

- Recommend hemodynamic monitoring. It will likely reveal an elevated PAP and a normal PCWP.

Decision Making (Treatment)

When treating patients with ARDS, it's important to treat the underlying cause. What caused the patient to get ARDS in the first place? That's what you treat!

For example, the patient had pneumonia that got worse and led to ARDS. In this case, the underlying cause would be pneumonia.

What to recommend for ARDS:

- Always recommend oxygen therapy! Increase the FiO₂ to as high as 60%, then add PEEP. If the patient improves, you can titrate the FiO₂ first back down below 60%, then reduce the PEEP.
- Use the ARDSNet ventilator protocol:
 - ARDS patients need smaller tidal volumes. Lower the tidal volume down to 6 mL/kg of IBW.
 - Keep their plateau pressure < 30 cmH₂O.
 - Use the permissive hypercapnia technique. As long as the pH can be maintained at or above 7.20, allow the PaCO₂ to rise.
- Recommend diuretics to prevent fluid overload.
- Again, closely monitor the patient's hemodynamics.
- Consider placing the patient in the prone position for up to 16 hours to improve oxygenation.
- Consider using alternative modes of ventilation, such as: HFOV, Inverse Ratio Ventilation (IRV), and Airway Pressure Release Ventilation (APRV).
- As a rescue therapy, you can recommend pulmonary vasodilators such as Inhaled Nitric Oxide (iNO).

What NOT to recommend for ARDS:

The following are considered ineffective therapies for ARDS patients and should not be recommended:

- Beta agonists
- Corticosteroids
- N-acetylcysteine
- Surfactant therapy
- Use of a Pulmonary Artery (PA) catheter

Neuromuscular Disorders

In this section, we will focus on disorders that cause paralysis, acute muscle weakness, and those that cause respiratory insufficiency and failure.

Here's what we'll cover:

- Myasthenia Gravis
- Guillain-Barré Syndrome
- Drug Overdose
- Muscular Dystrophy
- Stroke
- Tetanus

Exam Hint: For patients with any disorder in this section you should closely watch for ventilatory failure by monitoring the following:

- Spontaneous Tidal Volume (V_T)
- Vital Capacity (VC)
- Maximum Inspiratory Pressure (MIP)

Exam Hint: You will definitely have a case on the CSE where you need to know the difference between Guillain-Barré Syndrome and Myasthenia Gravis, so you must be able to differentiate the two.

No worries, we're going to show you how. ☺

Myasthenia Gravis

Myasthenia Gravis is a disorder that leads to muscle weakness of the skeletal muscles, particularly the muscles of the face, throat, and respiratory system.

Weakness and respiratory failure can occur rapidly as muscle strength decreases with repetitive contraction against a load.

Exam Hint: Remember that **Myasthenia Gravis** is a **Descending Paralysis**, meaning that it moves from **Mind to Ground**.

The paralysis starts in the brain and then spreads down throughout the body.

You can use the ‘MG’ mnemonic to remember this and differentiate it from Guillain-Barré Syndrome.

A **Myasthenic Crisis** is a severe episode of respiratory muscle weakness and can be life-threatening.

It is commonly triggered by **viral infections**, surgery, childbirth, emotional stress, febrile illnesses, temperature changes, and drug-related issues.

Information Gathering:

- The patient may show a gradual onset of muscle weakness and may have previous hospital admissions for Myasthenia Gravis.

Exam Hint: On the CSE, a key sign to look for is ptosis, or drooping eyelids. If you see a patient with this, you can automatically think Myasthenia Gravis.

- The patient has descending muscle weakness.
- The patient shows signs of dysphagia (difficulty swallowing).
- The patient has shallow breathing.
- The patient has diminished breath sounds.
- The patient will have decreased volumes (tidal volume, VC, and MIP).

Exam Hint: A special test that you should always recommend for a patient with Myasthenia Gravis is the **Endrophonium (Tensilon) Challenge Test**.

Once you give the patient Tensilon, if their tidal volume, VC, MIP, and muscle weakness improve, the drug is working and you can give more of it.

If the patient gets worse after Tensilon is given, you can reverse the effects of the drug by giving **Atropine**.

- The patient's ABG results will show acute alveolar hyperventilation with hypoxemia. Monitor the patient closely for ventilatory failure.
- Recommend a **blood test** to check the patient's **antibodies**.

Decision Making (Treatment)

- Closely monitor the patient's vital signs, tidal volume, vital capacity, and maximum inspiratory pressure. Recommend intubation and mechanical ventilation if/when indicated.
- Give **oxygen** for hypoxemia.
- Recommend **hyperinflation** and **pulmonary hygiene therapy**.
- Recommend the following **anticholinesterase drugs**:
 - **Neostigmine**
 - **Pyridostigmine**
- You may also recommend **Plasmapheresis** or a **Thymectomy**.

Guillain-Barré Syndrome

Guillain-Barré Syndrome is a rare autoimmune disorder characterized by lower extremity weakness that progresses to the upper extremities and face.

It eventually may lead to flaccid paraplegia and marked respiratory muscle weakness.

Exam Hint: Remember that Guillain-Barré Syndrome is an **Ascending Paralysis**, meaning that it moves from the Ground to the Brain.

The paralysis starts in the lower extremities (near the ground) and then spreads up throughout the body (to the brain).

You can use the 'GB' mnemonic to remember this and differentiate it from Myasthenia Gravis, which instead uses 'MG' (mind to ground).

Guillain-Barré Syndrome often follows viral or bacterial infections, but the precise cause is unknown.

Information Gathering:

- The patient will have a febrile illness that is usually viral in nature.
- The patient will have acute weakness that starts in the legs and lower extremities (ascending paralysis).
- The patient's breath sounds may be diminished with crackles and rhonchi.
- The patient may show signs of dysphagia and loss of the gag reflex.
- They will likely show signs of dyspnea and shallow breathing.

- The patient will have decreased volumes (tidal volume, VC, and MIP).

Exam Hint: A special test that you should always recommend for a patient with Guillain-Barré Syndrome is the **Lumbar Puncture** in order to gather cerebral spinal fluid.

- The patient's ABG results will show acute alveolar hyperventilation with hypoxemia. Monitor the patient closely for ventilatory failure.

Decision Making (Treatment)

- Closely monitor the patient's vital signs, tidal volume, vital capacity, and maximum inspiratory pressure. Recommend intubation and mechanical ventilation if/when indicated.
- Give oxygen for hypoxemia.
- Recommend hyperinflation and pulmonary hygiene therapy.
- Recommend Plasmapheresis in severe cases only.
- Other treatment modalities that you could possibly recommend include: Anti-coagulant therapy, corticosteroids, and physical rehabilitation therapy (during recovery).

Drug Overdose

A **drug overdose** is a harmful overuse of medication that exceed the recommended medical dose. It can be accidental or intentional.

There are literally thousands of different drugs, so it would be impossible to cover them all here.

Instead, we'll focus more on the general aspects of what a Respiratory Therapist (you) should do in the real-life case of a drug overdose. This will, of course, prepare you in case one of these problems come up on your version of the CSE.

Information Gathering:

- In some cases, the patient may have shown signs of mental illness, like depression or addiction.
- The patient will likely have slow and shallow respirations.
- If possible, try to determine what drug was ingested.
- The patient will have an altered or diminished level of consciousness.
- Obtain an ABG to check the patient's acid-base imbalances, ventilatory and oxygenation status.
- Recommend drug toxicology and monitor the basic lab tests, including the following:
 - Serum electrolytes
 - CO-oximetry (to check for carbon monoxide poisoning)
 - EKG

Decision Making (Treatment)

- As a Respiratory Therapist, your first priority should be to establish an artificial airway.
 - Recommend intubation for those who are obtunded or those who are at risk for aspiration.

- Recommend mechanical ventilation for ventilatory failure.
- Provide oxygen for hypoxemia.

Exam Hint: Recommend Naloxone (Narcan) to reverse a narcotic overdose.

If you get a drug overdose case on your version of the CSE, you will most likely need to recommend Narcan.

- Recommend Acetylcysteine for an acetaminophen overdose.
- If the patient overdosed by orally ingesting drugs, you can recommend a gastric lavage or activated charcoal.

Muscular Dystrophy

Muscular dystrophy refers to diseases that cause progressive muscle weakness and loss.

This will eventually result in the inability to walk, swallowing difficulty, respiratory muscle insufficiency, and respiratory failure.

This disease state occurs in different stages, which means that the treatment varies according to whichever stage the patient is currently in.

Information Gathering:

- If the patient is in the earlier stages, it would be a good idea to obtain baseline respiratory function values (PFTs). This way you can compare results as the patient progresses.
- You can recommend polysomnography (sleep study) to assess the patient's breathing while asleep.
- Of course, recommend a chest x-ray.

Decision Making (Treatment)

- Monitor the patient's respiratory function (PFTs).
- Recommend immunizations and regular doctor visits.
- Provide airways clearance therapy, such as mechanical insufflation-exsufflation.
- If the patient has sleep-disorder breathing, you should recommend NPPV (BiPAP) at night while asleep.
 - You should avoid CPAP in this case because it does not overcome hypoventilation.
- Provide oxygen for hypoxemia.
- Recommend intubation and mechanical ventilation for ventilatory failure.

Stroke

A **stroke** is a condition characterized by the sudden onset of a neurologic deficit that results from the lack of blood flow to the brain.

It results from vascular occlusion or hemorrhage.

The causes of a stroke include: Cerebral thrombi or emboli, atherosclerosis, and hypertension.

Information Gathering:

- You may see that the patient has a decreased level on consciousness (and they may need to be intubated).
- The patients may have loss of speech and motor skills.
- The patient's respiratory pattern will exhibit Cheyne-strokes respirations.
- You will want to recommend a CT scan and MRI of the brain, as well as a cerebral angiogram.
- Be sure to monitor the intracranial pressure, because it may be elevated.

Decision Making (Treatment)

- You can recommend the following drug therapy: Vasodilators, Anticoagulation therapy, and thrombolytic therapy.
- Recommend mechanical ventilation for ventilatory failure or to help reduces the intracranial pressure.

Tetanus

Tetanus is a neuromuscular disorder that stems from bacteria from a wound exposure or a puncture wound.

This one isn't super-likely to be on the CSE, but it has been on different versions in the past. That is why we want to briefly cover it here for you.

Information Gathering:

- Look for the history of present illness. If there is some type of wound involved or a penetrating wound, always be on the lookout for tetanus.
- Lockjaw is a prime symptom.
- The patient may exhibit signs of dysphagia or an abnormal gag reflex.
- Keep in mind, no lab or x-ray tests can diagnose this disorder. However, the presence of serum antitoxin levels greater than 0.01 U/mL can help rule out the diagnosis of tetanus.

Decision Making (Treatment)

- Once tetanus is diagnosed, you should recommend the administration of tetanus immunoglobulin.
- Keep a close monitor of the patient's tidal volume, vital capacity, and maximum inspiratory pressure.
- You can recommend an antibiotic to cease the spread of the tetanus bacteria.
- Recommend intubation and mechanical ventilation for ventilatory failure.

Cardiovascular Diseases

In this section, we will focus on disorders of the heart and cardiovascular system that the NBRC expects you to know for the CSE.

Here's what we'll cover:

- CHF
- Heart Attack
- Shock
- Coronary Artery Disease
- Cor Pulmonale
- Pulmonary Embolism

Exam Hint: Before we dive in, let's discuss arrhythmias, which are irregularities in the patient's cardiac rhythm.

You will mostly likely see a patient with an arrhythmia on the CSE, which is why we're covering it now.

The causes may include: hypoxemia, ischemia, electrolyte imbalances, and conduction disorders.

The different types include:

- PVC (Premature Ventricular Contraction) – treat with oxygen.
- V-fib (Ventricular Fibrillation) – requires immediate defibrillation.
- Pulseless V-tach (Ventricular Tachycardia without a pulse) – requires immediate defibrillation.
- Atrial flutter – consider synchronized cardioversion.
- Atrial fibrillation – consider synchronized cardioversion.
- V-tach with a pulse – consider synchronized cardioversion.

To treat arrhythmias, anti-arrhythmic agents can be administered.

Exam Hint: We literally just discussed it, but I want to make sure you remember this...

The ONLY (2) rhythms that require defibrillation are:

- Ventricular Fibrillation
- Pulseless Ventricular Tachycardia

Now, let's dive into the cardiovascular diseases that you must know for the CSE.

Congestive Heart Failure

CHF occurs when the heart's ability to pump blood is impaired and does not meet the body's metabolic needs.

Exam Hint: For the CSE, in general, you should always remember that CHF and pulmonary edema go hand in hand.

(Cardiogenic Pulmonary Edema, that is.)

When you hear pulmonary edema — think CHF — and vice versa.

Also for these, know that they are associated with **fluid overload**.

Cardiogenic Pulmonary Edema – when fluid from the pulmonary vascular system accumulates in the alveoli of the lungs.

CHF is caused by:

- Myocardial Infarction
- Coronary Artery Disease
- Ischemic Heart Disease
- Hypertension
- Cardiomyopathy

Cardiogenic Pulmonary Edema is caused by things directly related to CHF. However, **Noncardiogenic Pulmonary Edema** is caused by and is related to ARDS.

Information Gathering:

- The history of present illness could happen suddenly, or there could be a gradual onset.
- Of course, the secretions will be pink and frothy. When you see this, automatically think CHF/pulmonary edema.

Exam Hint: Orthopnea is labored breathing while lying flat. When you see orthopnea, automatically think CHF/pulmonary edema.

- The patient will likely have a fast breathing rate (tachypnea) and they could appear cyanotic.
- The patient will have increased tactile and vocal fremitus.
- During auscultation, you will hear crackles and rhonchi.
- Look for signs of pedal edema (swelling and fluid accumulation in the feet).
- Other signs of fluid overload that you may see include: diaphoresis, jugular venous distention, tachycardia, and increased anxiety levels.
- Of course, you should recommend a chest x-ray to access the heart and chest. You will see fluffy opacities, butterfly or batwing pattern, and Kerley B lines.
- Recommend a 12-lead EKG.
- Recommend serum electrolytes.
- Recommend an ABC. It will likely show respiratory alkalosis with hypoxemia.
- PFT results would show reduced lung volumes with a normal FEV₁/FVC ratio.
- Hemodynamic monitoring would show an increased PCWP and PAP.
- You can recommend an echocardiogram to further assess the heart.
- Recommend cardiac biomarkers to assess for a heart attack.
- Recommend BNP (brain natriuretic peptide), which is a hormone that is useful for diagnosing CHF.

Decision Making (Treatment)

- Restrict fluid because the patient is already fluid overloaded. Also, definitely recommend diuretics (Lasix) in order to help with fluid excretion.

- Provide oxygen for hypoxemia. These patient's will most likely need 100% O₂.
- Closely monitor the patient's vital signs — especially blood pressure.
- Keep the patient positioned upright in the Fowler's position, because as we stated, they will have difficulty breathing while lying flat, due to the fluid.
- Recommend positive inotropic agents, which help increase the contractility of the heart. Examples are: Digitalis, Digoxin, and Dopamine.
- Recommend NPPV (BiPAP/CPAP) to improve gas exchange and to decreases venous return and ventricular preload.
- Recommend morphine or a benzodiazepine in order to reduce anxiety.
- Recommend vasodilators and afterload reducing agents such as: nitroglycerin, sodium nitroprusside, and ace inhibitors.
- Recommend intubation and mechanical ventilation if the patient develops severe respiratory acidosis while on NPPV.
 - The patient will need PEEP.
- Recommend the electrolyte replacement of sodium and potassium.

Myocardial Infarction

A **heart attack**, or Myocardial Infarction, occurs when a portion of the heart is deprived of oxygen due to blockage of a coronary artery.

This causes irreversible damage to the heart muscle and sudden death can occur.

Coronary Artery Disease is the narrowing or blockage of the coronary arteries that is usually caused by atherosclerosis. This reduces the blood flow to the myocardium which will cause ischemia, angina, or an infarction.

Exam Hint: Angina, or chest pain, is dangerous when it's unstable and is a sign of impending failure.

For the CSE, in general, when you have a patient with angina, in most cases, you should think heart attack. Just be sure that there are other signs and symptoms as well to back up this assumption.

The causes of a heart attack include: heart disease, hypertension, and a thrombus or blockage.

Other risk factors include: diabetes, elevated LDL lipids, hypertension, smoking, obesity, sedentary lifestyle, and a family history of coronary artery disease.

Information Gathering:

- The patient will most likely (obviously) have chest pain. It's possible that the patient has a history of heart attacks in the past.

- The patient will likely show signs of shortness of breath and tachypnea, with possible cyanosis. They may also appear anxious and diaphoretic (sweaty).
- The patient will have hypertension and likely tachycardia.
- Their ABG results will display hypoxemia.
- When assessing the patient's electrolytes, it's key to look at the potassium levels for a heart attack patient. They can be increased or decreased.
- Definitely recommend an EKG. The results will likely show arrhythmias.
 - Look for ST-segment elevation, and also look for significant Q waves.
- Recommend a test to check the patient's cardiac enzymes. You will see elevated troponin levels.

Decision Making (Treatment)

- ALWAYS... for a suspected heart attack patient, always recommend 100% oxygen. A nonrebreather would be the first and fastest option.
- Keep a close eye on the patient's vital signs — specifically their SpO₂, EKG, and blood pressure.
- You can recommend Aspirin.
- Recommend anti-arrhythmic agents such as amiodarone and atropine.
- You can recommend nitrates for chest pain.
- In order to maintain the patient's blood pressure, you can recommend fluid or vasopressors as needed.
- And remember... always defibrillate the patient if the EKG shows V-fib or Pulseless V-tach.
- On discharge, you can recommend cardiac rehab and smoking cessation.

Exam Hint: Remember MONA. Give Morphine for pain. Oxxygen for hypoxemia. Nitroglycerin. Aspirin.

Shock

Shock is a condition in which perfusion to the tissues and vital organs is inadequate to meet metabolic needs. Life cannot be sustained without adequate blood flow to the tissues.

There are (6) different types of shock to be familiar with:

- **Cardiogenic shock** – caused by heart failure.
- **Hypovolemic shock** – caused by decreased fluid levels.
- **Neurogenic shock** – caused by alterations in vascular smooth muscle tone.
- **Septic shock** – caused by an infection.
- **Traumatic shock** – can be caused by both the loss of fluid (blood) or by an infection.
- **Anaphylactic shock** – caused by an allergic reaction.

Information Gathering:

- The patient will likely have shortness of breath with tachypnea and possible cyanosis.
- The patient may appear lethargic and unresponsive, dizzy, sweaty, cold and clammy, with poor capillary refill.
- The patient's vital signs will show hypoxemia, tachycardia, hypotension, and likely hypothermia.
- The patient's hemodynamics will show decreased volumes.
- Their urine output will be decreased as well.

Decision Making (Treatment)

- Give oxygen for hypoxemia.
- Initiate mechanical ventilation for ventilatory failure.
- Recommend atropine if the patient has significant bradycardia.

- Monitor the patient's fluid levels closely. Recommend IV fluids for hypovolemia. Recommend vasopressors for hypotension.
- Recommend Digitalis or Digoxin for heart failure.
- Recommend antibiotics if an infection is present (septic shock).

Cor Pulmonale

Cor Pulmonale is another term for 'right heart failure'. It is an abnormal enlargement of the right ventricle as a result of disease of the lungs or the pulmonary blood vessels.

It is caused by an increased workload to the right ventricle that is caused by pulmonary hypertension.

Exam Hint: Cor Pulmonale is often caused by COPD and is commonly seen in COPD patients.

Just something to keep in mind for the CSE.

Information Gathering:

- The patient likely has a history of COPD or chronic lung disease.
- The patient will exhibit shortness of breath with an increased AP diameter of the chest and chest pain.
- You will also likely note that the patient has distended external jugular veins and peripheral edema.
- The patient's hemodynamics will show an increased CVP.
- Their EKG will show right ventricular hypertrophy.

Decision Making (Treatment)

- Give oxygen for hypoxemia and closely monitor the patient's vital signs.
- Treat the underlying cause of — for example, COPD.
- For these patient's, you should strive to lower the workload of the right ventricle by decreasing the pulmonary artery pressure.
- Recommend the following drug therapies: Digitalis, Diuretics, and Pulmonary Vasodilators.

Pulmonary Embolism

A **pulmonary embolism** is a blockage in one of the pulmonary arteries in the lungs that is caused by blood clots that travel to the lungs from the legs or other parts of the body.

Exam Hint: A good thing to remember is that a pulmonary embolism results in a deadspace condition. This means that there is ventilation without perfusion.

So as air/oxygen goes through the lungs, the blood is not properly picking up oxygen due to the embolism.

The causes include: recent surgery, fractures, blood clots, fat or air emboli, and immobility.

Information Gathering:

- The patient may show signs of chest pain, dyspnea, hemoptysis, tachypnea, and cyanosis.
- The patient will also likely appear anxious and diaphoretic.
- The patient's breath sounds may have wheezing, crackles, or a **pleural friction rub**.
- The patient will likely have a decreased blood pressure with tachycardia, and a decreased cardiac output.
- The chest x-ray will likely appear normal, but it could show a wedge-shaped infiltrate.
- Their ABG results will show respiratory alkalosis with hypoxemia.
- Hemodynamics will show an increased PAP and CVP.
- Capnography would show a decreasing P_ECO_2 with a normal $PaCO_2$.
- The V_D/V_T ratio will be increased.
- Recommend a CT scan.
- Recommend a V/Q scan.
- Recommend a pulmonary angiogram.

- Recommend a d-Dimer test.

Exam Hint: For the CSE, you may get a case or situation such as this in regard to a pulmonary embolism:

There is a postoperative patient with sudden dyspnea, hemoptysis, chest pain, and tachycardia.

Know that these are the signs of a pulmonary embolism. The key is that it happens suddenly.

Also remember to always recommend a d-Dimer test and pulmonary angiography.

Decision Making (Treatment)

- Give oxygen for hypoxemia and closely monitor the patient's ABGs and vital signs.
- Recommend anticoagulation drugs such as heparin or warfarin.
- Recommend analgesics for chest pain.
- Recommend positive inotropic agents (Digitalis, Digoxin) to help maintain circulation.
- Recommend thrombolytic agents such as urokinase or streptokinase.
- Recommend early movement or ambulation of the patient.
- Recommend the anti-embolism stockings to prevent blood clots.

Pediatric Diseases

Whether you plan to work with kids some day or not, the CSE takes place in “NBRC hospital.” And you know what that means...

It means that we have to play by their rules. There are some things you must know about pediatric diseases and we'll cover them in this section.

Just a reminder, you will see (2) cases on pediatric diseases on the CSE.

Not to worry — after you finish this section, you'll be prepared to ace this portion of the exam.

Here's what we'll cover in this section:

- Croup
- Epiglottitis
- Bronchiolitis
- Cystic Fibrosis
- Foreign Body Aspiration

But first and foremost, we're going to learn the difference between croup and epiglottitis.

Exam Hint: You are pretty much guaranteed to have either croup and/or epiglottitis as one of your cases on the CSE. Most people do.

This is why it's critical that you understand how to differentiate the two.

Croup and Epiglottitis

Croup

Croup, or Laryngotracheobronchitis, is a viral subglottic infection of the upper airway, which obstructs breathing and causes an inspiratory barking cough.

The infection causes swelling of subglottic tissue (below the vocal cords) including the larynx, trachea, and larger bronchi.

Since it is a viral infection, it is often caused by *Parainfluenza virus*.

Exam Hint: Croup is associated with inspiratory stridor. So for the CSE, when you see a child with inspiratory stridor, you should automatically think and know that he or she has croup.

Epiglottitis

Epiglottitis is a bacterial supraglottic infection of the upper airway that causes swelling above the glottis.

The swelling occurs above the vocal cords to the epiglottis, aryepiglottic folds, and arytenoids.

Epiglottitis is a life-threatening emergency! Death can occur if it is not treated!

(We put this text in red to show emphasis so that you are more likely to remember this. ☺)

Since epiglottitis is a bacterial infection, it is often caused by *Haemophilus influenzae B*.

It's no secret that students have a difficult time distinguishing the difference between these two diseases. So, to make it easier on you, we compiled what you need to know in the tables below.

Information Gathering:

Croup	Epiglottitis
<ul style="list-style-type: none">It has a <u>gradual</u> onset that usually stems from a cold over 2-3 days.	<ul style="list-style-type: none">It has a <u>sudden</u> onset that usually occurs within a <u>few hours</u>. It is a medical emergency!
<ul style="list-style-type: none">Their cough will be very hoarse with a barking sound and <u>inspiratory stridor</u>.	<ul style="list-style-type: none">The cough will be <u>muffled</u>. This is a distinguishing factor because with croup, there will be a barking cough.
<ul style="list-style-type: none">Their breathing pattern will be fast (tachypnea) with use of accessory muscle during breathing. There may be signs of cyanosis and diminished breath sounds. Intercostal retractions may be present.	<ul style="list-style-type: none">Their breathing pattern will also show tachypnea with possible <u>intercostal retractions</u>. Breath sounds will be diminished and there may be signs of <u>cyanosis</u>.
<ul style="list-style-type: none">Their vital signs will likely show an increased heart rate and blood pressure.	<ul style="list-style-type: none">Their vital signs will likely show an increased heart rate and blood pressure, and also a <u>high fever</u>.
<ul style="list-style-type: none">Recommend a lateral neck x-ray and look for the <u>"steeple sign."</u>	<ul style="list-style-type: none">Recommend a lateral neck x-ray and look for the <u>"thumb sign."</u>

<ul style="list-style-type: none"> The swelling is below the glottis. 	<ul style="list-style-type: none"> The swelling is above the glottis.
<ul style="list-style-type: none"> The ABG results will show acute alveolar hyperventilation with hypoxemia. 	<ul style="list-style-type: none"> The ABG results will show acute alveolar hyperventilation with hypoxemia.
<ul style="list-style-type: none"> CBC results would show an elevated white blood count (due to the infection). 	<ul style="list-style-type: none"> CBC results would show an elevated white blood count (due to the infection).

Decision Making (Treatment)

Croup	Epiglottitis
<ul style="list-style-type: none"> Recommend close monitoring of vital signs and ventilatory and oxygenation status. 	<ul style="list-style-type: none"> Recommend close monitoring of vital signs and ventilatory and oxygenation status.
<ul style="list-style-type: none"> Provide oxygen for hypoxemia. 	<ul style="list-style-type: none"> Provide oxygen for hypoxemia.
<ul style="list-style-type: none"> Recommend antibiotics for the infection. 	<ul style="list-style-type: none"> Recommend antibiotics for the infection.
<ul style="list-style-type: none"> Recommend a cool aerosol mist for the stridor, and also recommend placing the patient in a cool environment. 	<ul style="list-style-type: none"> As we stated already, this is a medical emergency and you should recommend immediate intubation and mechanical ventilation.

<ul style="list-style-type: none"> Recommend aerosolized racemic epinephrine. If repeated racemic treatments do not work, you can recommend Heliox therapy. 	<ul style="list-style-type: none"> If the intubation attempt fails and it cannot be accomplished, you can recommend a cricothyroidotomy or emergency tracheotomy.
<ul style="list-style-type: none"> Also, you can recommend corticosteroids for patients who do not respond to cool aerosol and racemic epinephrine therapy. 	<ul style="list-style-type: none"> You can recommend to proceed with extubation when the child's condition is stable, or when the swelling in the airway has gone down.
<ul style="list-style-type: none"> In severe cases, the child will be very lethargic, have marked inspiratory stridor, and extreme use of accessory muscles during breathing. 	
<ul style="list-style-type: none"> Recommend intubation for ventilatory failure, or if the patient is unable to protect the airway. 	

Exam Hint: Again, this is one of the biggest distinguishing factors that you should remember for the exam.

Epiglottitis is a medical emergency and requires immediate intubation, whereas croup does not.

Croup occurs more gradually, where epiglottitis happens suddenly.

Bronchiolitis

Bronchiolitis is a viral acute lower respiratory tract infection that occurs in infants younger than 2 years old.

It is usually caused by RSV (Respiratory Syncytial Virus).

It results in inflammation in the bronchioles that causes edema and excessive mucous production. This can lead to airway obstruction, air trapping, and atelectasis.

Information Gathering:

- It usually starts as an upper respiratory tract infection and then the symptoms and respiratory distress gets worse.
- It can be treated on an outpatient basis or may require hospitalization.
- The patient will have an intermittent cough and a fast breathing rate (tachypnea). Also, they may have intercostal retractions as well.
 - In severe cases, apnea may be present.
- On auscultation, you may hear wheezing, rhonchi, or crackles.
- Vital signs will show tachycardia, hypertension, and fever.
- You can look at the appearance of the child and likely see nasal discharge, cyanosis, grunting, nasal flaring, and lethargy.
- A chest x-ray would show hyperinflation with consolidation.
- ABG results would show acute alveolar hyperventilation with hypoxemia.

Decision Making (Treatment)

- Recommend hospitalization if their condition worsens. Or, if there is severe respiratory distress, signs of cyanosis, bradycardia, or periods of apnea.

- If the infant is hospitalized, recommend that they are placed in **droplet isolation** to prevent the spread of the infection.
- Provide oxygen for hypoxemia.
- Perform nasal suctioning if indicated.
- Do **NOT** recommend routine bronchodilator therapy because the **wheezing in this case is due to edema, not bronchospasm**.
- Do not recommend corticosteroids, ribavirin, or antibiotics.
 - Unless a bacterial infection is present, then you can recommend antibiotics.
- Provide mechanical ventilation for impending or acute ventilatory failure.
- Remember, only recommend hospitalization for severe cases. Most cases can be treated at home with humidification and oral decongestants.

Cystic Fibrosis

Cystic Fibrosis is a genetic disorder that effects the exocrine glands and causes chronic respiratory infections.

It causes abnormal electrolytes and water in and out of the epithelial cells.

It is associated with:

- The accumulation of thick, viscous mucous in the lungs.
- Blocked passageways in the pancreas.
- Inhibition of the digestion of protein and fat.
- Deficiencies of vitamins A, D, E, and K.

Information Gathering:

- The signs of CF include: family history of CF, chronic cough and sputum production, barrel chest, digital clubbing, and recurring respiratory infections.
- The patient may be small in size. The condition causes a lack of growth.
- They will have large amounts of thick, purulent secretions.
- They will show signs of dyspnea including tachypnea, pursed-lip breathing, cyanosis, and the use of accessory muscles during breathing.
- Their vital signs will show tachycardia and hypertension.
- The chest x-ray would show translucent lung fields and a flattened diaphragm. You may also see an enlarged right ventricle and areas of atelectasis.
- ABG results would show acute alveolar hyperventilation with hypoxemia.
- Their PFT values would show decreased flows (because it is an obstructive disease).
- Their CBC results would show elevated hemoglobin and hematocrit.

- A sputum gram stain would reveal *Haemophilus influenzae*, *Pseudomonas*, or *Staphylococcus aureus*.

Exam Hint: On the CSE, if it is suspected that the patient has cystic fibrosis, always recommend a **Sweat Chloride Test**.

The test is considered positive for CF if the level is $> 60 \text{ mEq/L}$.

With that being said, if the case tells you that the patient has CF, then there is no need to order the test, however.

Decision Making (Treatment)

- Recommend airway clearance therapy. Examples include: postural drainage, chest percussion, PEP therapy, directed cough, and high frequency chest wall compression (the vest).
- Recommend aerosol drug therapy. Give a bronchodilator followed by mucolytics (Pulmozyme), followed by anti-inflammatory agents.

Exam Hint: Recommend the appropriate inhaled antibiotics.

For CF patients, ALWAYS recommend '**TOBI**' or Tobramycin.

- Give oxygen therapy for hypoxemia.
- Recommend digestive enzyme replacements.

Once the patient is stable, you can recommend the following:

- Annual flu immunizations.
- Recommend a diet high in fat and salt.
- Regular exercise regimens.
- Clinic visits every 2-3 months to assess basic tests.

Foreign Body Aspiration

This section involves a medical emergency that occurs when a child aspirates a foreign object causing an airway obstruction.

Most often occurs in children less than 3 years old and is the leading cause of accidental deaths in infants and toddlers.

Exam Hint: Keep in mind that most organic foreign objects that are aspirated (for example, food) are radiolucent, so they do not show up on a chest x-ray.

However, the inorganic objects (like toys, coins, etc.) tend to be **radiopaque** and can be seen on the chest x-ray.

Information Gathering:

- There may or may not be a choking event with the child. If there is a complete airway obstruction, the child will be in severe respiratory distress with a violent cough.
- They will possibly show signs of tachypnea, cyanosis, and retractions.
- Their breath sounds may be absent on one side if there is a complete obstruction. Also, you may hear **unilateral wheezing on the side of a partial obstruction.**

Exam Hint: For the CSE, if you get a case that has a child with unilateral wheezing — boom — you should automatically know that they have aspirated a foreign object.

- As we stated before, the chest x-ray may or may not show the aspirated object.
- Also, the chest x-ray may show air trapping, hyperinflation, and unequal ventilation.

Decision Making (Treatment)

- Of course, you should recommend that the object be removed as soon as possible.
- You can recommend rigid bronchoscopy to remove the object.
- If it still cannot be removed, you may need to recommend an emergency cricothyroidotomy.
- After the object has been removed, it may be necessary for you to recommend aerosolized bronchodilators or corticosteroids if coughing or wheezing persists.
- Do not recommend antibiotics unless an infection is present.

Neonatal Diseases

Again... whether or not you want to work with babies in the future, you still have to know this information.

That is because, you will see (2) cases on the CSE regarding neonatal diseases.

We're going to cover what you need to know here in this section.

That includes:

- Delivery Room Management
- Apnea of Prematurity
- Meconium Aspiration
- Infant Respiratory Distress Syndrome
- Congenital Heart Defect
- Bronchopulmonary Dysplasia
- Congenital Diaphragmatic Hernia

Are you ready to get started with the neonatal diseases? If so, let's go ahead and dive right in.

Delivery Room Management

As a Respiratory Therapist working in the NBRC hospital, you will be called to the delivery room to assist with the delivery of a high-risk infant.

The infant will most likely be less than 35 weeks gestation.

Information Gathering:

- Immediately after birth, you should assess the infant's heart rate, respiratory rate, muscle tone, color, and reflexes. And as I'm sure you are aware, these are the parameters needed to obtain an **Apgar score**.
- You should perform an Apgar score 1 minute and 5 minutes after delivery.

APGAR Scoring Chart			
	2 (good)	1 (bad)	0 (very bad)
<u>Appearance</u> (color)	Full body pink	Body pink but extremities are blue	blue
<u>Pulse</u>	>100	<100	No pulse
<u>Grimace</u>	Coughing or sneezing	Grimace	No response
<u>Activity</u>	Active motion	Some flexion of extremities	No movement
<u>Respiratory effort</u>	Strong cry	Weak cry	No cry

- When you repeat the Apgar score at 5 minutes, if it is less than 7, you should repeat the assessment every 5 minutes for up to 20 minutes.
- If the infant is cyanotic, provide oxygen for hypoxemia.

- You may or may not see this on the CSE. Just be familiar that you can recommend the Silverman-Anderson scale to assess the infant's level of respiratory distress.

Decision Making (Treatment)

- Once you receive the Apgar score during the Information Gathering section, the treatment for the neonate depends on the score that they receive.
 - A score of 0–3 is a medical emergency! You should recommend resuscitation and CPR.
 - If they receive a score of 4–6, you should stimulate and warm the neonate. You may also need to provide oxygen and assist with ventilation.
 - If they receive a score of 7–10 and are crying and breathing normally, there is no need for resuscitation. Dry the infant, monitor, and provide routine care.
- For meconium stained babies, we will discuss how to treat them below in the next section.

Meconium Aspiration

Meconium Aspiration Syndrome is a condition where the fetus has marked respiratory distress due to meconium stained amniotic fluid.

It usually occurs in infants that are born at or beyond full term.

Information Gathering:

- Again, this condition is more common in post-term infants.
- The infant will show signs of respiratory distress, including grunting, nasal flaring, retractions, tachypnea, cyanosis, and possibly periods of apnea.
- The infant's vital signs will show tachycardia and hypertension.
- The infant will have a dark-green-ish appearance due to the meconium (stool) stain.
- The infant's breath sounds may reveal wheezing, rhonchi, or crackles.
- Be sure to closely monitor the infant.
- The infant will likely have a low Apgar score.
- Recommend a chest x-ray. It will likely reveal some atelectasis and/or consolidation.
- The ABG results would most likely show hypoxemia and/or possibly metabolic acidosis.

Decision Making (Treatment)

- Do not recommend intubation just because the infant is meconium stained. If they have a good respiratory effort, muscle tone, and heart rate, there isn't a need to intubate.
- Recommend a thorough suction of the nasopharynx and oropharynx.

- However, if the infant has poor respiratory efforts, poor muscle tone, and a heart rate less than 100 — you should recommend intubation.
 - In this case, intubate and suction the trachea immediately.
- Recommend surfactant replacement therapy.
- Closely monitor vital signs and oxygenation status.
- Provide oxygen therapy for hypoxemia to maintain the PaO₂ at 55–80 torr and the SpO₂ at 88–95%.
- If mechanical ventilation is necessary, you can recommend High-Frequency Oscillation Ventilation if it's available.

Exam Hint: The key to succeeding with one of these Meconium Aspiration Syndrome cases on the CSE is this:

Knowing when to recommend intubation and when not to.

Again, to make it simple for you — if the infant is crying with good muscle tone, strong respirations, and a heart rate greater than 100 — you do NOT need to intubate.

However, if the infant is not crying, has poor muscle tone, weak respirations, and a heart rate less than 100 — you know what this means — it's a medical emergency and you should recommend intubation immediately.

Apnea of Prematurity

Apnea of Prematurity is a disorder that effects infants born less than 37 weeks gestation that is caused by physiologic immaturity of the respiratory control center in the CNS.

The earlier the infant is born and the lower the birth weight, the higher the incidence of Apnea of Prematurity.

Information Gathering:

- The infant will be experiencing episodes of central apnea and irregular breathing.
- Bradycardia is also likely in these infants.
- Cyanosis is possible.

Decision Making (Treatment)

- Recommend continuous apnea monitoring for respirations and heart rate.
- Recommend continuous pulse oximetry to monitor for hypoxemia during periods of apnea. And, of course, provide oxygen therapy if hypoxemia is present.
- Recommend that the infant be cared for in the prone position.
- Recommend intubation and mechanical ventilation if the episodes get more frequent or longer.
- Recommend daily doses of methylxanthines (caffeine).
- If the infant still has regular periods of apnea but is still stable and doesn't require mechanical ventilation — you can recommend nasal CPAP or high-flow nasal cannula.

IRDS

IRDS, or Infant Respiratory Distress Syndrome, is a disease that is common in premature infants because their lungs have not fully developed yet.

Another name for this is Hyaline Membrane Disease.

Exam Hint: IRDS is associated with the lack of surfactant production, which leads to atelectasis and hypoxemia.

So if you get a case on the CSE where you determine that the infant has IRDS, you can immediately know that you should recommend surfactant replacement therapy.

Information Gathering:

- For IRDS to be present, the infant will be born prematurely (less than 37 weeks gestation) and a low birth weight of less than 1,500 grams.
- They will likely have low Apgar scores.
- You may need to recommend to test the L:S ratio. It will likely be less than 2:1.
- The infant will show signs of respiratory distress, including cyanosis, retractions, grunting, nasal flaring, tachypnea, and possible periods of apnea.
- The infant's vital signs will show an increased heart rate and blood pressure.
- For breath sounds, you will hear bronchial breath sounds, or possibly crackles.
- Definitely recommend a chest x-ray. You will see a 'ground glass' appearance with increased opacity and air bronchograms.
- Definitely recommend an ABG. The results will show respiratory acidosis with hypoxemia.

Decision Making (Treatment)

- Recommend oxygen therapy for hypoxemia. You may need to recommend nasal CPAP at 4–6 cmH₂O.
 - Strive to keep PaO₂ between 50–70 torr and the SpO₂ between 85–92%.
- As we stated before in the Exam Hint, you *must* recommend surfactant replacement therapy because the infant will have a deficiency.
 - Just a reminder: surfactant can be administered and directly instilled down the ET tube.
 - Types of surfactant include:
 - Survanta (beractant)
 - Curosurf (poractant alfa)
 - Infasurf (calfactant)
- A high-flow nasal cannula at 1–6 L/min can be recommended as an alternative to nasal CPAP.
- Recommend the maintenance of the infant's neutral thermal environment with an incubator or radiant warmer.
- Recommend intubation and mechanical ventilation if the infant cannot maintain a pH greater than 7.25 while on nasal CPAP.
 - PEEP will most likely be necessary as well.

Congenital Heart Defects

This section covers the **Congenital Heart Defects** that you need to know for the CSE. Basically, this refers to structural abnormalities of the heart that are present at birth.

The first (2) that are going to cover cause severe hypoxemia. They are:

- **Tetralogy of Fallot** – is a combination of four congenital abnormalities that affects normal blood flow through the heart. The four defects include:
 - Ventricular septal defect (VSD)
 - Pulmonary valve stenosis
 - Misplaced aorta
 - Right ventricular hypertrophy
- **Transposition of the Great Vessels** – A heart defect where there is an abnormal arrangement of the vessels. The aorta is connected to the right ventricle, and the pulmonary artery is connected to the left ventricle, which is the opposite of normal.

Both of these cause **right-to-left shunting** with cyanosis and hypoxemia and usually **require surgery** in order to correct the defect.

Information Gathering:

- **Respiratory distress** will likely be present with labored breathing and cyanosis.
- A **heart murmur** may be present and an abnormal heart rate.
- Definitely recommend a **chest x-ray** to assess the heart!
 - **Tetralogy of Fallot** – the heart will be **boot-shaped**.
 - **Transposition of the Great Vessels** – the heart will be **egg-shaped**.
- Definitely recommend an **echocardiogram**. This is the most important test to diagnose cardiac defects.

- Recommend pre and post-ductal ABG studies.

Other Heart Defects

Here are just a few other congenital heart defects that we want to refresh your memory on, just to be safe.

Each of these defects leads to left-to-right shunting.

Patent Ductus Arteriosus – a condition where the ductus arteriosus fails to close after birth.

- Early symptoms are uncommon, but in the first year of life include increased work of breathing and poor weight gain.
- An uncorrected PDA may lead to congestive heart failure with increasing age.

Truncus Arteriosus – a rare type of heart disease where the aorta and pulmonary artery are combined into one vessel.

Coarctation of the Aorta – a defect where the aorta is constricted, which leads to hypotension in the lower extremities and hypertension in the upper extremities.

Atrial Septal Defect – a birth defect where there is a hole in the wall that divides the atria.

Ventricular Septal Defect – a birth defect where there is a hole in the wall that divides the ventricles.

Decision Making (Treatment)

- As I stated previously, these defects require surgery in order to correct. So, you should recommend surgery once the congenital heart defect is confirmed.
- Provide oxygen therapy for hypoxemia.

- If the defect causes the infant to have low blood pressure or low cardiac output, recommend a positive inotropic agent like dopamine.
- You can recommend Prostaglandin E₁ in order to maintain or dilate a patent ductus arteriosus.
- Recommend intubation and mechanical ventilation for ventilatory failure.

Bronchopulmonary Dysplasia

Bronchopulmonary Dysplasia is a chronic lung disease that affects mostly premature newborn infants and requires long-term need for supplemental oxygen.

The cause of BPD is unknown, but it is associated with infants that are born early and/or with a low birth weight.

It often requires mechanical ventilation with high concentrations of oxygen.

Information Gathering:

- The infant will show signs of respiratory distress including retractions, nasal flaring, grunting, abdominal distention, and cyanosis.
- The infant will have an extremely fast breathing rate (extreme tachypnea).
- Breath sounds will reveal crackles and expiratory wheezes.
- Vital signs will show tachycardia and hypertension.
- Recommend a chest x-ray. It will show decreased lung volumes and atelectasis, and will often resemble IRDS.
- Recommend an ABC. The results will show respiratory acidosis with hypoxemia.

Decision Making (Treatment)

- You will definitely need to recommend oxygen therapy. Strive to use the lowest level possible to maintain the SpO₂ in the 88–92% range.
- You may need to recommend surfactant replacement therapy.
- Recommend pulmonary hygiene.
- Monitor fluid levels closely.

- Recommend mechanical ventilation for ventilatory failure and select a volume-control mode, as opposed to a pressure-control mode.
- Wean the infant from the ventilator. It will be a slow process, but strive to wean them to nasal CPAP.
- Bronchodilators may be helpful, so you can recommend them if wheezing (bronchospasm) is present.

Congenital Diaphragmatic Hernia

A **Congenital Diaphragmatic Hernia** occurs when the diaphragm does not close completely during prenatal development.

This is a medical emergency!

Prompt surgical repair is imperative. Mortality rate is up to 40% if the hernia isn't treated properly within the first few hours.

Information Gathering:

- The infant will be in respiratory distress, including signs of retractions, grunting, nasal flaring, and cyanosis.
- The respiratory rate will be extremely fast (extreme tachypnea).
- Breath sounds will likely be absent on the affected side.
- The vital signs will show tachycardia and hypertension.
- The infant may have a **barrel chest** appearance due to some air trapping.
- You should recommend a chest x-ray, and it will likely show intestinal loops in the sternum due to the open diaphragm. The heart and **mediastinum** will be shifted away from the affected side. You will also likely see atelectasis or a total lung collapse.
- ABG results will show respiratory acidosis with hypoxemia.

Decision Making (Treatment)

- As I said before, this is a medical emergency! Always recommend surgery to repair the hernia.
- Once the diagnosis has been made, recommend the insertion of an oral gastric tube to decrease gas in the bowel.
- Provide oxygen therapy for hypoxemia.
- Recommend that the infant be placed on the affected side.

- Recommend intubation and mechanical ventilation. Do not ventilate with a bag-valve mask.
 - This infant would be a good candidate for high-frequency oscillation ventilation.
- For severe cases, recommend ECMO.

Other Adult Medical Conditions

Almost to the end! You've done a great job focusing and retaining the information thus far. Keep up the good work!

Now, we're going to cover a few disorders that you may see on the CSE that didn't quite fit into the other sections.

I know, I know — it's more information for you to learn.

BUT, as I said, I want you to be as prepared as possible. So, it would be a disservice to you if I didn't include them for you here.

Learning about these conditions now will do nothing but benefit you, both for the CSE as well as your career as an RRT.

Here's what we'll cover in this section:

- Sleep Disorders
- Hypothermia
- Pneumonia
- AIDS
- Renal Failure
- Diabetes
- Thoracic Surgery
- Head Trauma
- Spinal Injury

Whoof! I know, it's sounds like a lot. BUT... these conditions are very straight-forward, and the sections are much shorter than the others in this study guide.

You got this! Let's go ahead and dive right in.

Sleep Disorders

In this section, we will cover the disorders or dyssomnias that keep patient's from maintaining normal sleep. Particularly, I'm referring to sleep apnea.

Sleep Apnea is a sleep disorder that can be diagnosed in patients who have more than 5 episodes of apnea per hour while asleep in a 6-hour period.

- Technically, a period of **apnea** is the cessation of breathing for a period of at least 10 seconds.

Information Gathering:

Patient History

- Insomnia
- Snoring
- Frequent awakenings
- Morning headaches
- Hypertension
- Hyperthyroidism
- Morning dry mouth/sore throat
- Obesity
- Increased neck circumference
- More common in males
- Age > 50 years old
- ABG results would show chronic ventilatory failure
- PFT results would show decreased volumes

Exam Hint: You must know the difference between central and obstructive sleep apnea.

Central Sleep Apnea – the absence of breathing as the result of medullary depression that inhibits respiratory movement, which becomes more pronounced during sleep.

- It occurs as a result of the failure of the brain to send signals to the respiratory muscles.

Obstructive Sleep Apnea – it is characterized by occlusion of the oropharyngeal airway with continued efforts to breathe.

- This is the most commonly encountered type of sleep apnea.

Mixed Sleep Apnea – as the name implies, it's a mixture of central and obstructive sleep apnea.

Exam Hint: For the Information Gathering or Decision Making portion of the CSE, when you have a patient with sleep apnea, **ALWAYS** recommend a **sleep study**.

Sleep Study (Polysomnography) – is a test used to diagnose sleep disorders. You always want to recommend this for sleep apnea patients.

- During the sleep study, in **central sleep apnea**, the patient isn't moving air because there is no effort to move air.
- In **obstructive sleep apnea**, the patient will not be moving any air because of an obstruction, but you will see that they did make a breathing effort to do so.

Apnea-Hypopnea Index – the average number of apneas and hypopneas per hour of sleep.

- Normal is < 5 per hour
- Mild is 5–15 per hour
- Moderate is 16–30 per hour
- Severe is > 30 per hour

Decision Making (Treatment)

Central Sleep Apnea

- Noninvasive positive pressure ventilation is recommended.

Obstructive Sleep Apnea

- CPAP is recommended. You may have to change or adjust the mask/interface to make it comfortable for the patient.
 - For example, you may have to recommend switching from a full-face mask to a nasal mask.
- Weight loss for obese patients
- Improve sleep posture and avoid the supine position
- Provide oxygen therapy for hypoxemia
- Reconstructive surgery of the upper airway

Hypothermia

Hypothermia is a medical emergency that occurs when the patient has a dangerously low body temperature (Below 95° F).

It is usually caused by cold water immersion, or by prolonged exposure to a cold environment.

Information Gathering:

- In most cases, this will be a medical emergency. You will likely need to recommend immediate CPR.
- Recommend the measurement of the patient's body temperature.
- The patient will be extremely cold with shivering, confusion, and cyanosis.
- Their vital signs will show bradycardia and bradypnea.
- Recommend an ABG. The results will likely show respiratory acidosis with hypoxemia.
 - Remember that when obtaining an ABG on a hypothermic patient, the results will need to be adjusted.
 - Their pH will be falsely increased, and the PaCO₂ and PaO₂ will be falsely decreased.
- Recommend EKG monitoring.
- Recommend a chest x-ray. It may show pneumonia or pulmonary edema.

Decision Making (Treatment)

- Remove any wet or cold clothing and cover with warm blankets to increase the body temperature.
- If the patient displays no signs of life, initiate CPR immediately.
- Provide (warm) supplemental oxygen for hypoxemia.

- Recommend intubation and mechanical ventilation for ventilatory failure.
 - Use a heated humidifier instead of an HME.
- Warm IV fluids can help increase the patient's body temperature.

Pneumonia

Pneumonia is an infection that causes inflammation to the alveoli in the lungs that leads to consolidation and atelectasis.

It is caused by bacteria, viruses, or aspiration.

It's one of the most common diseases that you'll deal with as a Respiratory Therapist.

Information Gathering:

- The patient's signs and symptoms will be like a cold or flu.
- The patient may experience shortness of breath with a productive cough.
 - Sputum may be colored which indicates an infection is present.
- The patient's chest appearance will show decreased expansion and increased tactile fremitus.
- Their vital signs would show tachypnea, tachycardia, hypertension, and likely a fever.
- Breath sounds would show crackles or bronchial breath sounds.
- The diagnostic chest percussion note would be dull or flat.
- Recommend a chest x-ray. It will show consolidation, atelectasis, air bronchograms, or possibly a pleural effusion.
- Recommend an ABC. The results would show respiratory alkalosis (hyperventilation) with hypoxemia.
- PFT results would show decreased volumes.
- A CBC may show increased white blood cells with a bacterial infection and decreased white blood cells with a viral infection.
- You can recommend a sputum culture to access the infection.

Exam Hint: For the CSE, when you see a patient with consolidation (fluid in the chest) — look for other signs too, of course, but you can usually associate that with pneumonia.

Decision Making (Treatment)

- Give supplemental oxygen for hypoxemia.
- Recommend hyperinflation therapy as well as pulmonary hygiene therapy.
- Recommend bedrest and adequate fluid intake.
- Recommend a thoracentesis to remove large amounts of fluid (pleural effusion).
- Recommend antibiotics for the infection.
- Recommend intubation and mechanical ventilation for ventilatory failure.
 - Be sure to abide by the VAP protocol.

AIDS

Although the percentages are small, there have been versions of the CSE in the past to have a case about AIDS.

So, we will briefly cover a few important things about the disease for you here.

AIDS, or Acquired Immune Deficiency Disorder, is essentially a weakened immune system.

Information Gathering:

- The patient could have a history of drug abuse.
- The patient may appear pale in color and have weight loss.
- The patient will likely have a recurrent fever.
- Recommend the ELISA test to check for AIDS.
- You can recommend a bronchoscopy to obtain a biopsy to check for AIDS.
- The patient may test positive for *Pneumocystis carinii*.

Exam Hint: Definitely know to recommend the ELISA test in order to check for AIDS or HIV.

Decision Making (Treatment)

- *Pneumocystis carinii* can be treated with Pentamidine via aerosol.
 - Make sure the therapist administering the treatment wears a mask.
- Recommend the use of standard precautions in order to protect medical personal from acquiring the disorder.
- Blood culture tests would not be helpful. That is because, *Pneumocystis carinii* cannot grow outside of the body.

Renal Failure (Diabetes)

We're going to briefly cover what you should look for if you were to get a case on the CSE where the patient is in renal failure or diabetes.

Information Gathering:

- Their respiratory pattern would display Kussmaul breathing.

Exam Hint: If you see a patient with Kussmaul breathing — boom — automatically think renal failure.

- Auscultation may reveal crackles if CHF is present.
- The patient may be lethargic, confused, or even comatose.
- The patient may have pedal edema (fluid overload).
- Recommend an ABG. The results will show metabolic acidosis.
- Their urine output will be decreased (<500 mL/day).
- Recommend to check their blood glucose level.
- Recommend to check their electrolytes.

Decision Making (Treatment)

- For diabetes, you should closely monitor their blood glucose levels. Also, monitor their ABG results for ventilatory failure.
- For renal failure, you should closely monitor their fluid levels. Also monitor their electrolytes and watch for signs of CHF.

Thoracic Surgery

In this section, we will be referring to any type of surgical procedure to the chest or thoracic cavity.

Examples include heart surgery, lung repairs, and tracheal repairs etc.

Exam Hint: Remember the importance of **hyperinflation therapy** both before and after surgery in order to prevent atelectasis.

Incentive spirometry, for example.

- Focus on preventing infection after surgery.
- Monitor the chest tubes and drainage systems.
- Recommend the use of a **pillow for splinting** when coughing.
- Monitor for post-surgery complications. Examples include:
 - Decreased lung compliance
 - **Hypovolemic shock due to the loss of blood**
 - **Subcutaneous emphysema**
 - Increased pressures on the ventilator
- If the patient was extubated and begins to deteriorate, recommend that they be **re-intubated and placed back on mechanical ventilation**.

Head Trauma

In section, we're going to cover injuries to the brain or skull.

Examples include traumatic brain injury, tumors, aneurysms, seizures, and cerebrovascular accidents.

Information Gathering:

- The patient's breathing pattern will show Cheyne-Stokes breathing.
- Recommend continuous capnography to monitor for hypercapnia.
- Recommend the Glasgow Coma Scale to assess the level of consciousness (Severe is 8 or less).
- The patient's pupillary response will likely be abnormal.

Exam Hint: On the CSE, if you get a case where the patient has a Cheyne-Stokes breathing pattern — you should automatically know the patient most likely has had a traumatic brain injury.

Decision Making (Treatment)

- Provide 100% oxygen. If using a mask, be sure to keep the patient's head/neck area stable until a spinal cord injury has been ruled out.
- If the patient scores 8 or less on the Glasgow Coma Scale, recommend immediate intubation and mechanical ventilation.
- Recommend continuous monitoring of the patient's blood pressure.
- Closely monitor the patient's intracranial pressure. Keep the ICP less than 20 mm Hg (Normal is 5–10 mm Hg).
 - Avoid hypercapnia.

- Keep PEEP levels to a minimum to reduce ICP.
 - Recommend Mannitol to decrease the ICP.
- Recommend barbiturates for sedation.
- If the patient has seizures, recommend the drug Dilantin.

Spinal Cord Injuries

This section refers to the injuries of the neck or spinal cord. These often will be seen in motor vehicle accidents, falls, and other accidents — possibly tumors, as well.

Information Gathering:

- Evaluate airway patency. If apnea is present, initiate manual ventilation.
- Recommend basic labs like ABC, CBC, Hb & Hct, blood lactate, and a toxicology screen.
- Recommend imaging scans like a CT scan and an MRI.
- The patient may have bruises over the affected area.
- You can recommend to check the patient's respiratory muscle function ONLY after they are stable. This includes checking the vital capacity and MIP/NIF.

Decision Making (Treatment)

- Focus on keeping the spine and neck stable with as little movement as possible.
- Provide oxygen therapy for hypoxemia.
- Focus on maintaining a patent airway.
 - To intubate, you will need to use the modified jaw thrust technique.
 - Also, recommend using a flexible bronchoscope to assist with intubation.
- Recommend a tracheostomy if the patient is likely to be ventilator-dependent for a longer period of time.