

VOLUME 2 • CHAPTER 32 • PART 3

Infection, Embolism, and the Rest

URI, pneumonia, coronaviruses, cancer, inhalation, CO, PE, pneumothorax, and neurologic causes

The diseases where the chest often sounds fine — and the patient is not.
Aligned to Region SOPs

Ten conditions — and a chest that often sounds fine

1 Infection

Upper respiratory infection, pneumonia, and the coronaviruses — SARS, MERS and COVID-19. Shared mechanism, and a shared PPE protocol.

2 Inhaled and malignant

Lung cancer, toxic inhalation, and carbon monoxide — the number one cause of poisoning in industrialised countries.

3 Vascular and mechanical

Pulmonary embolism and spontaneous pneumothorax. Both commonly present with a chest that sounds close to normal.

4 Not really lung disease at all

Hyperventilation syndrome, CNS dysfunction, and spinal cord or neuromuscular disease. Normal lungs, failing ventilation.

Part 2 was the diseases you can hear. Today is mostly the ones you cannot.

Run the list and ask which would give you abnormal breath sounds. Pneumonia yes. ARDS yes. Pneumothorax sometimes, and often subtly. Pulmonary embolism, carbon monoxide, hyperventilation syndrome and every neurologic cause — frequently nothing at all.

Which is why this session leans so hard on the HISTORY and on the monitors from Part 1. A clear chest is a finding, not the absence of one.

Three of today's conditions have completely NORMAL lungs

Hyperventilation syndrome, CNS dysfunction, and spinal cord or neuromuscular disease. The patient is hypoxic or hypercarbic because nothing is telling the lungs to work, or because the muscles cannot execute the order.

Those patients are invisible to a stethoscope, and they are the purest example of why Part 1's VENTILATION category exists as something separate from the lungs themselves.

Respiratory Infection

From the common cold to a pandemic — and the protocol that sits behind all of it.

URI · Pneumonia · SARS, MERS, COVID-19

Upper respiratory infection, and pneumonia

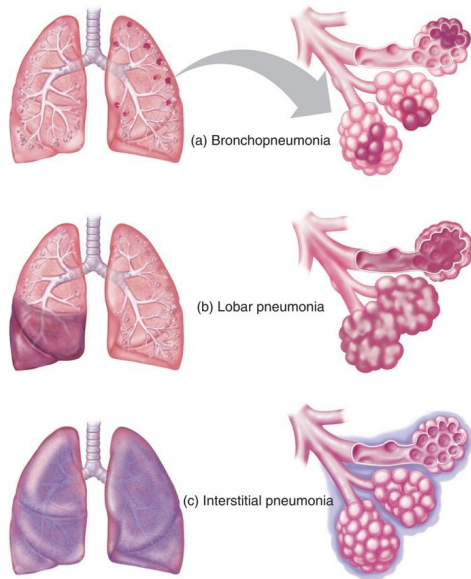


Figure 32-36 Bronchopneumonia, lobar and interstitial pneumonia.



Figure 32-37 Consolidation on a chest radiograph.
Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

Egophony — the closest thing to bedside confirmation

Have the patient say “eeee” while you listen. Over normal lung it sounds like “eeee.” Over CONSOLIDATED lung it sounds like “aaaa,” because solid tissue transmits higher frequencies better.

Alongside it: rales in the involved segment, fever, tachypnea, tachycardia, cough, and pleuritic chest pain.

1 URI — viral, and usually self-limiting

Among the most common infections for which patients seek attention. Symptoms are determined by WHICH PORTION of the upper tract is affected — same illness, different address.

2 Why EMS sees them at all

A URI triggers an asthma or COPD exacerbation — the common route. In a frail elderly patient it may be the visible edge of something worse. And epiglottitis and croup start out looking ordinary.

3 Pneumonia — and the framework label

“Pneumonia is PRIMARILY A VENTILATION DISORDER.” Affected alveoli stop being ventilated at all, so air never arrives — a ventilation problem with a diffusion consequence.

4 Especially in the aged, and in HIV

Bacterial and viral are most frequent. It begins in ONE PART of the lung and spreads to nearby alveoli — which is why findings are often localised to a segment.

And what EMS actually does

Pneumonia: place the patient in a POSITION OF COMFORT and use supplemental oxygen to correct hypoxia. That is the whole prehospital management, and it is enough.

URI: focus on the airway and ventilation; most are treated symptomatically.

SARS, MERS, and COVID-19

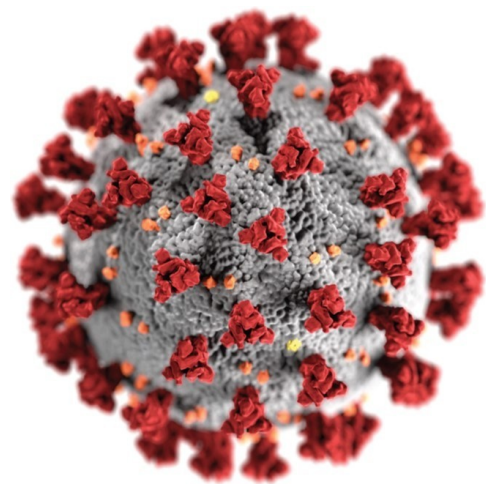


Figure 32-38 SARS-CoV-2.

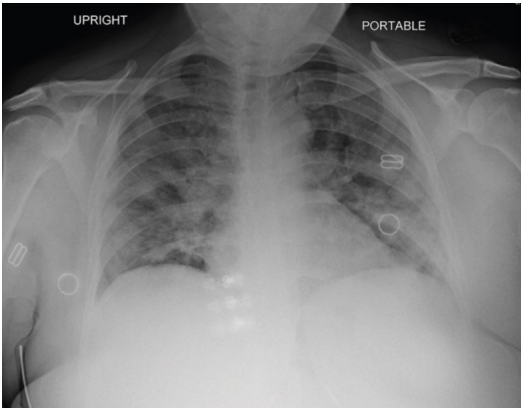


Figure 32-39 Viral pneumonia on a chest radiograph.
Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

	SARS	MERS	COVID-19
The virus	SARS-CoV	MERS-CoV	SARS-CoV-2 — the virus; COVID the disease
Spread	Close person-to-person contact. Highly infectious	Close contact, including caring for or living with someone infected	Human to human, primarily via DROPLETS from nose or mouth
Incubation / course	2–7 days, some 10–14	Coexisting illness → pneumonia and renal failure	80% recover · 20% become severely ill with dyspnea
Worth knowing	Progresses to respiratory distress and failure	Kills 3–4 of every 10 infected. NO vaccine	Loss of taste or smell · conjunctival discoloured fingers or toes

Management is the same for all three — and one step protects everyone downstream

Supplemental oxygen to correct hypoxia. If wheezing, consider a nebulised bronchodilator. And NOTIFY THE RECEIVING HOSPITAL of your suspicions, so it can arrange isolation and protect its staff before you arrive.

REGION SOP Severe Febrile Respiratory Illness: patient dons a surgical mask, hand hygiene, tissue instruction. Provider dons N95, gloves, gown and eye protection — avoid touching the outside of the N95. LIMIT the number of personnel exposed. Consider initial facility evaluation in the back of the ambulance to determine isolation needs. Notify the receiving facility, leave equipment in the patient room until cleaned, and document the exposure.

Triggers for that protocol: fever > 100.4°F, cough, shortness of breath or hypoxia, travel history, or contact with a confirmed case within 10 days.

Inhalation and Carbon Monoxide

Three conditions where what the patient breathed in — over years or over minutes — is the whole story.

Lung cancer · Toxic inhalation · Carbon monoxide

LUNG CANCER, AND TOXIC INHALATION

LUNG CANCER

1 The leading cause of cancer death in the US

The vast majority caused by CARCINOGENS. Four types: adenocarcinoma, small cell, epidermoid, and large cell carcinoma.

2 Hoarseness, vague chest pain, hemoptysis

Physical findings are NONSPECIFIC. Hoarseness has a mechanism worth knowing — a tumour compressing the recurrent laryngeal nerve.

3 And a management step that is not clinical

“Be attentive for DO NOT RESUSCITATE orders, advance directives, or end-of-life care wishes.” Look for the paperwork, ask the family, involve medical control if it is unclear. Doing everything is not automatically doing right by this patient.

TOXIC INHALATION

1 Four causes — and steam surprises people

Superheated air · toxic products of combustion · chemical irritants · STEAM. Water carries far more heat than dry air, so steam injures much deeper into the airway.

2 Determine WHAT was burning

The nature of the inhalant or combusted material matters enormously — and the answer is usually available from the fire crew or from the scene itself.

3 Examine the face, mouth and throat

Soot, singed nasal hair, burns around the mouth, voice change. Then: remove from the environment, open the airway, oxygen, saline lock, TRANSPORT PROMPTLY.

“Laryngeal edema is OMINOUS and may require prompt endotracheal intubation.”

The airway of an inhalation injury patient gets WORSE over the next hour, not better — so the decision to intubate is made early or it is not made at all. Your protocol: a high index of suspicion and a LOW INTUBATION THRESHOLD when airway involvement is possible.

The number one cause of poisoning in industrialised countries



Figure 32-41 Non-invasive CO-oximetry.

Source: Paramedic Care: Principles & Practice, 6th ed. © Pearson Education.

SpCO	What the patient looks like
< 5%	Normal for a non-smoker
5–9%	Minor headache — and may be NORMAL for a smoker
10–19%	Headache, shortness of breath
20–29%	Headache, nausea, dizziness, fatigue
30–39%	Severe headache, vomiting, vertigo, altered LOC
40–49%	Confusion, syncope, tachycardia
50–59%	Seizures, shock, apnea
> 59%	Coma, death, cardiac dysrhythmias

Headache, nausea and confusion in winter is a heating system until proven otherwise

The symptom list is deliberately non-specific — headache, nausea, vomiting, confusion, agitation, LOSS OF COORDINATION, chest pain, loss of consciousness, seizures. The classic clue is not a symptom at all: MULTIPLE PEOPLE in the same building with the same complaints, including the pets.

1 Odourless, tasteless, colourless

Every property there is a DETECTION problem. The patient cannot smell, taste or see it — nor can you.

2 200 to 250 times the affinity of oxygen

Oxygen cannot compete. Even a small airborne concentration captures a large fraction of the hemoglobin.

3 Cherry red skin is a VERY LATE finding

Say it plainly. People look for it, and it is essentially a post-mortem sign. Nobody is saved by waiting for it.

4 And the oximeter reads normal

It cannot distinguish carboxyhemoglobin from oxyhemoglobin. CO-OXIMETRY detects it non-invasively.

REGION SOP Remove from the environment. OXYGEN 100% by NRB or support respirations with a BVM. Monitor capnography. Consider CYANIDE poisoning in smoke/fire situations. Hyperbaric oxygen may be used in severe cases — though the chapter is honest that its effectiveness is questionable.

Embolism and Pneumothorax

Two conditions with a quiet chest — and one of them is the answer to your case study.

Pulmonary embolism · Spontaneous pneumothorax

PULMONARY EMBOLISM, AND SPONTANEOUS PNEUMOTHORAX

PULMONARY EMBOLISM

1 A clot or particle **LODGED** in a pulmonary artery

Sources: blood clots, air, FAT after long-bone fracture, and AMNIOTIC FLUID during delivery. Two of those are not clots and both present the same way.

2 The history is the diagnosis

Anything causing **IMMOBILITY**: recent surgery, long-bone fracture with immobilisation, bedridden state, venous pooling in pregnancy. Plus sudden, unexplained dyspnea.

3 Part 1's sentence, made flesh

The affected lung can no longer exchange gases — a perfusion and ventilation **MISMATCH**. A segment without blood flow is unavailable **REGARDLESS** of oxygenation.

4 The finding that means dying now

RIGHT HEART FAILURE — jugular venous distention with a falling blood pressure — is the sign of a **MASSIVE PE**. Also look for a warm, swollen extremity and calf pain.

The honest tension in PE management

Give oxygen at the **HIGHEST POSSIBLE CONCENTRATION** — while knowing it will help less than usual, because blood is not arriving. Oxygen is still correct; calibrate expectations. Then **TRANSPORT QUICKLY**: the treatment is in a hospital.

SPONTANEOUS PNEUMOTHORAX

1 No trauma — that is what spontaneous means

Ventilation is diminished by **LOSS OF INTEGRITY OF THE PLEURAL SPACE**. Part 1's potential space, becoming a real one.

2 Sudden, sharp, pleuritic

Chest or shoulder pain of sudden onset, with dyspnea commonly reported.

3 And the honest clause about breath sounds

"Decreased breath sounds on the involved side **MAY BE DIFFICULT TO NOTE**." Do not expect an obvious difference, and do not rule it out because you did not hear one.

4 Oxygen is usually all that is required

Use symptoms and pulse oximetry as your guides. Most spontaneous pneumothoraces need supportive care and transport, nothing more.

Where your own treatment can create the emergency

Be careful with positive pressure ventilation by mask or tube — the increased pressure **MAY CAUSE A TENSION PNEUMOTHORAX**, which will then require needle decompression.

When the Lungs Are Fine

Hyperventilation syndrome, CNS dysfunction, and neuromuscular disease — normal lungs, failing ventilation.

Hyperventilation · CNS dysfunction · Spinal cord and muscle

1 Hyperventilation syndrome

Rapid breathing, chest pain and numbness, usually with anxiety or situational stress. Excess CO₂ elimination causes RESPIRATORY ALKALOSIS — which lowers ionised calcium and produces the perioral tingling and carpopedal spasm.

2 Treatment is REASSURANCE

Instruct the patient to voluntarily reduce the rate. And breath holding or breathing into a PAPER BAG IS DISCOURAGED — it does not reliably work, and it is catastrophic if your diagnosis is wrong.

3 CNS dysfunction

Rarely the cause — with the exception of DRUG OVERDOSE and MASSIVE STROKE. Head trauma, stroke, tumours and drugs affect the respiratory control centre. Treat the underlying problem where you can; ventilate where you cannot.

4 Cord, nerve and muscle disease

Spinal cord trauma, polio, ALS, myasthenia gravis, Guillain-Barré, certain tumours. Watch for SUBTLE findings — a weakening voice, difficulty clearing secretions, an inability to count to twenty on one breath. Management is purely supportive.

“In a PURELY ANXIOUS patient” — and that qualifier is doing all the work

Hyperventilation is a SYMPTOM before it is a diagnosis, and the list of serious causes is long: pulmonary embolism, metabolic acidosis including DKA, sepsis, salicylate overdose, hypoxia of any cause. Remember from Part 1 that Kussmaul respirations are CORRECTIVE — slowing that patient down is harmful. This is a diagnosis of exclusion, and in the field you can rarely exclude enough.

145 minutes, three parts — and what actually matters

1 Three processes carried eighteen diseases

VENTILATION moves air, DIFFUSION crosses the membrane, PERFUSION brings the blood. Every disease in this chapter broke one or more — three categories to reason about, not eighteen things to memorise.

2 The primary treatment is to correct hypoxia

Establish and maintain the airway, assist ventilations as required, administer supplemental oxygen. Pharmacology follows, ordered by local protocol.

3 And that is deliberately not “diagnose it”

The chapter is explicit: priorities of care for airway and breathing matter more than naming the disease. Field diagnosis was never the assignment.

4 Every monitor is blind to something

The oximeter cannot see carbon monoxide. Peak flow needs a cooperative patient. Capnography reports CO₂ — which is as much about perfusion as ventilation.

5 Oxygen is a drug

A dose, a target, an indication, side effects. Titrate for normoxia, and never withhold it from a hypoxic patient to protect a drive that does not work the way folklore says.

6 The quiet patient is the one in trouble

A silent chest in asthma. Decreasing stridor in croup. A falling rate in a tiring patient. A clear chest in a hypoxic one. All read as improvement; none of them is.

Chapter 22 taught how to open and support an airway. Chapter 32 taught what closes it.

Same anatomy, different question — and the two chapters are meant to be held together. Use capnography, end-tidal CO₂, pulse oximetry and carbon monoxide detection to determine where a respiratory patient actually is.

Your 54-year-old, eleven days after a knee replacement

The history made the diagnosis

Recent surgery plus eleven days of immobility is the classic risk factor — any condition producing immobility of the extremities. Sudden, unexplained dyspnea is the named presentation. And the warm, swollen calf is the source.

The clear chest was a FINDING

Not the absence of one. Nothing is wrong with her airways or her alveoli — which rules out the whole of Part 2 and points straight at PERFUSION.

The ETCO₂ was the elegant part

26 mmHg with a NORMAL waveform at a rate of 30. CO₂ reaches the lungs by pulmonary blood flow — a blocked artery means less delivered to exhale. The HEIGHT is wrong, not the shape; in asthma it is the reverse.

And what you actually do

ABCs. Oxygen at the highest possible concentration, expecting less improvement than usual. Saline lock. Watch for JVD and a falling pressure — that means massive PE. Then transport quickly: the definitive treatment is not on your ambulance.

Her lungs were never the problem. Everything you could hear with a stethoscope was normal, and she was still dying — which is the argument for the framework, in one patient.

Check your understanding

- 1 What causes the vast majority of URIs, and what determines which symptoms the patient has?
- 2 Give three reasons EMS is called to a patient whose only problem is a URI.
- 3 Which of the three processes does the chapter say pneumonia primarily disrupts — and why is that surprising?
- 4 How do you test for egophony, what does it sound like, and what does it suggest?
- 5 Distinguish SARS-CoV-2 from COVID-19.
- 6 Which coronavirus has the highest mortality, what is the figure, and is there a vaccine?
- 7 Give the 80/20 split in COVID-19, and three findings that are fairly distinctive to it.
- 8 List the steps of your Severe Febrile Respiratory Illness protocol — patient, provider, and scene.
- 9 What is the non-clinical management instruction for the lung cancer patient?
- 10 Name the four causes of toxic inhalation. Why does steam injure more deeply than hot dry air?
- 11 Which finding in inhalation injury is described as ominous, and why does the timing of your decision matter?
- 12 What is carbon monoxide's affinity for hemoglobin relative to oxygen, and what does that produce?
- 13 Why should you not wait for cherry red skin — and what is the useful scene clue instead?
- 14 What SpCO is normal for a non-smoker, and what range may be normal for a smoker? Why the difference?
- 15 Name four risk factors for pulmonary embolism, and three sources other than blood clots.
- 16 Which examination finding indicates a MASSIVE pulmonary embolism?
- 17 What does the chapter say honestly about breath sounds in spontaneous pneumothorax — and what can your own treatment cause?
- 18 Give the treatment for hyperventilation syndrome, what is discouraged, and four serious conditions that mimic it.
- 19 Which two CNS conditions are actual causes of respiratory emergencies?
- 20 Name four diseases of cord, nerve or muscle that impair respiration. What is the management?

Twenty questions closing 145 minutes. Answer them before the session and again after — that gap is the measure of the whole chapter.