

Croup and Bronchiolitis

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THE STORY IN ONE SENTENCE

Croup and bronchiolitis are both viral infections in young children — croup swells the upper airway just below the voice box and causes a barking cough and a high-pitched noise on breathing in (stridor), while bronchiolitis inflames the tiny lower airways and causes wheezing and fast breathing.

“Croup is upper airway — think a high-pitched noise on breathing in (stridor) and bark. Bronchiolitis is lower airway — think wheeze and retractions. Both are viral, both are common in little kids.”

Normal anatomy — the body's job

A child's airway is a smooth, open tube that carries air from the nose and mouth down past the voice box, through the windpipe, and into the lungs. In young children, this tube is very narrow — even a small amount of swelling can block the flow of air and make breathing hard.

BODY'S JOB

The airway's job is to let air move freely in and out of the lungs so oxygen can reach the blood and carbon dioxide (the waste gas your body makes) can leave. The voice box (larynx) sits at the top of the windpipe and helps make sound. Just below the voice box is a narrow ring called the subglottic space — this is the tightest part of a child's upper airway. Further down, the windpipe branches into smaller and smaller tubes (bronchi, then bronchioles) that deliver air to every part of the lung.

1. Air enters through the nose or mouth.
2. It passes through the throat and voice box (larynx).
3. Just below the voice box is the subglottic space — the narrowest part of a child's upper airway.

4. Air continues down the windpipe (trachea).
5. The windpipe splits into two main branches (bronchi), one for each lung.
6. Each bronchus branches into smaller tubes (bronchioles) that spread air through the lung tissue.
7. At the end of the smallest tubes are tiny air sacs (alveoli) where oxygen moves into the blood and carbon dioxide moves out.

What breaks

In croup, a virus (usually parainfluenza) infects the airway just below the voice box, causing it to swell and fill with mucus — this narrows the tube and makes a barking cough and a high-pitched noise on breathing in (stridor) (a high-pitched noise when breathing in). In bronchiolitis, a virus (usually RSV) infects the tiny lower airways (bronchioles) deep in the lungs, causing them to swell and fill with thick mucus — this blocks airflow and causes wheezing and fast, hard breathing.

CLINICAL TERM

Croup: viral laryngotracheobronchitis, most often parainfluenza, causing subglottic inflammation and swelling (edema). Bronchiolitis: viral infection of the bronchioles, most often RSV, causing bronchiolar inflammation, mucus plugging, and air trapping.

How the body compensates

The body tries to keep oxygen flowing by breathing faster and working harder. Vital signs can look okay for a while, but this effort uses energy and cannot last forever. The danger is missing the signs that the child is getting tired and heading toward respiratory failure.

1. {'step': 'The child breathes faster (tachypnea) to pull in more air through the narrow tube.', 'why': 'More breaths per minute helps keep total oxygen delivery steady, even though each breath is smaller.'}
2. {'step': 'The chest and neck muscles work harder — you see retractions (skin pulling in between the ribs, above the collarbone, or below the rib cage with each breath).', 'why': 'The child is using extra muscles to create stronger suction and pull air past the blockage.'}
3. {'step': 'The child sits upright or leans forward (tripod position in severe cases) to open the airway as much as possible.', 'why': 'Gravity helps keep the tongue and soft tissue from falling backward and blocking the throat even more.'}
4. {'step': 'Heart rate goes up (tachycardia) to deliver what oxygen is available to the body faster.', 'why': 'If less oxygen is getting in with each breath, the heart pumps faster to keep organs fed.'}

5. {'step': 'The child may become agitated or restless at first.', 'why': 'Low oxygen makes the brain feel uncomfortable, so the child fights to stay alert and breathe.'}
6. {'step': 'Eventually the child becomes very tired, quiet, or hard to wake — this is a red flag for respiratory failure.', 'why': 'The muscles are exhausted, the brain is not getting enough oxygen, and the body is about to stop being able to compensate.'}

Domino effect

1. A virus (parainfluenza in croup, RSV in bronchiolitis) infects the airway lining. — The virus enters cells in the throat or lungs, multiplies, and kills those cells — this triggers the immune system to send white blood cells and fluid to the area, causing swelling and mucus production.
2. The airway narrows — in croup, the subglottic space swells; in bronchiolitis, the bronchioles fill with mucus and debris. — Swelling and mucus take up space inside the tube, leaving less room for air to flow. In a child, even one millimeter of swelling can cut airflow dramatically because the tube is so small to begin with.
3. Airflow becomes turbulent (rough and noisy) instead of smooth. — When air is forced through a narrow, rough passage at high speed, it vibrates the tissue and makes sound — a high-pitched noise on breathing in (stridor) (high-pitched noise) in croup, wheezing (musical whistling) in bronchiolitis.
4. The child has to work much harder to breathe — faster rate, retractions, flaring nostrils. — The body senses low oxygen and high carbon dioxide in the blood, so the brain tells the breathing muscles to work harder and faster to pull in more air.
5. Oxygen levels in the blood start to drop, especially during sleep or when the child is tired. — The narrow airway and mucus plugs block enough airflow that the lungs cannot pull in enough oxygen to keep the blood fully loaded — this shows up as low oxygen saturation on a monitor.
6. In severe cases, the child becomes exhausted, stops fighting to breathe, and may stop breathing (apnea) or turn blue (cyanosis). — The muscles are too tired to keep working, and the brain does not have enough oxygen to stay alert — this is respiratory failure and requires emergency help (oxygen, breathing support, or a breathing tube).
7. Treatment (steroids for croup, supportive care for bronchiolitis) reduces swelling and buys time for the body to clear the virus. — Steroids shrink the swelling in croup, and epinephrine temporarily tightens blood vessels to reduce swelling even faster. In bronchiolitis, there is no medicine that kills the virus, so we give oxygen, suction mucus, and keep the child hydrated while the immune system clears the infection over several days.

8. Most children recover fully as the virus is cleared and the airway heals. — Once the immune system defeats the virus, the swelling goes down, mucus is coughed out or absorbed, and the airway returns to normal size — usually within three to seven days for croup, one to two weeks for bronchiolitis.

Symptoms · what the patient feels, and why

- Croup: Barking cough that sounds like a seal: The voice box (larynx) and the windpipe right below it swell up from the virus. When air pushes through that narrow, swollen space, it makes a loud, harsh bark instead of a normal cough.
- Croup: A high-pitched noise on breathing in (Stridor) (high-pitched squeaky sound when breathing in): The swollen windpipe is so narrow that air rushing in makes the tissues vibrate and create a high whistle or squeak. You hear it most when the child breathes in deeply or cries.
- Croup: Hoarse voice: The vocal cords inside the voice box are swollen and cannot vibrate smoothly, so the voice sounds raspy, scratchy, or weak instead of clear.
- Croup: Worse at night: Lying flat lets more fluid settle into the airway tissues, and cooler night air can make the muscles around the windpipe tighten a little, both making the narrowing worse.
- Bronchiolitis: Fast, shallow breathing: The tiny air tubes (bronchioles) deep in the lungs are clogged with mucus and swollen shut. The baby has to breathe faster and work harder to pull in enough oxygen through the narrow tubes.
- Bronchiolitis: Wheezing (high-pitched whistle when breathing out): Air is squeezed out through the narrowed, mucus-filled bronchioles. The tight space and sticky mucus make the air whistle as it leaves the lungs.
- Bronchiolitis: Chest retractions (skin sucking in between ribs or above collarbone): The baby is working so hard to breathe that the muscles pull inward with each breath. You see the skin dip in because the lungs are stiff and need extra effort to expand.
- Bronchiolitis: Nasal flaring (nostrils spread wide with each breath): The body automatically opens the nostrils wider to let in as much air as possible when breathing is hard. It is a reflex to help get more oxygen.
- Bronchiolitis: Poor feeding or refusal to eat: Breathing is taking so much energy and effort that the baby is too tired to suck and swallow. Also, it is hard to eat and breathe at the same time when every breath is a struggle.
- Bronchiolitis: Pauses in breathing (Apnea) (pauses in breathing, especially in babies under 6 months): Very young babies have an immature brain-stem breathing center. The infection and low oxygen can disrupt the signal to breathe, causing dangerous pauses of 15–20 seconds or more.

Focused exam

- A high-pitched noise on breathing in (Stridor) (high-pitched sound when breathing in) in croup; wheezing (whistling sound when breathing out) in bronchiolitis: A high-pitched noise on breathing in (Stridor) means the blockage is in the upper airway, right below the voice box (the subglottic space). Wheezing means the blockage is deep in the tiny lung tubes (bronchioles). This one sound tells you which disease you are looking at.
- Barking, seal-like cough in croup; wet, rattly cough in bronchiolitis: The cough sound shows where the virus is attacking. A bark means the swelling is up high near the voice box. A rattly cough means mucus is stuck down in the small lung tubes. Listen carefully and you will know which disease it is.
- Retractions (skin pulling in between the ribs or above the collarbone) and flaring nostrils: Both diseases make the airways tight or swollen, so the child has to work much harder to pull air in. The deeper the skin pulls in and the wider the nostrils flare, the more tired the breathing muscles are getting and the closer the child is to needing hospital care.
- Hoarse voice or cry in croup; normal voice in bronchiolitis: Croup swells the area just below the vocal cords, so the voice sounds raspy or weak. Bronchiolitis happens deep in the lungs and never touches the vocal cords, so the voice stays normal. This splits the two diseases apart.
- Oxygen level (pulse oximeter reading) below 90% on room air: Both diseases can make the airways so swollen or clogged with mucus that oxygen cannot get through into the blood. A reading below 90% means the body is not getting enough oxygen and the child needs extra oxygen or hospital monitoring right away.
- Tripod position (sitting up, leaning forward on hands) or sudden tiredness and confusion: Tripoding means the child is using every muscle to breathe and cannot lie down or rest. Sudden tiredness or confusion means the brain is running low on oxygen. Either sign is a red flag that the child needs emergency care immediately.

Diagnostics · every test answers a question

- Pulse oximetry (oxygen saturation) → Is enough oxygen getting through the swollen or mucus-filled airways into the bloodstream?
- Respiratory rate and heart rate → Is the child working too hard to breathe, and is the heart speeding up to try to deliver more oxygen?
- Nasal swab for respiratory syncytial virus (RSV) antigen or PCR → Is RSV the virus causing bronchiolitis, especially in a baby who might need isolation or extra monitoring?
- Chest x-ray → Is there a hidden complication like pneumonia (lung infection with bacteria) or collapsed lung, or does the child have something that looks like bronchiolitis but is actually a foreign object stuck in the airway?

- Blood gas (arterial or capillary) if the child is very sick → Is carbon dioxide building up in the blood because the child is too tired to breathe hard enough to blow it out?

Treatment logic

- Dexamethasone (steroid) by mouth or through an IV, single dose of 0.6 mg per kilogram (maximum 10 mg) → Calms the body's inflammatory response to the virus in croup. This shrinks the swelling in the subglottic space (the area just below the voice box), opens the airway, and makes breathing quieter and easier within a few hours. Works for mild, moderate, and severe croup.
- Nebulized epinephrine (racemic epinephrine 0.5 mL in 3 mL saline, or L-epinephrine 0.5 mg/kg up to 5 mg) for moderate to severe croup → Tightens the blood vessels in the swollen tissue below the voice box, which squeezes fluid out of the tissue and opens the airway fast (within 10 to 30 minutes). Reduces a high-pitched noise on breathing in (stridor) and work of breathing quickly.
- Supplemental oxygen (by nasal cannula or blow-by) and keep the child calm → Keeps blood oxygen levels safe while the airway is swollen. Keeping the child calm (on a parent's lap, not forcing anything scary) prevents crying and agitation, which make the airway narrow even more and worsen a high-pitched noise on breathing in (stridor).
- Nasal suctioning (gentle bulb or suction catheter) and hydration (oral fluids or IV if the child cannot drink) → Removes thick mucus from the nose and upper airway that makes it even harder to breathe. Keeps the child hydrated so mucus stays thin and easier to clear. Especially important in bronchiolitis where mucus clogs the tiny lung tubes.
- Hospital admission with continuous pulse oximetry for a high-pitched noise on breathing in (stridor) at rest, severe retractions, drooling, bluish skin (cyanosis) (blue color), or oxygen saturation below 90% → Allows close monitoring in case the airway swelling gets worse suddenly. Gives fast access to oxygen, epinephrine, and emergency airway equipment if the child's breathing fails.
- Do NOT use cough medicine, albuterol (bronchodilator), or antibiotics in routine croup or bronchiolitis → Cough medicine does not help and can be dangerous in young children. Albuterol does not work in bronchiolitis because the problem is swelling and mucus, not tight muscles around the airways. Antibiotics do not work because both diseases are caused by viruses, not bacteria.

Medications

Dexamethasone · Corticosteroid (a medicine that calms down swelling and overactive immune signals)

Dexamethasone shuts down the chemical alarm bells that tell the body to swell. In croup, the airway just below the voice box (the subglottic area) gets swollen and tight because the immune system is fighting the parainfluenza virus. This swelling makes the barking cough and the a high-pitched noise on breathing in (stridor) (the high-pitched squeaky sound when breathing in). Dexamethasone tells the cells lining that airway to stop releasing swelling chemicals like prostaglandins and leukotrienes, so the swelling shrinks and the airway opens back up.

1. Dexamethasone enters the cells lining the swollen airway.
2. It binds to receptors inside the cell and travels to the nucleus (the cell's control center).
3. It turns OFF the genes that make swelling chemicals (prostaglandins, leukotrienes, cytokines).
4. Fewer swelling chemicals means the tissue shrinks, the airway widens, and air moves easier.
5. The effect starts in 1–2 hours and lasts 24–48 hours, so one dose usually covers the worst days.

SAFETY WATCH

Very safe for a single dose or short course (2–3 days). · May make a child slightly more thirsty or hungry for a day or two. · Extremely rare: temporary irritability or trouble sleeping. · If a child has chicken pox or recent exposure, tell the doctor—steroids can make that infection worse.

Racemic epinephrine (nebulized) · Alpha and beta adrenergic agonist (a medicine that squeezes blood vessels and relaxes airway muscles)

Epinephrine is the body's emergency 'fight or flight' chemical. When you breathe it in as a mist, it acts in two ways. First, it squeezes the tiny blood vessels in the swollen airway lining, so less fluid leaks out and the tissue shrinks fast—like wringing water out of a sponge. Second, it tells the smooth muscle wrapped around the airway to relax, which opens the pipe a little more. Both effects together make it easier to breathe within minutes.

1. The child breathes in the epinephrine mist through a nebulizer mask.
2. Epinephrine lands on the swollen tissue and binds to alpha receptors on blood vessels.

3. The vessels constrict (squeeze tight), so less fluid oozes into the tissue—swelling shrinks fast.
4. Epinephrine also binds to beta-2 receptors on the smooth muscle around the airway.
5. The muscle relaxes, the airway opens, and a high-pitched noise on breathing in (stridor) (squeaky breathing) gets quieter.
6. The effect peaks in 10–30 minutes but wears off in 2–4 hours, so the swelling can come back (rebound).

SAFETY WATCH

Very safe when given as a mist in the emergency department or hospital. · May make the heart beat a little faster or make the child feel jittery for 15–30 minutes. · Because the effect wears off (rebound), the child must be observed for 2–4 hours after treatment to make sure breathing does not get tight again. · Not used at home—only in a hospital or clinic setting.

Supplemental oxygen · Supportive therapy (not a drug, but a medical gas that raises the oxygen level in the blood)

In moderate to severe bronchiolitis, the tiny air sacs (alveoli) in the lungs get clogged with mucus and debris from the virus (usually RSV—respiratory syncytial virus). Oxygen cannot cross into the blood as easily, so the oxygen saturation (the percentage of red blood cells carrying oxygen) drops below 90%. Giving extra oxygen through a nasal cannula, mask, or high-flow nasal cannula raises the oxygen concentration in the air the child breathes, so even with clogged air sacs, enough oxygen gets through to keep the organs safe.

1. The child breathes in air that has a higher percentage of oxygen than normal room air (room air is 21% oxygen; supplemental oxygen can be 30–100%).
2. The extra oxygen reaches the alveoli, even if mucus is blocking some of them.
3. More oxygen dissolves into the blood and binds to hemoglobin in red blood cells.
4. The oxygen saturation rises back toward the safe range ($\geq 90\%$).
5. Organs (brain, heart, kidneys) get enough oxygen to work normally.

SAFETY WATCH

Very safe when the oxygen level is monitored with a pulse oximeter (the clip on the finger or toe). · Too much oxygen for too long (days to weeks) in premature babies can rarely harm the eyes or lungs, but short-term use in bronchiolitis is safe. · High-flow nasal cannula (HFNC) is safe and comfortable; it delivers warm, humidified oxygen at higher flow rates to help keep the airways open.

Intravenous (IV) fluids · Supportive therapy (sterile salt water given through a vein to replace lost fluid)

Babies and toddlers with bronchiolitis breathe very fast (tachypnea) and work hard to breathe, so they lose extra water through their breath. They also may not drink well because they are tired or their nose is so stuffy they cannot suck or swallow easily. When the body loses more water than it takes in, it becomes dehydrated—the blood gets thicker, the organs get less flow, and the child may urinate less and have a dry mouth or sunken eyes. IV fluids (usually normal saline or a balanced salt solution) go straight into the bloodstream to replace the lost water and keep the blood volume and organ function normal.

1. A small plastic tube (IV catheter) is placed into a vein, usually in the hand or arm.
2. Sterile salt water (normal saline or lactated Ringer's) drips into the vein at a controlled rate.
3. The fluid mixes with the blood and increases the blood volume.
4. The kidneys filter the blood and make urine again if they were too dry before.
5. The child's heart rate slows down, the mouth gets moist, and energy improves as hydration is restored.

SAFETY WATCH

Very safe when the rate and amount are carefully chosen for the child's weight. · Too much fluid too fast can rarely overload the lungs and make breathing worse, so doctors watch fluid balance closely. · The IV site may become sore or the vein may get irritated; nurses check it regularly. · Once the child is drinking well again, the IV is removed.

Nasal suctioning · Supportive care technique (not a drug, but a physical method to remove mucus)

Babies under 6 months are 'obligate nose breathers'—they breathe almost entirely through their nose, not their mouth. In bronchiolitis, thick mucus plugs the nose and the airways, so the baby cannot move air in and out well. Suctioning uses a soft rubber bulb or a small suction catheter to gently pull mucus out of the nostrils. This clears the airway opening so air can flow, feeding becomes easier, and the baby does not have to work as hard to breathe.

1. A few drops of saline (salt water) are placed in each nostril to loosen thick mucus.
2. A bulb syringe or suction catheter is gently inserted into the nostril.
3. Suction (either by squeezing the bulb or using a wall suction machine) pulls the mucus out.
4. The airway opens, and the baby can breathe, eat, and sleep more comfortably.
5. Suctioning is repeated as needed—before feeds and before sleep are common times.

SAFETY WATCH

Safe when done gently. Avoid forcing the catheter deep or suctioning too hard, which can irritate the delicate lining and cause a little bleeding or more swelling. · Suctioning too often (more than every 2–4 hours) can irritate the nose. · Always use saline drops first to soften the mucus—never suction dry tissue. · If bleeding occurs, stop and let the nose rest; it usually heals on its own.

High-flow nasal cannula (HFNC) oxygen · Supportive respiratory therapy (a device that delivers warmed, humidified oxygen at higher flow rates)

Standard oxygen flows at low rates (1–2 liters per minute), but in moderate to severe bronchiolitis, the child works so hard to breathe that low-flow oxygen is not enough. High-flow nasal cannula delivers oxygen at much higher rates (up to 2 liters per kilogram per minute—so a 10 kg baby might get 20 liters per minute). The high flow does three things: it washes out the carbon dioxide that gets trapped in the upper airway, it delivers a steady stream of oxygen-rich air so every breath has more oxygen, and the slight pressure from the fast flow helps keep the small airways from collapsing. The oxygen is also warmed and humidified so it does not dry out the delicate airway lining.

1. Soft nasal prongs are placed in the child's nostrils.
2. Oxygen flows at a high rate (much faster than standard nasal cannula).
3. The fast flow creates a gentle positive pressure (like a breeze holding a door open) that keeps small airways from collapsing.
4. The flow washes out carbon dioxide from the upper airway so each new breath brings in fresh oxygen.
5. The oxygen saturation improves, the child breathes less hard, and the need for a breathing tube (intubation) often is avoided.
6. The warm, humidified gas keeps the airway lining moist and prevents mucus from drying into hard plugs.

SAFETY WATCH

Very safe and well-tolerated by infants and toddlers. · The flow and oxygen percentage are carefully set and monitored by respiratory therapists and nurses. · Rarely, the prongs can cause a small sore in the nostril if left in for many days; the team checks and adjusts as needed. · If the child does not improve on HFNC or gets worse, the next step may be CPAP (continuous positive airway pressure) or intubation.

Red flags

- A high-pitched noise on breathing in (Stridor) when the child is calm and resting (means the airway is very narrow)
- Severe chest retractions or the child is leaning forward and drooling (struggling to breathe)
- Blue or gray lips, tongue, or skin (not enough oxygen in the blood)
- Baby is too tired to cry, feed, or wake up (exhaustion from breathing effort)
- Breathing faster than 60 breaths per minute in an infant, or grunting with each breath

Nursing priorities

1. Assess airway and breathing every 15 to 30 minutes—listen for a high-pitched noise on breathing in (stridor) at rest, count respiratory rate, watch for chest retractions, and check oxygen saturation with pulse oximetry. — The airway can swell quickly and close off in croup, and small babies with bronchiolitis tire out fast—frequent monitoring catches worsening respiratory distress (breathing failure) before the child stops breathing.
2. Keep the child calm and upright in the parent's lap—do not force the child to lie flat or upset them with unnecessary procedures. — Crying increases oxygen demand and worsens airway swelling in croup—keeping the child calm prevents a high-pitched noise on breathing in (stridor) from getting worse and conserves energy in bronchiolitis.
3. Administer dexamethasone (a steroid) 0.6 mg per kilogram by mouth or IV as a single dose, maximum 10 mg, as ordered by the provider. — Dexamethasone reduces inflammation (swelling) in the larynx (voice box area) and decreases airway obstruction (blockage) in croup—it works within 2 to 6 hours and prevents worsening symptoms.
4. Give nebulized epinephrine (racemic epinephrine 0.5 mL in 3 mL saline, or L-epinephrine 0.5 mg per kilogram up to 5 mg) for moderate to severe croup with a high-pitched noise on breathing in (stridor) at rest, and monitor for rebound swelling 2 to 4 hours after treatment. — Epinephrine causes vasoconstriction (blood vessels squeeze tight) that shrinks airway swelling fast—but the effect only lasts 2 hours, so the child must be watched for rebound (swelling comes back) and may need repeat doses or admission.
5. Suction the nose gently with a bulb syringe or suction catheter before feeds and when the baby cannot breathe through the nose—use saline drops first to loosen mucus. — Babies under 6 months are obligate nose breathers (can only breathe through the nose) and thick mucus blocks the small nasal passages—clearing mucus improves air entry and helps the baby eat and breathe at the same time.

6. Provide supplemental oxygen by nasal cannula or blow-by if oxygen saturation is below 90 percent, and titrate (adjust) to keep saturation 90 percent or higher. — Low oxygen in the blood (Hypoxemia) (low blood oxygen) damages the brain and heart—oxygen supports the body while the lungs recover, but too much oxygen in bronchiolitis does not help and may delay recognition of worsening disease.
7. Encourage small, frequent feedings by mouth or give IV fluids if the child is too tired to drink or breathing faster than 60 times per minute. — Fast breathing (Tachypnea) (fast breathing) increases insensible water loss (water lost through breathing) and makes swallowing unsafe because of aspiration risk (liquid going into the lungs)—hydration keeps mucus thin and maintains blood pressure.
8. Educate parents on red-flag signs to watch for at home—a high-pitched noise on breathing in (stridor) when calm, blue lips, extreme sleepiness, refusal to drink, or breathing that gets faster or harder—and give clear return instructions. — Most children with mild croup and bronchiolitis go home—parents must recognize early warning signs of decompensation (child getting worse) so they bring the child back before respiratory failure (breathing stops) happens.

Sources

- AAP Clinical Practice Guideline: Bronchiolitis 2014
- AAP Clinical Report: Croup 2022
- CDC Respiratory Syncytial Virus (RSV) Guidance
- Cochrane Review: Glucocorticoids for Croup

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