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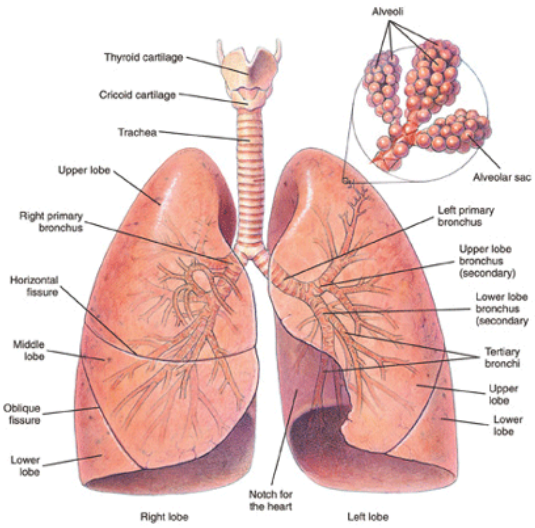
BREATHING PROBLEMS AND AIRWAY EVALUATION

What is the airway?



The airway refers to the passageway that allows air in and out of the body. It begins at the nose and mouth, through the voice box (larynx) to the branches of the lungs. The smallest parts of the lung ends as a tiny "bubble" called an alveolus, where air (oxygen) is transferred into the blood and carbon dioxide is released.

How do we breathe?

We move in air (inhale) from the environment to the lungs using our airway. Inhaling involves the use of breathing (respiratory) muscles. This inhaled air is rich in oxygen. Oxygen is then transferred from the lungs into the bloodstream and is exchanged with a "waste" gas (carbon dioxide) that we then breathe out (exhale). We can get more oxygen into our bodies by breathing faster or by taking a larger breath by using the respiratory muscles. Although we can control the amount of air we breathe voluntarily, the amount of oxygen our body needs at any given time is also registered in the brain in the respiratory center. This is why we don't have to think about breathing, for example, while we sleep.

The brain, the heart, lungs, respiratory (breathing) muscles, and the airway must all work well together to keep the body breathing normally. A problem with any of these can cause breathing difficulties. The body also gives us clues to the location of the problem by causing a certain kind of sound.

What are some causes of difficulty breathing?

1. The brain - if the respiratory center in the brain isn't working normally, even if everything else is working well, breathing difficulty can occur. Causes for this include trauma to the brain, increased pressure in the brain, some drugs (narcotics for example), and problems with chemical balances in the blood.
2. The heart - if the heart has problems pumping blood to the lungs or throughout the body, the body will not get enough blood with oxygen and will cause difficulty breathing. Examples include "holes" in the heart, valve problems, or a heart that can't keep up with the amount of blood that needs to be pumped (congestive heart failure).
3. The lungs - even though the blood can get to the lungs, and oxygen can get to the lungs, if the lungs don't work well, they cannot transfer the oxygen. Examples include infection or fluid in the lungs (pneumonia) and diseases like cystic fibrosis.
4. The respiratory muscles - if the muscles that are used to help breathe are weak or paralyzed, breathing difficulties can occur. Reasons for this can include some medications causing muscle

paralysis, damage to the nerves that go to these muscles, and neurologic diseases like Guillian-Barre syndrome.

5. The airway - anything that blocks any part of the airway restricts air from getting to the lungs. Examples of this include infections, foreign bodies, and some congenital abnormalities of the airway.

How does a patient <u>look</u> when they are having difficulty breathing?

For the patient, difficulty breathing is usually described as a feeling of being "out of breath" or "needing more air". For an observer, the way a patient looks can depend on the cause of difficulty, as well as the age of the patient.
Generally, a patient who is having difficulty breathing appears anxious. He/she is usually breathing faster than normal, may be making various noises during each breath. In severe cases, the patient's tongue, lips, or even skin may look bluish in color and the patient may become less responsive. In children, the ribs may be more noticeable during each breath, the belly may stick out, and/or their nostrils may flare out.

How does a patient <u>sound</u> when they are having difficulty breathing?

The airway can be divided into the upper airway and lower airway. The upper airway consists of the nasal passages, mouth, upper throat (pharynx), and the voice box (larynx). The lower airway consists of the windpipe (trachea), and the larger branches of the airway (bronchi) in the lungs, the smaller branches of the airway in the lungs (bronchioles) and the air sacs or "bubbles" of air at the end of the lungs called alveoli.
The noise associated with a breathing difficulty often depends on the location in the airway. As we said before, this allows us some clues to the cause of the problem.

UPPER AIRWAY

- **NASAL PASSAGES** - results in snoring type noises. The medical term for this is **stertor**. This is a congested, stuffy nose sound that is very common in infants. This may be due to nasal obstruction, large adenoids, or nasal deformities.
- **MOUTH/UPPER THROAT (PHARYNX) –** results in a muffled voice. Enlargement of the **tonsils and adenoids** in this area can cause a muffled voice, snoring with pauses in the breathing (apnea) and "Darth Vader" type breathing during the day.
  In children, a collection of pus in the tissue behind the pharynx (**retropharyngeal abscess**) can develop in severe throat infections. The voice may sound muffled in these children, as air is unable to get out from the voice box effectively. These abscesses must be drained as soon as possible, so that the airway is not blocked entirely or that the abscess does not break open and allow pus to drain into the lungs.
- **THE LARYNX** - can be divided into three areas in relation to the glottis:
  - Above the glottis (**SUPRAGLOTTIC**) - blockage in this area usually results in a muffled voice, as air cannot move through the voice box normally.
    Probably the most serious disorder in this area involves enlargement of the epiglottis. If the epiglottis becomes enlarged, usually as a result of a bacterial infection (**epiglottitis**), the entire airway may become blocked. Luckily, bacterial epiglottitis is rarely seen any more because of the immunizations children receive today. The symptoms and an x-ray of the neck are usually all that is needed to make this diagnosis. Antibiotics and carefully putting in a breathing tube (intubation), is usually involved in treating this condition.
    In addition to a muffled voice, sounds produced while breathing in (inspiring) can also identify breathing problems at the supraglottic level. These coarse sounds are

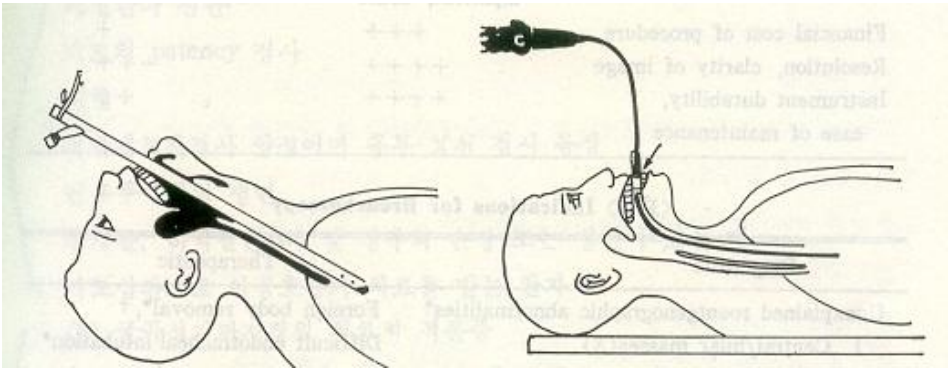
called **inspiratory stridor**. The most common cause of inspiratory stridor in infants is **laryngomalacia** which is produced by floppiness of and around the epiglottis. A good evaluation of the laryngeal airway can distinguish supraglottic problems for glottic problems.

- At the **GLOTTIS** (vocal folds)- the second most common cause of stridor in infants is **vocal cord paralysis**. If one vocal cord is paralyzed, the voice may be weak or breathy. If both cords are paralyzed, the voice is normal but the stridor is very loud and the child will easily become distressed. Airway noises tend to be **biphasic** in nature (both inspiratory and expiratory stridor). A good evaluation of the laryngeal airway can distinguish supraglottic problems for glottic problems.
- Below the glottis (**SUBGLOTTIC**) - obstruction in this area results in a high-pitched noise while breathing. The noise occurs when breathing in and out (**biphasic stridor**). One of the more common causes of an obstruction here is a viral infection called laryngotracheobronchitis (**croup**). It is usually identified by symptoms (especially a characteristic barking cough) and an x-ray. This infection requires careful observation of the patient, fluids, and treatment as in other viral infections. However, if the obstruction becomes more severe, hospitalization, inhaled medications, and rarely, a breathing tube may be needed until the infection resolves. Other causes of obstruction here are narrowing of the airway (subglottic stenosis), webs of tissue across the airway (webs), hemangiomas (collection of blood vessels), or foreign bodies.

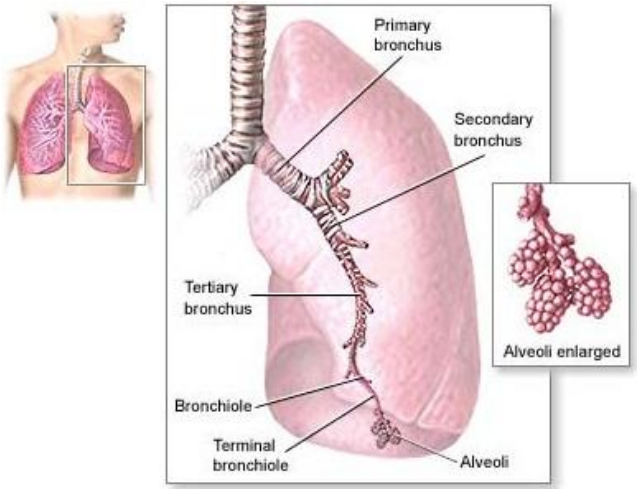
In rare situations in which a breathing tube cannot be inserted into the airway due to obstruction, it may require a tube to be placed directly into the trachea from outside the neck (tracheotomy) to secure the airway first and allow careful evaluation of the problem. This is a temporary tube, so removal is planned once the obstruction is resolved.

LOWER AIRWAY

- **TRACHEA** - obstruction in this area of the airway can result in noisy breathing out. This is called **expiratory stridor**. Causes of obstruction in this area include infections (tracheitis), foreign bodies, abnormal blood vessels that wrap around the trachea (vascular ring), or congenital abnormalities resulting in a floppy or too narrow trachea. An x-ray can help identify a problem in this area. Magnetic resonance imaging (MRI) and Computed Tomography (CT) also may be used to confirm a diagnosis.
  However, <u>examining the airway directly is the only way to completely evaluate the cause of breathing problems</u>. This is performed in the operating room as a **microlaryngoscopy and bronchoscopy**.



- **BRONCHI** - once the trachea splits into the bronchi, the obstruction sound is more of a musical type **wheeze**. This wheeze is best heard on **expiration** and often requires the use of a stethoscope. Severe obstructions may be heard on inspiration and expiration, or not at all if the airway is entirely blocked.
  Infections of the bronchi (bronchitis) or foreign bodies are the more common causes of obstruction in this area. X-rays and possibly direct visualization of the bronchi via bronchoscopy may be used to evaluate obstructions in this area.



- **BRONCHIOLES** - Small branches off of the bronchi. Less severe obstructions in this area can cause **expiratory wheezing**, which is usually heard only with a stethoscope. More severe obstruction of these tiny airways may result in both inspiratory and expiratory wheezing. Even more concerning is if there is no air movement at all.
  Conditions that may result in obstruction at this level are bronchiolitis (inflammation of these small airways usually caused by a virus) and asthma (a temporary narrowing of these airways as a result of allergies, smoking, genetics and other reasons). These conditions are usually identified by symptoms and characteristic findings on x ray. Treatment includes oral medications, breathing treatments, providing extra oxygen and rarely, placement of a breathing tube.
- **ALVEOLI** - obstruction at the level of these tiny sacs of air requires the use of a stethoscope to hear. The sounds picked up are usually like a crackle noise as these air sacs pop open and closed during breaths. An infection in the lungs (pneumonia) is one of the more common causes of this, but anything that allows fluid to build up in the lungs (pulmonary edema) would cause obstruction in the alveoli.

When would you be referred to an ear, nose, and throat specialist for evaluation and/or treatment of a breathing difficulty?

Many times, the only way to make an accurate diagnosis of the cause of a breathing difficulty is to look and examine the airway directly. This is performed in the operating room as a **microlaryngoscopy and bronchoscopy**. With this technique, a foreign body can be removed at the same time as it is visualized. In other cases, a sample of fluid in the lungs can be obtained for culture or other tests.

Supraglottic and glottic reasons for airway noises (stridor) can be evaluated in the office setting using a **flexible laryngoscopy** and/or **videostroboscopy**. If the evaluation is not sufficient in the office setting, one can obtain the best evaluation via a microlaryngoscopy and bronchoscopy in the operating room if necessary.

Treatment of the many causes of breathing problems is individualized to your child's specific circumstances. Every child is different and presents with unique challenges. After careful evaluation, your pediatric ear, nose and throat surgeon will outline the options for treatment.