Chapter 12: Hypopharynx and Larynx

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Throat Pain and Odynophagia

Definition

Throat pain is any discomfort of the pharynx and usually refers to the oropharynx, larynx, and hypopharynx, but can involve the inferior nasopharynx and the posterior portion of the oral cavity. Odynophagia is painful deglutition and can involve any area from posterior oral cavity to the cervical esophagus. So, in any complaint of throat pain and/or odynophagia, a complete evaluation must be made of the oral cavity, oropharynx, hypopharynx, larynx, and inferior nasopharynx. Commonly seen by primary care physicians, the patient with throat pain may ultimately be discovered to have a carcinoma of the hypopharynx.

Subjective Complaints

Throat pain with or without odynophagia can involve any of the above-described areas. Sharp knifelike pain is non-specific but seen more with inflammatory lesions. Deep, boring, aching pain is either chronic mild inflammation or neoplasm. Sharp, brief, lancinating pain is neurologic as in glossopharyngeal neuralgia.

Acute. Sudden onset and short duration are usually inflammatory; occasionally a neoplasm with secondary infection will give acute symptoms.

Chronic. Usually neoplastic; but can be chronic irritative or mild inflammatory (from chronic postnasal discharge).

Constant. Usually neoplastic but can be irritative and mild inflammatory (from chronic postnasal discharge).

Intermittent. Usually inflammatory, but early neoplastic disease can give intermittency.

Fever. Inflammatory.

Dysphagia. Neoplastic, inflammatory, and neurologic.

Weight Loss. Usually neoplastic.

Referred Otalgia. Any: source can be from nasopharynx to hypopharynx.

Neck Mass. Usually inflammatory if tender; neoplastic if nontender lymphadenopathy.

Cough. Chronic irritation from bronchitis and/or sinusitis. Tuberculosis and other granulomatous disease must be kept in mind.
**Chronic Sinus Disease with Postnasal Discharge.** Often a cause of chronic throat pain; usually in the morning and improves as the day progresses; worse when the postnasal discharge is purulent.

**Dyspnea, Acute.** Usually inflammatory seen with peritonsillar, parapharyngeal and retropharyngeal abscess, and epiglottitis, floor of the mouth abscess, and Ludwig's angina. Rarely, a large neoplasm with secondary infection can obstruct the airway acutely.

**Dyspnea, Chronic.** Large neoplasm.

**Trauma.** Usually with acute trauma: either blunt or penetrating trauma, caustic ingestion, smoke inhalation, or hot food/liquid ingestion. Chronic trauma gives stenotic symptoms, except perichondritis of the larynx (with tenderness of the neck, sometimes with purulent discharge from the neck).

**Age.** Younger - usually inflammatory. Older - neoplastic, atrophic pharyngitis and laryngitis.

**Radiation Therapy.** Performed for neoplastic disease of the oral cavity, oropharynx, larynx, hypopharynx, and esophagus. Throat pain starts 3-4 weeks after the beginning of radiation therapy, is due to radiation mucositis and can last for 2-3 months. If occurring late after completion of radiation therapy, perichondritis or tumor persistence is suspected.

**Systemic Diseases.** Especially autoimmune diseases. Throat pain occurs in cricoarytenoid arthritis, most commonly seen with rheumatoid arthritis, but can occur with any autoimmune disease.

**Neurologic.** Except for neuralgia, throat pain and odynophagia are rare. More likely to cause dysphagia and aspiration.

**Allergy.** A common cause of chronic postnasal discharge.

**Psychogenic.** Rare, must rule out all organic causes.

**Tobacco/Alcohol.** Both are irritative and can cause chronic pharyngitis and laryngitis. Squamous cell carcinoma of the head and neck is closely linked to tobacco use - cigarette, pipe and cigar.

*Objective Findings*

**Diffuse Pharyngitis.** Most common cause of throat pain. There are two types. Viral pharyngitis is the more common; the pharynx is minimally erythematous or normal-appearing. In the bacterial variety, the pharynx is erythematous and usually with exudate.

**Acute Tonsillitis.** Marked inflammation of the tonsils. May have exudate and purulent material in the tonsillar crypts.
Peritonsillar Abscess/Cellulitis. A lateral extension of acute tonsillitis to peritonsillar tissues. The tonsillar pillars and ipsilateral soft palate are inflammed and swollen. The uvula is displaced to the opposite side. Fifty percent contain abscess and 50% are cellulitis. Aspiration in the proper area is important for diagnostic differentiation.

Parapharyngeal Abscess/Cellulitis. An extension of infection to parapharyngeal space. The origin is pharyngeal or dental. The lateral pharyngeal tissues are inflammed and swollen. The tonsils and surrounding pillars are displaced medially and not as swollen as peritonsillar abscess. Cervical lymphadenopathy is common. Infection can extend from base of skull to mediastinum.

Retropharyngeal Abscess. Usually occurs in children under 2 years of age and is secondary to suppuration of retropharyngeal lymph node. Because of the median raphe of the constrictor muscles, the swelling occurs only on one side of the pharynx and can extend from nasopharynx to posterior hypopharynx. Bilateral swelling means involvement of prevertebral space. It is best to avoid spontaneous rupture or uncontrolled aspiration, as aspiration pneumonitis and lung abscess may result.

Floor of Mouth Infection. Marked inflammation and swelling of the floor of the mouth. In severe cases, swelling at the base of the tongue results in airway obstruction. The floor of mouth is very tender on palpation and cervical lymphadenopathy is common.

Membranous Pharyngitis

1. Nonspecific bacterial pharyngitis or viral pharyngitis: the most common type.

2. Diphtheric pharyngitis: has a dirty white or gray membrane that is adherent and when detached bleeds easily.

3. Vioncent's angina: acute membranous pharyngitis that involves tonsils, both fauces, soft palate, and gums. The membrane is gray and separates easily.

4. Candidiasis: the most common fungal pharyngitis and may be membranous with white patches in the fauces, tonsils, tonsil, and buccal mucosa. Discomfort is minimal. Microscopic examination of the exudate will reveal the yeast.

Acute Laryngitis. This is an extension of acute pharyngitis. The entire larynx is mildly inflammed in viral and moderately inflammed in bacterial laryngitis.

Chronic Pharyngitis. Findings can be minimal. If from sinuses and postnasal discharge, the vertical lymphoid streaking can be seen in the posterior oropharynx. If from bronchitis, larynx and vocal cord also show chronic inflammation.

Chronic Laryngitis. The vocal cords have normal mobility. It is secondary to irritative and chronic inflammation. The findings are minimal with thickened, white vocal cords. Smoking, postnasal discharge, chronic sinusitis, and chronic bronchitis are the common causes.
Atrophic Laryngitis. This is the end stage of chronic laryngitis and is seen in the elderly. The mucosa is atrophic, with dryness and some inflammation. Dry, crusted exudate may be seen.

Tuberculosis. May occur any place in the pharynx, from oropharynx to larynx; is uncommon and almost always associated with pulmonary tuberculosis. The lesions ulcerate and tend to coalesce and are very painful.

Herpes of Pharynx and Larynx. Extremely rare. Groups of ulcerative lesions with erythematous bases are seen. Lesions are painful.

Perichondritis. Persistent tenderness and swelling of the larynx. The external neck is tender to palpation over the thyroid cartilages, with swelling of the laryngeal structures and loss of anatomic definition.

Trauma. In acute trauma, external neck examination shows swelling and tenderness of the neck, and thyroid cartilage prominence may be flattened or lost. The thyroid cartilage may be displaced laterally from the cricoid or trachea. Mirror examination may show hematoma, swelling, mucosal lacerations, exposed cartilage, vocal cord paralysis, and displacement of epiglottis posteriorly and the arytenoids anteriorly.

Chronic trauma will result in deformed laryngeal contour with loss of normal laryngeal crepitance and movement. Mirror examination may show stenosis, displacement of epiglottis posteriorly and arytenoids anteriorly, and vocal cord paralysis.

Cricoarytenoid Arthritis. Of rheumatoid arthritis patients, 25% will have cricoarytenoid arthritis. In acute phase, there is inflammation and some decrease in motion of this joint. Late changes include lack of tenderness but fixation of cricoarytenoid joints.

Carcinoma. Most common are the squamous cell carcinomas. They are exophytic or deeply infiltrating masses and are friable. They can occur in any place - oral cavity, oropharynx, hypopharynx, and larynx. Large carcinomas usually have lymph node metastasis.

Radiation Mucositis. Diffuse erythema and inflammation with moderate tenderness, sometimes with exudation.

Psychogenic. No abnormalities are seen.

Assessment

Thorough examination of the oral cavity, oropharynx, and hypopharynx is necessary. Good indirect nasopharyngoscopy and laryngoscopy are mandatory and often yield the diagnosis. Palpation of the tonsils and base of tongue must be done.

Inflammatory Diseases. Proper culture and sensitivities must be obtained. Culture and examination of the membrane under microscope yields the diagnosis. Heterophil titers are used to diagnose infectious mononucleosis.
Sinuses x-rays are helpful in those with chronic nonspecific pharyngitis and laryngitis to search for chronic sinus disease.

Chronic bronchitis and possible tuberculosis or other granulomatous disease must have chest x-rays. Skin tests should be done. Bronchoscopy and mediastinoscopy may be necessary.

All suspicious neoplastic lesions must be biopsied. Except oral cavity lesions, all other neoplastic lesions must be examined under general anesthesia so the full extent can be appreciated. In lesions of the hypopharynx and larynx, a direct laryngoscopy must be performed.

Patients with suspected cricoarytenoid arthritis should have autoimmune disease workup with erythrocyte sedimentation rate, rheumatoid factor, antinuclear antibodies, and LE preparation.

Trauma. Acute: Evaluate for airway obstruction, CNS and cervical vertebral injuries, chest and abdominal injuries first. Soft tissue x-rays and xeroradiography of the neck are helpful. Direct laryngoscopy is performed. Arteriography is useful in suspected major vessel injuries.

Chronic: Pain is not the usual symptom. Soft tissue x-rays and xeroradiography of the neck, dye contrast or air tomogram of the laryngopharynx, and direct laryngoscopy are necessary. Where there is severe airway obstruction, dye contrast laryngograms should not be done, as this will precipitate acute airway obstruction.

Allergy. Suspicious allergic basis must have allergy workup.


Plan

Acute Diffuse Pharyngitis. Viral etiology is treated with rest, adequate liquids, and analgesia.

Bacterial etiology is treated with specific antibiotics. Since the organism is usually a gram-positive variety (group A, beta-hemolytic streptococcus and Streptococcus pneumoniae), penicillin, 250 mg QID, or erythromycin, 250 mg QID, for 7-20 days will suffice. Analgesia and an antipyretic are used as necessary.

Acute Tonsillitis. Viral etiology is treated with analgesia and antipyretics, and adequate hydration.

Bacterial tonsillitis: This is usually from group A beta-hemolytic streptococcus. Penicillin or erythromycin will be sufficient. Cultures must be taken, as viral and bacterial tonsillitis cannot always be distinguished clinically. Tonsillectomy is not recommended for
the occasional acute tonsillitis. If this occurs more often than three to four times per year, tonsillectomy may be considered.

**Peritonsillar Abscess/Cellulitis.** Half are abscess and half are cellulitis. Aspiration of the most fluctuant area is made. If there is no purulent material with a no. 18 needle aspiration in the most likely site, incision and drainage are not indicated. If purulent material is aspirated, incision and drainage are performed. This is done with local anesthesia.

There are then two treatment plans: The first is immediate tonsillectomy. After the diagnosis is made, the aspirate is cultured and the patient is hospitalized and given the antibiotic intravenously, and tonsillectomies are performed under general anesthesia, after 12-24 hours of treatment.

The second treatment plan is incision and drainage of the abscess. Antibiotics are given for 7-10 days, and a delayed tonsillectomy is performed 4-6 weeks later, after resolution of the inflammation. Tonsillectomy should be performed in all patients with peritonsillar abscess/cellulitis, as 25-30% will subsequently develop another peritonsillar abscess or cellulitis. This can be a serious problem, leading to severe airway obstruction and sepsis.

**Parapharyngeal Abscess/Cellulitis.** This is a serious form of infection. There is no natural barrier to this infection; it can spread to the base of the skull or down to the mediastinum. Culture may be difficult to obtain as there is no fluctuant area. Intravenous broad spectrum antibiotic coverage is used with methicillin and ampicillin in dosages of 4 million to 6 million units per day, in divided doses. Airway obstruction must be watched and tracheotomy is performed as indicated. If the infection is small, intravenous antibiotics is all that is necessary. If the infection is extensive, incision and drainage via upper external neck incision (Mosher procedure) is necessary.

**Retropharyngeal Abscess.** The inflammation and swelling is in the oropharynx. This is usually in the infant and young child. The patient is admitted to the hospital. The incision and drainage must be performed in the operating room under general anesthesia. With a gentle and proper intubation, the abscess is not ruptured. A ruptured abscess can seed the tracheobronchial tree, leading to pneumonitis and lung abscesses. The patient is given intravenous and later oral antibiotics for 7-10 days. Ampicillin is the drug of choice, since the bacteria us usually *D. pneumococcus* or *Haemophilus influenzae*.

**Floor of Mouth Infection.** Patient must be admitted to the hospital. Broad spectrum antibiotics are given intravenously, usually ampicillin. Watch for airway obstruction. If infection is small, this therapy will be sufficient. If large, incision and drainage are necessary. If the infection is above the mylohyoid (minimal neck induration), the incision and drainage are through the mouth. If the infection extends into the upper neck (below the mylohyoid), drainage is via external neck approach. Tracheotomy must be performed if there is impending airway obstruction.

**Membranous Pharyngitis**

1. Viral pharyngitis can cause a membranous exudate. This is self-limiting; treatment is with proper hydration, analgesia, and antipyretics.
2. Exudative bacterial pharyngitis is usually due to beta-hemolytic streptococcus. Penicillin is the antibiotic of choice. Keep up hydration; use antipyretics and analgesics as necessary.

3. Diphtheric pharyngitis: Recognition is important; this is a rare disease in this country. Treatment is antitoxin (20,000 to 100,000 units) after culture and gram stain have been performed. An antibiotic is used for any secondary infections. Penicillin is the most commonly used drug.

4. Vincent's angina: May be membranous and involves a gram-negative fusiform bacillus and a spirillum (*Spirochaeta denticola*). Treatment is systemic and local mouth care with debriding mouthwashes, such as Amoson or peroxide. Penicillin is the antibiotic of choice, and antipyretics and analgesia are used as necessary.

5. Candidiasis is recognized easily and confirmed by examination of the smear for the yeast. Treatment is with nystatin mouthwashes of 100,000 units per mL. Gentian violet can also be used to paint the lesions. Must check for the causes such as prolonged antibiotic therapy or undiagnosed diabetes mellitus.

**Acute Laryngitis.** Can be an extension of pharyngitis and is viral or bacterial. Treat the same as for acute pharyngitis, with the addition of voice rest for 1 week. Steam inhalations are helpful.

**Chronic Pharyngitis.** If sinusitis and postnasal discharge are the source, systemic decongestant is given, usually Sudafed. If there is secondary bacterial infection, a 7- to 10-day course of broad spectrum antibiotic is used - ampicillin or tetracycline. Contributing factors of tobacco and alcohol must be stopped. Similarly, chronic bronchitis must be treated.

**Chronic Laryngitis.** Usually secondary to irritative and chronic mild inflammation (same as for chronic pharyngitis). If suspicious at all for neoplasm, do direct laryngoscopy and biopsy.

**Atrophic Laryngitis.** End stage of chronic laryngitis; humidification is helpful, and antibiotic is for secondary infection.

**Herpes of Pharynx and Larynx.** Analgesia medications; antibiotic if secondary infection.

**Tuberculosis.** Almost always from a pulmonary source. The treatment is chemotherapy, as for pulmonary disease.

**Cricoarytenoid Arthritis.** If this is acute, anti-inflammatory agents such as aspirin or Butazolidin are used. This condition must be followed closely to prevent the late sequelae of cricoarytenoid joint fixation. If both joints are fixed, the vocal cords are medially placed and severe airway obstruction can develop; tracheotomy is then necessary.

**Carcinoma.** The treatment plan depends on the site, size, and evidence of regional and distant metastasis. Small lesions usually have no nodal or distant metastasis, and treatment
can be tumoricidal radiation therapy or complete surgical excision. Large lesions usually involve nodal spread, and treatment is a combination of radiation therapy (preoperative or postoperative), surgical excision with possible radical neck dissection, and adjuvant chemotherapy.

**Radiation Mucositis.** Plenty of analgesia; push fluids to prevent dehydration; broad spectrum antibiotic if secondary infection; and avoid alcohol and smoking. Will resolve in several weeks to several months.

**Perichondritis.** The most common cause is radiation therapy for neoplasms. A trial of high dose intravenous antibiotics and steroids is warranted; if unresponsive, a laryngectomy may be necessary.

**Trauma.** Acute trauma: If minimal and with mild to moderate edema, and hematoma, observe. If there are fractures of laryngeal cartilage, large lacerations and hematoma, vocal cord avulsion, cricoarytenoid joint dislocation, and posterior displacement of epiglottis, open reduction of the injury is mandatory. Tracheotomy is performed for airway obstruction and in conjunction with open reduction of the larynx.

**Dysphagia**

**Definition**

Dysphagia is difficulty in swallowing. It can be, but is not necessarily, painful (odynophagia = painful deglutition). The site can be anywhere, including the oral cavity, oropharynx, hypopharynx, and esophagus.

**Subjective Complaints**

**Acute.** Usually inflammatory. Also neurologic, traumatic, and foreign body (especially fish bone).

**Chronic.** Neoplastic, neurologic, obstructive (stricture).

**Intermittent.** Inflammatory, irritative.

**Persistent.** Neoplastic, irritative (especially from postnasal discharges), neurologic, obstructive (stricture).

**Fever.** Usually inflammatory; rarely, caustic ingestion will cause necrosis of esophagus and mediastinitis.

**Weight Loss.** Neoplastic; severe stenosis with impaired nutrition.

**Referred Otalgia.** Any: inflammatory, neoplastic.

**Hoarseness.** Any: inflammatory, neoplastic, neurologic, stricture, and stenosis.

Retained Secretions. Neoplastic, neurologic.

Aspiration. Usually neurologic; also large neoplastic lesions.

Regurgitation of Food or Retained Undigested Food. Zenker's diverticulum, neoplasm.

Dyspnea. Severe inflammation - acute epiglottitis. Neoplastic - very large and extensive laryngeal involvement.

Trauma. Blunt or penetrating trauma to the neck; ingestion of caustic agents.

Tobacco/Alcohol History. Usually neoplastic; can be chronic irritative.

CNS Disorders. Usually neurologic basis, especially brainstem cerebral vascular disease, multiple sclerosis, and other demyelinating diseases; rarely, brainstem and cerebellopontine angle tumors.

Achalasia (Cardiospasm). Will cause dysphagia and is due to failure of relaxation of distal esophagus.

Gastrointestinal Problems. Reflux esophagitis with or without hiatal hernia can cause esophagitis or strictures. Occasionally reflux esophagitis will cause a lump in throat sensation mimicking globus hystericus.

Nervous and Psychiatric Disorder. Scleroderma involves the esophagus primarily. Dermatomyositis involves the pharynx.

Dysphagia Lusoria. Dysphagia due to compression of the esophagus from either (1) right subclavian artery arising abnormally from the thoracic aorta and passing behind or in front of the esophagus, or (2) a double aortic arch. Aberrant right subclavian artery compresses the esophagus and causes dysphagia only, whereas a double aortic arch compresses both the trachea and esophagus, giving dyspnea and dysphagia.

Objective Findings

Acute pharyngitis, acute tonsillitis, peritonsillar abscess/cellulitis, parapharyngeal abscess/cellulitis, and floor of mouth infections can also cause dysphagia (see Throat Pain.)

Acute Epiglottitis. Actually, acute inflammation of the supraglottis. The entire area is markedly swollen and inflamed, with very narrowed airway (see Stridor).

Acute Laryngitis. Diffuse erythema of not only larynx but also hypopharynx. Can be viral or bacterial. Viral laryngitis gives mild erythema and bacterial laryngitis gives moderate erythema and edema; exudate is uncommon.
Esophagitis. Distal esophageal causes (neoplasms, strictures, and reflux of gastric juice) cannot be seen. May see pooling and retention of saliva in hypopharynx. Jackson’s sign is pooling of saliva in pyriform sinus.

Referred Globus Hystericus. Normal examination.

Caustic Ingestion. Acute burns in oral cavity, oropharynx, hypopharynx, and esophagus. Caustic lye burns are coagulative, and strong acid burns are liquefactive and more likely to be through and through. Crystalline lye agent gives contiguous burns. Liquid lye almost always involve the esophagus.

Neoplastic Lesions. Usually squamous cell carcinoma; rarely, sarcomas and mixed tumors of minor salivary glands.

Squamous cell carcinomas are exophytic friable tumors or can be ulcerative with friable surrounding tumor masses. To cause dysphagia, carcinoma of the base of tongue, oropharynx, larynx, and hypopharynx must be large and usually have neck lymph node metastasis.

Carcinomas of the esophagus, except those of the cervical esophagus, are not seen except for the indirect evidence of retained secretions at the cervical esophageal inlet.

Esophageal Strictures. Not seen except for retained secretions.

Zenker's Diverticulum. Retained secretion in the hypopharynx, and may see undigested food.

Achalasia. May see retained secretion in hypopharynx.

Collagen Vascular Disease. Scleroderma involvement of the esophagus is not seen, but other evidence of scleroderma is the clue. Same with dermatomyositis.

Neurologic. Neurologic disease, especially those of the brainstem. Brainstem disease will commonly be associated with other cranial neuropathies. The oropharyngeal gag reflex is decreased (IXth nerve); hemiatrophy of the tongue (XIth nerve); loss of normal symmetrical soft palate elevation (pharyngeal plexus of Xth nerve); vocal cord paralysis (Xth nerve); and sternocleidomastoid muscle atrophy or lack of trapezius or sternocleidomastoid muscle movement (XIth nerve). The cranial nerves IX to XII are the more commonly involved ones; but nerves V, VI, VII, and VIII can be affected. Multiple sclerosis and other demyelinating diseases may have associated cranial neuropathies but also have long tract signs.

A large number of neuologic dysphagias are due to neuromuscular incoordination of the swallowing mechanisms. No abnormalities are noted on examination but are seen with ciné or video pharyngo-esophagogram.

Trauma. Acute: Edema, hematoma, lacerations of the hypopharynx with/without laryngeal trauma (see Throat Pain).
Chronic: Associated with stenosis of the hypopharynx and larynx.

Trauma to the esophagus from external causes is rare as this structure is well protected.

**Vascular Anomalies.** Retained secretions may be seen in the hypopharynx; the patient is usually an infant or young child. Good subglottic visualization by indirect laryngoscopy will show extrinsic compression of the anterior tracheal wall, suggesting double aortic arches.

**Psychiatric Disorders.** No organic abnormality.

**Assessment**

*A complete physical examination* with a good neurologic examination and a good indirect laryngoscopy is mandatory.

*A ciné/video contrast pharyngoesophagogram* is performed in all cases of dysphagia. Esophageal lesions can be diagnosed by this method. A ciné or video study is performed with the contrast pharyngoesophagogram, as the dysphagia secondary to neuromuscular dysfunction cannot be diagnosed by any other means. No esophagoscopy must be performed before a contrast esophagogram. Without an esophagogram to demonstrate lesions, there is a much higher incidence of esophageal perforation with esophagoscopy.

An *acid upper GI study* is helpful if one suspects a reflux esophagitis or lump in throat sensation secondary to acid reflux esophagitis.

*Esophagoscopy* is helpful and needs to be performed in neoplastic lesions and strictures. Neuromuscular dysfunction and scleroderma of esophagus need not be esophagoscoped. In patients with caustic ingestion, the direct laryngoscopy and esophagoscopy help determine the degree and extent of burns. The endoscopic instruments must not be passed through an area of severe or circumferential burns, as perforations can result. Zenker's diverticula should be examined by esophagoscopy before excision to rule out a carcinoma in the diverticulum.

For vascular anomalies, a *contrast esophagogram* is helpful in the diagnosis of an aberrant right subclavian artery. *Bronchoscopy* is helpful in the diagnosis of double aortic arches. As indicated, arteriograms are used to distinguish the type and extent of vascular anomalies.

For acute inflammation, complete blood count with differential, proper cultures, and sensitives are determined.

For collagen vascular diseases, LE preparations, rheumatoid factor, antinuclear antibodies, erythrocyte sedimentation rates (Westergren method), etc, should be obtained as indicated.
Neurologic consultation must be obtained in those patients with suspected neurologic causes of dysphagia.

Psychiatric consultation is helpful with dysphagia nervosa and other causes of psychogenic dysphagia.

**Plan**

Acute pharyngitis, acute tonsillitis, peritonsillar abscess/cellulitis, parapharyngeal abscess/cellulitis, floor of mouth infections, and acute and chronic laryngitis: see Throat Pain.

**Acute Epiglottitis.** Hospitalize; intravenous antibiotic - ampicillin as *H. influenzae* is the most common organism in the child. Watch for airway obstruction, as 50% of these patients will require either endotracheal intubation or tracheotomy for airway obstruction. This disease is of brief duration, seldom lasting over 1 week.

**Esophagitis.** Reflux esophagitis is treated with antacid and anticholinergic medications. In those with accompanying large hiatal hernia, a repair of the hiatal hernia may be necessary.

**Esophageal stricture.** These are treated with serial dilations. Severe strictures without response to dilations are treated with surgical resection and colon interposition or other gastroesophageal procedures.

**Globus hystericus.** These symptoms from acid reflux are relieved if the acid gastric reflux is treated.

**Caustic ingestion.** Determination of the extent. Burns confined to the oral cavity and oropharynx are self-limiting, and treatment is with an antibiotic suspension to prevent secondary infection; analgesia; and proper nutritional intake.

1. Esophageal burn: Hospitalize and give intravenous feedings until able to tolerate oral feedings. Broad spectrum antibiotics such as ampicillin suspension are used to prevent secondary bacterial infections and given for a course of 7-10 days. A 1-week course of corticosteroids is used to prevent strictures. In those with severe burns, a string is passed into the stomach to facilitate later dilations.

   Patients with chronic esophageal strictures are tested with serial dilations and followed-up for the rest of their lives. In those with very severe strictures where dilations are not helpful, resection of the stricture and colon interposition or gastric pull-up procedures are used.

2. Burns of the hypopharynx and larynx: Mild burns will respond to antibiotics to prevent secondary bacterial infections. Severe burns: Antibiotics and 1 week of corticosteroids should be used to prevent strictures and secondary bacterial infection. Chronic strictures of the larynx and hypopharynx are among the most difficult problems to treat, and there are no satisfactory methods.
**Neoplasms.** Carcinomas of the base of the tongue, oropharynx, larynx, and hypopharynx which cause dysphagia are large and often extensive. The treatment will usually consist of radiation therapy pre- and postoperatively, wide surgical resection with radical neck dissection (if clinical lymph node spread is present or highly suspected), and adjuvant chemotherapy.

Carcinomas of the esophagus are treated with wide resection and reconstruction with colon or other intestinal interposition, if resectable; and radiation therapy alone if unresectable.

Minor salivary gland tumors and granular cell myoblastomas (rare) may be treated with local resections.

**Zenker's Diverticulum.** The cause is chronic spasm of the cricopharyngeus muscle and secondary pharyngeal diverticular outpouching. The definitive treatment is diverticulectomy and cricopharyngeal myotomy. In the elderly debilitated patients, the diverticulum is sutured high in the neck for dependent gravity drainage. This can be done under local anesthesia.

**Cricopharyngeal Muscle Spasm.** This can lead to Zenker's diverticulum, but in the earlier stage only the spasm exists. A cricopharyngeal myotomy will relieve this problem.

**Collagen Vascular Disease.** Scleroderma of the esophagus is treated medically with corticosteroids. If significant dysphagia is present, dilation is used. Similarly, dermatomyositis is treated medically with corticosteroids.

**Neurologic.** The primary neurologic process is treated and the dysphagia may or may not resolve. In those with brainstem infarctions, the extensive disorder of the deglutition precludes simple management. Occasionally, a spastic cricopharyngeus muscle may be treated with a myotomy. Commonly, chronic aspiration is the more serious problem, therefore esophagotomy or gastrostomy is performed.

Similarly, dysphagia due to multiple sclerosis and other demyelinating diseases are treated as for the primary diseases.

Achalasia can be treated with methacholine (5-10 mg subcutaneously). Esophagocardiomyotomy is necessary in 20-25% of cases.

Dysphagia secondary to neuromuscular incoordination may respond to periodic dilation.

**Trauma.** Acute trauma (see Throat Pain).

Chronic traumatic changes: Dysphagia may be a part of the entire deformity complex (see Throat Pain).

**Vascular Anomalies.** These are treated with thoracic and cardiovascular surgery to alleviate the problems.
Psychogenic Dysphagia. Psychiatric care.

Hoarseness

Definition

Hoarseness is any unnatural deepening and harsh quality of the voice. Only the normal true vocal cords can produce the sharp and crisp qualities of the human voice.

Subjective Complaints

Acute. Inflammatory is most common; vocal cord paralysis and trauma are less likely causes.

Chronic. Any: Inflammatory, irritative, neoplastic, or neurologic disorder (vocal cord paralysis).

Persistent. Any: neoplastic, neurologic (vocal cord paralysis), inflammatory, and irritative (vocal cord polyps, nodules, and chronic laryngitis).

Intermittent. Inflammatory.

Fever. Inflammatory.

Upper Respiratory Infections or Viral Infections. Often precede acute laryngitis.

Weight Loss. Neoplastic.

Referred Otalgia. Neoplastic from hypopharynx; rarely, acute laryngitis will give referred ear pain.

Neck Mass. Tender lymphadenopathy is inflammatory. Nontender lymphadenopathy is neoplastic. Thyroid mass is important in unilateral ipsilateral vocal cord paralysis, as the mass can be a thyroid carcinoma.


Tuberculosis. Laryngeal involvement occurs in 5% of pulmonary tuberculosis cases. Other pulmonary granulomatous disease can involve the larynx.

Chronic Sinusitis and Postnasal Discharge. The secretion is irritating to the larynx and the hypopharynx. The hoarseness is worse in the morning and improves with the day, and worse when the postnasal discharge is thicker and purulent. This is often associated with throat pain.

Tobacco/Alcohol. Squamous cell carcinoma rarely occurs in those individuals who have not been moderate to heavy smokers. Tobacco is the most evident cause of squamous
cell carcinoma of the larynx. Alcohol is a contributing factor. Chronic laryngitis, vocal cord polyps, and nodules can also be caused by these agents.

**Dyspnea.** Associated conditions are very large laryngeal or hypopharyngeal carcinoma, bilateral vocal cord paralysis, and large laryngeal cysts and internal laryngoceles.

**Trauma.** Blunt and penetrating trauma to the neck can cause laryngeal hematoma, vocal cord avulsion, and arytenoid dislocations. Endotracheal tube intubation and rigid bronchoscopy can cause cricoarytenoid dislocation and posterior commissure granuloma and ulceration.

**Voice abuse.** Acute: acute laryngitis with or without vocal cord hematoma.

Chronic: Vocal cord polyps and nodules develop; this is the most common cause of childhood chronic hoarseness.

**Metabolic Diseases.** Hypothyroidism can produce myxedema of the vocal cords.

**Granulomatous Disease.** Tuberculosis and other granulomatous disease can involve the larynx and most commonly the posterior commissures.

**Syphilis.** Involves the larynx, especially the posterior commissure.

**Vocal Cord Paralysis.** Unilaterally, the symptom is hoarseness without dyspnea. Bilateral vocal cord paralysis results in severe dyspnea and some hoarseness of a mild nature as the vocal cords are almost in apposition. Once diagnosis of vocal cord paralysis is made, the etiology must be sought. Central nervous system disorders account for 10%. They include CNS hemorrhage in the neonate, vascular occlusive disease of the vertebro-basilar arteries, brainstem tumors and, rarely, cerebellopontine angle tumors. Peripheral causes account for 90% of the etiologies. They can occur from any head and neck region to the chest. The hidden areas include: thyroid, chest, mediastinum, cardiac, and esophageal lesions. Diabetes mellitus and other causes of polyneuropathy must be sought.

**Psychogenic.** Rare, and only where organic abnormalities are ruled out. Spastic dysphonia and dysphonia plicae ventricularis have strong psychogenic components.

**Objective Findings**

Indirect laryngoscopy is performed with laryngeal mirror examination (most commonly used), fiberoptic laryngoscope, or Ward-Berci indirect laryngoscope.

**Acute Laryngitis.** This is the most common cause of hoarseness and usually follows an upper respiratory infection. The laryngeal mucosa is inflamed. The vocal cords are erythematous and edematous but have normal mobility.

**Chronic Diffuse Laryngitis.** This is the second most common cause of hoarseness and the most cause of persistent hoarseness. Smoking is the most common cause in the adult. The
findings are thickened, white vocal cords with normal mobility. A variant is pachyderma laryngis, in which the chronic inflammatory changes involve more the posterior larynx.

Vocal Cord Polyps and Nodules. These are variants of chronic laryngitis, and the most common cause is tobacco; but voice abuse, chronic bronchitis, and postnasal discharges are other causes. The polyps are localized edematous tissues in the vocal cord, and nodules are hyperkeratotic nodular tissues. They are most often found at the junction of the anterior and mid-third of the vocal cord. The vocal cords are normally mobile.

Vocal Cord Paralysis. The immobile vocal cord or cords are in a paramedian position (2 mm from the midline). It can be unilateral (most common) or bilateral. Accompanying laryngeal and hypopharyngeal neoplastic diseases can be found, or the larynx and hypopharynx can be normal. If the larynx is normal, systemic workup for the etiology must be made.

Neoplastic Lesions. The most common is squamous cell carcinoma. It can be exophytic or a deeply infiltrating growth. Often there is a surrounding edema. In large hypopharyngeal lesions, the edema can obscure the tumor, therefore marked edema of the laryngopharynx points to a carcinoma. The laryngeal carcinoma can be small to very extensive. In order for hypopharyngeal carcinoma to produce hoarseness, it must be large and have spread to the larynx.

Rarely, a fibroma, chondroma, or granular cell myoblastoma can produce hoarseness.

Trauma. Acute: Blunt and penetrating neck trauma can cause lacerations, edema, swelling, hematoma, avulsion of the vocal cords, and arytenoid dislocations. Endotracheal intubations and rigid bronchoscopy can cause dislocation of the arytenoid and granuloma formations in the posterior commissure.

Chronic: This is also from blunt or penetrating trauma with late fibrotic changes and often stenosis. The anatomy is distorted. The vocal cords can be displaced and fixed, and the laryngeal lumen can be distorted and stenotic.

Cricoarytenoid Arthritis and Fixation. Cricoarytenoid arthritis is an acute process with inflammation of the cricoarytenoid joint. Of the patients with rheumatoid arthritis, 25% will have this, and a lesser percentage from other collagen vascular disease. The vocal cords have impaired mobility and the cricoarytenoid joint is quite erythematous. In the late changes, there is cricoarytenoid joint fixation with the vocal cord in the paramedian position.

Granulomatous Diseases. Granulation tissue or chronic inflammation of the posterior commissure is often from tuberculosis and other granulomatous involvement of the larynx.

Syphilis. Also involves the posterior commissure with its gummatous reactions.

Hypothyroidism. Myxedema of the larynx can occur with a thickened, myxedematous deposition in the larynx and the vocal cords.

Spastic Dysphonia. Tense voice with overadduction of vocal cords.
**Dysphonia Plicae Ventricularis.** The false vocal cords meet before the true vocal cords and produce a harsh, breathy voice.

**Assessment**

A good indirect laryngoscopy (IDL) must be performed in all patients complaining of hoarseness.

Direct laryngoscopy (DL) is performed either under general or local anesthesia. It is used for diagnostic and occasionally therapeutic purposes. Patients with acute laryngitis, chronic diffuse nonsuspicious laryngitis, and vocal cord polyps that resolve do not need a direct laryngoscopy. Direct laryngoscopy is always used for anyone with a suspicious neoplastic lesion. Direct laryngoscopy is therapeutic in patients with vocal cord polyps, nodules, and localized squamous cell carcinoma *in situ*, as the lesions are removed at the time of the direct laryngoscopy.

Laryngograms - contrast dye and air tomograms - are used for neoplastic and chronic laryngeal stenosis. The dye contrast gives better definition. Air tomograms of the larynx are used for those with large laryngeal neoplasms or severe stenosis in which the dye may precipitate an acute airway obstruction.

Soft tissue x-rays and xeroradiograms of the neck are useful, especially in neoplastic and traumatic cases.

*Barium swallow* is used for neoplasm if a second primary or extension of the laryngeal neoplasm is suspected.

*Bronchoscopy and esophagoscopy* are used in neoplastic cases where extension or a second neoplasm is suspected.

For airway obstruction, usually with very large laryngeal or laryngopharyngeal carcinomas and bilateral vocal cord paralysis, the indications for *tracheotomies* are the same as for any impending airway obstruction.

*VDRL and other serologic tests* are indicated if one suspects syphilis.

*Sputum cultures and sensitivity tests* are performed for tuberculosis, other granulomatous disease, and chronic bronchitis.

*Thyroid function tests* are performed for myxedema of the larynx.

For collagen vascular disease, especially rheumatoid arthritis, use rheumatoid factor, LE preparation, antinuclear antibodies, and erythrocyte sedimentation rate.

*Sinus x-rays* are obtained if chronic sinusitis or postnasal discharge is suspected as the cause of the hoarseness.
For neck mass, there is no place for early biopsy. Acute inflammatory lymphadenopathy will respond to systemic antibiotics. In those with carcinoma of the larynx or hypopharynx, the nontender lymph nodes are assumed to be metastatic. Indiscriminate biopsy results in higher rate of local tumor recurrence and distant metastases.

*Pulmonary function tests* are particularly important if one is contemplating conservative laryngeal surgery for a small carcinoma of the larynx. Assessment of the degree of obstruction is helpful in those with bilateral vocal cord paralysis.

*Psychogenic or psychiatric* consultations are helpful in psychogenic hoarseness.

**Plan**

**Acute Laryngitis.** Treat expectantly with antipyretic and analgesic agents, for the cause is a viral upper respiratory infection. If there is a secondary bacterial infection, antibiotics are used. Penicillin or erythromycin are the usual choices. Voice rest is necessary for 1-2 weeks.

**Chronic Diffuse Laryngitis.** Treat the source. Avoidance of tobacco and alcohol should be advised, as these are the most common causes. If the cause is chronic sinusitis and postnasal discharge, use systemic decongestant such as Sudafed and antibiotics if secondarily infected. Chronic bronchitis should be treated with expectorants and broad spectrum antibiotics like tetracycline if there is purulent sputum. Voice rest for 1-2 weeks is necessary.

**Vocal Cord Polyps and Nodules.** Treatment is similar to that for chronic diffuse laryngitis. An additional cause seen with vocal cord polyps and nodules, but not in chronic diffuse laryngitis, is voice abuse. Cessation of the voice abuse is mandatory. In those who use their voice for a living (politicians, singers), speech therapy helps to prevent recurrence of the polyps and nodules. If the nodules and polyps do not respond to medical treatment, do a direct laryngoscopy and removal.

**Vocal Cord Paralysis.** A thorough evaluation of the entire head and neck, cardiac, chest, mediastinum, and esophageal areas must be made to try to find the etiology. Treatment is directed at the various etiologies, if found. In over 25% of the cases, an etiology is not found for the vocal cord paralysis.

1. Unilateral paralysis (left greater than the right): Wait for 6 months to see if there is any spontaneous vocal cord function return or overcompensation by the opposite vocal cord. If none in 6 months and there is persistent hoarseness, bothersome weakness of voice, or aspiration, direct laryngoscopy and injection of paralyzed cord with Teflon will give good voice and cure the aspiration.

2. Bilateral vocal cord paralysis: If there is airway obstruction, do a tracheotomy. Wait 6 months to see if there is any spontaneous return of vocal cord function. If none, a permanent tracheotomy can be left in, and the patient will talk by (1) plugging the lumen of the tracheotomy tube or (2) installation of a one-way valve in the tracheotomy tube so that during expiration, part of the air is expired through the apposed vocal cords. Another choice
is an arytenoidectomy and lateralization of the vocal cord. This results in a harsh voice, but the tracheotomy is removed.

Neoplastic Lesions. Small laryngeal carcinomas can be treated equally well with tumoricidal radiation therapy or surgery. Radiation therapy leaves a better voice. Large laryngeal tumors require combination of radiation therapy and total laryngectomy with radical neck dissection if there is evidence of neck node metastasis. Adjuvant chemotherapy may be useful.

Hypopharyngeal carcinomas causing hoarseness are large, therefore the treatment is combination therapy: radiation therapy pre- or postoperatively, pharyngolaryngectomy and radical neck dissection if there is evidence of neck node metastasis, and adjuvant chemotherapy.

The benign tumors of the larynx (rare) can be removed surgically without a total laryngectomy.

Trauma. Acute: Impending airway obstruction should have tracheotomy. If the trauma is mild with just edema and small hematoma, patient can be observed. If the trauma is moderate to severe, especially with large hematoma, lacerations, fractures of laryngeal cartilages, vocal cord avulsions, arytenoid dislocations, and epiglottis dislocations, open reduction must be performed to restore vocal cord function and prevent laryngeal stenosis.

Chronic: The problems are impaired vocal cord function and stenosis. This is a most difficult problem to treat and no surgical method is uniformly successful. It is better to treat the acute injuries aggressively than to try to treat a chronic stenotic useless larynx.

Cricoarytenoid Arthritis and Fixation. The arthritis is usually secondary to rheumatoid arthritis and treatment is aspirin. Butazolidin, or corticosteroids. Must follow patient for a long time to prevent cricoarytenoid fixation.

Cricoarytenoid fixation, if unilateral, requires no treatment. If bilateral, arytenoidectomy and lateralization are necessary.

Granulomatous Disease. The pulmonary aspect must be evaluated. Direct laryngoscopy with biopsy for histologic examination and tissue cultures must be performed. The treatment is chemotherapy, as for pulmonary disease.

Syphilis. Serologic testing is helpful, but direct laryngoscopy and biopsy for histologic examination must be performed. The treatment is adequate dose of penicillin or ampicillin.

Hypothyroidism. This is treated with thyroid replacement, and direct laryngoscopy is not performed.

Spastic Dysphonia. Aggressive speech therapy is helpful. In cases in which speech therapy response is not satisfactory, section of the recurrent laryngeal nerve has been successful.
**Dysphonia Plicae Ventricularis.** Speech therapy is often helpful. If this is without success, stripping of the false vocal cord is helpful.

**Stridor**

**Definition**

Stridor refers to any noisy respiration. Inspiratory stridor is any noisy respiration arising from above the true vocal cords and can be from nasal cavity to supraglottic area. Inspiratory and expiratory stridor comes from the true vocal cord area or immediately below. Expiratory stridor comes from below the vocal cords and is produced from the tracheobronchial tree.

The three types of stridor are produced from the same areas regardless of age, but the etiologies and findings differ with age.

**Neonatal and Infant Stridor**

**Subjective Complaints**

Most are congenital stridors and are evident soon after birth.

**Laryngomalacia.** The most common form of congenital stridor, accounting for 75%. It is inspiratory and changes with position; better in prone position and worse with crying and supine position.

**Vocal Cord Paralysis.** The second most frequent neonatal and infant stridor (10%). There is inspiratory and expiratory stridor with severe dyspnea.

**Subglottic Stenosis/Hemangioma.** The third most common cause of neonate and infant stridor. The stridor is inspiratory/expiratory. Severe airway obstruction occurs in 50%, necessitating a tracheotomy. The stenosis versus the hemangioma can be distinguished only on examination.

Recurrent or intractable croup may herald a previously undiagnosed subglottic stenosis.

**Vocal Cord Webs.** This is fusion of the vocal cords at the anterior two-thirds. Inspiratory/expiratory stridor and a weak voice are evident.

**Laryngeal Cyst.** A rare cause presenting with dyspnea and stridor. Hoarseness depends if vocal cord function is impaired, as the cyst does not arise from the vocal cords but usually from the supraglottic area, especially near the ventricle.

**Fever.** The congenital stridors seen in the neonate and infant are rarely febrile.

**Acute.** The congenital stridors are acute if present soon after birth but they are persistent.
**Chronic.** All congenital stridors are persistent and chronic.

**Aspiration.** Aspiration accompanying stridor is rare and is caused by congenital laryngeal cleft, an extremely rare deformity in which there is a cleft in the posterior aspect of the laryngeal and trachea, resulting in a common channel from the esophagus to the trachea. Tracheal esophageal fistula gives aspiration, pneumonitis, and feeding problems, but stridor is not usually accompanying.

**Associated Neurologic Disorder:** Associated neurologic problems may accompany vocal cord paralysis. Especially seen are other cranial neuropathies.

**Prolonged Intubation and Tracheotomy.** Prolonged endotracheal tube intubation can produce iatrogenic subglottic stenosis (2-5). Prolonged tracheotomy can result in tracheal stenosis or tracheomalacia. High tracheotomy can cause subglottic stenosis.

**Vascular Anomalies.** These may or may not be associated with dysphagia. The most common cause is double aortic arch.

**Blowing.** Internal laryngocele will enlarge with blowing.

**Objective Findings**

**Laryngomalacia.** The epiglottis and supraglottic structures are flabby, and on inspiration can be seen being sucked through the vocal cords.

**Vocal Cord Paralysis.** Both vocal cords are in a paramedian position and immobile.

**Subglottic Stenosis/Hemangioma.** The vocal cords are normal with normal function. In stenosis, there is fibrotic tissue just below the vocal cords. In the hemangioma, there is a reddish-purplish mass below the vocal cords.

**Laryngeal Web.** A web of either thick or thin tissue is between the true vocal cords and involves the anterior two-thirds of the true vocal cords.

**Laryngeal Cysts and Internal Laryngocele.** A cystic lesion can occur anywhere in the larynx, usually not from the true vocal cords. The most common sites are the ventricles and laryngeal surface of the supraglottic area. Internal laryngocele may be indistinguishable from cyst of larynx and may be accompanied by external laryngocele. The external laryngocele is compressible and is crepitant. It may change in size with Valsalva maneuver.

**Vascular Anomalies.** They are the result of abnormal arterial development. A double aortic arch or an aberrant innominate artery will cause anterior extrinsic compression of the trachea. Double aortic arch is accompanied by esophageal compression and dysphagia, while aberrant innominate artery is not accompanied by dysphagia.
Trauma

1. Blunt and penetrating: this is extremely uncommon in the neonate.

2. Prolonged intubation causes a subglottic stenosis in 2-5%. The stenotic area is fibrotic and often annular. The posterior commissure can also be fibrotic so that the vocal cords are fixed in a paramedian-intermediate position.

3. High tracheotomy (at level of first tracheal ring) causes subglottic stenosis, more in the anterior subglottic area.

4. Tracheal stenosis occurs at the tracheal stoma or tracheotomy cuff site. Tracheomalacia occurs with prolonged tracheotomy and causes expiration stridor due to collapse of tracheal wall on expiration.

Assessment

Airway evaluation must be made with all stridor, for impending airway obstruction. Increasing hypoxia and hypercapnia are indications for tracheotomy or endotracheal intubation. Careful auscultation over mouth, larynx, trachea, and lungs may be help identify the level of stridor source.

Direct laryngoscopy must be performed for all congenital stridors, to make or confirm the diagnosis. A second congenital pathologic process occasionally occurs.

Barium swallow is used to help delineate tracheal-esophageal fistula, laryngeal cleft, and vascular anomalies (as double aortic arch).

Bronchoscopy is not used routinely but is necessary with expiratory stridor. Direct laryngoscopy can visualize only the upper 1 cm of trachea.

Arteriogram is used if one suspects vascular malformation and is contemplating surgical repair.

Blunt or penetrating traumas are treated the same way regardless of age. Air tomograms of the larynx and direct laryngoscopy are necessary.

Subglottic and tracheal stenosis can be evaluated by (1) laryngotraceogram - air tomogram and dye contrast, and (2) direct laryngoscopy and bronchoscopy.

Plan

Laryngomalacia. This is a self-limiting disease and the patient will outgrow it by the age of 2 years. Reassurance is offered to the parents that the noisy breathing will go away and the child is in no danger. Occasionally, tracheotomy is required.
**Vocal Cord Paralysis.** Tracheotomy may be necessary. If there is no vocal cord function return, an arytenoidectomy and arytenoid lateralization may be performed when the child is much older. Laryngeal surgery in the infant and young child is very difficult and can result in impaired laryngeal growth.

**Subglottic Stenosis.** Tracheotomy is necessary in 50% of the cases. With time and growth of the larynx and subglottic area, most patients can be decannulated. Dilation and injection of the stenotic area with corticosteroids may be helpful.

**Subglottic Hemangioma.** Tracheotomy is necessary in 50%. Biopsy for diagnosis is contraindicated, as death can occur from uncontrolled bleeding into the lungs. Irradiation is contraindicated. At the age of 2 years, the hemangioma can be resected.

**Laryngeal Web.** Thin mucosal webs can be incised and cured. Incision of thick webs will lead to recurrence and more fibrosis. It is best in thick webs to wait until the child is 2 years old and threat with laryngofissure opening of the larynx, incision of the web, and placement of laryngeal keel for 3 weeks. This is usually successful.

**Laryngeal Cysts.** Aspiration if small, or marsupialization if large via direct laryngoscopy. *Internal laryngoceles* can also be treated this way. *Internal with external laryngoceles* must be excised through an external neck approach.

**Vascular Anomalies.** These are treated by thoracotomy and corrective surgery.

**Trauma**

1. Iatrogenic subglottic stenosis: The best cure is prevention. Avoidance of prolonged intubation is the best. While there is no good answer as to the length of intubation necessary to cause subglottic stenosis, it is best to tracheotomize a patient after 1-2 weeks of intubation. The very small infant with a subglottic stenosis, may outgrow it with age and increase in laryngeal size during growth.

   In a large child the stenosis will not be outgrown. The treatment with dilation and steroid injections has been dismal. Various surgical methods have been proposed with some, but not universal, success in relieving the subglottic stenosis.

2. High tracheotomy: This procedure causes chondritis and fibrosis of the cricoid area. All high tracheotomies must be converted as soon as possible to regular tracheotomy to prevent subglottic stenosis.

3. Tracheal stenosis: Tracheal stenosis from tracheotomy can be minimized by a soft and proper-sized tracheotomy tube and good care to prevent infection. In short tracheal stenotic segments, a primary resection and anastomosis can be performed. Long tracheal stenosis is difficult to repair.
Childhood Stridor

Subjective Complaints

**Croup or Acute Laryngotracheobronchitis.** This is the most common form of childhood stridor. It is inspiratory and expiratory, with a barking, croupy type of cough. The age is 2-7 years, and is endemic, more during the winter. Hoarseness may be associated.

**Acute Epiglottitis.** A supraglottic infection due mostly to *H. influenzae*. Age range is similar to that of croup. The stridor is inspiratory and often is associated with a "hot potato" voice, but not hoarseness. The onset is rapid, over 2-4 hours.

**Allergic Rhinitis.** Causes chronic nasal obstruction and inspiratory stridor and may or may not be accompanied by enlarged adenoids. After enlarged adenoids, allergy is the next most common cause of chronic nasal obstruction.

**Markedly Enlarged Tonsils and Adenoids.** Can give inspiratory stridor. Pulmonary hypertension and cor pulmonale can result.

**Foreign Body.** Common in the child. The stridor is expiratory if it lodges in the tracheobronchial tree. Foreign body can occasionally lodge in the larynx giving an inspiratory/expiratory stridor. This can mimic a chronic or recurrent croup.

**Fever.** Inflammatory lesions, especially croup and acute epiglottitis. Rarely, an infection secondary to foreign body aspiration.

**Acute.** Inflammatory process and foreign body are the common causes of acute onset.

**Chronic.** Markedly enlarged tonsils and adenoids are chronic. Laryngeal cysts are chronic but they are very rare in the child. Occasionally an undiagnosed foreign body gives persistent symptoms.

**Trauma.** Birth trauma can injure the recurrent laryngeal nerve and give vocal cord paralysis. Blunt and penetrating trauma to the neck is uncommon in the child. The more soft tissue and higher position of the larynx protect the child's larynx from trauma. Automobile accidents and falling are the most common injuries to the infant and child's neck.

**Prolonged Intubation and Tracheotomy.** Prolonged endotracheal tube intubation can produce iatrogenic subglottic stenosis (2-5%). Prolonged tracheotomy can result in tracheal stenosis or tracheomalacia. High tracheotomy can cause subglottic stenosis.

Objective findings

**Acute Laryngotracheobronchitis (Croup).** Viral infections of the larynx, trachea, and bronchus with accompanying acute inflammation of all the involved areas. The subglottis, being the smallest area in the airway at this stage, is most severely affected and gives rise to the stridor.
Acute Epiglottitis. An acute bacterial infection of the supraglottic larynx. The tissues are erythematous and edematous. The epiglottis and the aryepiglottic folds are markedly swollen so that the normal C-shape assumes an annular pattern. The airway below this is obstructed and the vocal cords, which are normal and mobile, cannot be seen.

Marked Enlarged Tonsils and Adenoid Tissues. A markedly enlarged adenoid obstructs the entire nasopharynx. Markedly enlarged tonsils meet and touch in the midline in a noninflamed state on just routine examination.

Allergic Rhinitis. Nasal mucosa is boggy, edematous with bluish discoloration. Secondary bacterial infection may be present. Adenoids may be hypertrophied as a secondary lymphoid reaction to the allergic rhinitis.

Foreign Body. Usually lodges in the bronchus, right more than left because of the right's greater diameter and more vertical path. Occasionally, a foreign body can lodge between the vocal cords, giving inspiratory and expiratory stridor and minimally croup. A localized expiratory stridor is indicative of a bronchial foreign body.

Trauma

1. Blunt/penetrating: This is extremely uncommon in the child. Penetrating trauma is rare. Blunt trauma is more common; edema, hematoma, lacerations of mucosa, vocal cords avulsion, and arytenoid dislocations can be seen.

2. Prolonged intubation causes a subglottic stenosis in 2-5%. The stenotic area is fibrotic and often annular. The posterior commissure can also be fibrotic so that the vocal cords are fixed in a paramedian intermediate position.

3. High tracheotomy (at level of first tracheal ring) causes subglottic stenosis but more in the anterior subglottic area.

4. Tracheal stenosis occurs at the tracheal stoma or tracheotomy cuff site. Tracheomalacia occurs with prolonged tracheotomy and causes expiration stridor due to collapse of tracheal wall on expiration.

Assessment

With all stridor, evaluation must be made for impending airway obstruction. Hypoxia and hypercapnia are indications for tracheotomy or endotracheal intubation.

Croup. A direct laryngoscopy is not necessary and can precipitate a complete airway obstruction. Anteroposterior (AP) and lateral x-rays of the neck will show the narrowing of the subglottic area and no enlargement of the epiglottis. As with any infection, a complete blood count (CBC) is indicated. Recurrent or intractable croup must have direct laryngoscopy, as foreign body of the larynx and subglottic stenosis can mimic croup.

Acute Epiglottitis. If the child has impending airway obstruction, no diagnostic test is performed. He is taken quickly to the operating room. With endotracheal intubation or
bronchoscope ready, a direct laryngoscopy is performed. If the diagnosis is confirmed, either intubation or a tracheotomy is performed. CBC, blood cultures, and cultures of the supraglottic areas are made.

Sometimes the diagnosis between croup and epiglottitis is unclear. If there is no impending airway obstruction, a lateral x-ray of the neck can evaluate the epiglottis. A gently performed indirect laryngoscopy can easily visualize the epiglottis. It is important that only the smallest laryngeal mirror is used and that the visualization is only for the epiglottis, not the vocal cords.

Markedly Enlarged Adenoids and Tonsils. Enlarged adenoids can be evaluated by lateral x-rays of the nasal and oropharynx or by palpation through the mouth. Arterial blood gases and cardiac catheterization for pulmonary hypertension are helpful. If the tonsils and adenoids are abnormal, an adenoidectomy and tonsillectomy are indicated.

Allergy Workup. This is done in all suspected allergy cases.

Foreign Body. All patients with suspected foreign body must have a direct laryngoscopy and bronchoscopy. Cultures are taken at the time of the endoscopy if there is a secondary bacterial infection. Intractable or recurrent croup and localized expiratory stridor must be evaluated for foreign body.

Trauma. Blunt or penetrating traumas are treated the same way, regardless of age. Air tomograms of the larynx and direct laryngoscopy are necessary. Contrast laryngograms can be performed in the older child if no impending airway obstruction.

Subglottic and Tracheal Stenosis. This can be evaluated by (1) laryngotracheogram - air tomogram and dye contrast - and (2) direct laryngoscopy and bronchoscopy.

Plan

Croup. This is treated with hydration, steam inhalation (warm or cold). Severe airway obstruction necessitating a tracheotomy occurs only in 3%. As this is a viral lesion, antibiotics are indicated only if there is evidence of secondary bacterial infection.

Epiglottitis. Fifty percent of the patients will require either endotracheal intubation or tracheotomy. Either method is acceptable. To perform endotracheal tube intubation, a skilled anesthesiologist must be available to put in the tube and replace if it dislodged. Similarly, to perform a tracheotomy a skilled head and neck surgeon is necessary to keep the mortality and morbidity to a minimum. Before any tracheotomy is performed, securing of the airway is necessary either with an intubation or with a ventilating bronchoscope. Tracheotomy in infants and children without a controlled airway results in very high mortality and morbidity.

Intravenous antibiotics are given. The organism is usually *H. influenzae*, so ampicillin is the drug of choice. This disease is of a short duration, rarely lasting over a week; therefore the tracheotomy or intubation can be decannulated quickly.
Foreign Body. All foreign bodies must be removed. A skilled endoscopist must perform it.

Markedly Enlarged Tonsils and Adenoids. If properly indicated, a tonsillectomy and adenoidectomy are performed.

Allergy. Allergic workup and treatment are necessary for suspected allergic disorders. Routine systemic decongestant is not helpful in those with allergic rhinitis.

Trauma

1. Blunt/penetrating: Similar to adults, moderate to severe acute injury must be repaired as soon as possible with open reduction regardless of the age of the patient. Minimal injuries can be watched. This aggressive attitude prevents late vocal cord dysfunction and stenosis, which are very difficult to treat.

2. Iatrogenic subglottic stenosis: The best cure is prevention. Avoidance of prolonged intubation is the best. While there is no good answer as to the length of time intubation is necessary to cause subglottic stenosis, it is best to tracheotomize a patient after 1-2 weeks of intubation. The very small infant with a subglottic stenosis may outgrow it with age and the increase in laryngeal size with growth.

3. Subglottic stenosis in the large child and adult will not be outgrown. The treatment with dilation and steroid injections has been dismal. Various surgical methods have been proposed with some, but not universal, success in relieving the subglottic stenosis.

4. High tracheotomy causes chondritis and fibrosis of the cricoid area. All high tracheotomies must be converted as soon as possible to regular tracheotomy to prevent subglottic stenosis.

5. Tracheal stenosis from tracheotomy can be minimized by a soft and proper-sized tracheotomy tube and good care to prevent infection. In short tracheal stenotic segments, a primary resection and anastomosis can be performed. Long tracheal stenosis is difficult to repair.

Adult Stridor

Subjective Complaints

Acute. Usually inflammatory, but can occur with neoplasms, bilateral vocal cord paralysis, and trauma. In those with large laryngeal neoplasms or longstanding bilateral abductor vocal cord paralysis, a mild laryngitis or other inflammatory process can precipitate acute airway obstruction.

Intermittent. Inflammatory.

Chronic/Persistent. Usually neoplastic or vocal cord paralysis; cysts of larynx and stenosis of larynx, subglottis, or trachea are other causes.
**Fever.** Inflammatory.

**Dysphagia.** Neoplastic and neurologic.

**Weight Loss.** Neoplastic.

**Referred Otalgia.** Acute: inflammatory. Chronic: neoplastic lesion of the hypopharynx.

**Neck Mass.** Tenderness: inflammatory lymph nodes. Nontender: neoplastic; if sufficient to cause stridor, the neoplasm is quite large.

**Throat Pain.** Inflammatory and neoplastic.

**Neurologic.** Associated with vocal cord paralysis. Search for brainstem diseases, multiple sclerosis, and other demyelinated diseases.

**Psychogenic.** Rare; the psychiatric symptoms may be subtle and may require several visits to be aware of this etiology.

**Trauma**

1. Cricothyrotomy or high tracheotomy causes subglottic stenosis if not converted early to regular tracheotomy.

2. Prolonged intubation can cause subglottic stenosis. While no specific time of intubation will cause stenosis, the (1) duration, (2) trauma, and (3) number of times of intubation are factors in development of subglottic stenosis.

3. External trauma: blunt/penetrating.

4. Tracheotomy can cause tracheal stenosis or tracheomalacia.

**Allergy.** Asthma causes bilateral expiratory wheezes and stridor.

**Tobacco/Alcohol.** Excess prolonged tobacco usage of cigarettes, pipe, or cigars is the single most important factor in squamous cell carcinoma of the head and neck. Excess alcohol consumption is a factor as well.

**Surgery.** Previous surgery, especially thyroid surgery. The recurrent laryngeal nerve is most commonly injured with thyroid surgery but can be injured by improperly performed tracheotomy and any neck and chest surgery.

An ill-performed laryngofissure can produce laryngeal stenosis. The most common complication of a hemilaryngectomy is glottic stenosis.
Objective Findings

Nasopharynx/Nasal Cavity. Markedly enlarged adenoid tissues in a young adult may cause inspiratory stridor. Carcinoma of the nasopharynx may cause inspiratory stridor. Any cause of nasal obstruction can cause inspiratory stridor; these include septal deviation, allergic rhinitis, and hypertrophic rhinosinusitis.

Oral Cavity/Oropharynx. Enlarged tonsils, peritonsillar abscess/cellulitis, parapharyngeal abscess, floor of mouth infections, and large carcinomas of the base of tongue and oropharynx can cause inspiratory stridor and airway obstruction (see Throat Pain).

In order for tonsils to be considered markedly enlarged, they must be touching each other in the midline without acute inflammation.

Supraglottis

1. Cysts/internal laryngocele. Cysts are large, mucosa-covered cystic masses and can arise from anywhere in the supraglottic region. The internal laryngocele arises from the ventricular apices and is air-containing. It may have an accompanying external laryngocele, which is compressible, has crepitance, and may enlarge with Valsalva.

2. Acute epiglottitis. This is not a disease of the child only but also occurs in adults. The findings are similar with such marked inflammation and swelling of the supraglottic area that the epiglottis and aryepiglottic folds are markedly enlarged and assume an annular shape. The airway is markedly narrowed and the vocal cords are not to be seen.

3. Neoplasm. Squamous cell carcinomas are the most common. To cause stridor they are large and are either exophytic, friable masses or deeply infiltrating with marked surrounding edema. The vocal cords may be obscured.

Larynx

1. Carcinoma. A common laryngeal cause of stridor is carcinoma. They are large and resemble in appearance the above description in the supraglottic tumor. They can arise from the true vocal cords or be an extension from hypopharyngeal primary.

2. Cricoarytenoid fixation. Late sequela of cricoarytenoid arthritis. The vocal cords are fixed on a paramedian position. On indirect laryngoscopy, it can not be differentiated from bilateral vocal cord paralysis. On direct laryngoscopy, cricoarytenoid joint is fixed.

3. Vocal cord paralysis. Bilateral vocal cord paralysis is required to give stridor. The vocal cords are immobile and in a paramedian position. The glottic aperture (space between the two vocal cords) is 2-4 mm.

4. Subglottic stenosis. Usually acquired in the adults, either from prolonged intubation or high tracheotomy. The vocal cords are normal-appearing and are usually normally mobile. Circumferential fibrotic tissues are seen below the vocal cords with airway lumen narrowing.
5. **Laryngeal trauma.** Acute: results from blunt or penetrating trauma and can have marked edema, hematoma, vocal cord avulsion, arytenoid dislocation, and posterior epiglottic displacement posterior.

Chronic: stenosis with marked distortion of anatomy and narrowing of larynx and pharynx; vocal cords may be immobile.

**Psychogenic.** Noisy inspiratory and expiratory breathing without any abnormalities.

**Neurologic.** Seen occasionally with vocal cord paralysis. Cranial nerves IX to XII are the most commonly involved cranial neuropathies, followed by V to VII involvement. Occasionally polyneuropathies may have bulbar involvement.

**Thyroid.** While thyroid carcinoma can cause vocal cord paralysis, this is usually unilateral. In the extensive carcinoma, bilateral vocal cord paralysis may be evident. Both carcinoma of the thyroid and markedly enlarged benign diseased thyroid glands can cause extrinsic compression of laryngeal and tracheal structures.

**Neck Lymphadenopathy.** Tender lymph nodes are inflammatory. Nontender lymphadenopathy is neoplastic until proved otherwise. (See Masses in the Neck).

**Trachea.** Carcinoma and benign tumors of the trachea are rare. Tracheal stenosis and tracheomalacia are complications of tracheotomy and can cause airway obstruction. In stenosis, the tracheal lumen is narrowed by fibrosis. In tracheomalacia, the lumen is narrowed because of the weak wall. On expiration, the tracheal wall collapses as a result of positive intrathoracic pressure.

**Bronchus.** Acute asthma is the most common cause of expiratory stridor from the bronchus.

**Assessment**

A well performed indirect laryngoscopy is important and often yields the diagnosis. *Tracheotomy* is indicated for any impending airway obstruction, regardless of the etiology. A rising pCO₂ or a dropping pO₂ are indications of impending obstruction.

For infections, complete blood count, proper cultures and sensitivities, and blood cultures are taken as indicated.

*Lateral soft tissue x-rays of the neck and xeroradiograms* are helpful, especially in trauma, neoplasm, and stenosis.

*Laryngograms - dye contrast or air tomograms* - are useful in neoplasm, trauma of the larynx, and stenosis. They help to delineate the extent of the disease. If there is significant airway compromise, only air tomography is used as the contrast dye can precipitate airway obstruction.
Tracheogram - dye contrast or air tomogram - is used for neoplasm, stenosis, and tracheomalacia.

Direct laryngoscopy is not necessary for acute inflammatory disease, but is mandatory for neoplastic diseases, trauma (acute or chronic), and stenosis.

Bronchoscopy is helpful if one suspects tracheal or bronchial pathology. Either rigid or fiberoptic bronchoscopy can be used, but the latter can be performed more easily with less discomfort to the patient, at the bedside or in the office.

Barium swallow and esophagoscopy are necessary for evaluation of the esophagus if one suspects esophageal extension of the neoplasm or a secondary esophageal neoplasm.

Arterial blood gas determinations are helpful in evaluating the extent of the obstruction by the stridor.

Pulmonary function test with flow volume loop studies are helpful and can delineate the extent of extrathoracic and intrathoracic disease. This is invaluable in those patients with combined laryngeal and intrapulmonary diseases.

Allergy workup is indicated for patients with asthma and allergic rhinitis.

Neurology workup (complete neurologic examination) is necessary for all patients with bilateral vocal cord paralysis. Bilateral vocal cord paralysis is less likely to be from a neoplastic lesion in the head and neck and thoracic region and more likely to be from a diffuse neurologic process (eg, myasthenia gravis).

Psychiatric evaluation is needed if there is suspicion of a psychogenic origin.

Thyroid evaluation, with thyroid function tests, radioactive iodine (RAI) uptake, and thyroid scan, is made if stridor is related to thyroid disorders, either benign enlargement or malignant lesions.

Neck node biopsies are rarely indicated in those with stridor. Inflammatory lymph nodes need not be biopsied. Nontender lymph nodes in patients with stridor usually indicate a carcinoma, and a lymph node biopsy compromises the treatment of the cancer.

Rheumatoid arthritis is associated with cricoarytenoid arthritis in 25%. Autoimmune disease workup includes rheumatoid factor, LE preparation, and antinuclear antibodies. On direct laryngoscopy, the cricoarytenoid joint is fixed (late sequela of cricoarytenoid arthritis).

**Plan**

**Nasal Cavity/Nasopharynx.** Mechanical obstruction of the nasal cavity by deviated nasal septum, polyps, and hypertrophied turbinates can be surgically corrected. Hypertrophic mucosal disease and allergic rhinitis can be treated with medication and with allergy workup and treatment. Enlarged adenoids are removed by an adenoidectomy. Carcinoma of the
nasopharynx is treated by tumoricidal dose of radiation therapy to the primary tumor and neck nodes.

**Oral Cavity/Oropharynx.** Treatment of peritonsillar, parapharyngeal, and floor of mouth abscesses and cellulitis are described in the section on Throat Pain. Carcinoma of the base of tongue and oropharynx are treated with combination of radiation therapy, surgical excision, and radical neck dissection if lymph nodes are palpable, and adjuvant chemotherapy. Markedly enlarged tonsils are treated with tonsillectomy.

**Supraglottis**

1. **Cysts and laryngocele:** Cysts can best be managed by direct laryngoscopy and marsupialization. Internal laryngoceles can be likewise treated. If the laryngocele has both an internal and external component, and external neck approach is the procedure of choice.

2. **Acute epiglottitis.** Fifty percent will develop airway obstruction necessitating intubation or tracheotomy. High dose intravenous antibiotics (broad spectrum) are given. This disease is of short duration, seldom lasting over 1 week.

3. **Carcinoma.** Small supraglottic carcinomas rarely cause stridor. If they are small, either tumoricidal radiation therapy or conservation laryngectomy is used. If there is evidence of lymph node metastasis or a high statistical likelihood of metastasis, radical neck dissection may be performed. Usually the carcinomas are extensive, so the treatment is radiation therapy (pre- or postoperatively), total laryngectomy, radical neck dissection if lymph node spread, and adjuvant chemotherapy.

**Larynx**

1. **Carcinoma.** Treatment is the same as for supraglottic carcinoma. Usually the carcinoma is large if stridor is present.

2. **Vocal cord paralysis.** There must be bilateral vocal cord paralysis to give stridor. Tracheotomy is performed for airway obstruction. Then wait for 6 months for return of vocal cord function. If no return, can leave in tracheotomy indefinitely and patient still can talk. Alternative is arytenoidectomy and lateralization of one vocal cord. This allows decannulation of tracheotomy but leaves patients with a harsh, breathy voice.

3. **Cricoarytenoid fixation.** Treated the same way as bilateral vocal cord paralysis. The accompanying autoimmune disease (usually rheumatoid arthritis is treated with aspirin, Butazolidin, or corticosteroid).

4. **Subglottic stenosis.** A most difficult problem to treat. Can leave patient with permanent tracheotomy or perform some type of operation to open this area. Serial dilation of the stenotic area has been uniformly poor in opening up the stenotic area.
Trauma

1. Acute trauma: If minimal with just swelling, watch; if significant injury, open reduction is indicated.

2. Chronic trauma: Usually has marked stenosis and vocal cord dysfunction. Dilation is never successful. Surgical repair has limited success. It is best to avoid this problem with early reduction of acutely traumatized larynx.

Psychogenic Stridor. A more difficult problem to treat and best left to psychiatrist.

Neurologic Stridor. Stridor comes from bilateral vocal cord paralysis. Some neurologic processes may be treated. Myasthenia gravis can be treated, medically and/or with a thymectomy, and the vocal cords may return to normal function.

Thyroid. Carcinoma of thyroid with bilateral vocal cord paralysis is far advanced, with poor prognosis. Benign thyroid disease is usually in adenomatous goiter with large cysts, and a thyroid lobectomy will solve the airway obstruction problem. These patients should be on thyroid replacement therapy or else the remaining thyroid will enlarge and give similar problem. Rarely will Graves’ disease represent with airway obstruction; if it does, suppression and ablative therapy is used.

Trachea. Carcinoma of the trachea is rare and is treated by resection if small and by radiation if large and unresectable. All benign tracheal neoplasms are excised. Tracheal stenosis can be treated either by leaving in a permanent tracheotomy tube or by tracheal resection (Grillo method) if deemed resectable. Tracheomalacia is treated the same way as tracheal stenosis, with either resection or permanent tracheotomy.

Bronchus. Acute asthma is treated medically with epinephrine 1/1000 at 0.3-1 mL, given in divided doses subcutaneously. Aminophylline intravenously or by suppository may be needed. In some cases, intravenous steroids may be necessary.