Compensation — EMT Quick Reference

How the body defends perfusion, how it fails · 2025 AHA Guidelines for CPR & ECC (Part 7 Adult BLS, Part 10 Special Circumstances) · 2025 ACC/AHA ACS Guideline · EMT/BLS scope

THE MATH BEHIND EVERY COMPENSATION

MAP = cardiac output × systemic vascular resistance · **Cardiac output = heart rate × stroke volume**. Every compensatory mechanism defends **rate**, **stroke volume**, **resistance**, or **volume**. Compensation spends reserve — it is a timer, not a cure.

TYPES OF COMPENSATION

System	What it does
Neural / sympathetic	Baroreceptors sense falling pressure → HR ↑, contractility ↑, arterial **and venous** constriction (venous tone protects preload fastest), bronchodilation, diaphoresis, dilated pupils
Hormonal	Catecholamines; **renin–angiotensin–aldosterone** (angiotensin II constricts, aldosterone holds Na^+/water); ADH; cortisol and glucagon → hyperglycemia without diabetes
Respiratory	Rate → depth → accessory muscles. Most visible, **first to fatigue**
Fluid shift	Transcapillary refill (interstitial → plasma), venous and splenic reservoir. **Borrowing, not replacement**
Renal	Oliguria — a finding of compensation, not a kidney problem
Cellular	Anaerobic metabolism, lactate, Na^+/K^+ pump failure → the boundary where compensation becomes a countdown
Behavioral	Thirst, restlessness, anxiety, sense of impending doom — the brain reporting hypoperfusion before the cuff agrees

COMPENSATION BY ILLNESS

Cause	Pattern & failure point
Hemorrhage / trauma	HR ↑, skin/gut/muscle constricted, **narrowing pulse pressure with systolic held normal through ~30% blood loss**. Watch for the lethal triad: hypothermia, acidosis, coagulopathy
Pneumonia / sepsis	Fever, tachypnea, **warm flushed skin, bounding pulse, wide pulse pressure** (vasodilation). Fails by respiratory fatigue, or the shift from warm to **cold** shock (cool mottled)
Anaphylaxis	Vasodilation + capillary leak + bronchospasm at once — **no time to compensate**. Epinephrine is the treatment, not a compensation aid (IM lateral thigh, 0.3–0.5 mg adult per protocol)
Cardiogenic	Compensation makes it worse: tachycardia ↑ demand, vasoconstriction ↑ afterload on a failing ventricle
Neurogenic	No sympathetic tone → **hypotension with normal or slow HR, warm dry skin**
Obstructive	Tension pneumothorax, tamponade, massive PE — mechanical block; vasoconstriction cannot fix it

EARLY COMPENSATION VS THE END OF COMPENSATION

Early — the body winning	Late — reserve gone
Restless, anxious, fast-talking, thirsty, sometimes combative	Confusion → drowsiness → unresponsive
HR ↑, RR ↑	HR very fast, then **bradycardia** (peri-arrest)
BP normal or slightly high, **pulse pressure narrowing**	**BP falls — the last thing to fall**; pulse pressure converges
Cool, pale, clammy, mottled extremities with warm core	Cold, mottled, cyanotic; cap refill prolonged/absent
Radial weak; cap refill > 2 s	Radial thready → absent while carotid remains
Urine output falling; dizzy on sitting up	Rapid shallow → slow irregular → agonal; arrhythmias → arrest

> **The teaching point:** a compensated patient is not a stable patient. **A normal blood pressure is not a normal patient** — hypotension means you are late.

WHAT THE EMT DOES

- Treat the **cause**, not the number: control external hemorrhage, epinephrine for anaphylaxis, the intervention your protocol allows for a tension pneumothorax.
- Oxygen for saturation **<90%** per the 2025 ACS guideline — not a reflex high-flow mask.
- Assess **trends**: a pressure of 110 that was 140 twenty minutes ago is a hypotensive patient.
- Reassess after every intervention and record the direction of travel.
- Supine for hypotension; sitting/semi-recumbent only for the patient in respiratory distress who cannot lie flat. Keep them warm. **Never elevate the legs for shock — not a valid treatment.**
- Transport early, prenotify, and do not wait for the pressure to fall before acting.

Education, not medical direction. Follow your local protocols and scope of practice. Sources: 2025 American Heart Association Guidelines for CPR and Emergency Cardiovascular Care (Part 7: Adult Basic Life Support; Part 10: Special Circumstances); 2025 ACC/AHA/ACEP/NAEMSP/SCAI Acute Coronary Syndromes Guideline. EMT Tutor · Munden Interactive · emttutor.com