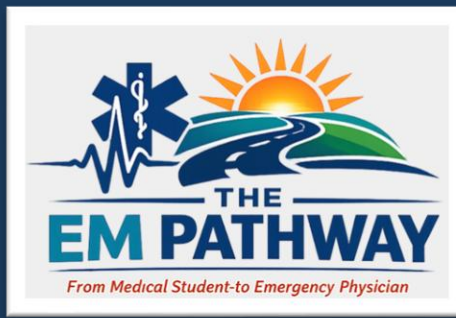




Emergency Medicine Bootcamp for MS4

2-Day Intensive

Differential Diagnosis • Management-Driven Thinking • Case-Based Learning

From Medical Student to Emergency Physician

OPENING CASE

You are working in the emergency department when a 46-year-old male arrives with epigastric pain.

Vital signs: HR 87 | RR 16 | BP 168/90 | T 98.3°F | O₂Sat 96%

He describes the symptoms as sharp.

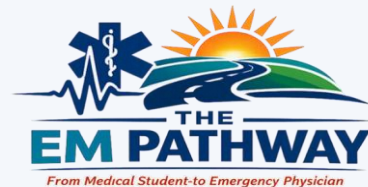
What's running through your mind?

Building a Differential Diagnosis

When faced with epigastric pain, consider both common AND life-threatening conditions:

- Common causes
- Serious / life-threatening causes (red flags — when to suspect them)

“Think out loud — what are your top 3 differentials?”



Refining the Differential: Key History & Exam

History Pearls:

- What to ask
- Red flag symptoms

Physical Exam Findings:

- What to look for on exam

Diagnostic Tests:

- Labs, imaging, decision rules (Wells Score, HEART Score)



The EM Approach to Undifferentiated Patients

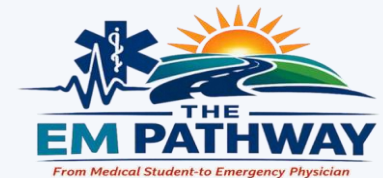
1 Sick vs Not Sick

2 ABCs First

3 Worst-First Differential

4 Frequent Reassessment

5 Disposition Thinking Early

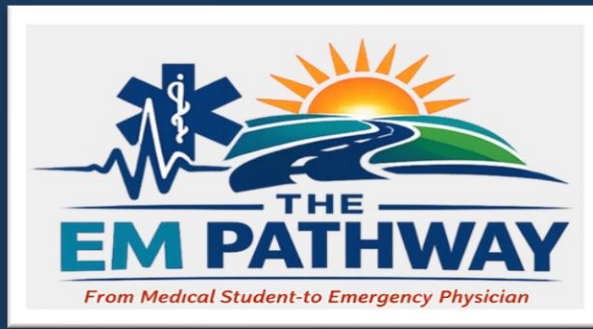


The 4 Critical Questions

For every undifferentiated patient, ask:

- What could KILL them?
- What do you do in the first 5 minutes?
- What test CONFIRMS the diagnosis?
- What would happen if you MISSED it?





ECG Interpretation

Systematic Approach for Emergency Medicine

ECG Case Introduction

Case 1 — Normal ECG

- 22-year-old healthy male, routine physical
- ECG performed — waves and lines that seem confusing
- How do you approach this systematically?

Case 2 — Abnormal ECG

- 55-year-old male with chest pain
- ECG shows ST elevation in leads II, III, and aVF
- What does this mean? What do you do?



ECG Basics: What Is It & Why Does It Matter?

Electrical Waveforms

- P wave: Atrial depolarization
- QRS complex: Ventricular depolarization
- T wave: Ventricular repolarization

The ECG Paper

- Small box = 0.04 sec
- Large box = 0.2 sec
- Standard paper speed = 25 mm/sec



Step-by-Step ECG Interpretation

1. Heart Rate:

- 300 → 150 → 100 → 75 → 60 → 50 rule (large boxes between R waves)
- Alternate: Count QRS in 6 sec × 10

2. Rhythm:

- Regular or irregular? P waves present? P before every QRS?

3. Axis:

- Normal: Lead I & aVF both positive | LAD: I+, aVF- | RAD: I-, aVF+

4. Intervals:

- PR (0.12–0.20s) • QRS (<0.12s) • QTc (<450ms men, <460ms women)



Common Normal vs. Abnormal ECG Findings

Normal Sinus Rhythm:

- Regular rhythm, HR 60–100, every P followed by a QRS

Bradycardia & Tachycardia:

- Sinus bradycardia: HR <60 | Sinus tachycardia: HR >100

Atrial Fibrillation:

- Irregularly irregular rhythm, no distinct P waves

STEMI:

- ST elevation in contiguous leads — act immediately



ECG Interpretation — Key Takeaways



- ✓ Systematic approach: Rate → Rhythm → Axis → Intervals → ST-T changes
- ✓ Normal ECGs have P, QRS, and T waves that follow predictable patterns
- ✓ Life-threatening signs: ST elevations, irregular rhythms, wide QRS
- ✓ Practice makes perfect — the more ECGs you read, the better you get

ECG Systematic Interpretation (Always Same Order)

1 Rate (300-150-100 rule)

2 Rhythm (P before every QRS?)

3 PR Interval

4 QRS Width

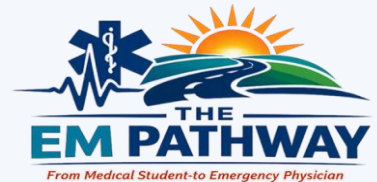
5 QTc

6 Axis

7 ST-T Changes

Common Presentations Requiring ECG

- Chest pain
- Syncope
- Palpitations
- Dyspnea
- Altered mental status



⚠ Can't-Miss ECG Diagnoses

- STEMI — ST elevation in contiguous leads
- Complete Heart Block — dissociated P waves and QRS
- Ventricular Tachycardia — wide complex, regular, fast
- Hyperkalemia — peaked Ts → wide QRS → sine wave
- WPW — delta waves, short PR, wide QRS
- Long QT — risk for Torsades de Pointes

Initial Management Framework

Is the patient UNSTABLE?

- Yes → Follow ACLS immediately

STEMI:

- Activate the cath lab NOW — time is myocardium

VT (Unstable):

- Immediate synchronized cardioversion

Bradycardia (Unstable):

- Atropine → transcutaneous pacing

Hyperkalemia:

- Calcium first to stabilize the membrane

TEACHING PEARL

“Treat the patient, not just the tracing.”



ECG CASE 1



Patient: 65-year-old male with chest pain

ECG Findings:

- ST elevation in leads II, III, and aVF
- Reciprocal changes in anterior leads

What is the diagnosis? What do you do next?

65M with inferior ST elevation. Next best step?

A Repeat ECG in 30 minutes

B Start heparin only

C Activate the cath lab

D Discharge with follow-up

STEMI Recognition & Pitfalls

Classic Criteria:

- ST elevation in 2+ contiguous leads

Reciprocal Changes:

- Mirror image depression in opposite leads — helps confirm

Posterior MI:

- ST depression V1-V3 + tall R waves — do posterior leads

RV Infarct:

- Inferior STEMI + right-sided leads (V4R) — avoid nitrates!

LBBB Equivalents:

- Sgarbossa criteria in the setting of LBBS



Wide Complex Tachycardia

Rule #1: Assume VT until proven otherwise

- Unstable patient → synchronized cardioversion
- Stable patient → amiodarone

Critical Pearls:

- Avoid adenosine if rhythm is irregular (may be pre-excited AF)
- VT is the most common wide complex tach in adults
- If in doubt — treat as VT

ECG CASE — Wide Complex Tachycardia



Patient: Adult, HR 180 bpm, hypotensive, altered mental status

ECG Findings:

- Wide QRS complex
- Regular rhythm
- Hemodynamically unstable

What is the most important next step?

**Patient is hemodynamically unstable with wide complex tachycardia.
Next step?**

A

Amiodarone IV

B

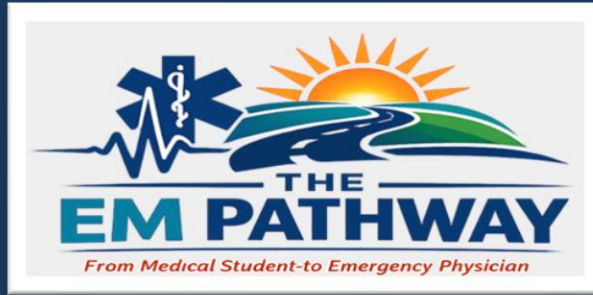
Adenosine IV push

C

Synchronized cardioversion

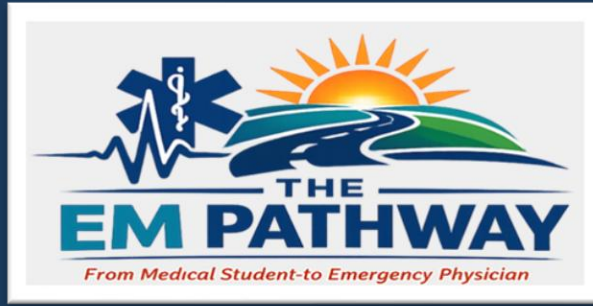
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Observe and monitor



15 Rapid ECGs

Interpret each tracing using your systematic approach



Chest Pain

Differentiating the Life-Threatening from the Benign

CHEST PAIN CASE



55-year-old male with chest pain for 1 hour

"Crushing" sensation radiating to left arm
Diaphoretic and nauseated

Vitals: HR 98 | BP 145/90 | RR 18 | SpO₂ 98% | Temp 98.6°F

What's your initial thought process?

Chest Pain — The EM Approach

Key principle:

- Chest pain is broad and potentially dangerous
- Musculoskeletal causes are common, but life-threatening conditions **MUST** be ruled out first

The **big 3** you cannot miss:

- Acute Coronary Syndrome (ACS)
- Aortic Dissection
- Pulmonary Embolism (PE)



Chest Pain — Differential by Category

Cardiac / Vascular

- ACS: STEMI, NSTEMI, Unstable Angina
- Pericarditis, Myocarditis
- Aortic Dissection

Pulmonary / Other

- Pulmonary Embolism, Pneumothorax
- Pneumonia, GERD
- Esophageal Spasm, Costochondritis



CLINICAL REASONING



If you had to pick the top 3 diagnoses to consider IMMEDIATELY for this patient, what would they be?

Discuss with your group — and explain WHY each one is on your list.

⚠ Chest Pain — Red Flags by Diagnosis

ACS:

- Crushing pain, diaphoresis, radiation to jaw or arm

Aortic Dissection:

- Tearing/ripping pain, unequal pulses, history of hypertension

Pulmonary Embolism:

- Pleuritic pain, dyspnea, recent immobilization or travel

Chest Pain Framework

1 The 5 Killers

2 Risk Stratification

3 HEART Score Application

4 Troponin Interpretation

5 When NOT to CT



Chest Pain — Clinical Features & Workup

Key History Questions:

- When did it start? Constant or intermittent? Better or worse with anything?
- History of heart disease, smoking, diabetes, hypertension?

Physical Exam:

- Listen for murmurs, check pulses, assess for heart failure signs

Diagnostics:

- ECG: ST elevations, T-wave inversions, Q waves
- Troponin levels (serial if initial negative)
- CXR: Rule out pneumothorax, pneumonia, widened mediastinum
- D-dimer & CT-PA if PE suspected

Chest Pain Management in the ED

STEMI:

- Time is myocardium! Aspirin, nitroglycerin (if BP allows), heparin, activate PCI

NSTEMI / Unstable Angina:

- HEART Score → aspirin, nitrates, anticoagulation, cardiology consult

Aortic Dissection:

- BP control (beta-blockers + nicardipine), CT angiogram, CT surgery consult STAT

Pulmonary Embolism:

- Wells criteria → CT-PA → anticoagulation; massive PE → thrombolysis

Chest Pain — Clinical Pearls

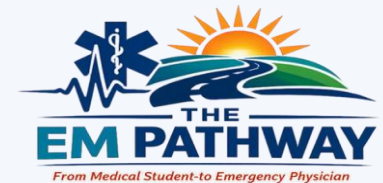


- ✓ Not all chest pain is a heart attack — but always rule out life-threatening causes first
- ✓ ACS requires urgent workup: ECG + serial troponins
- ✓ Always consider PE, aortic dissection, and tension PTX
- ✓ HEART Score stratifies low, intermediate, and high-risk ACS patients

Chest Pain — The 5 Killers

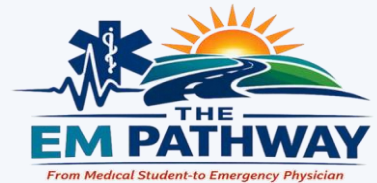
These five diagnoses can kill before you leave the room:

- 1. Acute Coronary Syndrome (ACS / STEMI)
- 2. Aortic Dissection
- 3. Pulmonary Embolism (PE)
- 4. Tension Pneumothorax
- 5. Esophageal Rupture (Boerhaave syndrome)



Chest Pain — Associated Presentations

- Chest pain
- Dyspnea
- Syncope
- Palpitations
- Shock



CHEST PAIN CASE



Tearing chest pain radiating to the back

Unequal blood pressures in the arms

What is your top diagnosis? What do you do first?

For this patient with tearing chest pain radiating to back — most important FIRST test?

A Troponin

B ECG

C CT Angiography of the Chest

D D-dimer

Aortic Dissection

Classic Presentation:

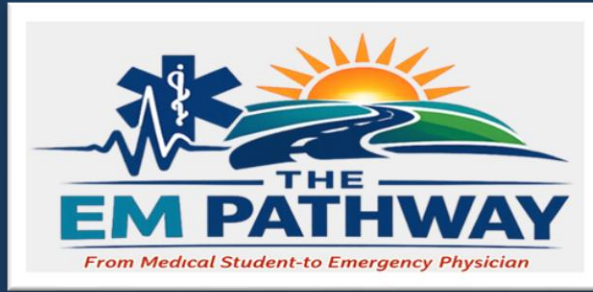
- Tearing or ripping pain radiating to back
- Pulse deficits, unequal BP between arms

Management Sequence:

- BP control FIRST (target SBP <120) — beta-blockers + nicardipine
- CTA chest/abdomen for confirmation
- Vascular/CT surgery consult EARLY — don't delay

⚠ Can't-Miss Chest Pain Diagnoses

- Inferior STEMI with RV infarct — AVOID nitrates (will crash BP)
- Aortic dissection with pulse deficit — NO thrombolytics
- Tamponade — Beck's triad (hypotension, JVD, muffled heart sounds) → pericardiocentesis



Dyspnea

Oxygenation First, Diagnosis Second

DYSPNEA CASE



68-year-old female, increasing shortness of breath × 3 days

History: hypertension, heart failure

Tachypneic, speaking in short sentences

O₂ Sat 89% on room air

What's your initial differential?

Dyspnea — Differential Diagnosis

Pulmonary / Cardiac

- PE
- Pneumonia
- Pneumothorax
- COPD/Asthma exacerbation
- Pulmonary edema (CHF)
- Tamponade

Metabolic / Neuromuscular

- DKA
- Severe anemia
- Guillain-Barré syndrome
- Myasthenia Gravis
- Sepsis

⚠️ Dyspnea — Red Flags

- Sudden dyspnea + pleuritic chest pain → Think PE or pneumothorax
- Orthopnea, pink frothy sputum → Think pulmonary edema (CHF)
- Wheezing + prolonged expiratory phase → Think asthma/COPD exacerbation
- Weakness + hypoventilation → Think neuromuscular disease (GBS, MG)

Dyspnea — Clinical Features & Workup

Key History Questions:

- Sudden or progressive? Chest pain, fever, recent travel, or lung disease history?

Physical Exam Clues:

- Rales + JVD → CHF | Wheezing → Asthma/COPD | Unilateral BS → PTX | Tachy + hypoxia → PE

Diagnostics:

- CXR: CHF, pneumonia, pneumothorax
- ECG: Ischemia, PE (S1Q3T3), arrhythmias
- BNP: Elevated in CHF | ABG: Acidosis vs alkalosis
- D-dimer / CT-PA if PE suspected

Dyspnea — Management

Oxygenation FIRST:

- Nasal cannula → non-rebreather → BiPAP → intubation (escalate as needed)

Specific Treatment:

- CHF/Pulmonary edema: Diuretics (furosemide), nitroglycerin, BiPAP
- COPD/Asthma: Albuterol, ipratropium, steroids, BiPAP
- PE: Anticoagulation (heparin); massive PE → thrombolytics
- Pneumonia: IV antibiotics + supportive care
- Pneumothorax: Needle decompression (unstable) or chest tube

Dyspnea — Clinical Pearls



- ✓ Dyspnea can be cardiac, pulmonary, metabolic, or neuromuscular — rule out life threats first
- ✓ PE and pneumothorax often present suddenly; CHF and pneumonia develop more gradually
- ✓ CXR, ECG, BNP, and ABG are key initial tests; CT-PA for PE workup
- ✓ Oxygenation first, then diagnose and treat the underlying cause

Dyspnea Algorithm

1 Airway Protection

2 Oxygen Escalation Ladder

3 Lung Ultrasound

4 BNP Interpretation

5 PE Risk Stratification

Dyspnea — Presentations

- Dyspnea at rest or exertion
- Hypoxia (O_2 Sat <94%)
- Tachypnea (RR >20)
- Pleuritic chest pain



Dyspnea Framework

Approach:

- Airway first, then oxygen escalation
- Differentiate CHF vs Asthma vs PE vs PTX using history + exam

Key Tool:

- Bedside lung ultrasound (POCUS) — B-lines = CHF, absent sliding = PTX

Dyspnea — Differential for Acute Onset

- Asthma / COPD exacerbation
- Pulmonary Embolism (PE)
- Pneumonia
- CHF / Pulmonary Edema
- Pneumothorax
- ARDS



Differentiating Acute Dyspnea

Absent breath sounds + hypotension =

- Tension Pneumothorax until proven otherwise

Treatment:

- Needle decompression IMMEDIATELY (2nd ICS MCL) — don't wait for imaging



Absent breath sounds + hypotension on one side. Next step?

A CT scan of chest

B Needle decompression

C Nebulizer treatment

D IV antibiotics

Pulmonary Embolism — Management

Risk Stratification:

- Wells criteria → D-dimer (low/mod risk) or CT-PA (high risk)

Anticoagulation:

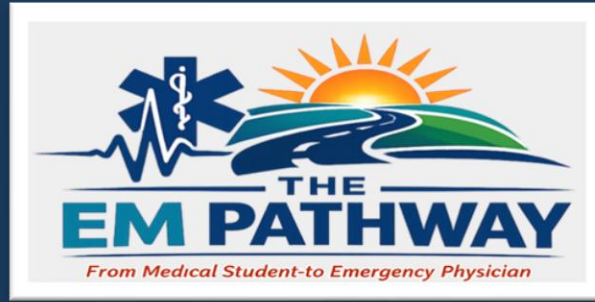
- Heparin or LMWH if no contraindications

Massive PE (obstructive shock):

- Systemic thrombolytics (tPA 100mg over 2h) or catheter-directed therapy

Sub-massive PE:

- Monitor closely; consider thrombolytics if deteriorating



Shock & Resuscitation

Identify the Type, Treat the Cause

Shock Physiology

Hypovolemic:

- Volume loss — hemorrhage, dehydration, burns

Cardiogenic:

- Pump failure — MI, CHF, cardiomyopathy

Distributive:

- Vasodilation — sepsis (most common), anaphylaxis, neurogenic

Obstructive:

- Outflow obstruction — PE, tamponade, tension PTX

Mixed:

- Multiple mechanisms simultaneously (e.g., septic + cardiogenic)

Resuscitation Pearls

- Early vasopressors if not responding to fluids — don't wait for fluid overload
- Balanced transfusion (1:1:1) in hemorrhagic shock
- TXA within 3 hours of trauma bleeding
- Ultrasound-guided resuscitation (POCUS) — guide your interventions
- Avoid over-resuscitation — fluids are not benign

SHOCK CASE



Septic patient remains hypotensive after 2L of IV fluids

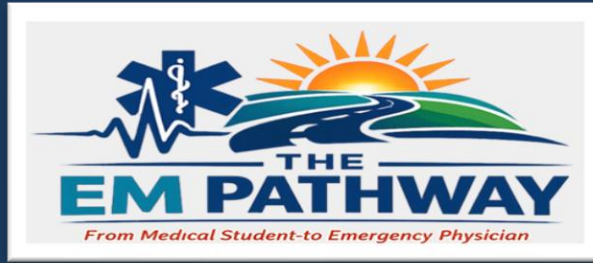
MAP 55 mmHg, HR 118, altered mental status

What is your next step in management?

TEACHING PEARL

“Fluids are not benign.”





Abdominal Pain

Location-Based Approach to Life-Threatening Causes

CASE 1

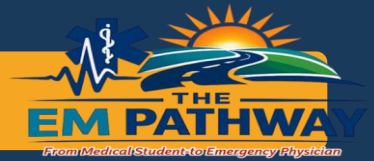


32-year-old male with severe RLQ pain
Started periumbilical 12h ago, now migrated
Nausea, no appetite

Vitals: HR 110 | BP 130/80 | RR 18 | Temp 100.5°F

What is your differential?

CASE 2



45-year-old male with sudden-onset severe abdominal pain
Describes it as 'ripping' radiating to his back

BP 90/60 | Pale and diaphoretic

What are you thinking? What do you do in the next 60 seconds?

Abdominal Pain — Differential by Location

RUQ / RLQ

- Cholecystitis (RUQ)
- Hepatitis (RUQ)
- Appendicitis (RLQ) — most common surgical emergency
- Ovarian torsion (RLQ)
- Ectopic pregnancy (RLQ)

LUQ / LLQ / Epigastric

- Splenic infarction (LUQ)
- Diverticulitis (LLQ)
- Acute pancreatitis (Epigastric)
- Peptic ulcer disease / GERD
- MI presenting as abdominal pain!

Abdominal Pain — Diffuse & High-Risk Causes

Diffuse / High-Risk:

- Peritonitis: Rebound tenderness, rigid abdomen → perforated viscus
- Mesenteric ischemia: Pain OUT OF PROPORTION to exam, AFib hx
- DKA: Can present with abdominal pain

Retroperitoneal:

- Ruptured AAA: Sudden back/flank pain, hypotension, pulsatile mass
- Pyelonephritis: Flank pain, fever, CVA tenderness

Surgical Emergencies — Must Not Miss (Part 1)

Appendicitis:

- Periumbilical pain migrating to RLQ, nausea, fever, elevated WBC

Cholecystitis:

- RUQ pain, postprandial, positive Murphy's sign

Bowel Obstruction:

- Crampy pain, distension, vomiting, no bowel movements — CT confirms



Surgical Emergencies — Must Not Miss (Part 2)

Perforated Peptic Ulcer:

- Sudden severe epigastric pain, rigid abdomen, free air on X-ray

Ruptured AAA:

- Sudden flank/back pain, hypotension, pulsatile abdominal mass

Ischemic Bowel:

- Severe pain out of proportion to exam, history of AFib or atherosclerosis

Non-Surgical but Serious Causes

Pancreatitis:

- Epigastric pain radiating to back, nausea, elevated lipase

Pyelonephritis:

- Flank pain, fever, dysuria, CVA tenderness

Gastroenteritis:

- Diffuse pain, diarrhea, viral prodrome (diagnosis of exclusion in ED)



Gynecologic Causes — Never Miss These

Ectopic Pregnancy:

- RLQ or LLQ pain, positive pregnancy test, hemodynamic instability
- Treatment: Methotrexate vs emergent surgery

Ovarian Torsion:

- Sudden severe pelvic pain, nausea, absent Doppler flow on ultrasound
- Treatment: Emergent surgical detorsion

⚠ Abdominal Pain — Red Flags

- Peritonitis: Rebound tenderness, guarding → perforated viscus until proven otherwise
- Severe sudden onset pain → AAA rupture, torsion
- Pain OUT of proportion to exam → Mesenteric ischemia
- Hypotension + back pain → AAA rupture
- Hypotension + positive pregnancy test → Ectopic pregnancy

Abdominal Pain — Clinical Workup (Part 1)

Key Questions:

- When did the pain start and how has it changed? Fever, nausea, vomiting, bowel changes?
- For all females of childbearing age: Could you be pregnant?

Physical Exam:

- RLQ tenderness: Appendicitis, ectopic, torsion
- RUQ + Murphy's sign: Cholecystitis
- Diffuse guarding/rebound: Peritonitis
- Hypotension + pulsatile mass: AAA rupture

Abdominal Pain — Clinical Workup (Part 2)

Special Signs:

- Murphy's sign → Cholecystitis | McBurney's point → Appendicitis
- Rovsing's sign → Appendicitis | Rebound/guarding → Peritonitis

Labs:

- CBC (WBC) | CMP (LFTs, BMP) | Lipase | Lactate | β -hCG (ALL females!)

Imaging:

- Ultrasound: First-line for gallbladder, OB/GYN causes, AAA
- CT A/P with contrast: Appendicitis, diverticulitis, ischemia, perforation

Abdominal Pain — Management

General:

- IV fluids, pain control (opioids are okay!), antiemetics

Specific:

- Appendicitis: NPO, IV antibiotics, surgery consult
- Cholecystitis: IV antibiotics, surgery referral
- Pancreatitis: Fluids, pain control (NO antibiotics unless necrotizing)
- Ectopic pregnancy: Methotrexate vs emergent surgery
- Ruptured AAA: Immediate surgery — don't delay

Abdominal Pain — Clinical Pearls



- ✓ Localizing the pain is key — use location to narrow the differential
- ✓ Ruptured AAA, mesenteric ischemia, ectopic pregnancy can all kill rapidly
- ✓ Always check a β -hCG in any female of childbearing age with abdominal pain
- ✓ Ultrasound first-line for biliary and GYN; CT best for most other causes
- ✓ Don't delay surgical consult when you suspect a surgical emergency

Abdominal Pain Framework

1 Location-Based DDx

2 Onset (sudden vs gradual)

3 Peritoneal Signs?

4 Pregnancy Test

5 Hemodynamic Status

6 Early Surgical Consult

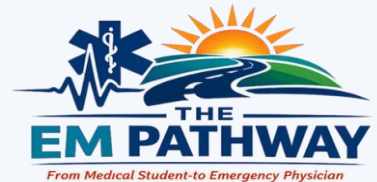


Abdominal Pain — Framework (Detailed)

- Location-based differential diagnosis
- Onset: sudden vs. gradual
- Peritoneal signs present?
- Pregnancy test (all females of childbearing age)
- Hemodynamic stability
- Early surgical consult if concerned

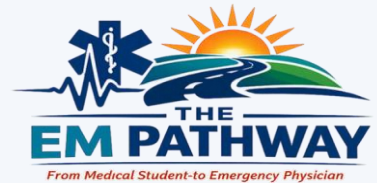
GI Emergencies

- Appendicitis
- Small bowel obstruction (SBO)
- GI bleed (upper vs lower)
- Pancreatitis
- Mesenteric ischemia



GI & GU Presentations

- Abdominal pain
- Vaginal bleeding
- Flank pain
- Vomiting
- Testicular pain



Female with abdominal pain. What is the most important FIRST test?

A CT abdomen/pelvis

B Pregnancy test (β -hCG)

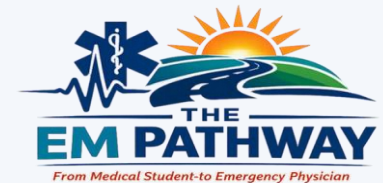
C MRI pelvis

D Colonoscopy

Can't-Miss Abdominal Diagnoses

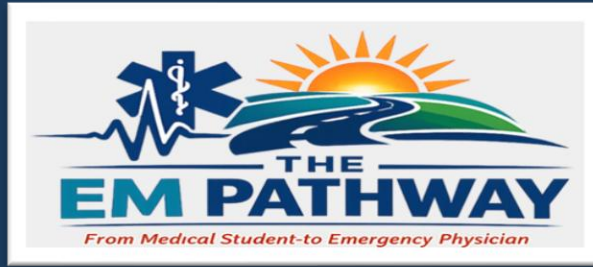
Never miss these:

- Ruptured AAA — BP + pulsatile mass = OR now
- Appendicitis — serial exams, CT confirmation
- Small bowel obstruction — high-pitched BS, distension
- Mesenteric ischemia — pain out of proportion to exam



GU & OB Emergencies

- Ectopic pregnancy — β -hCG + ultrasound
- Ovarian torsion — sudden pain, absent Doppler flow
- Testicular torsion — manual detorsion + emergent urology
- PID — Chandelier sign, discharge, fever
- Postpartum complications — bleeding, sepsis



Syncope & Altered Mental Status

Cardiac Until Proven Otherwise

SYNCOPE CASE



67-year-old male, collapsed while shopping
Out for ~20 seconds, woke confused, no seizure-like movements

Vitals: BP 88/60 | HR 40 | RR 18 | SpO₂ 99%

What's running through your mind?

Syncope — Differential Diagnosis

High-Risk (Cardiac)

- Arrhythmias (brady, tachy, AV block)
- Structural heart disease (Aortic stenosis, HOCM)
- Pulmonary embolism

Lower-Risk Causes

- Vasovagal (common, preceded by nausea/warmth)
- Orthostatic hypotension (dehydration, meds)
- Seizure (NOT true syncope)
- Metabolic: Hypoglycemia, electrolytes



⚠ Syncope — High-Risk Red Flags

- Syncope during exertion → Think cardiac (HOCM, aortic stenosis, arrhythmia)
- No prodrome before collapse → Suggests cardiac etiology
- Family history of sudden cardiac death → Consider Long QT, Brugada
- Age >60 + structural heart disease → High risk regardless of cause

Syncope — Clinical Workup

History is Key!

- What was patient doing? (Exertion = cardiac)
- Any warning signs? (Vasovagal = prodrome; Cardiac = sudden collapse)
- Witnessed? (Seizure-like vs. simple loss of tone)
- Postictal period? (Seizures = confusion; Syncope = quick recovery)

Physical Exam:

- Orthostatic vitals | Carotid sinus massage (caution in elderly) | Cardiac murmur?

Diagnostics:

- ECG (FIRST step!), troponins, echo if structural suspected

Syncope — Management

High-Risk (Cardiac) Syncope:

- Arrhythmias: Admit for telemetry, consider pacemaker for bradycardia
- HOCM/Aortic Stenosis: No exertion! Cardiology consult
- PE: Anticoagulation + admission

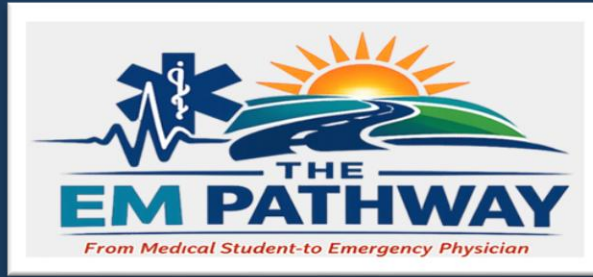
Benign Causes:

- Vasovagal: Reassurance, hydration, avoid triggers
- Orthostatic: IV fluids, medication adjustment

Syncope — Clinical Pearls



- ✓ Syncope = transient loss of consciousness with quick recovery — always rule out cardiac
- ✓ No prodrome or exertional syncope = HIGH RISK (arrhythmias, HOCM, PE)
- ✓ ECG is the FIRST step — but history provides the most diagnostic value
- ✓ Vasovagal is common and benign; orthostatic may indicate an underlying issue



Seizures

Stop the Seizure, Find the Cause

SEIZURE CASE



25-year-old male, witnessed seizure at home
Convulsed ~1 minute, then confused (postictal)
History of epilepsy — ran out of medications

Vitals: BP 132/80 | HR 92 | Temp 98.6°F | O₂ 98%

What is your approach?

Seizure — Differential Diagnosis

Neurologic Causes

- Epilepsy (breakthrough seizure)
- New-onset seizure disorder
- Stroke/TIA
- CNS infection (meningitis, encephalitis)
- Brain tumors / mass lesions

Systemic Causes

- Hypoglycemia (always check first!)
- Hyponatremia or hypocalcemia
- Alcohol or benzo withdrawal
- Cocaine, tramadol, isoniazid
- Eclampsia (pregnancy)

⚠ Seizure — Red Flags

- First-time seizure in an adult → Always rule out structural brain disease (tumor, stroke)
- Seizure lasting >5 minutes (Status Epilepticus) → MEDICAL EMERGENCY
- Persistent altered mental status after seizure → Prolonged postictal, ongoing seizure, or metabolic cause
- New focal neurologic deficits → Todd's paralysis vs stroke

Seizure — Clinical Workup

Key History:

- Aura before event? Postictal state? History of epilepsy or meds?
- Recent illness, fever, trauma, new medications?

Physical Exam Clues:

- Tongue biting, incontinence → True seizure
- Postictal confusion → Common in generalized seizures
- Focal deficits → Stroke, tumor, or Todd's paralysis

Diagnostics:

- Fingerstick glucose (ALWAYS first!), electrolytes, tox screen, Head CT

Seizure Management

Actively Seizing — Immediate Steps:

- Protect airway — lateral decubitus position
- IV Lorazepam 4mg or IM Midazolam — first-line benzos

Second-Line (Ongoing Seizures):

- IV Fosphenytoin, Valproic Acid, or Levetiracetam (Keppra)

Status Epilepticus (>5 min or recurrent without recovery):

- Benzos + second-line AEDs; if still seizing → intubation + propofol/midazolam drip

Seizure Management — Treating Underlying Causes

- Hypoglycemia → IV Dextrose (D50 push)
- Electrolyte abnormalities → Correct Na, Ca, Mg
- Infections → Empiric antibiotics if meningitis suspected
- Withdrawal seizures → Benzodiazepines

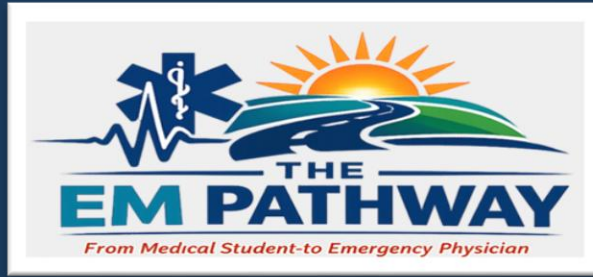
Disposition:

- First-time seizure: Admit for monitoring & neuro workup
- Known epilepsy + breakthrough: Restart meds, discharge if stable
- Status epilepticus: ICU admission

Seizures — Clinical Pearls



- ✓ Not all seizure-like events are true seizures — consider syncope, metabolic, intoxication
- ✓ First-time seizures in adults ALWAYS need structural/metabolic workup
- ✓ Benzodiazepines are first-line; escalate to second-line if refractory
- ✓ Status epilepticus is a medical emergency — treat early and aggressively



Neurologic Emergencies

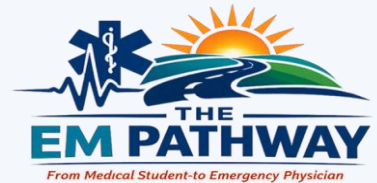
Time-Sensitive Diagnoses

Neurologic Emergencies

- Stroke (ischemic vs hemorrhagic)
- Subarachnoid hemorrhage (SAH)
- Status epilepticus
- Meningitis / encephalitis
- Increased intracranial pressure (ICP)

Neurologic Presentations

- Headache
- Seizure
- Focal weakness
- Altered mental status (AMS)
- Syncope



Neurologic Emergency Approach

1 Check Glucose First

2 Stroke Scale (NIHSS)

3 CT Head Non-Contrast

4 LP if Needed (SAH, Meningitis)

5 BP Management

Sudden worst headache of life, CT head is negative. What is the next step?

A Discharge with neurology follow-up

B Lumbar puncture (LP)

C MRI brain next week

D IV steroids

Stroke Management

Time-Sensitive Steps:

- Establish last known well (LKW) time
- tPA eligibility: <4.5h from LKW, no contraindications
- Thrombectomy window: up to 24h in eligible patients

BP Management:

- Ischemic stroke: $\leq 15\%$ reduction if $>185/110$ before tPA
- Hemorrhagic stroke: Target SBP <140

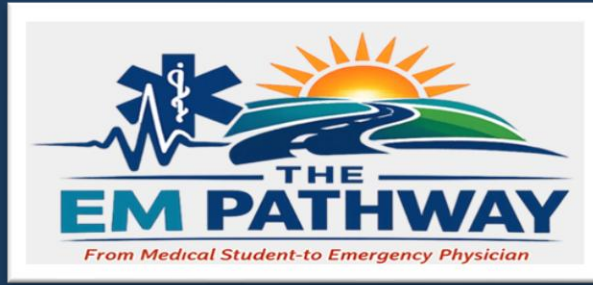
Glucose Control:

- Hyperglycemia worsens outcomes — treat aggressively

Neurologic Management Pearls

- tPA eligibility evaluation — know the absolute contraindications
- BP control in hemorrhage: Target SBP <140
- Benzodiazepines first-line for seizures
- LP for suspected SAH even if CT is negative (xanthochromia)





Endocrine & Metabolic Emergencies

DKA, HHS, Adrenal Crisis, Thyroid Storm

DKA CASE



23-year-old female with Type 1 Diabetes, brought by EMS

Vomiting, weakness, heavy breathing × 12h

Ran out of insulin 2 days ago

Vitals: BP 95/60 | HR 120 | RR 28 | Temp 98.8°F | SpO₂ 98%

What is your initial impression?

DKA — Clinical Features & Workup

Symptoms:

- Polyuria, polydipsia, vomiting, abdominal pain, fruity breath (acetone), Kussmaul respirations

Diagnostics:

- Fingerstick glucose: Typically >250 mg/dL in DKA
- ABG/VBG: pH <7.3, HCO_3^- <18
- Serum ketones (beta-hydroxybutyrate): Present in DKA
- Potassium: Often appears high initially but drops rapidly with insulin
- BUN/Cr: Elevated due to dehydration

DKA vs HHS

DKA (Type 1 DM)

- Absolute insulin deficiency
- Glucose: 250–600 mg/dL
- pH <7.3, HCO_3^- <18
- Significant ketosis
- Kussmaul breathing
- Fruity breath (acetone)

HHS (Type 2 DM)

- Relative insulin deficiency
- Glucose: 600–1000+ mg/dL
- pH >7.3 (no significant acidosis)
- Minimal to no ketosis
- Profound dehydration
- AMS, lethargy, even coma

⚠ DKA / HHS — Red Flags

- Altered mental status → More common in HHS due to profound dehydration
- Severe acidosis (pH <7.0) → Risk of cardiovascular collapse
- Hypokalemia BEFORE insulin → Hold insulin, replace K+ first
- Hypotension + tachycardia → Severe volume depletion

DKA Management — Step by Step

Step 1: IV Fluids (Most Important First!)

- 1–2L NS bolus over first 1–2h; switch to D5-½Ns when glucose <250 mg/dL

Step 2: Potassium Check

- K+ <3.3 → Hold insulin, give IV K+ first! | K+ 3.3–5.0 → Add K+ to fluids

Step 3: Insulin

- IV regular insulin 0.1 U/kg bolus then 0.1 U/kg/hr infusion

Step 4: Monitor

- Glucose, pH, electrolytes q2–4h; DKA resolved when acidosis clears (not just glucose)

DKA — Transitioning to Subcutaneous Insulin

DKA is Resolved When ALL Three Met:

- Glucose <200 mg/dL
- Bicarb >18 mEq/L
- pH >7.3, no anion gap

Transition:

- Overlap IV insulin with subcutaneous insulin by 1–2 hours
- Prevents rebound ketoacidosis

Don't forget:

- Treat the underlying cause (infection, missed insulin, MI, pancreatitis)

DKA / HHS — Clinical Pearls



- ✓ DKA = ketoacidosis + hyperglycemia (Type 1 DM); HHS = severe hyperglycemia + dehydration (Type 2 DM)
- ✓ IV fluids first, then insulin — always monitor potassium
- ✓ If $K^+ < 3.3$: DO NOT give insulin until potassium is replaced
- ✓ DKA resolves when ACIDOSIS clears, not just when glucose normalizes

ADRENAL CRISIS CASE



52-year-old male with Addison's disease
Profound weakness, nausea, vomiting, confusion
Recent GI illness, couldn't take his usual medications

BP 75/45 | HR 110 | RR 22 | Temp 98.1°F

What's your next step?

Adrenal Crisis — Pathophysiology & Causes

Causes:

- Primary adrenal insufficiency (Addison's) — autoimmune destruction
- Chronic steroid use with sudden withdrawal (MOST COMMON in ED)
- Acute stress in patients with adrenal insufficiency (infection, surgery, illness)

Why Cortisol Matters:

- Maintains BP | Regulates glucose | Suppresses immune response
- Without it: vasodilatory shock refractory to fluids

⚠ Adrenal Crisis — Red Flags

- Hypotension refractory to IV fluids → Think adrenal crisis
- History of chronic steroid use + acute illness → Risk for adrenal suppression
- Hyponatremia + hyperkalemia + hypoglycemia → Classic triad of primary adrenal insufficiency
- Hyperpigmentation (Primary AI) → Due to excess ACTH stimulating melanin

Adrenal Crisis Management

Step 1: IV Hydrocortisone IMMEDIATELY

- Hydrocortisone 100 mg IV bolus, then 50 mg IV q6h or 200 mg continuous infusion
- If unavailable: Dexamethasone 4 mg IV (doesn't interfere with cortisol test)

Step 2: IV Fluids for Shock

- Bolus 1–2L NS or D5NS (corrects dehydration and sodium loss)

Step 3: Treat Hypoglycemia

- IV Dextrose (D50) if symptomatic

Step 4: Identify & Treat Underlying Cause

- Infection: IV antibiotics | Steroid withdrawal: Reinstate maintenance steroids

Adrenal Crisis — Clinical Pearls



- ✓ Adrenal crisis is life-threatening cortisol deficiency — always suspect in refractory shock
- ✓ Classic triad: Hypotension + hyponatremia + hyperkalemia + hypoglycemia
- ✓ Immediate treatment: IV hydrocortisone + IV fluids + correct hypoglycemia
- ✓ DON'T WAIT for labs — treat first if adrenal crisis is suspected!

THYROID STORM CASE



Case 1: 42-year-old female, Graves' disease
High fever, tachycardia, confusion, profuse sweating
Stopped antithyroid meds 2 weeks ago
BP 140/90 | HR 140 | Temp 103.1°F

Case 2: 65-year-old male, hypothyroidism
Confusion, bradycardia, hypothermia
Ran out of levothyroxine 2 months ago
BP 90/60 | HR 48 | Temp 94.2°F

Thyroid Emergencies — Differential

Thyroid Storm (Differentials)

- Sepsis / pneumonia
- Pheochromocytoma (excess catecholamines)
- Cocaine toxicity
- Malignant hyperthermia

Myxedema Coma (Differentials)

- Sepsis
- Adrenal insufficiency
- Stroke
- Hypothermia (environmental)

Thyroid Storm vs Myxedema Coma — Features

Thyroid Storm

- Hyperthermia ($>103^{\circ}\text{F}$)
- Tachycardia $\pm$ Afib
- HTN $\rightarrow$ shock
- Agitation, delirium
- Tremors, nausea/vomiting

Myxedema Coma

- Hypothermia ($<95^{\circ}\text{F}$)
- Bradycardia + hypotension
- Respiratory depression
- Lethargy, coma
- Puffy face, dry skin, delayed reflexes

Thyroid Emergencies — Labs

Key Labs for Both:

- TSH, T3, T4:

Thyroid Storm:

- TSH ↓ | T3/T4 ↑

Myxedema Coma:

- TSH ↑ | T3/T4 ↓

Additional:

- CBC + Blood Cultures (rule out infection)
- Cortisol (consider adrenal insufficiency in both)
- ABG (check for respiratory failure in myxedema)

Thyroid Emergencies — Management

Thyroid Storm

- Propranolol (beta-blocker) → HR control
- PTU or Methimazole → blocks synthesis
- Lugol's iodine (1h AFTER thionamides)
- Hydrocortisone 100mg IV
- Cooling + supportive care

Myxedema Coma

- IV Levothyroxine (T4) ± Liothyronine (T3)
- Hydrocortisone 100mg IV
- Passive rewarming (NO aggressive warming)
- IV fluids ± vasopressors
- Ventilatory support if needed

Thyroid Emergencies — Clinical Pearls



- ✓ Thyroid Storm = overactive thyroid → fever, tachycardia, altered mental status
- ✓ Myxedema Coma = hypothyroidism → hypothermia, bradycardia, respiratory depression
- ✓ Thyroid Storm: beta-blockers FIRST, then PTU → then iodine (ALWAYS in that order)
- ✓ Myxedema: IV thyroid hormone + hydrocortisone + passive rewarming
- ✓ Check for adrenal insufficiency in BOTH conditions

Endocrine Emergencies Overview

- DKA / HHS
- Thyroid storm
- Myxedema coma
- Adrenal crisis
- Electrolyte emergencies



Endocrine — Presentations

- Altered mental status
- Weakness
- Polyuria / polydipsia
- Arrhythmia
- Seizures



DKA Management Sequence

1 Fluids First (NS bolus)

2 Check Potassium (before insulin!)

3 Start Insulin (if $K^+ > 3.3$)

4 Monitor Anion Gap

What is the FIRST step in DKA management?

A Insulin infusion

B IV Fluids (NS bolus)

C IV Bicarbonate

D IV Potassium

Electrolyte Disturbances

Hyperkalemia — ECG Changes:

- Peaked T waves → wide QRS → sine wave → PEA arrest

Hyponatremia — Correction:

- Max 8–10 mEq/L per 24h (risk of central pontine myelinolysis)

Hypercalcemia Crisis:

- IV fluids + furosemide + bisphosphonates; consider calcitonin

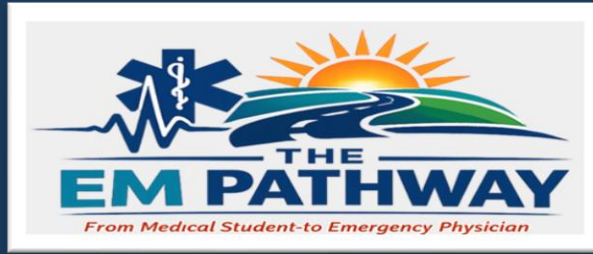
Magnesium Disorders:

- Hypomagnesemia: Associated with refractory Afib and arrhythmias

TEACHING PEARL

“Electrolytes can kill faster than infections.”





Pediatric Emergencies

Children Compensate — Then Crash

PEDIATRIC CASE



2-month-old infant, fever 101.2°F
Parents report poor feeding and irritability

What are the next steps?

Remember: Neonates are immunologically naive — treat aggressively.

Febrile Infant — Differential Diagnosis

Consider:

- Viral infections (most common overall)
- Bacterial sepsis (most dangerous)
- Kawasaki Disease (fever >5 days + 4/5 criteria)
- UTI (very common, often missed)
- Meningitis (LP if indicated)



Febrile Infant — Clinical Workup

Red Flags:

- Poor feeding, lethargy, bulging fontanelle, toxic appearance

Workup:

- CBC, blood cultures, urinalysis + urine culture
- LP (lumbar puncture) for neonates <28 days and selected 28–60 day infants
- CXR if respiratory symptoms



Febrile Infant — Management

Neonates (<28 days): Admit ALL

- IV Ampicillin + Gentamicin or Cefotaxime
- Add Vancomycin if LP done, add Acyclovir if HSV concern
- Consider Dexamethasone for meningitis

28–60 Day Infants:

- Risk stratify using clinical criteria (Rochester, Philly, Step-by-Step)
- Low-risk: May observe if reliable follow-up

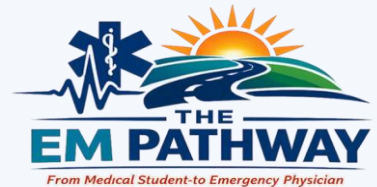
Febrile Infant — Clinical Pearls



- ✓ Neonates with fever = automatic admission & IV antibiotics — no exceptions
- ✓ Red flags: Lethargy, poor feeding, bulging fontanelle, toxic appearance
- ✓ Always get blood cultures, UA/UCx; LP in neonates and selected infants
- ✓ The younger the infant, the more aggressively you must evaluate

Pediatric Emergencies Overview

- Respiratory distress
- Sepsis recognition in children
- Febrile infant approach
- Intussusception
- DKA in teenagers



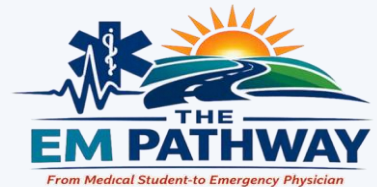
TEACHING PEARL

“Children compensate — then crash.”



Pediatric Presentations

- Fever
- Respiratory distress
- Vomiting / diarrhea
- Trauma
- Seizures



Pediatric Approach

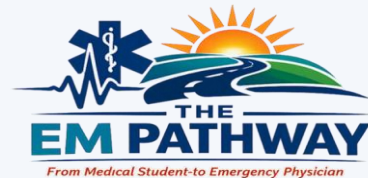
1 Weight-Based Dosing

2 Airway Positioning Critical

3 Assess Hydration

4 Consider Non-Accidental Trauma (NAT)

5 Broselow Tape



Pediatric Can't-Miss Diagnoses

- Sepsis — treat early, broad antibiotics
- Epiglottitis — don't look in the throat! Airway first
- Intussusception — currant jelly stools, intermittent crampy pain
- DKA in teenagers — Kussmaul breathing, fruity breath



⚠ Pediatric Red Flags

- Tachycardia — earliest sign of shock in children (NOT hypotension)
- Poor perfusion — delayed cap refill, mottled skin
- Lethargy or abnormal mental status
- Hypotension — LATE sign of decompensated shock in children

What is the EARLIEST sign of shock in a pediatric patient?

A Hypotension

B Bradycardia

C Tachycardia

D Cyanosis

Pediatric Shock

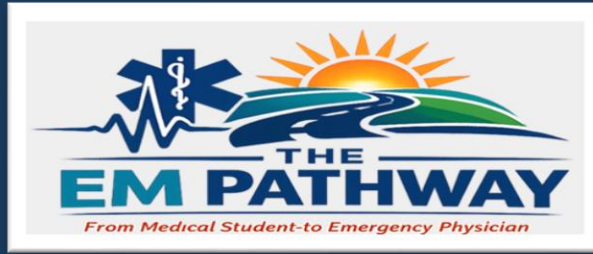
Early Signs

- Tachycardia (FIRST sign)
- Increased capillary refill >2 sec
- Mottled skin / cool extremities
- Anxiety or irritability

Late Signs

- Hypotension (children compensate late)
- Bradycardia (PRE-ARREST)
- Decreased mental status
- Cyanosis, apnea





Trauma

ABCDE — Systematic. Fast. Life-Saving.

TRAUMA CASE 1



32-year-old male, motor vehicle collision
Unresponsive at scene

Vitals: BP 80/40 | HR 130 | RR 30

What is your immediate approach?

TRAUMA CASE 2



25-year-old male, gunshot wound to abdomen
Alert but hypotensive

Vitals: BP 90/60 | HR 115

How does this change your management?

Trauma — Types of Injury

Blunt Trauma

- MVCs (most common)
- Falls
- Assaults
- Hidden injuries — focus on shock

Penetrating Trauma

- Gunshot wounds
- Stab wounds
- Direct injury — surgical intervention often needed



Trauma — Primary Survey (ABCDE)

A — Airway:

- Open? Stridor? Need intubation or surgical airway?

B — Breathing:

- Bilateral breath sounds? Pneumothorax? Tension?

C — Circulation:

- Hemorrhagic shock? FAST exam? Direct pressure on bleeding?

D — Disability:

- GCS score, pupil exam

E — Exposure:

- Full body assessment, logroll, hidden injuries

Trauma Management

Blunt Trauma:

- IV fluids + blood transfusions (1:1:1 in massive hemorrhage)
- FAST exam, CXR, pelvic X-ray in primary survey
- Emergent laparotomy for peritonitis or refractory hemorrhagic shock

Penetrating Trauma:

- Direct pressure for bleeding control
- Abdominal GSWs: Surgery consult IMMEDIATELY
- Do not remove impaled objects in the field

Trauma — Clinical Pearls



- ✓ Blunt trauma: Hidden injuries — FAST exam + CT to find them
- ✓ Penetrating trauma: Direct injury — surgical intervention often required
- ✓ ABCDE approach ensures no life-threatening injuries are missed
- ✓ Massive transfusion protocol (1:1:1) for hemorrhagic shock — activate early

Trauma Advanced Concepts

- ATLS primary/secondary survey
- Massive transfusion protocol (MTP)
- Pelvic stabilization (pelvic binder)
- Head injury management (ICP monitoring)
- Cervical spine clearance (NEXUS / Canadian C-Spine)



Trauma — Primary Survey

- Airway (with C-spine protection)
- Breathing (bilateral breath sounds)
- Circulation (hemorrhage control)
- Disability (GCS, pupils)
- Exposure (full undress, temperature control)



Trauma — FAST Exam

Focused Assessment with Sonography for Trauma:

- Pericardial view — tamponade?
- RUQ (Morison's pouch) — hepatorenal free fluid?
- LUQ (Splenoarenal space) — splenic injury?
- Pelvis (retrovesical/rectouterine) — pelvic free fluid?

Extended FAST (E-FAST):

- Add bilateral thoracic views for pneumothorax and hemothorax

⚠ Trauma — Can't-Miss Diagnoses

- Tension pneumothorax — tracheal deviation, absent BS, hypotension → needle decompression
- Hemorrhagic shock — activate MTP, control bleeding source
- Pelvic fracture with active bleed — pelvic binder + IR/OR
- Subdural hematoma — lucid interval then deterioration

Trauma Management (Advanced)

- Massive transfusion protocol: 1:1:1 (pRBC:FFP:Platelets)
- TXA within 3 hours of injury for hemorrhagic shock
- FAST exam to guide resuscitation decisions
- Early trauma surgery involvement — don't wait to consult



Pelvic fracture + hypotension. Immediate next step?

A

CT scan to evaluate fracture

B

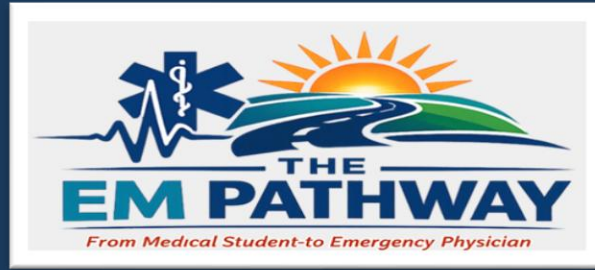
Apply pelvic binder

C

Observe for spontaneous improvement

D

Discharge with outpatient follow-up



Toxicology

Recognize the Toxidrome, Know the Antidote

Toxicology Advanced Concepts

- Toxidrome recognition
- Opioid epidemic management
- Acetaminophen overdose nomogram
- CO poisoning
- Unknown overdose algorithm



Common Toxidromes

Opioid:

- Miosis, respiratory depression, altered mental status

Anticholinergic:

- Dry as bone, blind as bat, red as beet, hot as hare, mad as hatter

Cholinergic (SLUDGE):

- Salivation, Lacrimation, Urination, Defecation, GI upset, Emesis

Sympathomimetic:

- Tachycardia, HTN, diaphoresis, mydriasis, hyperthermia

Sedative-Hypnotic:

- CNS depression, respiratory depression, normal pupils

Toxicology — Common Presentations

- Altered mental status (AMS)
- Respiratory depression
- Seizures
- Arrhythmias

Unknown Overdose Algorithm

Approach to the Unknown Overdose:

- Check glucose FIRST
- Assess ABCs — airway is priority
- Identify toxidrome from clinical exam
- Consider empiric naloxone if opioid toxidrome
- Get ECG — QRS widening (TCAs), QTc prolongation
- Toxicology screen (often doesn't change acute management)
- Consult Poison Control: 1-800-222-1222

Antidotes to Know

Naloxone:

- Opioid overdose (titrate to respiratory effect, not consciousness)

N-Acetylcysteine (NAC):

- Acetaminophen toxicity (use Rumack-Matthew nomogram)

Atropine / Pralidoxime:

- Organophosphate / cholinergic toxidrome

Hydroxocobalamin:

- Cyanide poisoning / CO poisoning



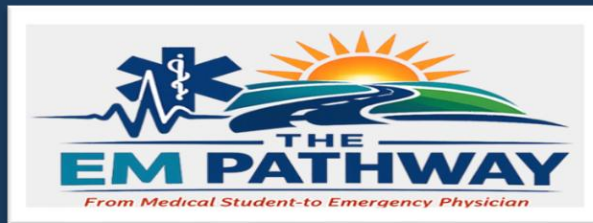
Patient with pinpoint pupils and respiratory depression. What is the antidote?

A N-Acetylcysteine (NAC)

B Atropine

C Naloxone

D Flumazenil



In July, you are not expected to know everything.
You are expected to recognize when someone is sick.
You are expected to act.
You are expected to ask for help early.

The best interns are not the smartest. They are the safest.
They check glucose. They look at the airway. They reassess. They escalate.

Medicine is not about memorizing everything.
It's about protecting the patient in front of you.

"Wherever you match — you will be okay."