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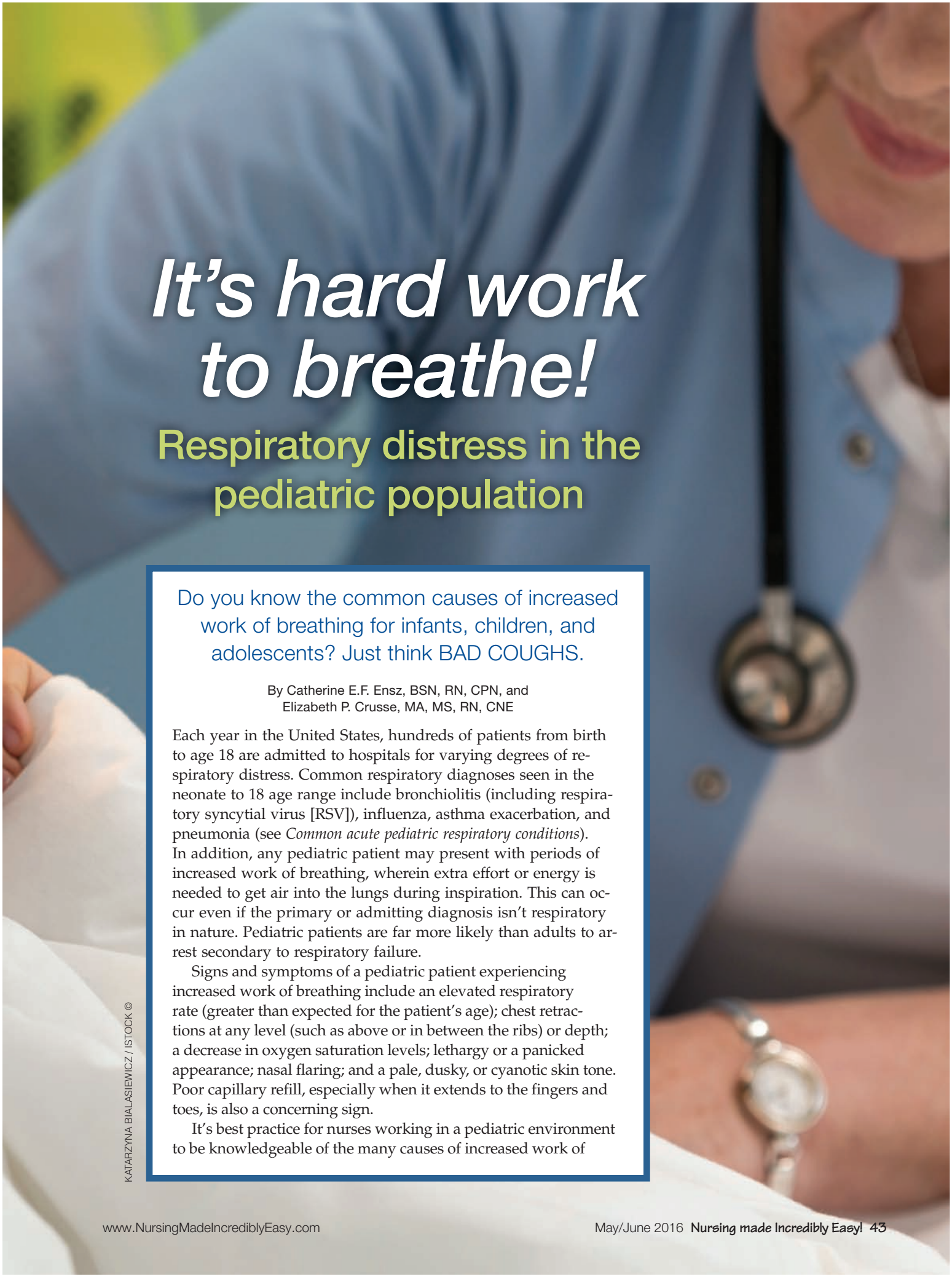

It's hard work to breathe!

Respiratory distress in the pediatric population

Do you know the common causes of increased work of breathing for infants, children, and adolescents? Just think BAD COUGHS.

By Catherine E.F. Ensz, BSN, RN, CPN, and
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Each year in the United States, hundreds of patients from birth to age 18 are admitted to hospitals for varying degrees of respiratory distress. Common respiratory diagnoses seen in the neonate to 18 age range include bronchiolitis (including respiratory syncytial virus [RSV]), influenza, asthma exacerbation, and pneumonia (see *Common acute pediatric respiratory conditions*). In addition, any pediatric patient may present with periods of increased work of breathing, wherein extra effort or energy is needed to get air into the lungs during inspiration. This can occur even if the primary or admitting diagnosis isn't respiratory in nature. Pediatric patients are far more likely than adults to arrest secondary to respiratory failure.

Signs and symptoms of a pediatric patient experiencing increased work of breathing include an elevated respiratory rate (greater than expected for the patient's age); chest retractions at any level (such as above or in between the ribs) or depth; a decrease in oxygen saturation levels; lethargy or a panicked appearance; nasal flaring; and a pale, dusky, or cyanotic skin tone. Poor capillary refill, especially when it extends to the fingers and toes, is also a concerning sign.

It's best practice for nurses working in a pediatric environment to be knowledgeable of the many causes of increased work of

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Common acute pediatric respiratory illnesses

Illness	Signs and symptoms	Nursing interventions
RSV (and nonRSV bronchiolitis)	• Increased (often copious) nasal secretions • Increased respiratory rate • Retractions • Cough (often in prolonged spells) • Nasal flaring • Wheezing that may or may not respond to inhaled bronchodilators • Fever • Irritability • Poor intake, resulting in decreased output	• Oral and nasal suctioning of excess secretions • Hydration via I.V. or oral routes, or through a feeding tube (such as a nasogastric [NG] tube) • Positioning with the head of bed up • Inhaled bronchodilators, if prescribed • Treatment of fever as needed (an elevated core temperature increases respiratory rate and effort) • Supplemental oxygen via nasal cannula or face mask, as prescribed • Ongoing caregiver education and support; the population most likely to be hospitalized for RSV is neonates and infants; supportive care will continue after discharge and may last a few weeks
Influenza	• Increased secretions often present • Fever • Body aches and shakes (febrile rigors) • Irritability • Cough • Gastrointestinal upset (nausea, vomiting, diarrhea) may accompany respiratory symptoms • Poor intake, resulting in decreased output	• Hydration via I.V. or oral routes, or through a feeding tube (such as an NG tube) • Positioning for comfort and optimal oxygenation • Treatment of fever and/or pain as needed • Caregiver education, support, and encouragement that recovery is usually relatively quick without prolonged effects
Pneumonia	• Abnormal breath sounds whether they be decreased, absent, wheezing, or otherwise adventitious • Cough • Fever • Decreased energy • Increased respiratory rate • Retractions • Poor intake, resulting in decreased output	• Hydration via I.V. or oral routes, or through a feeding tube (such as an NG tube) • Positioning with the head of bed up • Supplemental oxygen via nasal cannula or face mask, as prescribed • Oral or I.V. antibiotics if bacterial pneumonia is suspected, as prescribed • Bronchodilator as prescribed if wheezing is present
Acute asthma exacerbation	• Abnormal breath sounds, especially wheezing during inspiration (more concerning), expiration, or both • Afebrile • Responsiveness to bronchodilator • Retractions • Nasal flaring • Abnormal positioning of self in an attempt to “clear lungs” (leaning back, forward) • Worsening symptoms with exposure to triggers (commonly include cigarette smoke, allergens, and weather changes) • Cough (often nonproductive and experienced in prolonged spells) • Perioral pallor or cyanosis • Petechiae on cheeks from coughing spells	• Inhaled bronchodilator and corticosteroid, as prescribed • Systemic (I.V. or oral) steroid “burst” to decrease acute inflammation of bronchioles • Avoidance or removal of triggers • Positioning with the head of bed up • Hydration via I.V. or oral routes, or through a feeding tube (such as an NG tube) should the patient be unable to eat/drink (less common) • Supplemental oxygen via nasal cannula or face mask, as prescribed • Extensive caregiver support and education (whether it’s a new diagnosis or not), including revision or establishment of a medical plan to avoid future exacerbations

breathing and the corresponding interventions to use before the patient experiences acute respiratory distress or failure.

Potential causes

There are numerous reasons why a pediatric patient may experience increased work of breathing. The most obvious are related to respiratory problems. Others may be related to congenital defects or medical conditions involving nonrespiratory systems. The mnemonic BAD COUGHS is one way to help you remember the common causes of pediatric increased work of breathing:

- behavioral issues, such as hyperventilation
- asthma
- defect (physiologic malformation)
- cardiac output insufficiency
- obstruction, including anaphylactic reactions
- unresolved acute illness
- gastroesophageal reflux disease (GERD)
- hypoxia (inadequate oxygenation)
- secretions in excess.

Behavioral issues

Children and adolescents respond to higher levels of emotional stress in a variety of ways. Some children experience an acute physical response. One common response is an increased respiratory rate in conjunction with minimal depth of breathing, or hyperventilation. This is an ineffective breathing pattern that can't be sustained for a prolonged period of time. As such, the nurse's role is often to refocus the patient's attention onto something else. Has the child's parent or primary caregiver had to leave his or her bedside? Is the child scared of an exam or invasive medical procedure?

Utilize other members of the healthcare team, such as a child life specialist, who can remain at the bedside and provide a distraction for the patient. In many cases, it's in the pediatric patient's best interest to resume the medical intervention only after the respiratory rate and depth have stabilized and the patient has shown evidence that he or she can manage the emotional stress of the procedure. With neonates, infants, and toddlers, the parent or primary caregiver is the person most likely to be a support to the patient.

After the episode of hyperventilation is over, be mindful that it may recur should the patient get upset or agitated again. Remain calm and repeat the intervention(s) that worked previously. Remember that any medical intervention will be more difficult, if not impossible, to accomplish if the patient is hyperventilating.

memory jogger

To remember the most common causes of pediatric respiratory distress, think **BAD COUGHS.**

- **B** Behavioral issues, such as hyperventilation
- **A** Asthma
- **D** Defect (physiologic malformation)
- **C** Cardiac output insufficiency
- **O** Obstruction, including anaphylactic reactions
- **U** Unresolved acute illness
- **G** GERD
- **H** Hypoxia (inadequate oxygenation)
- **S** Secretions in excess

Asthma

Asthma is one of the most common chronic pediatric health conditions, affecting 7 million children in the United States. Exacerbations account for many hospital admissions and readmissions in the pediatric population. Poorly controlled asthma is extremely dangerous and can lead to acute respiratory distress and, ultimately, arrest. Asthma may be exacerbated by a wide variety of triggers, including cigarette smoke, pet dander, exercise, changes in environmental temperature, and acute illness.

All nurses need to understand the inflammatory process of asthma, no matter the cause of the acute exacerbation. The best immediate response to an asthma attack is often a bronchodilator to decrease constriction of the bronchioles and open up the lower airway, allowing for better flow of oxygen to the lungs. Common bronchodilators include albuterol (the gold standard of treatment) and levalbuterol. An inhaled corticosteroid may be used in conjunction with a bronchodilator.

As nurses, we're responsible for auscultating breath sounds and recognizing wheezing or decreased breath sounds (a later, more concerning sign of pending distress), monitoring for retractions, and knowing when to administer or request that the respiratory therapist administer a prescribed bronchodilator.

consider this

You're the clinical nurse caring for SJ, a 3-week-old boy recovering from open-heart surgery to correct a congenital cyanotic heart defect. He came off of the ventilator a few days ago and was weaned to room air yesterday. He's been maintaining oxygen saturation levels of greater than 94% on room air, according to his continuous pulse oximetry reading. He's also on a cardiac monitor. Although he's NPO, total parenteral nutrition and intralipids are infusing continuously via a central venous femoral line. He has multiple drains coming from his chest area postoperatively.

The morning has been uneventful for this patient. In fact, SJ is stable enough that you're orienting a new graduate RN to his case. You're discussing the case in the room with the new graduate nurse when SJ's mother calls for you to come to the side of the crib. A quiet, high-pitched whimper is noted and the mother is visibly alarmed. She explains that the sound isn't SJ's typical cry and is adamant that something is acutely different about the baby. As she's saying this, the baby begins to look dusky in his lower face and the pulse oximeter indicates that his oxygen saturation level is dropping to the mid-80s. How do you respond to the situation?

You ensure that the head of bed is at a 45-degree angle and SJ's head is positioned at midline. You note no excess oral or nasopharyngeal secretions, or foreign bodies present in his mouth. A quick assessment reveals the following: the right-sided chest tube is putting out a small amount of serosanguinous drainage, the insertion site is clean and the dressing secure, and the left-sided drain appears to be putting out less than noted on previous checks. You also note that the tape at the insertion site to his chest is slightly damp.

As the situation progresses, SJ's mother yells for help. The pediatric ICU physician hurries into the room and agrees that a rapid decline in status has occurred. The patient now shows perioral cyanosis (blueness around his lips), less responsiveness, and oxygen saturation levels in the low 80s (worsening hypoxia). As you describe the acute change in status, including a concerning chest tube site, the physician starts to give rescue breaths with a bag-valve mask and is able to bring up the oxygen saturation level to greater than 92%. A stat bedside chest X-ray is ordered; the results reveal a significant left-sided pneumothorax. Air is taking up enough space in the left side of SJ's chest cavity that his lung can't fully inflate, thus obstructing the airflow.

You learn from a member of the medical team that SJ had been treated for a right-sided pneumothorax a few days before as a result of a dislodged chest tube during extubation. The physician inserts a new chest tube into the left side, which immediately allows the patient to breathe easier. His respiratory rate goes down, the intercostal retractions subside, and the oxygen saturation level goes up without respiratory support. The obstruction has cleared and the patient's breath sounds are clear bilaterally. SJ is no longer making the high-pitched cry, but rather resting and breathing comfortably.

To apply the BAD COUGHS mnemonic to this case study, see *A closer look at BAD COUGHS*.

Defect

Patients in the neonate to adolescent age range may exhibit signs and symptoms of increased work of breathing secondary to a congenital or acquired defect. These include physiologic malformations, such as tracheomalacia (weakness of the trachea) and torticollis (poor, disproportionate tone in the neck muscles). These defects are more progressive than life-threatening from birth. A neonate may be discharged from the well-baby nursery or neonatal ICU only to return to the primary care provider or hospital when the parents note that their baby is breathing loudly (as in the narrowing or malformation of the trachea seen in tracheomalacia) or appears to be struggling for normal breaths.

When completing an assessment, obtain a thorough medical history. The nature of the defect helps determine appropriate nursing interventions. Something as simple as proper positioning can open up the patient's airway and provide optimal oxygenation and ventilation. In pediatric patients, the turn of the head and neck can be dramatic enough to constrict or narrow an already small airway. A rolled receiving blanket or hand towel placed under the patient's neck can have a profound and immediate impact. Emergency supplies, such as an intubation set, should be easily accessible.

Notify the respiratory therapist and other healthcare team members of the defect if the patient requires emergent assistance. As in the case with any patient with a compromised airway, such as a tracheostomy patient, a caution sign above the bed is an important nursing intervention.

Cardiac output insufficiency

Congenital heart disease is the most common birth defect in the United States,

according to the experts at The Children's Hospital of Philadelphia, a leader in the treatment of these conditions. Congenital cyanotic heart lesions, in particular, place patients at risk for cardiac output insufficiency. When oxygenated blood doesn't flow adequately to the lungs, the patient is unable to breathe effectively.

The added strain on the pulmonary system leads to an increase in work of breathing as the patient attempts to take oxygen into the lungs. The nurse should be aware of the anatomical difference in the affected patient's heart and know how to intervene as needed. Because oxygenation levels prescribed for the patient are likely lower than those for an unaffected patient, overoxygenation can also lead to medical complications. Supplemental oxygen should be titrated as ordered. The patient may also appear pale or dusky at baseline. It's important to know what's normal for this patient so you can react should the status worsen.

Know what to anticipate following correction of the defect. Should the patient be able to maintain normal oxygenation saturation levels without supplemental oxygen? If the patient with insufficient cardiac output begins to show signs of difficulty breathing, notify the medical team immediately. This patient will be on a continuous cardiac monitor and pulse oximeter in the acute post-op period. Be aware of any post-op cardiac pacing wires or a pacemaker that may need to be used should the patient require support. Nursing care is often supportive as the patient prepares for and recovers from surgical or other medical interventions.

Obstruction

Pediatric patients are at risk for experiencing an airway obstruction. A narrower airway than that of an adult and a higher propensity for at-risk behavior, such as insertion of a foreign object, place greater emphasis on the need to be cognizant of this potential cause of increased work of breathing, as well as how to respond. Something as small as a grape may be easy for an adult to cough up, but can completely obstruct a toddler's upper airway.

Foreign objects are most likely to obstruct an infant or child's upper airway; however, lower airway obstruction

A closer look at BAD COUGHS

Let's utilize our mnemonic to take a retrospective look at SJ's case.

B: This patient is a medically-fragile neonate. Behavior as cause of increased work of breathing isn't applicable here. The parent is also at the bedside providing the child with emotional support.

A: The patient doesn't have an asthma diagnosis. Often, asthma diagnoses aren't made until a child has reached age 2.

D: The patient has a repaired congenital heart defect, but no other defect has been diagnosed. It's unlikely that a significant defect went undetected based on the level of care the patient has been receiving. SJ's status changed acutely, not steadily declining as one would suspect with an untreated condition.

C: Cardiac output insufficiency is a potential cause of increased work of breathing in the child with a complex congenital cardiac defect. However, this patient is post-op and has been under close observation for impaired cardiac function. Keep this possibility in mind, but explore nursing interventions that are likely to be of immediate benefit to the patient before assuming this is the cause.

O: An obstruction is a definite possibility. Did your repositioning of the patient open the airway and improve his status? What medical lines (tubes, drains, I.V.s) are present?

U: This patient has been in an ICU since birth. Although it's a possibility, an unresolved acute illness isn't probable as the cause of his acute change in status. Should immediate assessments and interventions not detect the cause of distress, a thorough infectious workup, including a complete set of vital signs and labs, may be considered.

G: GERD is an extremely common complication for patients with congenital cardiac defects. If this patient had anything in his gastric tract, this would be something to investigate. However, aspiration as result of GERD isn't likely the culprit here.

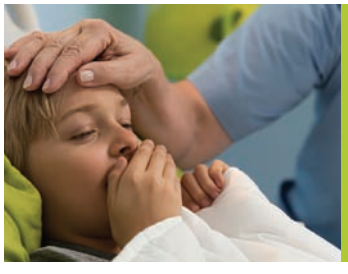
H: This patient is exhibiting signs of hypoxia and utilizing accessory muscles in an effort to improve oxygenation. His pulse oximetry reading shows desaturation. Remember that the pulse oximeter reads the oxygen as it reaches the extremity to which the probe is connected and, therefore, can't give as complete a picture of the patient's true oxygenation status as a capillary blood gas reading. Maintain use of the monitor, but seek other objective data to get a more complete picture of SJ's status.

S: Could SJ be struggling with excess post-op secretions? Do his lungs sound "wet"? Is suctioning appropriate? Cardiac patients, particularly neonatal cardiac patients, are highly susceptible to significant shifts in bodily fluids. Remember that the pediatric, including the neonatal, patient has a higher percentage of fluid volume and status can change rapidly based on a sudden increase or decrease in intake or output.

is another source of potential respiratory crisis. In the case of a pneumothorax, air leaks into and starts to fill up the patient's lung space. The affected lung can't fully inflate and, therefore, can't fully oxygenate. A large pneumothorax can progress rapidly and be devastating.

Anaphylaxis can also cause obstruction as a result of airway edema. The potential result is increased work of breathing. Signs of obstruction caused by anaphylaxis may present acutely or hours after exposure to an allergen. In either case, as the patient struggles to clear his or her airway completely, he or she may appear panicked. There's often a color change that progresses to cyanosis in an Asian or White child; a patient with a darker skin tone may show only pallor.

Remember that if the patient is experiencing anaphylaxis, a rash may mask pallor or cyanosis. Breath sounds may or may not be stridulous (very high-pitched) or diminished based on where the obstruction has occurred (upper versus lower airway). If the cause of obstruction is visible, determine if it's safe to remove. If you aren't in a setting with emergency resources readily available, don't attempt to remove the object because it may dislodge and cause further obstruction. If allergic anaphylaxis is the suspected cause, a dose of diphenhydramine and/or epinephrine in conjunction with an inhaled bronchodilator is the likely course of treatment. Respiratory distress or arrest may be imminent, so don't leave the patient's side.



An overlooked cause of increased work of breathing is unresolved acute illness.

Epinephrine is the treatment of choice in severe anaphylaxis. Following a dose of epinephrine, you can expect almost immediate improvement in airway status. However, patients sometimes experience rebound swelling of the airway after initial treatment. Frequent vital sign measurement is part of your ongoing assessment in the case of a suspected or known airway obstruction. Continuous observation of the patient is your priority and his or her status should be considered critical until resolution is confirmed.

Unresolved acute illness

An overlooked cause of increased work of breathing is unresolved acute illness. An example of this may be a child who's admitted to the pediatric floor for a minor, but unplanned, surgery, such as the repair of a fractured bone. An acute upper respiratory infection causes the patient to have a delayed recovery from anesthesia. Although nonemergent, planned surgeries are held off during an acute illness to avoid respiratory complications, sometimes patients can't avoid being anesthetized despite the added risk.

Perform a thorough review of the patient's acute and chronic history. Armed with this information, you're better prepared to act in the event that the patient begins to show signs of increased work of breathing. An immediate response is providing supplemental oxygen as ordered, repositioning to elevate the head of bed, and perhaps nasal suction if repositioning and suctioning aren't contraindicated postoperatively. After the patient appears more stable, notify the surgical and/or medical team about the acute upper respiratory infection signs and symptoms in case the patient needs additional medical interventions.

Some acute illnesses are seasonal in nature. As noted by the CDC, RSV typically affects patients during the colder months of the year. It's also important to have a thorough understanding of acute illnesses

common to your geographic area to anticipate potential unresolved diagnoses that may cause increased work of breathing.

GERD

GERD is common in the pediatric population. Increased gastrointestinal secretions from the stomach reenter the esophagus and extend into the upper airway region, providing the perfect opportunity for a young patient to choke on and/or aspirate the excess, acidic fluid. Most infants experience at least occasional episodes of GERD and may or may not spit up.

Some populations such as premature infants, especially those born at very low birth weights, and patients with congenital heart disease are more likely to experience significant GERD. In a compromised patient, the risk of complications also increases. Often, the compromised pediatric patient lacks coordination for a strong suck-swallow-breathe pattern, causing an aspiration event. Aspiration as a result of GERD can lead to pneumonia or even apnea.

Be aware of the diagnosis of GERD and what to watch for in the undiagnosed patient. Signs and symptoms include arching of the back, unusual fussiness, repeated attempts to swallow in between oral or nasogastric tube feedings, and frequent or chronic cough in the absence of another acute illness. The patient with GERD who's experiencing a period of increased work of breathing may additionally experience coughing attacks, fever (such as with aspiration pneumonia), irregular breathing patterns (such as apneic episodes), cyanosis, and oxygen desaturation. As is the case with many patients experiencing increased work of breathing, the pediatric patient may appear panicked. Infants struggling to breathe often flail their extremities. When GERD is the cause of respiratory difficulty, the infant in particular may appear to be choking on the acidic fluid.

Immediate nursing interventions include stopping the feeding, positioning with the head of bed up, oral and/or nasal suctioning, and auscultating the lungs to assess for sounds of aspiration. Other potential interventions include an alternative feeding regimen; caregiver education; and administration of medications, such as a proton pump inhibitor to decrease acid or medications that aid in peristalsis. When severe GERD persists, a surgical approach may be a treatment option.

Signs and symptoms of increased work of breathing

cheat sheet

- Increased respiratory rate
- Chest retractions at any level or depth
- Decreased oxygen saturation levels
- Lethargy or a panicked appearance
- Nasal flaring
- Pale, dusky, or cyanotic skin tone
- Poor capillary refill

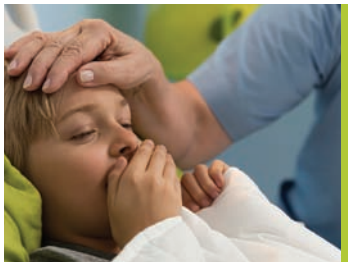
Hypoxia

Hypoxia is another cause of increased work of breathing. Causes of hypoxia in the pediatric population (not already included in this article) include patients trying to blow off excess carbon dioxide, such as with pediatric diabetic ketoacidosis or in the sickling of the blood cells in sickle cell disease.

The hypoxic pediatric patient struggling to get oxygen into his or her lungs and out to the rest of the body can present with a wide range of sign and symptoms. Flailing of the extremities, irritability, malaise, panicked appearance, cyanosis, and coughing fits are among the most common reactions to the body's fierce fight to breathe. Patients who experience baseline lower than normal oxygen saturation levels, such as those with cardiac defects, won't present in this way because their bodies have adapted to this chronic state.

The ultimate goal is to resolve the underlying cause of the hypoxia.

Delivering prescribed supplemental oxygen via a nasal cannula or face mask is an immediate nursing intervention. The pediatric patient acutely placed on supplemental oxygen should remain on a pulse oximeter until he or she is able to maintain adequate oxygen levels without an increase in effort or rate of breathing.



Parent(s) or primary caregivers provide critical background information and support.

Additional nursing interventions include changing pulse oximeter sites as warranted to ensure good adherence to the skin. Anticipate appropriate labs, such as arterial blood gas levels, for a more thorough picture of the patient's oxygenation status.

Secretions in excess

Medically vulnerable pediatric patients are often unable to effectively clear secretions from their respiratory tracts. This can lead to excessive secretions. Without proper intervention, an inability to manage these secretions can progress toward respiratory distress. Patients with artificial airways, such as a tracheostomy or nasal trumpet, have already demonstrated a compromised respiratory system. The compromised airway in conjunction with an excessive amount of oral, tracheal, or nasal secretions can choke, gag, or cause aspiration, similar to the case with severe GERD. In addition, particularly thick secretions can obstruct the upper airway, causing a mucus plug and leaving the patient without an effective air exchange.

Pediatric patients with a diagnosis of cystic fibrosis (CF) also struggle to manage excess, and excessively thick, respiratory secretions. Without adequate chest physiotherapy and medication to clear and thin remaining secretions, CF patients can't bring up the excess. They're at risk for acute and chronic respiratory infections. Patients with extremely low muscle tone, such as with Duchenne muscular dystrophy, don't have the strength to cough up excess secretions and are also at risk for devastating respiratory outcomes.

When caring for patients with compromised airways or impaired muscle tone, be prepared to handle episodes of increased work of breathing. Working with the respiratory therapist as applicable, the patient may need frequent oral, nasal, and/or tracheostomy suctioning. Chest physical therapy, when not contraindicated, can help the patient manage excess secretions over time, as well as bring them up during a period of respiratory difficulty. Medications may be administered to help thin the secretions so that they're easier to cough up or be suctioned out of the patient's airway.

A team effort

Good pediatric healthcare requires a collaborative effort. A respiratory therapist can provide additional assessments of the patient's respiratory status and assist with administering medications and therapies as prescribed by the provider. A child life specialist can make all the difference in a patient's behavior during a scary medical procedure. A social worker may need to be called in to help alleviate a parent's concern and fear during or following a particularly grim respiratory emergency. Lastly, but certainly not least, are the pediatric patient's parent(s) or primary caregivers. They know the child's baseline appearance and behavior better than the healthcare team and can provide critical background information and support for the infant or child in the event of an episode of increased work of breathing.

It's imperative that we complete a thorough nursing assessment whenever a respiratory complication is suspected. What's causing the patient to experience increased work of breathing? Is it the result of an illness, anaphylaxis, or a congenital defect? The mnemonic BAD COUGHS can help you identify the potential cause of the respiratory concern and develop an appropriate care plan. ■

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