur (P 9-28). The risk of malignant transformation in dysplasia is 24%, but, 60% in carcinoma in situ.

**Spread**

1. *Local spread:* this occurs in an anterior direction, and the structures invaded depends on the site of origin of the tumor (Fig 9-16). The main tissues involved are: The pre-epiglottic area, prelaryngeal space and trachea (P 9-29).

2. *Lymph spread:* again, the frequency of lymph node metastases varies markedly according to tumor location (Table 9-6). Glottic carcinomas are

**Table 9-6** Sites of Origin of Laryngeal Carcinoma and their Related Frequency of Lymph Node Metastases

Site	% of tumors	% lymph node metastases
Supraglottic	34	40
Glottic	65	5
Subglottic	1	40

(Smith, 1973)

**Table 9-7** TNM Staging and survival of Laryngeal Carcinoma

Stage		5-year Survival
0	Carcinoma in situ (noninvasive)	
I	Limited to one site (T1), mobile cord	67%
II	Invasion of 2 sites, limited cord mobility	54%
III	Invasion of all sites of larynx or ipsilateral node metastases (N1)	43%
IV	Extra laryngeal spread (T4), bulky node metastases (> 3 cm), bilateral node metastases or distant metastases (M1)	30%

(Edge et al., 2010)

associated with the lowest rate of lymph node metastases since the vocal cord is poor in lymphatics. Node metastases involve the internal jugular groups (levels II, III and IV).

3. *Blood spread:* is exceedingly rare.

**Staging**

The TNM staging system and its related 5-year survival is presented in (Table 9-7). Survival varied between 67% to 30% according to stage. The 5-year survival also varied according to the site of tumor (80% in glottis carcinoma, 65% in supraglottic and 40% in subglottic location).

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