NOISY BREATHING
Objectives.

- Discuss various types of noisy breathing and ways differentiate between them.
- Review common conditions that cause noisy breathing in particular congenital stridor and persistent wheezing.
- Suggest an algorithm for a work up of noisy breathing.
NOISY BREATHING.

- Common and difficult to assess accurately.
NOISY BREATHING.

- Stridor: is usually inspiratory or possibly biphasic
- Stertor: which primarily is caused by airway obstruction in the nasal or pharyngeal regions.
- Snorgle: gurgle and snore.
NOISY BREATHING.

- Wheeze: high pitched continuous.
- Rhonchus: low pitched continuous.
- Crackles: discontinuous fine or coarse.
NOISY BREATHING.

1. Are we dealing with merely transmitted nasal sounds?
2. Is it mostly an inspiratory stridor?
3. Is It mostly an expiratory wheeze?
STRIDOR.
STRIDOR

- Stridor is from airflow limitation in the extra-thoracic portion of the trachea.
CONGENITAL STRIDOR

- Mild stridor, to severe respiratory distress
- May be relatively asymptomatic in the neonatal period and present later in life
- Often is intermittent
CONGENITAL STRIDOR

In addition to stridor, symptomatology often may include

- Choking while eating/Aspiration.
- Hoarseness or aphonia.
- Apnea or cyanosis.
- Growth failure.
- Ask about H/O of intubation.
CONGENITAL STRIDOR / Initial Workup

- Anterior-posterior and lateral radiographs of the cervical airway
- Barium swallow
- Airway fluoroscopy
Croup
CONGENITAL STRIDOR /
Workup

- Flexible fiberoptic laryngoscopy and bronchoscopy.
CASE SCENARIO

- A 4 month old is transferred from an outside hospital to the PICU for increasing stridor and distress.
- There is no H/O of apnea or cyanosis.
- He is gaining weight well.
- Stridor is high pitched, vibratory and ramps up.
Stridor was first noted at 2 weeks of age.
- It appears to have worsened over the first three months.
- There is occasional difficulty feeding.
- X-ray neck is normal.
CASE SCENARIO

- What is your diagnosis?
- Laryngomalacia.
- Choanal stenosis.
- Cysts, webs and other anomalies
CASE SCENARIO

- What is your diagnosis?
- Laryngomalacia.
- Choanal stenosis.
- Cysts, webs and other anomalies
You admit a term newborn to the neonatal intensive care unit because of noisy breathing. Findings on physical examination include mild micrognathia, an intact palate, and inspiratory stridor with suprasternal retractions when the infant is in the supine position that diminish but do not disappear when the infant is prone. Stridor becomes more audible when the infant cries. When the infant is asleep and prone, the breath sounds are clear and equal bilaterally, with no stridor or wheezing. There is no heart murmur. Pulse oximetry is 94% on room air.

Of the following, the MOST likely cause of this infant’s stridor is
A. cleft lip
B. laryngomalacia
C. tracheal hemangioma
D. tracheomalacia
E. vocal cord polyp
Question: 114
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LARYNGOMALACIA

- Commonest cause of congenital stridor.
- Usually resolves within 12 to 18 months
LARYNGOMALACIA (o5)
LARYNGOMALACIA

- Stridor from laryngomalacia typically develops within the first few weeks of life and progresses in severity over a period of a few months.
- High-pitched and fluttering in nature
LARYNGOMALACIA

- Severe cases of stridor may be associated with sternal retractions, respiratory distress, and feeding difficulties.
LARYNGOMALACIA

- It is exacerbated by exertion, crying, feeding, agitation, or supine positioning.
- Placing the infant in the prone position or in a side position and extending the neck may relieve the stridor.
LARYNGOMALACIA

- The gold standard in diagnosis for laryngomalacia is visualizing supraglottic structures getting sucked into the glottis during inspiration with flexible laryngoscopy
  - Omega-shaped epiglottis (that may occur in 30% to 50% of normal asymptomatic infants)
  - Redundant aryepiglottic folds
  - Excessive tissue in the supra-arytenoid area that may prolapse into the laryngeal inlet upon inspiration
CHOANAL ATRESIA/STENOSIS.

- Unilateral or Bilateral
- 1:5,000 to 8,000 live births
- Variable age of onset,
- Low-pitched inspiratory stridor/stertor.
- Feeding difficulties
- Muffled cry
- Retractions.
CHOANAL ATRESIA/STENOSIS.

- Bony or membranous
- Confirm by passing a catheter
- Unilateral may be diagnosed later for persistent unilateral secretions
- Bilat. assoc. with craniofacial anomalies, CHD, and TEF
- Thin cut axial CT 1.5-3.0 mm is diagnostic.
OTHER CAUSES OF STRIDOR.

- Nasopharyngeal masses which obstruct the nose.
  - Encephalocele
  - Dermoids
  - Teratomas
  - Gliomas
- Bifid Epiglottis.
- Saccular cysts.
BIFID EPIGLOTTIS

- May present as laryngomalacia with inspiratory stridor and airway obstruction.

- May be associated with congenital syndromes, most notably Pallister-Hall syndrome. (AD, GLI3 mutation, polydactyly, cutaneous syndactyly, hypothalamic hamartoma, hypothalamic hamartomas, seizures or hormone abnormalities. Also bifid epiglottis, imperforate anus, and kidney abnormalities.)

- Endocrine evaluation because possible hypothyroidism or hypothalamic abnormalities.
SACULAR CYST.

Similar in their embryological development to laryngocele
CASE SCENARIO

- 3 month old has a H/O of recurrent croup.
- He has a hoarse rather “breathy” voice.
- There is a H/O of choking during feeding from time to time.
- There are no signs of distress.
- X-ray neck is normal.
CASE SCENARIO

- What is your diagnosis?
- Unilateral or partial vocal cord paralysis.
- Laryngeal web.
- Sub-glottic stenosis.
What is your diagnosis?
- Unilateral or partial vocal cord paralysis.
- Laryngeal web.
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VOCAL CORD PARALYSIS

- 10% of all congenital laryngeal anomalies and is the second most common cause of congenital stridor, next to laryngomalacia
- Birth trauma may induce vocal cord paralysis, possibly by stretching of the recurrent laryngeal nerve associated with difficult deliveries
VOCAL CORD PARALYSIS

- Central nervous system abnormalities
- Peripheral causes, such as cardiovascular and mediastinal problems, may present as unilateral vocal cord paralysis (the left side being more common)
VOCAL CORD PARALYSIS

- Bilateral vocal cord paralysis typically presents with high-pitched inspiratory stridor with normal cry or possibly a mildly hoarse cry.
- Presents immediately after birth and may be severe, requiring emergent airway intervention such as intubation and possibly tracheotomy.
Unilateral paralysis typically presents with a weak, breathy cry and feeding difficulties.

This may manifest as aspiration, resulting from the inability of the vocal cords to approximate to protect the airway.
VOCAL CORD PARALYSIS

- Laryngoscopy, either with a flexible endoscope while the patient is awake, or with rigid endoscopy under light anesthesia.
- To assess vocal cord mobility, patient should be breathing or crying.
Bronchoscopy also should be performed as part of the evaluation.

MR imaging of the head should be obtained to rule out any central nervous system abnormalities.
NORMAL VOCAL CORDS
RIGHT VOCAL CORD PARALYSIS
LARYNGEAL WEB

- Failure of recanalization of the larynx.
- Primarily glottic
- Thin or thick.
- Congenital hoarseness.
- Respiratory distress at birth.
LARYNGEAL WEB
(Congenital.) (o6)
A 6-month-old boy presents with a cough and rhinorrhea of several days’ duration. His parents deny that he has a fever but report constant “noisy breathing” that does not seem to change with position since birth. The boy is alert and has normal findings on physical examination except for mild stridor. Nasal suctioning elicits a very weak and ineffective cough.

Of the following underlying conditions, the MOST likely reason for why this child’s cough is weak is:

A. cerebral palsy
B. cystic fibrosis
C. laryngomalacia
D. ribcage abnormality
E. vocal cord paralysis
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6 month old has had many episodes of croup.
The frequency and severity of these episodes appears to be getting worse
For past 2 months he has constant inspiratory noise.

Neck X-ray shows possible asymmetrical narrowing of the subglottic area.
Laryngoscopy Image
Subglottic hemangioma.
SUBGLOTTIC HEMANGIOMA

- Only 30% present at birth.
- Majority present within the first few months of life.
SUBGLOTTIC HEMANGIOMA

- Natural history: rapid growth in the first few weeks or months of life, stable by 12-18 months of age, subsequent involution by 5 years of age.
- Cutaneous hemangioms in 50% of kids.
SUBGLOTTIC HEMANGIOMA

- 2:1 female preponderance.
- X-ray neck shows asymmetric narrowing of the sub-glottic area.
- CO₂ laser ablation.
CASE SCENARIO

- 9 month old has had episodes of croup and respiratory distress from birth.
- Had apnea at birth.
- Is diagnosed as having asthma.
CASE SCENARIO

- Gets hoarse from time to time.
- Is losing weight.
- Xray neck on next slide.
CASE SCENARIO

- Congenital subglottic stenosis.
SUBGLOTTIC STENOSIS (10)
Subglottic Stenosis Post-Intubation. (12)
CONGENITAL SUBGLOTTIC STENOSIS

- Less than 3.5mm in a new born.
- Upto 50% = normal.
- 50-70% = grade 1
- 70-90% = grade 2
- 90-99% = grade 3
- No stoma = grade 4
CONGENITAL SUBGLOTTIC STENOSIS

- Recurrent croup with viral infections.
- Apnea, cyanosis.
- Hoarseness of voice.
- Failure to thrive.
- Misdiagnosed as asthma.
CONGENITAL SUBGLOTTIC STENOSIS

- X-ray neck AP and lateral
- Bronchoscopy flexible or rigid.
- Intubation with differing size tubes and application of 20cm of $H_2O$ pressure to look for leaks.
CONGENITAL SUBGLOTTIC STENOSIS

- Expectant observation.
- Dilatation.
- Cricoid split.
- Tracheostomy.
- Tracheal reconstruction.
CASE SCENARIO

- 4 year old has had many episodes of croup.
- He is well during the day and typically wakes up with severe croup that mostly resolves by the next morning.
- No H/O of angio-edema
- Normal exam
- F/H of atopy
CASE SCENARIO (contd)

- No H/O of food allergy.
- Symptoms tend to cluster during late fall and winter.
- X-ray neck is normal.
- C₁' esterase inhibitor level and function are normal.
CASE SCENARIO

- What is your diagnosis?
  - Spasmodic croup
- What test could you do to support you diagnosis?
Question 116

A 2-year-old boy is brought to your clinic because he has a nighttime cough. According to his mother, several times over the past few months he has awakened with a barking, nonproductive cough that improves by the next morning. She denies fever and rhinorrhea with the episodes. Evaluation of his lungs yields normal results.

Of the following, the clinical feature that is MOST suggestive of spasmodic croup rather than recurrent laryngotracheobronchitis in this boy is

A. age of the patient
B. barking nature of the cough
C. lack of rhinorrhea and fever
D. nonproductive nature of the cough
E. normal findings on physical examination
CROUP SYNDROME.

The main symptoms of the “croup syndrome” are

• Stridor
• Respiratory distress
• Barking cough
The main causes of the “croup syndrome” are

- Viral Laryngo-Tracheo-Bronchitis.
- Congenital anomalies of the extra-thoracic trachea. (Recurrent croup or persistent stridor)
- Spasmodic croup (a variant of asthma)
- Pseudo croup (barking cough without the stridor)
Question: 132

A 2-year-old boy comes to the emergency department because of a barking cough. His mother reports that he has no fever or shortness of breath, but you note a barking, seal-like cough (Item Q132). His respiratory rate is 20 breaths/min, and there is no stridor. His lungs are clear, and other findings on the physical examination are normal.

Of the following, the MOST appropriate treatment is

A. cool mist therapy
B. helium/oxygen mixture
C. nebulized albuterol
D. nebulized racemic epinephrine
E. oral antibiotic
Critique: 132

The child described in the vignette has a barking cough but no other respiratory symptoms, which is most consistent with the diagnosis of laryngotracheobronchitis or croup. Croup may be caused by a number of respiratory viruses, including parainfluenza, influenza, respiratory syncytial virus, and adenovirus. Typical features are rhinorrhea and low-grade fever, followed by a barking cough and hoarseness. In severe cases, inspiratory stridor may be noted. Children who have croup generally appear well and tolerate oral intake well. Toxic appearance, drooling, and significant respiratory distress should alert the clinician to the possibility of a more serious airway infection, such as bacterial tracheitis or epiglottitis.

The mainstay of therapy for children who have simple viral croup is aerosolized cool mist therapy, which is administered best with the child seated on the parent’s lap. The mist thins and moistens airway secretions to improve clearance. Although a recent review of clinical trials found little benefit of mist over no therapy in children who had acute croup, it is a safe and easily administered therapy that may be soothing to the inflamed mucosa. There is good evidence that administration of steroids, either systemic dexamethasone or nebulized budesonide, improves the clinical course by reducing laryngeal mucosa inflammation, so this could be added to the cool mist for maximum benefit.

Both helium/oxygen and racemic epinephrine have been shown to be beneficial in the treatment of moderate-to-severe croup, but the child in the vignette has no evidence of respiratory distress or stridor, so these therapies are not indicated unless the child’s condition worsens. Nebulized albuterol may be helpful if wheezing was present and lower airway bronchospasm was suspected. Oral antibiotics have no role in the management of croup.
A 6-year-old boy presents to the emergency department with an 8-hour history of fever and respiratory difficulty. During the physical examination, the boy is seated in his mother’s arms and appears toxic. He has a temperature of 104°F (40°C), a heart rate of 130 beats/min, and a respiratory rate of 35 breaths/min. In addition, he is drooling. Each time you approach him, he starts crying, and his respiratory difficulty worsens.

Of the following, the MOST likely diagnosis is

A. diphtheria
B. epiglottitis
C. foreign body aspiration
D. laryngotracheobronchitis
E. pneumonia
Question 205

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E. pneumonia
PERSISTENT WHEEZING.
TRACHEAL ANOMALIES

- Tracheal lesions usually cause a prominent expiratory noise or wheeze. However they may present as a biphasic noise or stridor.
PERSISTENT WHEEZING.

- Tracheomalacia.
- Tracheal stenosis.
- Extrinsic compression (vascular or other mediastinal)
- Severe asthma.
- Asthma with GER.
- T-E fistula.
TRACHEOMALACIA

- Prevalence: Unknown
- Expiratory noise (wheeze) “Happy Wheezer Syndrome”
- Seal like cough
- Normal Voice
- Tendency to accumulate secretions
TRACHEOMALACIA

- Primary:
  - Cartilaginous.
  - Membranous.

- Secondary:
  - Vascular ring.
  - S/P T-E F repair.
TRACHEOMALACIA

- Diagnosis confirmed by bronchoscopy, preferably flexible.
- Rigid bronch might miss milder tracheomalacia.
- Goes away by 18-24 months of age.
- Rarely requires surgical intervention like tracheotomy or aortopexy.
TRACHEOMALACIA (14)
TRACHEAL STENOSIS.

- Fixed obstruction
- Noises during both phases of the respiratory cycle
Tracheal stenosis is associated with other anomalies especially pulmonary artery sling.
Cartilage rings may need to be split and patched with pericardium.
EXTRINSIC COMPRESSION

- Abnormal vasculature
- Mediastinal tumors
- Enlarged Thyroid.
VASCULAR RINGS.

- 3% of the population.
- Tight rings require surgery.
- Loose rings don’t.
VASCULAR RING (17)
### Vascular Rings

<table>
<thead>
<tr>
<th>Usually Symptomatic</th>
<th>Esophagus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Aortic Arch</td>
<td>Post. and right lat. (Double dent)</td>
</tr>
<tr>
<td>Right arch with left ductus originating from descending aorta</td>
<td>Post. and right lat.</td>
</tr>
<tr>
<td>Left arch with right ductus originating from descending aorta (Diverticulum of Komorrell.)</td>
<td>Post. and left lat.</td>
</tr>
<tr>
<td>Pulm. a. sling. Aberrant left pulm. a.</td>
<td>Anterior</td>
</tr>
<tr>
<td>Sometimes Symptomatic</td>
<td>Esophagus</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Right arch with aberrant left subclavian and left ductus</td>
<td>Post. and right lat. (Slant right to left)</td>
</tr>
<tr>
<td>Left arch with aberrant right subclavian and right ductus</td>
<td>Post. and left lat. (Slant left to right)</td>
</tr>
</tbody>
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## VASCULAR RINGS.

<table>
<thead>
<tr>
<th>Occasionally Symptomatic</th>
<th>Esophagus</th>
</tr>
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<tbody>
<tr>
<td>Anomalous innominate</td>
<td>None</td>
</tr>
<tr>
<td>Aberrant subclavian</td>
<td>Post. 70% angle T₄ to T₂</td>
</tr>
</tbody>
</table>
Bronchomalacia. (36)
T-E Fistula (21).
Cleft.
Algorithm for W/U

Try and differentiate between “stridor” and “wheeze.”

- Congenital stridor mostly from laryngomalacia, vocal cord problems and sub-glottic stenosis.
- Persistent wheezing mostly from tracheomalacia, vascular rings or asthma with GER.
Algorithm for W/U

- Congenital stridor:
  - Check for nasal patency.
  - X-ray soft tissue neck AP and lateral.
  - Upper GI
  - TVFL
  - Laryngo and Bronchoscopy.
Algorithm for W/U

- Persistent wheezing:
  - CXR
  - Upper GI
  - Bronch

- Other tests as needed.