

Acute Upper Airway Obstruction

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THE STORY IN ONE SENTENCE

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“Secure the airway first—nothing else matters if the child cannot breathe.”

Normal anatomy — the body's job

The upper airway is a flexible tube that starts at the nose and mouth, passes through the pharynx (throat), crosses the larynx (voice box where the vocal cords sit), and enters the trachea (windpipe). The epiglottis is a leaf-shaped flap of cartilage that tips backward to cover the larynx when you swallow, keeping food and liquid out of the airway. When you breathe in, the vocal cords pull wide apart, the epiglottis stands upright, and smooth muscles keep the pharynx from collapsing inward. The mucosa (soft inner lining) is smooth and thin, so air flows quietly and easily.

BODY'S JOB

This anatomy delivers air from the outside world to the lungs without effort or noise. When any part narrows—whether the epiglottis swells, the vocal cords stiffen, or the pharynx fills with pus—air has to squeeze through at high speed, making noise (stridor) and forcing the chest muscles to work much harder (retractions). Every abnormal sign you see is the body's response to that narrowed space.

1. Air enters through the nose (warmed, filtered by tiny hairs and mucus) or mouth.
2. Air travels down the pharynx, a shared highway for food (going to the esophagus) and air (going to the trachea).
3. At the top of the trachea sits the larynx, a box made of cartilage rings that holds the vocal cords. The epiglottis sits just above the larynx like a lid.
4. When you breathe in, the vocal cords spread wide open, the epiglottis lifts out of the way, and air flows silently into the trachea.

5. When you swallow, the larynx lifts upward, the epiglottis folds down like a trapdoor to cover the airway entrance, and food slides safely past into the esophagus behind the trachea.
6. The trachea is a firm tube held open by C-shaped cartilage rings, so it never collapses. Air flows down the trachea into the bronchi and then into the lungs.

What breaks

One mechanical problem—something shrinks the space inside the upper airway—causes every downstream finding. The narrower the opening, the louder the a high-pitched noise on breathing in (stridor), the harder the work of breathing, and the closer the child is to complete blockage and respiratory arrest.

CLINICAL TERM

Foreign body aspiration (an inhaled object like a peanut or toy lodges in the larynx or proximal trachea), anaphylaxis (IgE-mediated allergic reaction triggers mast-cell degranulation, releasing histamine that causes massive tissue swelling (edema) in the pharynx and larynx), infectious epiglottitis (bacterial infection, typically *Haemophilus influenzae* type b before widespread vaccination, now more often *Streptococcus* or *Staphylococcus*, causes the epiglottis to swell into a cherry-red, enlarged mass), retropharyngeal or peritonsillar abscess (pus collection behind the pharynx or beside the tonsils pushes forward and narrows the airway), viral croup (parainfluenza virus causes subglottic swelling—swelling just below the vocal cords—in children six months to three years old), trauma (blunt neck injury, inhalational burn, or caustic ingestion damages airway structures and triggers reactive swelling), or laryngeal or pharyngeal tumor (mass grows inward and occupies airway lumen). All these causes shrink the effective diameter of the airway. Airflow velocity through the narrowed segment increases, becomes turbulent, and vibrates the walls, producing a high-pitched noise on breathing in (stridor) (high-pitched inspiratory or biphasic sound). Every clinical sign—tripod positioning (sitting upright, leaning forward with arms braced to splint open the pharynx), drooling (saliva pools because swallowing is painful or risky), muffled or hoarse voice (swollen tissues muffle vocal-cord vibration), retractions (negative intrathoracic pressure sucks chest wall inward), fast breathing (tachypnea) and a fast heart rate (tachycardia) (compensatory attempt to maintain minute ventilation and oxygen delivery), agitation (hypoxia and hypercarbia stimulate the brain), and late low oxygen in the blood (hypoxemia) with a slow heart rate (bradycardia) (pre-arrest sign)—traces back upstream to the single mechanical problem: reduced airway cross-sectional area.

How the body compensates

The body compensates for partial airway obstruction by ramping up the work of breathing—using neck and chest accessory muscles, increasing respiratory rate, and adopting tripod positioning to mechanically splint the airway open. This compensation can maintain normal oxygen saturation and near-normal vital signs for a time, creating a false sense of stability. The danger is that this compensated phase hides how close the patient is to complete obstruction. Once compensation fails—because the obstruction worsens, the muscles tire, or instrumentation (exam, intubation attempt) triggers laryngospasm or dislodges a foreign body—decompensation is abrupt and complete. The airway closes, oxygen drops, the heart slows, and respiratory arrest follows within minutes. The key principle is to recognize and intervene during the compensated phase, before the airway closes completely and the window for safe intervention vanishes.

1. The child increases work of breathing by recruiting accessory muscles (sternocleidomastoid in the neck, intercostals between the ribs, abdominal muscles). This extra effort generates higher negative intrathoracic pressure to pull air through the narrowed segment, temporarily maintaining tidal volume (the amount of air moved with each breath) and oxygen saturation.
2. The child adopts tripod positioning—sitting upright, leaning forward, hands on knees or bedside table, neck slightly extended. This posture straightens the pharynx and larynx, reduces gravitational collapse of soft tissues, and maximizes the available airway diameter. Any attempt to lay the child flat worsens obstruction and can trigger complete closure.
3. Fast breathing (Tachypnea) (fast breathing rate) and a fast heart rate (tachycardia) (fast heart rate) increase minute ventilation (total air moved per minute) and oxygen delivery to tissues. These compensatory vital-sign changes can keep oxygen saturation in the normal range (above ninety-two percent) even as the airway narrows dangerously.
4. The child refuses to swallow and drools because swallowing requires complex coordination of pharyngeal muscles and epiglottis movement. With obstruction or inflammation, swallowing feels dangerous or is physically painful, so saliva pools and spills out.
5. The child instinctively stays very still and avoids agitation, because any increase in metabolic demand (crying, struggling) raises oxygen consumption and worsens low oxygen (hypoxia). Parents and clinicians must mirror this—keep the child calm, avoid forcing the child to lie down, and minimize stimulation.

6. This compensated state is precarious. Oxygen saturation and blood pressure may appear reassuringly normal, but the child is expending enormous energy to maintain those numbers. As obstruction worsens or muscles fatigue, compensation fails suddenly. The decompensation point is crossed when the airway occludes completely, when instrumentation (tongue blade, laryngoscope) triggers laryngospasm or bleeding, or when a foreign body shifts and lodges tighter. After that point, oxygen-starved (hypoxic) arrest occurs within two to three minutes, and the chance for safe intubation is lost.
7. Trending clinical signs over time is critical. Worsening a high-pitched noise on breathing in (stridor) (louder, biphasic, or paradoxically quiet as airflow drops), increasing retractions, rising heart rate, new agitation or lethargy, declining oxygen saturation, or a slow heart rate (bradycardia) are red flags signaling imminent decompensation. A child with stable oxygen saturation but escalating work of breathing is not stable—they are decompensating and require immediate definitive airway management.
8. Do not wait for low oxygen in the blood (hypoxemia) or a slow heart rate (bradycardia) to act. Those are late, pre-arrest signs. Intervene during the compensated phase—call for senior airway expertise (anesthesia, ENT, pediatric critical care), prepare for surgical airway (needle or surgical cricothyrotomy), and have backup airway equipment ready before attempting intubation.

Domino effect

1. Airway narrowing occurs at the pharynx (throat), larynx (voice box), or proximal trachea (upper windpipe) due to foreign body, anaphylactic swelling (edema) (allergic swelling), infectious swelling (epiglottitis, abscess, croup), trauma, or tumor. — The effective diameter of the airway lumen (inside space) shrinks. According to Poiseuille's law, resistance to airflow increases to the fourth power as radius decreases—halving the diameter increases resistance sixteen-fold. Air must now move much faster through the narrow segment to deliver the same volume per breath.
2. A high-pitched noise on breathing in (Stridor) (high-pitched, harsh inspiratory or biphasic sound) becomes audible without a stethoscope. — Turbulent, high-velocity airflow through the narrowed segment vibrates the airway walls, producing the characteristic whistle or squeak. Inspiratory a high-pitched noise on breathing in (stridor) suggests supraglottic or glottic obstruction (above or at the vocal cords). Biphasic a high-pitched noise on breathing in (heard on both inspiration and expiration) suggests subglottic or tracheal narrowing. Expiratory a high-pitched noise on breathing in alone suggests lower airway obstruction (bronchi). The pitch and timing of a high-pitched noise on breathing in localize the obstruction anatomically.

3. Suprasternal, intercostal, and subcostal retractions (skin pulling inward above the collarbone, between the ribs, and below the rib cage with each breath) appear. — The child generates large negative intrathoracic pressure (suction force inside the chest) to overcome the increased resistance and pull air through the obstruction. This pressure sucks the soft tissues of the chest wall and neck inward during inspiration. The degree of retractions reflects the severity of obstruction—deeper, more widespread retractions mean tighter obstruction and higher work of breathing.
4. Drooling, refusal to swallow, and tripod positioning (sitting upright, leaning forward with hands braced on knees or table, neck extended) develop. — Swallowing is painful when the pharynx or epiglottis is inflamed or obstructed, and the child fears that swallowing might close the airway completely, so saliva pools and drips out. Tripod positioning is an instinctive maneuver that straightens the pharynx and larynx, reduces gravitational collapse of soft tissues, and maximizes airway diameter. Any attempt to force the child to lie flat can precipitate complete obstruction.
5. Muffled voice (hot potato voice), hoarseness, or complete inability to speak (aphonia) occurs. — Swelling or mass at the epiglottis, vocal cords, or surrounding structures changes the resonance of the voice and prevents normal vocal-cord vibration. Muffled voice suggests supraglottic swelling (epiglottitis, abscess). Hoarseness suggests vocal-cord involvement (croup, laryngeal trauma). Aphonia (no voice at all) suggests severe vocal-cord swelling (edema) or complete laryngeal obstruction and is an ominous sign of imminent airway closure.
6. A fast heart rate (Tachycardia) (heart rate too fast) and fast breathing (tachypnea) (breathing rate too fast) increase. — The body tries to compensate for increased work of breathing and early tissue low oxygen (hypoxia) (low oxygen reaching cells) by raising heart rate and respiratory rate. This increases minute ventilation (total air moved per minute) and cardiac output (blood pumped per minute) to deliver more oxygen per minute. These compensatory vital-sign changes can temporarily maintain oxygen saturation in the normal range, masking the severity of the underlying obstruction.
7. Agitation, anxiety, restlessness, or altered mental status (confusion, lethargy) emerge. — Low oxygen (Hypoxia) (low blood oxygen) and hypercarbia (rising blood carbon dioxide from inadequate ventilation) stimulate the brain's respiratory centers in the brainstem, causing a sensation of suffocation, fear, and panic. The child senses they cannot get enough air. Agitation increases oxygen demand, worsening the low oxygen. As low oxygen deepens, the brain becomes less responsive, and agitation gives way to lethargy and confusion—a sign of impending respiratory arrest.

8. Low oxygen in the blood (Hypoxemia) (low blood oxygen saturation, typically below ninety percent), a slow heart rate (bradycardia) (heart rate too slow, a pre-arrest sign in children), and bluish skin (cyanosis) (blue or dusky discoloration of lips, tongue, and nail beds) appear late. — Exhausted respiratory muscles and worsening obstruction cause ventilation to fail—carbon dioxide rises, oxygen falls. Low oxygen in the blood (Hypoxemia) triggers reflex a slow heart rate (bradycardia) in children (unlike adults, who become with a racing heart (tachycardic)). A slow heart rate in a child with respiratory distress is a pre-arrest rhythm and signals imminent cardiac arrest unless the airway is opened immediately. Bluish skin (Cyanosis) appears when deoxygenated hemoglobin (hemoglobin without oxygen attached) exceeds five grams per deciliter in capillary blood, reflecting severe, prolonged low oxygen (hypoxia). These are late signs—by the time you see bluish skin and a slow heart rate, the child is seconds to minutes from respiratory arrest and requires emergent definitive airway control (intubation, surgical airway, or foreign-body removal).

Symptoms · what the patient feels, and why

- A high-pitched noise on breathing in (Stridor): When the airway narrows (like pinching a straw), air rushes through the smaller opening at high speed, spinning and bumping into the walls. This turbulent, fast flow makes the tissue vibrate and creates a high-pitched, harsh sound that you hear when the child breathes in, out, or both.
- Retractions (skin pulling in at the neck notch, between the ribs, below the ribs): To suck air through a blocked airway, the chest muscles work extra hard and create strong suction inside. That suction is so powerful it pulls the soft skin inward with every breath—you see the dips above the collarbone, between ribs, and under the ribs.
- Drooling and refusing to swallow: Swallowing hurts or feels scary when the throat is swollen, irritated, or blocked (maybe by a stuck object). So the child stops swallowing, saliva pools in the mouth, and it drips out.
- Tripod positioning (sitting upright, leaning forward, hands on knees): Leaning forward and propping up with the hands straightens the windpipe from throat to lungs (like unfolding a bent hose). Gravity also pulls the tongue and floppy throat tissue forward and away from the back wall, opening the airway as wide as possible.
- Muffled, hoarse, or no voice at all: The voice comes from air vibrating the vocal cords (two small bands inside the voice box). When swelling or a blockage sits on or near those cords—or on the epiglottis (the lid that covers the voice box)—the sound gets muffled, raspy, or completely silent.
- Fast breathing and fast heart rate: Breathing through a narrowed airway is hard work and oxygen levels start to drop. The body tries to fix this by breathing faster (to pull in more air) and pumping the heart faster (to deliver more oxygen to every cell).

- **Nasal flaring** (nostrils spreading wide with each breath): The brain automatically widens the nostrils to let in every bit of extra air possible when breathing is hard. It is an instinctive attempt to reduce resistance at the nose and get more oxygen in.
- **Agitation, anxiety, or confusion**: When oxygen drops (hypoxia) and carbon dioxide builds up (hypercarbia), the brain notices and sounds an alarm. The child feels a terrifying sensation of not getting enough air (air hunger), becomes restless, scared, and eventually confused as brain cells struggle.
- **Blue lips, tongue, or fingernails (cyanosis)**: Hemoglobin is the protein in red blood cells that carries oxygen and turns bright red when loaded. When the airway is so blocked that almost no oxygen gets into the blood, hemoglobin stays dark and deoxygenated, making the skin and lips look blue or purple. This is a late, dangerous sign that the body is running out of oxygen.
- **Slow heart rate (bradycardia) and barely responding**: Severe, prolonged lack of oxygen poisons the heart muscle and brain. The heart, which was racing at first, now slows dangerously (like a dying battery). The brain shuts down and the child becomes limp and unresponsive. These are the final warnings before the heart and breathing stop completely.

Focused exam

- **A high-pitched noise on breathing in (Stridor)**—a high-pitched whistling or crowing sound heard when breathing in, sometimes heard when breathing out, or a low-pitched rumble during exhalation: A high-pitched noise on breathing in (Stridor) is the single loudest clue that the throat (pharynx), voice box (larynx), or windpipe (trachea) is partly blocked. Air is squeezed through a narrowed space at high speed, like wind whistling through a crack in a door. When the opening shrinks by half, a high-pitched noise on breathing in appears. This sound tells you the airway is in danger.
- **Retractions**—chest wall and soft spaces between ribs, above collarbones, or below the ribcage pull sharply inward with each breath: The child's breathing muscles are working overtime to create enough suction to pull air past the blockage, like sucking hard through a collapsed straw. Severe retractions mean the blockage is getting worse and the muscles are starting to tire. When muscles give out, breathing stops (respiratory failure).
- **Tripod position**—child sits upright leaning forward with hands on knees and refuses to lie flat: Gravity and forward neck angle widen the airway opening, like pulling a garden hose straight to let water flow. The child's body instinctively finds this position when the airway is nearly blocked. Forcing the child to lie flat can close the airway completely. This posture signals severe, life-threatening obstruction.

- Drooling with inability to swallow saliva: The blockage is so high and so tight—usually at the epiglottis (the flap covering the windpipe) or just above the voice box—that even spit cannot go down the swallowing tube (esophagus). This finding strongly points to epiglottitis (infection and swelling of the epiglottis) or severe swelling above the vocal cords.
- Voice change—hoarse, muffled, or 'hot potato voice' (sounds like speaking with a mouth full of hot food): Swelling or blockage at or near the vocal cords distorts sound waves, like pressing on a speaker cone. A muffled or hot potato voice points to disease above the vocal cords—especially epiglottitis or a pus pocket near the tonsils (peritonsillar abscess).
- Anxiety, restlessness, or brief crying that stops because crying demands more oxygen than available: Anxiety and restlessness are early brain warnings that blood oxygen is dropping (hypoxemia). The brain senses the shortage and triggers a panic response. When crying stops and the child becomes quiet or limp, the brain is no longer getting enough oxygen—respiratory failure is starting.
- Bluish skin (Cyanosis)—blue or dusky color of lips, tongue, or skin (appears only when obstruction is nearly complete): Bluish skin (Cyanosis) is a very late danger sign, appearing only when oxygen saturation falls dangerously low (typically below 85–90%). Blue color means the airway is almost totally blocked and the heart and lungs are about to stop (cardiopulmonary arrest). Never wait for blue color to act—by then, seconds count.

Diagnostics · every test answers a question

- Pulse oximetry (oxygen saturation measurement) at bedside—continuous monitoring via finger or toe probe → Is the child's blood oxygen level staying normal despite the blockage, or is oxygen dropping (hypoxemia)?
- Lateral neck X-ray (only if child is stable, cooperative, and diagnosis is uncertain—never if child is distressed) → Is there X-ray evidence of epiglottitis (thumbprint sign—swollen epiglottis looks like a thumb pressing into the airway) or croup (steeple sign—narrowed windpipe below the voice box looks like a church steeple)?
- Direct laryngoscopy (camera or lighted scope to look directly at the voice box) in operating room with anesthesia and ENT surgeon standing by → What is the exact anatomic cause and location of the obstruction—swollen epiglottis, foreign object, pus pocket (abscess), or other structural problem?
- Blood culture and complete blood count (CBC) with differential if bacterial infection is suspected (epiglottitis, bacterial tracheitis, retropharyngeal or peritonsillar abscess) → Is there bacterial infection causing the obstruction, and which organism is responsible?
- Arterial or capillary blood gas (ABG or CBG) if child is stable enough for blood draw and ventilatory status is uncertain → Is the child retaining carbon dioxide (hypercapnia), signaling inadequate ventilation and impending respiratory failure?

- Chest X-ray (posteroanterior and lateral views) if foreign body aspiration is suspected and object may be radiopaque (visible on X-ray) → Is there a visible foreign object in the airway, or indirect signs such as air trapping (hyperinflation) or lung collapse (atelectasis) downstream from the blockage?

Treatment logic

- Position child upright in caregiver's lap, provide humidified oxygen by blow-by or mask (never force), and keep environment calm—do not agitate, do not force child to lie flat, do not attempt IV placement or throat examination unless airway is secure → Upright positioning uses gravity to pull the tongue and epiglottis forward, widening the airway opening (like straightening a bent tube). Humidified oxygen raises blood oxygen levels while the airway remains narrowed. Calm environment prevents crying and agitation, which increase oxygen demand and create stronger negative pressure on inspiration (both worsen obstruction and can trigger complete closure).
- Administer dexamethasone 0.6 mg/kg by mouth, IV, or IM (maximum single dose 16 mg) for croup, angioedema (allergic swelling), or any inflammatory upper airway obstruction → Dexamethasone (a corticosteroid) blocks inflammatory signals (cytokines) that cause blood vessels in the airway lining (mucosa) to leak fluid and swell. This reduces tissue thickness and widens the airway opening within 1 to 4 hours. Cochrane reviews and AAP guidelines show single-dose dexamethasone improves outcomes in croup at all severity levels, reduces hospital admissions, and lowers need for intubation. Effect lasts 48 to 72 hours.
- Give racemic epinephrine 0.5 mL of 2.25% solution via nebulizer (or L-epinephrine 5 mL of 1:1000 if racemic unavailable) with supplemental oxygen for severe croup, acute epiglottitis as bridge to intubation, or laryngeal swelling (edema) → Nebulized epinephrine (adrenaline mist breathed into lungs) causes rapid constriction of blood vessels in the airway lining (vasoconstriction), squeezing fluid out of swollen tissue and shrinking the mucosa. This increases airway diameter within 10 to 30 minutes, like wringing water out of a sponge. Cochrane reviews and AAP croup guidelines support this intervention for moderate to severe obstruction.
- If foreign body is suspected and child is conscious with partial obstruction and able to cough or speak, encourage coughing and do not interfere; if complete obstruction (cannot cough, speak, or breathe), immediately perform back blows and chest thrusts (infants under 1 year) or abdominal thrusts—Heimlich maneuver (children over 1 year) per AHA pediatric basic life support guidelines → Coughing generates high pressure inside the chest (intrathoracic pressure) that can blast a foreign object out of the airway, like a cork from a bottle. Back blows, chest thrusts, and abdominal thrusts create sudden external pressure surges that compress the lungs and propel the object upward. Successful removal immediately restores airflow and reverses low oxygen (hypoxemia).

- Administer broad-spectrum IV antibiotics—ceftriaxone 50 mg/kg once daily or cefotaxime 50 mg/kg every 6 to 8 hours PLUS vancomycin 15 mg/kg every 6 hours if MRSA (methicillin-resistant *Staphylococcus aureus*) is suspected—for epiglottitis, bacterial tracheitis, retropharyngeal abscess, or peritonsillar abscess; prepare for emergency intubation in operating room with ENT and anesthesia, or surgical drainage of abscess → Broad-spectrum IV antibiotics kill bacterial pathogens causing infection and swelling—*Haemophilus influenzae* type b, *Streptococcus pyogenes*, *Staphylococcus aureus* (including MRSA), or oral anaerobes (bacteria from mouth). This stops further inflammation and allows swelling to resolve over 24 to 72 hours. Surgical drainage of abscess removes pus and relieves mass effect (pressure from fluid collection pushing on airway). IDSA guidelines recommend antibiotics covering typical pathogens until culture results guide narrower therapy.
- Keep child calm, allow parent to hold child at bedside, and avoid all unnecessary physical examination (do not examine throat, do not force tongue depressor, do not lay child flat) or procedures (no IV placement, no blood draws, no pulse oximetry probe application if child resists) until airway is secured in controlled setting → Minimizing agitation keeps respiratory rate and oxygen demand lower, reduces the suction force (negative inspiratory pressure) pulling the airway closed, and prevents crying or struggling—all of which can convert partial obstruction to complete obstruction in seconds. Parental presence reduces child anxiety and crying, like a security blanket for the airway.
- If complete airway obstruction occurs and ventilation cannot be achieved by bag-mask, immediately perform emergency cricothyrotomy (surgical airway through cricothyroid membrane) or needle cricothyrotomy (large-bore IV catheter through cricothyroid membrane for temporary oxygenation) per ATLS and PALS guidelines; if expertise available, perform emergency tracheostomy in operating room → Emergency surgical airway bypasses the obstruction entirely by creating a new opening below the blockage, directly into the trachea (windpipe). This restores ventilation and oxygenation within seconds when all other methods fail. Cricothyrotomy (through cricothyroid membrane between thyroid and cricoid cartilages) is faster and easier than tracheostomy in emergency. Needle cricothyrotomy provides temporary oxygen delivery (minutes) until definitive surgical airway is placed.

Medications

Oxygen · Respiratory support gas

When the airway is narrowed, less oxygen reaches the lungs and blood. Giving extra oxygen through a mask raises the oxygen percentage in each breath. Even though less air can squeeze

through the tight space, each bit of air that does get through carries more oxygen, keeping blood oxygen levels safer while the obstruction is being fixed.

1. Patient breathes a higher oxygen concentration (often 40–100% instead of room air's 21%).
2. More oxygen molecules dissolve in the blood and attach to hemoglobin.
3. Organs receive enough oxygen despite reduced total airflow, preventing low oxygen in the blood (hypoxemia) (low blood oxygen).

SAFETY WATCH

Watch oxygen saturation with a pulse oximeter; keep SpO₂ above 90–92%. · In infants and small children, avoid blowing oxygen directly into a crying child's face—it can worsen agitation and increase oxygen demand; let a calm parent hold the mask near the child's face. · High-flow oxygen over many hours can dry airway mucosa (lining tissue), so humidify when possible.

Heliox (Helium-Oxygen mixture) · Low-density gas mixture

Heliox is a blend of helium and oxygen (typically 70% helium, 30% oxygen or 80/20). Helium is much lighter than nitrogen (the main gas in room air), so heliox flows through narrow spaces more smoothly—like water sliding through a straw versus honey. When the airway is tight, breathing heliox lowers the work of moving air in and out, reduces noisy turbulent flow (stridor), and gives more time for definitive treatment.

1. Helium's low density reduces airflow resistance in the narrowed segment.
2. Turbulent flow (which causes a high-pitched noise on breathing in (stridor) and wastes breathing effort) converts to smoother laminar flow.
3. Respiratory muscles work less hard, lowering the risk of fatigue and respiratory failure.
4. Oxygen in the mix keeps blood oxygen adequate while the obstruction is being relieved.

SAFETY WATCH

Requires a sealed mask or reservoir system; helium escapes easily into room air. · Monitor oxygen saturation closely—if you use an 80/20 mix, the oxygen fraction is lower than 100% oxygen alone. · Not useful in complete obstruction (zero airflow) or when the patient is already in respiratory arrest—secure the airway first. · Effect is immediate but temporary; keep other treatments ready.

Epinephrine (adrenaline) · Sympathomimetic (alpha- and beta-adrenergic agonist)

Epinephrine is the body's natural 'fight-or-flight' hormone. It locks onto receptors on blood-vessel walls and airway smooth muscle. In the airway mucosa (lining tissue), it tightens blood

vessels (vasoconstriction), squeezing fluid out of swollen tissue and shrinking swelling (edema) (puffiness). It also relaxes the smooth muscle around small airways, which can help if there is any bronchospasm (muscle tightening). Epinephrine is the first-line drug for anaphylaxis (life-threatening allergic reaction) and is also used as a nebulized mist (racemic epinephrine) for croup.

1. Epinephrine binds to alpha-1 receptors on blood-vessel smooth muscle, causing vasoconstriction (vessels narrow).
2. Narrowed vessels push fluid out of the tissue, reducing mucosal swelling (edema) and opening the airway diameter.
3. Epinephrine also activates beta-2 receptors on airway smooth muscle, relaxing any constriction.
4. In anaphylaxis, systemic (whole-body) epinephrine also raises blood pressure and heart rate, counteracting shock.

SAFETY WATCH

For anaphylaxis: inject 0.3–0.5 mg intramuscular (IM) into the mid-outer thigh (vastus lateralis); repeat every 5–15 minutes if needed (AHA, ACLS 2020). · For croup: nebulized racemic epinephrine 0.5 mL of 2.25% solution in 3 mL saline, or L-epinephrine 5 mL of 1:1000; observe for at least 2–3 hours because swelling often returns. · Monitor heart rate and rhythm—epinephrine can cause a fast heart rate (tachycardia) (fast heart), tremor, and (rarely) arrhythmias. · Do NOT give into a vein by accident; always aspirate before IM injection. · Avoid in known severe coronary disease unless life-threatening airway emergency outweighs risk.

Corticosteroids (e.g. dexamethasone, prednisolone) · Glucocorticoid anti-inflammatory

Corticosteroids mimic cortisol, the body's natural anti-swelling hormone. They travel into cells and turn on genes that make anti-inflammatory proteins and turn off genes that make inflammatory chemicals (cytokines, prostaglandins). Over hours, the immune system calms down, white-blood-cell traffic into the airway lining drops, and fluid leaks out of tissue—swelling (edema) (swelling) shrinks. Steroids are key for croup (viral laryngotracheobronchitis), angioedema (deep tissue swelling), and post-intubation laryngeal swelling.

1. Steroid molecule crosses the cell membrane and binds to the glucocorticoid receptor inside the cell.
2. The receptor moves into the nucleus and changes which genes are active.

3. Pro-inflammatory genes (IL-1, IL-6, TNF- α , COX-2) are switched off; anti-inflammatory genes (lipocortin, IL-10) are switched on.
4. Fewer inflammatory chemicals are made, blood vessels become less leaky, and immune cells stop flooding into the tissue.
5. Over 4–6 hours, mucosal swelling (edema) decreases and airway diameter increases.

SAFETY WATCH

For croup: single dose of dexamethasone 0.6 mg/kg PO/IM/IV (max 10 mg) or prednisolone 1–2 mg/kg PO (AAP, Cochrane 2018). · For angioedema: dexamethasone 10 mg IV or equivalent; continues effect after epinephrine wears off. · Short courses (1–3 days) are safe in children and adults; watch for high blood sugar (hyperglycemia) (high blood sugar) in diabetics. · Do NOT withhold in severe airway obstruction because of infection fears—benefit outweighs risk. · No taper needed for single or short-course use.

Antibiotics (e.g. ceftriaxone, cefotaxime) · Third-generation cephalosporin (beta-lactam)

In bacterial causes of upper airway obstruction—especially acute epiglottitis (infection of the epiglottis, the cartilage flap above the voice box)—bacteria such as *Haemophilus influenzae* type b, *Streptococcus*, or *Staphylococcus* invade and inflame the tissue. Ceftriaxone and cefotaxime are antibiotics that punch holes in bacterial cell walls. The bacteria burst open and die, the infection clears, and inflammation and swelling in the epiglottis resolve over 24–48 hours.

1. Antibiotic enters the bacterial cell and binds to penicillin-binding proteins (enzymes that build the cell wall).
2. Cell-wall synthesis stops; the wall weakens.
3. Osmotic pressure (water trying to enter the cell) bursts the bacteria.
4. Dead bacteria are cleared by white blood cells; bacterial toxins and debris trigger less inflammation.
5. Swelling in the epiglottis decreases, and the airway opens.

SAFETY WATCH

For suspected epiglottitis: ceftriaxone 50–100 mg/kg/day IV (max 2 g/day) or cefotaxime 150–200 mg/kg/day divided every 6–8 hours, started immediately after securing the airway (do NOT delay for culture). · Check for penicillin/cephalosporin allergy; if present, use vancomycin or clindamycin. · Monitor renal function (creatinine); adjust dose in kidney disease. · Duration 7–10 days; switch to oral amoxicillin-clavulanate once the patient improves and can swallow.

Foreign-Body Removal Maneuvers (back blows, abdominal thrusts, Magill forceps under laryngoscopy) · Mechanical intervention (not a drug)

When a solid object (food, toy, coin) blocks the larynx or trachea, no medication can dissolve or shrink it—you must physically dislodge it. In a conscious, choking patient, back blows (sharp strikes between the shoulder blades) and abdominal thrusts (Heimlich maneuver: quick upward pushes below the ribcage) create bursts of pressure that shoot air up from the lungs, popping the object out like a cork from a bottle. In an unconscious patient, direct laryngoscopy (inserting a lighted blade to see the vocal cords) lets you grab the object with Magill forceps (long, angled tweezers).

1. For responsive choking (cannot cough, speak, or breathe): alternate five back blows (lean patient forward, strike between shoulder blades with heel of hand) and five abdominal thrusts (stand behind, fist above navel, quick upward pull) until object ejects or patient becomes unresponsive (AHA BLS 2020).
2. For unresponsive choking: begin CPR; each time you open the airway to give breaths, look in the mouth—if you see the object, sweep it out with a finger.
3. If basic maneuvers fail and the patient is in respiratory arrest, perform direct laryngoscopy, visualize the cords, and use Magill forceps to remove the object under direct vision.
4. Once the object is out, airflow resumes immediately; give oxygen and assess for injury.

SAFETY WATCH

Never perform abdominal thrusts on infants under 1 year—use back slaps and chest thrusts instead (AHA PALS 2020). · Abdominal thrusts can injure the liver, spleen, or ribs; examine the abdomen after successful dislodgement. · Do NOT attempt blind finger sweeps in a responsive patient—you may trigger vomiting or worsen the obstruction. · If the object does not dislodge and the patient arrests, proceed immediately to advanced airway management (intubation or cricothyrotomy). · For children, adjust force—use gentler back blows and chest thrusts; never hang an infant upside-down.

Flexible or Rigid Endoscopy · Diagnostic and therapeutic procedure (not a drug)

Endoscopy means passing a tube with a camera and light into the airway to see exactly where and what is blocking it. A flexible bronchoscope (thin, bendable scope) can navigate around corners and retrieve foreign bodies with tiny grasping tools, or it can suction out thick secretions and mucus plugs. A rigid bronchoscope (straight metal tube) gives a wider view,

allows better removal of larger objects, and can push aside swollen tissue. Endoscopy both diagnoses (tells you what is wrong) and treats (removes the problem).

1. Patient is sedated or under general anesthesia (depending on urgency and cooperation); oxygen is given through the side port of the scope.
2. Scope is inserted through the mouth (or nose for flexible scope) and advanced under direct camera vision.
3. Operator identifies the obstruction (foreign body, mucus plug, tumor, or swelling).
4. Grasping forceps, baskets, or suction tools passed through the scope remove the object or clear secretions.
5. Once the airway is clear, the scope is withdrawn and the patient breathes normally.

SAFETY WATCH

Always pre-oxygenate and monitor SpO₂; desaturation (oxygen drop) can happen quickly during the procedure. · Risk of laryngospasm (vocal-cord spasm), bleeding if tissue is injured, or perforation (tear) of the airway—perform only in a controlled setting with airway rescue equipment ready. · Rigid bronchoscopy requires general anesthesia and an operating room; flexible bronchoscopy can be done at the bedside with moderate sedation. · For suspected epiglottitis, do NOT perform endoscopy until the airway is secured in the OR—manipulation can trigger complete obstruction. · Post-procedure, observe for a high-pitched noise on breathing in (stridor), bleeding, or subcutaneous emphysema (air trapped under the skin, a sign of perforation).

Cricothyrotomy (Emergency Surgical Airway) · Surgical procedure (not a drug)

When the upper airway is completely blocked—by severe swelling, trauma, blood, or a foreign body that cannot be removed—and you cannot pass a breathing tube through the mouth or nose (failed intubation), cricothyrotomy creates a new airway hole below the blockage. You make a small cut through the skin and cricothyroid membrane (the soft spot between the thyroid cartilage—Adam's apple—and the cricoid ring just below it) and insert a tube directly into the trachea. Air bypasses the obstruction, and the patient can breathe again.

1. Identify landmarks: feel the notch of the thyroid cartilage (Adam's apple), slide your finger down to the next hard ring (cricoid), and find the soft dip between them (cricothyroid membrane).
2. Stabilize the larynx with one hand; make a vertical skin incision, then a horizontal stab incision through the membrane.
3. Insert a bougie (flexible guide wire), dilate the opening, and slide a 6.0 or 7.0 mm cuffed tube over the bougie into the trachea.

4. Inflate the cuff, attach a bag-valve device, and ventilate; confirm placement with end-tidal CO₂ and bilateral breath sounds.
5. Once the airway is secure, arrange transport to the OR for formal tracheostomy or definitive airway management.

SAFETY WATCH

Indications: 'Cannot intubate, cannot oxygenate' scenario (AHA ACLS 2020)—failed airway with oxygen saturation dropping despite BMV (bag-mask ventilation). · Contraindications: children under 10–12 years (landmarks are too small; perform needle cricothyrotomy with jet ventilation instead), and known laryngeal fracture (may worsen injury). · Complications: bleeding (especially from anterior jugular veins or thyroid vessels), misplacement (into soft tissue or esophagus), subglottic narrowing (stenosis) (scarring and narrowing) if the tube stays in too long. · Convert to formal tracheostomy within 24–48 hours if prolonged airway support is needed. · Practice landmarks on a manikin—in a real emergency, you will have seconds and one attempt.

Positioning and Airway Maneuvers (head-tilt/chin-lift, jaw-thrust, tripod position) · Physical intervention (not a drug)

Sometimes the airway is not blocked by an object but by the tongue, soft tissue, or neck position collapsing inward—especially in an unconscious or weak patient. Simple repositioning can lift the tongue and soft palate off the back of the throat, opening the airway instantly. In a conscious patient with partial obstruction (croup, epiglottitis), sitting upright and leaning forward (tripod position) uses gravity to pull the tongue forward and reduces compression of swollen structures, making each breath easier.

1. For unconscious patient with suspected tongue obstruction: perform head-tilt/chin-lift (tilt the forehead back, lift the chin up to extend the neck) or, if trauma is possible, jaw-thrust (place fingers behind the angles of the jaw and push the jaw forward without moving the neck).
2. For conscious patient in respiratory distress: let them sit upright, lean forward with hands on knees (tripod position), or hold their own preferred position—do NOT force them to lie down, which can collapse the airway and cause sudden complete obstruction.
3. For infants and small children: place in sniffing position (slight neck extension, head neutral or on a small towel) to align the airway axis; avoid hyperextension, which can kink the soft trachea.

SAFETY WATCH

In suspected cervical spine injury, use jaw-thrust only (do NOT tilt the head). · Never lay a child with a high-pitched noise on breathing in (stridor) flat or agitate them—crying increases oxygen demand and can worsen obstruction. · For epiglottitis: allow the child to sit in a parent's lap in tripod position; keep them calm, give oxygen by mask held near (not forced on) the face, and move directly to the OR for controlled intubation—do NOT examine the throat, start an IV, or lay them down (all can trigger complete obstruction). · Positioning is immediate and free—always optimize it before attempting advanced interventions.

Red flags

- Blue lips, tongue, or fingernails (cyanosis)—shows severe oxygen starvation and the child is minutes from collapse
- Heart rate suddenly slowing or dropping (bradycardia)—the oxygen-starved heart is failing and arrest is imminent
- Decreased consciousness, extreme sleepiness, or no response—the brain is shutting down from lack of oxygen
- Silent chest with little or no air moving despite hard breathing effort—the airway is almost completely blocked
- Cannot speak, cry, make sound, or cough—the airway is totally or nearly totally closed off

Nursing priorities

1. Keep the child upright in the position of comfort, usually sitting in the caregiver's lap, and do not force the child to lie flat or leave the caregiver. — An upright position uses gravity to keep the tongue and swollen tissues forward and away from the back of the throat, maximizing the open airway space; lying flat lets those tissues fall backward and can completely close the airway; agitation from separation increases oxygen demand and worsens obstruction.
2. Provide humidified oxygen by blow-by (tube or mask held near the face) at 4 to 6 liters per minute, never forcing the mask if the child resists. — Humidified oxygen raises the oxygen level in the blood (oxygenation) even when the airway is partly blocked; forcing a mask causes crying and struggling, which increases airflow resistance, worsens negative pressure in the airway, and can turn a partial obstruction into a complete one.

3. Maintain a calm, quiet environment—dim lights, speak softly, limit the number of people in the room, and delay all non-essential procedures like IV starts or blood draws until the airway is secured. — Crying and agitation increase the child's metabolic rate and oxygen consumption, create turbulent (rough, swirling) airflow that worsens a high-pitched noise on breathing in (stridor), and generate negative intrathoracic pressure (suction force inside the chest) that pulls swollen airway tissues inward and narrows the opening further.
4. Continuously monitor oxygen saturation with pulse oximetry and watch for the red-flag triad: bluish skin (cyanosis) (blue color), a slow heart rate (bradycardia) (heart rate dropping below normal for age), and decreased level of consciousness. — These three signs mean the brain and heart are critically starved of oxygen; the heart slows because it is failing, not because the child is calming down; this triad signals imminent respiratory arrest (breathing stops) and cardiac arrest (heart stops), requiring immediate advanced airway intervention such as intubation (breathing tube) or emergency tracheostomy (surgical airway through the neck).
5. Administer dexamethasone 0.6 mg/kg (maximum single dose 16 mg) by mouth, IV, or intramuscular injection as ordered, for croup or any inflammatory cause of obstruction. — Dexamethasone is a corticosteroid (anti-inflammatory medicine) that reduces swelling in the airway lining; it begins working within 30 minutes to 2 hours and prevents worsening obstruction; one dose decreases the need for intubation and shortens symptom duration by shrinking inflamed tissues.
6. Never perform a blind finger sweep, never insert a tongue blade to look at the throat, and never lay the child supine for examination unless anesthesia and intubation equipment are immediately available. — Instrumentation (putting anything in the mouth or throat) can trigger laryngospasm (the vocal cords slam shut reflexively), can rupture a retropharyngeal abscess and flood the airway with pus, or can dislodge a foreign body and push it deeper; any of these can cause instant complete airway obstruction and death.
7. Prepare emergency airway equipment at the bedside—appropriate-size endotracheal tubes (breathing tubes), laryngoscope (lighted blade to see the vocal cords), bag-valve mask, and suction—and notify the anesthesiologist or ENT surgeon if red-flag signs are present. — Children with upper airway obstruction can deteriorate from stable to full arrest in seconds; having rescue airway tools within arm's reach and expert help on standby allows immediate life-saving intervention; delayed airway access in a swollen or bleeding airway leads to oxygen-starved (hypoxic) brain injury (brain damage from oxygen loss) or death.

8. If anaphylaxis is suspected, administer intramuscular epinephrine 0.01 mg/kg (0.01 mL/kg of 1:1000 solution, maximum single dose 0.5 mg for adults, 0.3 mg for children) into the mid-outer thigh immediately, then give oxygen, position upright, and prepare for possible second dose in 5 to 15 minutes. — Epinephrine is a hormone that constricts (tightens) blood vessels and relaxes airway smooth muscle, reversing the rapid swelling (angioedema) caused by histamine release during allergic reactions; it works within minutes and is the only medication that stops anaphylaxis; steroids and antihistamines work too slowly to save the airway in anaphylaxis and are adjuncts (helpers), not primary treatment.

Sources

- American Academy of Pediatrics (AAP) Pediatric Advanced Life Support (PALS) 2020
- American Heart Association (AHA) PEARs Provider Manual 2020
- Difficult Airway Society (DAS) Guidelines 2015
- Cochrane Database: Interventions for croup in children (2018)

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