

CLINIVORA MEDICAL CREATIONS



CRITICAL CARE & EMERGENCY MEDICINE

HANDBOOK

A Rapid Clinical Reference to ICU Protocols, Airway, Sepsis & Shock Algorithms, Critical Care Procedures, and Review Tables for Bedside Decision-Making

When critical situations feel complex, you need a clinical framework you can trust.

Andrew B. Auclair

FIRST EDITION

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Critical Care & Emergency Medicine Handbook A Rapid Clinical Reference to ICU Protocols, Airway, Sepsis & Shock Algorithms, Critical Care Procedures, and Review Tables for Bedside Decision-Making

First Edition

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Guideline currency: clinical recommendations in this edition were reviewed against major society guidelines available at the time of writing, including the Surviving Sepsis Campaign 2026 adult guidelines, the 2025 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, the Difficult Airway Society 2025 guidelines, the 2026 AHA/ASA guideline for early management of acute ischemic stroke, Advanced Trauma Life Support 11th edition, the 2025 focused update of the SCCM PADIS guidelines, the 2025 ACC/AHA acute coronary syndromes guideline, and the 2024 international consensus on hyperglycemic crises. Guidelines change; readers should consult the current versions.

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For the nurses, paramedics, physicians, therapists, and pharmacists who keep watch through the night,

and for the patients and families who trust them.

With gratitude to all who dedicate their knowledge, compassion, and courage to saving lives and easing suffering.

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Preface

When a patient is deteriorating, the clinician at the bedside rarely lacks information. Monitors scroll numbers, laboratories return dozens of values, images arrive, and colleagues offer opinions. What is often missing is order: a way to decide which problem matters first, which finding changes the plan, and when the plan itself is wrong. This book was written to supply that order.

When critical situations feel complex, you need a clinical framework you can trust. The frameworks here are built around a small number of questions that recur in every chapter. What can kill this patient first? What must happen before the diagnosis is certain? Which findings should make me change course? Who needs to know, and when? How will I know whether my treatment is working? These questions apply equally to the septic patient in the emergency department, the ventilated patient whose saturation is falling at 03:00, and the trauma patient arriving with a tourniquet already applied.

The book is organized in twelve parts. The first two establish the habits of reasoning, communication, safety, assessment, and monitoring on which everything else depends. The middle parts work through the organ systems and syndromes of emergency medicine and critical care: airway and oxygenation, respiratory failure and ventilation, shock and sepsis, cardiovascular emergencies, neurologic, renal, metabolic, and endocrine emergencies, infection, trauma, bleeding, surgical critical care, and toxicology. Part 10 covers procedures and point-of-care ultrasound. Part 11 turns to the daily work of the ICU and to the patients whose needs differ from the standard adult: pregnant women, older adults, patients with obesity, liver or kidney disease, or cancer, and children. It closes with ethics, palliative care, and recovery after critical illness. Part 12 condenses the book into a bedside rapid reference.

Each clinical chapter follows a recognizable pattern without being forced into a template: orientation to the problem, recognition, immediate threats, first actions, differential diagnosis, diagnostic strategy, management priorities, escalation, monitoring, complications, and reassessment. Tables compress comparisons; algorithms sequence decisions; checklists guard against omissions at moments of transition; and cases show how the pieces fit together in real time.

Recommendations reflect major society guidelines available at the time of writing. The 2026 Surviving Sepsis Campaign guidelines, the 2025 American Heart Association resuscitation guidelines, the 2025 Difficult Airway Society guidance, the 2026 AHA/ASA stroke guideline, the eleventh edition of Advanced Trauma Life Support, the 2025 PADIS focused update, and the 2024 consensus on hyperglycemic crises all appeared within two years of this edition, and each changed bedside practice. Where evidence is uncertain or guidelines disagree, the text says so. Where a recommendation depends on local resources or expertise, it points to the institutional protocol.

No book can substitute for supervised experience, for the judgment of a senior colleague, or for the patient in front of you. The aim is more modest and, I hope, more useful: to make the reasoning visible, so that it can be learned before the shift, retrieved during it, and refined afterward.

Andrew B. Auclair

How to Use This Clinical Reference

This reference is designed to be used in two ways. Read in sequence, it builds a structured approach to acute and critical illness. Consulted at the bedside, it gives fast access to priorities, thresholds, and decision points. The features below are built for both uses.

Who This Book Is For

The book is written for clinicians who care for acutely unwell adults in emergency departments, intensive care units, high-dependency and step-down units, operating and recovery areas, rapid response teams, and prehospital and transport services. Its readers include emergency physicians and intensivists, anesthesiologists, hospitalists and internal medicine physicians, surgeons involved in acute care, residents and fellows, medical students on acute rotations, ICU and emergency nurses, advanced practice nurses, nurse practitioners, physician assistants, paramedics and critical care transport clinicians, and clinicians moving into higher-acuity roles.

The content assumes a working knowledge of physiology and pharmacology and focuses on application. Experienced readers can use the tables and algorithms directly; newer clinicians will benefit from reading the explanatory text first. Scope of practice differs between professions and jurisdictions. A procedure or drug discussed here is described so that every team member understands its purpose and risks, not as authorization to perform it.

How to Use Algorithms

Each algorithm is a sequence of decisions, drawn as boxes:

- **Start** boxes define the patient the algorithm applies to.
- **Action** boxes describe what to do, usually in parallel with continuing assessment.
- **Decision** boxes ask a yes-or-no question whose answer changes the next step.
- **Yes** and **No** boxes give the branch.
- **Reassess** boxes define what to re-examine and how often.
- **Escalate** boxes state when the situation exceeds the current team or setting.

Read an algorithm by its decision points. The value lies in knowing which question to ask next and why. When the patient does not fit the algorithm, the reasoning behind the decision points still applies. Algorithms in this book are educational frameworks; they do not replace institutional protocols, which reflect local resources and must take precedence.

How to Use Rapid-Review Tables

Tables compare items that are easier to see side by side than to read in sequence: shock types, vasopressors, toxidromes, reversal agents, ventilator modes. Each table answers one question, named in its title. Use tables to check a threshold, compare options, or test yourself by covering a column and reconstructing it. Tables simplify: when the patient straddles two categories or the findings conflict, return to the text and to the patient.

How to Use Checklists

Checklists protect against omission under stress, not against ignorance. They are placed at transitions where steps are commonly missed: before intubation, after intubation, before a procedure, at the start of an ICU day, during massive transfusion, and at handoff. Use them aloud, with the team, at the moment they are designed for. A checklist that is read after the event is documentation, not safety.

How to Use Clinical Cases

Every clinical chapter ends with an original case. Each case follows the same structure: presentation, vital signs, history, examination, key data, clinical problem, immediate threats, differential (common, dangerous, mimic), first actions, reassessment, clinical reasoning, outcome, and key lesson. To get the most from a case, pause after the key

data and decide on the problem, the threats, and the first actions before reading on. The cases are composites written for teaching and do not describe real patients.

Callout Boxes

Callout boxes used in this book

Box	Purpose
Clinical Orientation	Frames the chapter: why the topic matters and what the clinician must achieve
First Actions	What to do in the first minutes, usually in parallel
Red Flags	Findings that change urgency or demand escalation
Clinical Pearl	A practical insight that prevents a common error
Pitfall	A recognized trap and how to avoid it
Reassessment Trigger	What to recheck and when
Checklist	Steps to verify at a transition point
Key Takeaways	The essential points of the chapter

Guideline Currency and Evidence Notes

Recommendations were reviewed against major guidelines current at the time of writing. When a recommendation comes from a specific guideline, the text names it (for example, "SSC 2026" or "2025 AHA"). Where trials disagree, evidence is weak, or practice varies, the text states this rather than presenting a single answer as settled. Doses are typical adult doses in a stated context; they are not universal, and they must be checked against current product information and local protocols. Selected references at the end of each chapter, and the consolidated reference list at the end of the book, identify key sources for further reading.

Units

Laboratory values are given in conventional US units, with SI units in parentheses for key thresholds. Blood pressure is in mmHg, gas tensions in mmHg (with kPa for the main reference values), and temperatures in degrees Celsius.

Abbreviations and Common Clinical Acronyms

4F-PCC	four-factor prothrombin complex concentrate	CPP	cerebral perfusion pressure
4Ts	thrombocytopenia, timing, thrombosis, other causes (HIT score)	CPR	cardiopulmonary resuscitation
A-a	alveolar–arterial (oxygen gradient)	CRRT	continuous renal replacement therapy
ABCDE	airway, breathing, circulation, disability, exposure	CRS	cytokine release syndrome
ABCDEF	ICU liberation bundle (pain, trials, choice of sedation, delirium, early mobility, family)	CRT	capillary refill time
ABG	arterial blood gas	CSF	cerebrospinal fluid
ACC	American College of Cardiology	CT	computed tomography
ACE	angiotensin-converting enzyme	CTA	computed tomography angiography
ACLF	acute-on-chronic liver failure	CVP	central venous pressure
ACLS	advanced cardiovascular life support	CVT	cerebral venous thrombosis
ACS	acute coronary syndrome; abdominal compartment syndrome	DAPT	dual antiplatelet therapy
ADAMTS13	von Willebrand factor–cleaving protease	DAS	Difficult Airway Society
AF	atrial fibrillation	DBP	diastolic blood pressure
AG	anion gap	DCD	donation after circulatory determination of death
AHA	American Heart Association	DIC	disseminated intravascular coagulation
AKI	acute kidney injury	DKA	diabetic ketoacidosis
ALF	acute liver failure	DO₂	oxygen delivery
ALS	advanced life support	DOAC	direct oral anticoagulant
APRV	airway pressure release ventilation	DVT	deep vein thrombosis
ARB	angiotensin receptor blocker	ECG	electrocardiogram
ARDS	acute respiratory distress syndrome	ECLS	extracorporeal life support
ASA	American Stroke Association; American Society of Anesthesiologists	ECMO	extracorporeal membrane oxygenation
ASPECTS	Alberta Stroke Program Early CT Score	ECPR	extracorporeal cardiopulmonary resuscitation
ATLS	Advanced Trauma Life Support	eFAST	extended focused assessment with sonography in trauma
AUC	area under the concentration–time curve	EEG	electroencephalogram
AV	atrioventricular	EN	enteral nutrition
AVPU	alert, voice, pain, unresponsive	ERCP	endoscopic retrograde cholangiopancreatography
BHB	beta-hydroxybutyrate	ESBL	extended-spectrum beta-lactamase
BiPAP	bilevel positive airway pressure	EtCO₂	end-tidal carbon dioxide
BMI	body mass index	EVT	endovascular thrombectomy
BMV	bag-mask ventilation	EXTRIP	Extracorporeal Treatments in Poisoning workgroup
BNP	B-type natriuretic peptide	FiO₂	fraction of inspired oxygen
BP	blood pressure	FoCUS	focused cardiac ultrasound
BPS	Behavioral Pain Scale	FONA	front-of-neck airway
BRASH	bradycardia, renal failure, AV-nodal blockade, shock, hyperkalemia	G6PD	glucose-6-phosphate dehydrogenase
BUN	blood urea nitrogen	GCS	Glasgow Coma Scale
CAM-ICU	Confusion Assessment Method for the ICU	GFR	glomerular filtration rate
CAP	community-acquired pneumonia	GI	gastrointestinal
CAR-T	chimeric antigen receptor T-cell therapy	HAP	hospital-acquired pneumonia
CAUTI	catheter-associated urinary tract infection	HCO₃⁻	bicarbonate
CICO	cannot intubate, cannot oxygenate	HELLP	hemolysis, elevated liver enzymes, low platelets
CK	creatinine kinase	HFNC, HFNO	high-flow nasal cannula, high-flow nasal oxygen
CKD	chronic kidney disease	HHS	hyperosmolar hyperglycemic state
CLABSI	central line–associated bloodstream infection	HIT	heparin-induced thrombocytopenia
CNS	central nervous system	HR	heart rate
CO	carbon monoxide; cardiac output	HSV	herpes simplex virus
COPD	chronic obstructive pulmonary disease	IAP	intra-abdominal pressure
CPAP	continuous positive airway pressure	ICANS	immune effector cell–associated neurotoxicity syndrome
CPOT	Critical-Care Pain Observation Tool		

ICH	intracerebral hemorrhage	RR	respiratory rate
ICP	intracranial pressure	RRT	renal replacement therapy
ICU	intensive care unit	RSI	rapid sequence intubation
IHD	intermittent hemodialysis	RV	right ventricle
IM	intramuscular	SAH	subarachnoid hemorrhage
INR	international normalized ratio	SAT	spontaneous awakening trial
IO	intraosseous	SBP	systolic blood pressure; spontaneous bacterial peritonitis
IR	interventional radiology	SBT	spontaneous breathing trial
IV	intravenous	SCAI	Society for Cardiovascular Angiography and Interventions
IVC	inferior vena cava	SCI	spinal cord injury
IVT	intravenous thrombolysis	ScvO₂	central venous oxygen saturation
JVP	jugular venous pressure	SE	status epilepticus
KDIGO	Kidney Disease: Improving Global Outcomes	SGA	supraglottic airway
LKW	last known well	SGLT2	sodium-glucose cotransporter 2
LMWH	low-molecular-weight heparin	SIADH	syndrome of inappropriate antidiuretic hormone secretion
LP	lumbar puncture	SIRS	systemic inflammatory response syndrome
LV	left ventricle	SOFA	Sequential Organ Failure Assessment
LVO	large-vessel occlusion	SpO₂	peripheral oxygen saturation (pulse oximetry)
MAP	mean arterial pressure	SSC	Surviving Sepsis Campaign
MCS	mechanical circulatory support	STEMI	ST-elevation myocardial infarction
MEWS	Modified Early Warning Score	SVR	systemic vascular resistance
MI	myocardial infarction	SVT	supraventricular tachycardia
MRI	magnetic resonance imaging	TBI	traumatic brain injury
MRSA	methicillin-resistant Staphylococcus aureus	TBSA	total body surface area
MTP	massive transfusion protocol	TEG	thromboelastography
NAC	N-acetylcysteine	TIA	transient ischemic attack
NCSE	nonconvulsive status epilepticus	TIPS	transjugular intrahepatic portosystemic shunt
NEWS2	National Early Warning Score 2	TLS	tumor lysis syndrome
NIHSS	National Institutes of Health Stroke Scale	TTP	thrombotic thrombocytopenic purpura
NIV	noninvasive ventilation	TXA	tranexamic acid
NMB	neuromuscular blocker	UGIB	upper gastrointestinal bleeding
NSAID	nonsteroidal anti-inflammatory drug	VAP	ventilator-associated pneumonia
NSTEMI	non-ST-elevation myocardial infarction	VA-ECMO	venoarterial ECMO
NSTI	necrotizing soft-tissue infection	VBG	venous blood gas
ODS	osmotic demyelination syndrome	VF	ventricular fibrillation
PaCO₂	arterial partial pressure of carbon dioxide	VL	video laryngoscopy
PADIS	pain, agitation/sedation, delirium, immobility, sleep	VT	ventricular tachycardia; tidal volume
PaO₂	arterial partial pressure of oxygen	VTE	venous thromboembolism
PBW	predicted body weight	VTI	velocity-time integral
PCC	prothrombin complex concentrate	VV-ECMO	venovenous ECMO
PCI	percutaneous coronary intervention	WBC	white blood cell count
PE	pulmonary embolism		
PEA	pulseless electrical activity		
PEEP	positive end-expiratory pressure		
P/F	PaO ₂ /FiO ₂ ratio		
PICS	post-intensive care syndrome		
PLR	passive leg raise		
PN	parenteral nutrition		
POCUS	point-of-care ultrasound		
PPH	postpartum hemorrhage		
PPI	proton pump inhibitor		
PRES	posterior reversible encephalopathy syndrome		
PSA	procedural sedation and analgesia		
pVT	pulseless ventricular tachycardia		
RASS	Richmond Agitation-Sedation Scale		
ROSC	return of spontaneous circulation		

PART 1

Clinical Orientation, Safety, and Bedside Decision-Making

IN THIS PART

Chapter 1	Clinical Reasoning Under Time Pressure	2
Chapter 2	Escalation, Team Performance, Handoff, and Transfer	7
Chapter 3	Patient Safety, Medication Safety, and Quality in Acute Care	13

Clinical Reasoning Under Time Pressure

Acute care forces decisions before the evidence is complete. This chapter sets out the reasoning methods used throughout the book: sequencing problems by lethality, building a differential that protects against the dangerous diagnosis, recognizing the cognitive traps that cause delay, and converting every intervention into a test that the patient's response will either confirm or refute.

1.1 Acting Before the Diagnosis

Outpatient medicine runs in a familiar order: gather data, reach a diagnosis, then treat. Resuscitation reverses much of that order. A patient with a systolic pressure of 68 mmHg and cold extremities needs perfusion restored while the cause is still being sought, and the response to the first liter of fluid or the first dose of vasopressor becomes part of the diagnostic evidence. The clinician who waits for certainty before acting has already chosen a treatment: delay.

This does not mean acting without thought. It means separating two questions that are easily blurred. The first is *physiologic*: which organ system is failing, how fast, and what will keep the patient alive for the next ten minutes? The second is *etiologic*: why is it failing? The first question almost always has an answer at the bedside within seconds. The second may take hours, a CT scan, or a culture result. Good acute-care reasoning answers the physiologic question immediately, starts the treatments that are safe across the plausible causes, and keeps the etiologic question open.

Treatments that are safe across the differential

Some interventions help whatever the underlying cause: oxygen for hypoxemia, a secure airway for a patient who cannot protect it, correction of hypoglycemia, control of visible hemorrhage, and defibrillation for ventricular fibrillation. Others carry a cost if the working diagnosis is wrong. Anticoagulation for presumed pulmonary embolism is harmful in aortic dissection. A large fluid bolus helps hypovolemia and worsens cardiogenic pulmonary edema. Thrombolysis for presumed stroke is dangerous in a hypoglycemic mimic.

The practical rule is to move early with low-regret interventions and to demand a higher level of diagnostic confidence before committing to those that are hard to reverse. When a high-cost treatment is time-critical, the decision is not whether certainty has been reached but whether the expected benefit, weighted by probability, outweighs the expected harm. Explicitly naming that trade-off, even in a single sentence to the team, improves the decision and the documentation.

TABLE 1.1 Matching diagnostic confidence to the cost of being wrong

Intervention	Regret if diagnosis wrong	Typical stance
Oxygen to a target range	Low	Start immediately
Glucose for documented hypoglycemia	Very low	Start immediately
Balanced crystalloid 250–500 mL with reassessment	Low to moderate	Start, reassess within minutes
Broad-spectrum antimicrobials in suspected septic shock	Moderate (resistance, adverse effects)	Start within the hour; de-escalate later
Systemic anticoagulation	High (bleeding, dissection)	Require reasonable confidence
Thrombolysis	Very high	Require protocol-defined certainty
Intubation	High (peri-intubation arrest)	Prepare early; perform when indicated

1.2 First Problem → Worst Problem → Next Problem

When several abnormalities appear at once, the order in which they are addressed determines the outcome. A useful discipline is to ask three questions in sequence.

First problem: what will kill this patient soonest?

This is a question about time, not about importance. An obstructed airway kills in minutes, tension pneumothorax in minutes, hyperkalemia with a widening QRS in minutes to an hour, uncorrected septic shock over hours, and an undiagnosed cancer over months. The first problem is addressed before anything else, even if it is not the most interesting abnormality.

Worst problem: what is the most dangerous explanation that must not be missed? Once immediate threats are controlled, the clinician scans for the diagnosis with the highest cost of omission, even when it is not the most likely. Chest pain is most often benign, but aortic dissection, pulmonary embolism, and occlusion myocardial infarction must be deliberately considered. A headache is usually primary, but subarachnoid hemorrhage cannot be missed. The worst problem shapes the next investigation.

Next problem: what comes after stabilization? The septic patient whose blood pressure responds to fluids still has a source that needs control, a kidney that may be injured, and anticoagulants that may need stopping. Listing the next problems early prevents the familiar pattern in which an initial success is followed by a slow deterioration that no one was watching for.

CLINICAL PEARL Say the sequence aloud

Narrating "the first problem is the airway, the worst possibility is an expanding neck hematoma, and the next problem will be blood pressure after induction" aligns the team in a few seconds and invites correction from anyone who sees it differently.

Applying the sequence to a mixed picture

Consider a confused older patient with a temperature of 38.9 °C, a heart rate of 124/min, a blood pressure of 84/50 mmHg, and a potassium of 6.9 mmol/L. The tempting focus is sepsis, because fever and hypotension are prominent. The first problem, however, may be the potassium: if the ECG shows peaked T waves and a broadening QRS, membrane stabilization with calcium precedes everything except airway and breathing. The worst problem is a source requiring urgent control, such as an obstructed infected kidney, which would explain both the hyperkalemia and the sepsis. The next problems are acute kidney injury, medication review (an ACE inhibitor or potassium-sparing diuretic), and the patient's goals of care.

1.3 Common → Dangerous → Mimic

A bedside differential diagnosis is not an exhaustive list. It is a short, ranked set of hypotheses chosen to guide the next action. A three-tier structure keeps it both efficient and safe.

- **Common:** the diagnoses that account for most presentations of this pattern in this setting. They are where testing usually begins.
- **Dangerous:** the diagnoses that are less likely but would cause serious harm if missed. They earn a specific test or a specific reason for exclusion.
- **Mimic:** conditions that resemble the leading diagnosis but require different, sometimes opposite, treatment. They are the source of most harmful anchoring errors.

The structure prevents two opposite failures. Listing only common diagnoses leaves the dangerous ones unexamined. Listing everything produces a shotgun workup that delays the decisive test and generates incidental findings.

TABLE 1.2 Common → Dangerous → Mimic grid for high-frequency presentations

Presentation	Common	Dangerous (must not miss)	Mimic (treated differently)
Acute chest pain	Musculoskeletal, reflux, stable angina	Occlusion MI, aortic dissection, PE, tension pneumothorax, esophageal rupture	Pericarditis, myocarditis, Takotsubo, cholecystitis
Acute dyspnea	COPD or asthma exacerbation, pneumonia, heart failure	PE, tamponade, upper-airway obstruction, pneumothorax	Metabolic acidosis with respiratory compensation, anemia, anxiety
Hypotension	Hypovolemia, sepsis, medications	Hemorrhage, cardiogenic shock, tamponade, PE, adrenal crisis	Measurement error, chronic low baseline, autonomic failure
Altered mental status	Infection, intoxication, metabolic derangement	Hypoglycemia, stroke, intracranial hemorrhage, meningitis, nonconvulsive status	Delirium on dementia, primary psychiatric illness, hypercapnia

Presentation	Common	Dangerous (must not miss)	Mimic (treated differently)
Severe headache	Migraine, tension-type	Subarachnoid hemorrhage, meningitis, venous sinus thrombosis, dissection, CO poisoning	Hypertensive emergency, acute angle-closure glaucoma
Abdominal pain with shock	Perforation, cholangitis, pancreatitis	Ruptured aneurysm, mesenteric ischemia, ectopic pregnancy	DKA, inferior MI, lower-lobe pneumonia
Syncope	Vasovagal, orthostatic	Arrhythmia, PE, aortic stenosis, hemorrhage, dissection	Seizure, hypoglycemia
Fever with tachycardia	Viral or bacterial infection	Septic shock, endocarditis, necrotizing infection	Thyroid storm, drug toxidromes, NMS, transfusion reaction

Naming the falsifier

For each leading hypothesis, the clinician should be able to name one finding that would make it untenable. In presumed septic shock, the falsifier might be a pericardial effusion with right ventricular collapse, a new murmur, or a hemoglobin that has fallen by 3 g/dL. In presumed exacerbation of COPD, it might be a unilateral absent lung slide, or a normal PaCO₂ in a patient who is clearly tiring. A falsifier converts a static label into a hypothesis that can fail, and that is what keeps the differential alive.

1.4 Cognitive Bias and Premature Closure

Experienced clinicians reason mostly through pattern recognition, often called *System 1* thinking. It is fast, efficient, and usually right. Its failures are systematic rather than random, which means they can be anticipated. Deliberate analytic reasoning, *System 2*, is slower and is used to check the pattern when the stakes or the uncertainty are high. Most diagnostic errors in acute care involve a failure to switch from the first mode to the second at the right moment.

TABLE 1.3 Common cognitive biases in acute care and practical countermeasures

Bias	How it appears at the bedside	Countermeasure
Anchoring	The first label ("anxiety", "drunk", "COPD") persists despite new data	Restate the differential after every major result
Premature closure	Workup stops once one plausible cause is found	Ask "what else could this be?" before disposition
Diagnosis momentum	A label passed through triage and handoff gains unearned certainty	Verify inherited diagnoses against primary data
Availability	Recent or memorable cases dominate estimates of probability	Use base rates; consult decision tools
Confirmation bias	Tests are ordered to support the working diagnosis, not to challenge it	Order the test that would change management
Framing effect	Presentation wording ("frequent attendee") changes perceived risk	Re-describe the case in neutral clinical terms
Search satisficing	The first fracture or first abnormality ends the search	Complete the systematic survey after the first find
Omission bias	Reluctance to act because harm from action feels worse	Compare risks of acting and not acting explicitly
Fatigue and overload	Late-shift or high-census decisions degrade	Use checklists and a second reviewer at handoff

Situations that should trigger deliberate review

Some moments carry a high risk of reasoning error and justify a deliberate pause, even when the answer feels obvious:

- The patient is not improving as expected after treatment for the working diagnosis.
- A key result does not fit (a normal lactate in "septic shock", a normal troponin in "STEMI").
- The diagnosis was inherited from another clinician without independent verification.

- The patient belongs to a group in which serious disease is often under-recognized: older adults, people with intoxication or psychiatric illness, those who do not share the clinician's language, and frequent attenders.
- A high-risk, hard-to-reverse treatment is about to be given.

PITFALL Treating a number instead of a patient

A falling lactate or a normalized blood pressure can coexist with ongoing deterioration. Hypotension corrected with vasopressors still needs a cause, and a lactate falling because of renal replacement therapy may not reflect improving perfusion. Every number should be read against the clinical trajectory.

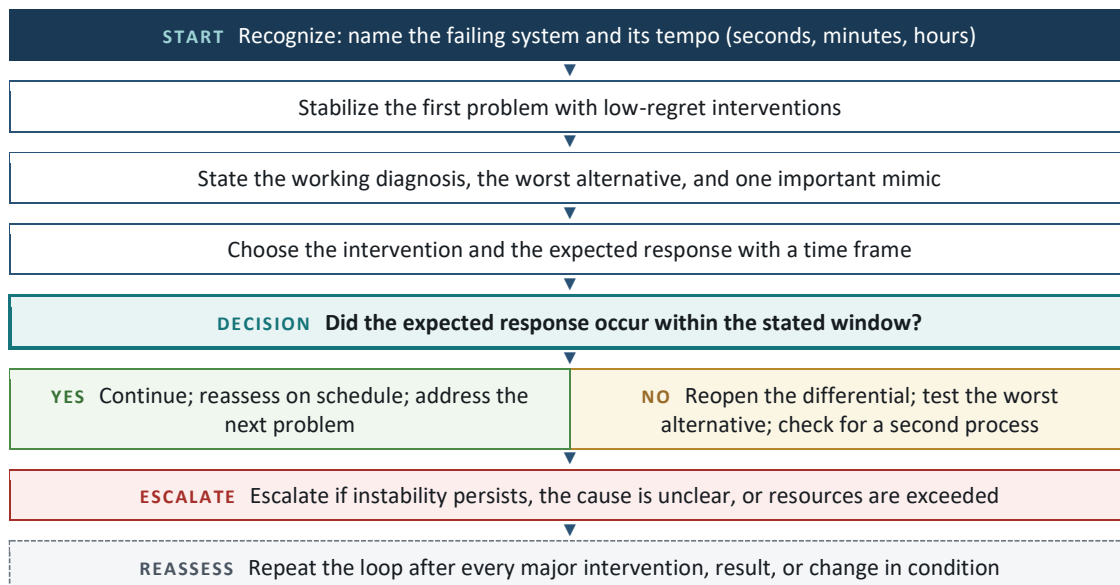
1.5 Problem → Evidence → Intervention → Response

The reassessment loop turns treatment into information. For each active problem, the clinician states the problem, the evidence for it, the intervention

chosen, and the response that would confirm the plan is working. That last element is set in advance and given a time frame.

A well-formed statement might read: "Problem: hypotension, likely septic. Evidence: fever, MAP 58 mmHg, lactate 4.6 mmol/L, cloudy urine. Intervention: 1 L of balanced crystalloid, cultures, ceftriaxone, norepinephrine if MAP stays below 65 mmHg. Expected response within 60 minutes: MAP at or above 65 mmHg, improving capillary refill, urine output beginning." If the response does not occur, the loop sends the clinician back to the differential rather than simply escalating the same therapy.

ALGORITHM 1.1 The Bedside Reasoning Loop



Educational framework. Adapt to patient-specific findings and institutional protocols.

Reassessment triggers

Reassessment is often scheduled by the clock, but it should also be triggered by events. The most important triggers are any new vital sign outside the expected trajectory, a new or rising oxygen requirement, a fall in level of consciousness, a sudden increase in vasopressor requirement, a new arrhythmia, any result that does not fit the working diagnosis, and a change in nursing concern. Nursing concern deserves explicit mention: experienced nurses frequently detect deterioration before it reaches a scoring threshold, and early-warning research consistently supports acting on that concern.

REASSESSMENT TRIGGER Questions to ask at every reassessment

Is the patient better, the same, or worse than at the last review? Has the response matched the prediction? Is there a new problem? Is the current level of care still the right one? Who else needs to know?

Common Pitfalls

- Pursuing a satisfying explanation while the first problem (airway, breathing, circulation) remains uncorrected.
- Treating all abnormalities with equal urgency rather than sequencing by time to harm.

- Accepting a triage or handoff label without checking it against the patient.
- Escalating the same therapy repeatedly when the patient fails to respond, instead of revisiting the diagnosis.
- Omitting the falsifier, so that no result can ever refute the working diagnosis.

Clinical Pearls

- A diagnosis is a plan with a prediction attached. If the prediction fails, the plan was wrong.
- Two diagnoses are common in critical illness: sepsis with GI bleeding, PE with pneumonia, MI with heart failure. A single unifying diagnosis is satisfying but not always correct.
- The patient who "doesn't look right" despite normal numbers should be treated as a diagnostic problem, not a reassurance.

CASE 1 The Fall That Was Not Mechanical

Presentation. A 78-year-old woman is brought from home after being found on the floor. The ambulance handoff describes a "mechanical fall" and requests a hip radiograph.

Vital signs. Heart rate 52/min, blood pressure 94/58 mmHg, respiratory rate 22/min, SpO₂ 95% on room air, temperature 36.1 °C, glucose 140 mg/dL (7.8 mmol/L).

Relevant history. Hypertension, atrial fibrillation, chronic kidney disease. Medications include bisoprolol, digoxin, ramipril, and apixaban. She has had nausea for three days.

Initial examination. Drowsy but oriented. Bruising over the left hip without shortening. Irregular pulse. Dry mucous membranes.

Key data. ECG: atrial fibrillation with a ventricular rate of 48/min and scooped ST segments. Creatinine 2.8 mg/dL (247 µmol/L), previously 1.5 mg/dL (132 µmol/L). Potassium 6.1 mmol/L.

Clinical problem. A frail patient with bradycardia, hypotension, acute kidney injury, and hyperkalemia whose fall has been labeled mechanical.

Immediate threats. Bradycardia with hypotension; hyperkalemia; possible digoxin toxicity; anticoagulated patient after a fall (occult intracranial or retroperitoneal bleeding).

Differential. Common: dehydration-related AKI with drug accumulation. Dangerous: digoxin toxicity, hyperkalemic bradycardia, intracranial hemorrhage. Mimic: primary conduction disease, inferior MI.

First actions. Continuous monitoring and pacing pads applied. Digoxin level sent, ECG repeated, calcium considered for hyperkalemia with ECG change. Nephrotoxic and rate-slowing drugs held. Cautious fluid with reassessment. CT head arranged because of anticoagulation and drowsiness.

Reassessment. The digoxin level returns markedly elevated. Heart rate remains 46/min. CT head is normal.

Clinical reasoning. The handoff label framed the case as orthopedic. Applying first-worst-next exposed a medical cause for the fall and an anticoagulated head injury that could not be ignored. Naming the falsifier for "mechanical fall" (bradycardia, AKI, nausea) reopened the differential.

Outcome / next step. Digoxin-specific antibody fragments were given after toxicology advice, with improvement in rate and blood pressure. The hip radiograph was normal.

Key lesson. An inherited label is a hypothesis. Verify it against the vital signs and the medication list before accepting it.

KEY TAKEAWAYS

- Answer the physiologic question first; keep the etiologic question open.
- Sequence problems by time to harm: first, worst, next.
- Build every differential with common, dangerous, and mimic tiers, and name one falsifier for the leading diagnosis.
- Set an expected response with a time frame for every intervention; failure to respond reopens the diagnosis.
- Treat nursing concern, unexplained results, and inherited labels as triggers for deliberate review.

References

1. Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med.* 2003;78(8):775-780.
2. Graber ML, Franklin N, Gordon R. Diagnostic error in internal medicine. *Arch Intern Med.* 2005;165(13):1493-1499.
3. Norman GR, Monteiro SD, Sherbino J, Ilgen JS, Schmidt HG, Mamede S. The causes of errors in clinical reasoning: cognitive biases, knowledge deficits, and dual process thinking. *Acad Med.* 2017;92(1):23-30.
4. National Academies of Sciences, Engineering, and Medicine. *Improving Diagnosis in Health Care.* Washington, DC: The National Academies Press; 2015.
5. Kahneman D. *Thinking, Fast and Slow.* New York: Farrar, Straus and Giroux; 2011.

Escalation, Team Performance, Handoff, and Transfer

Most preventable deaths in acute care involve a delay rather than a lack of knowledge: a call not made, a handoff that lost the key fact, a transfer started before the patient was stable enough to survive it. This chapter treats escalation, team communication, handoff, and transport as clinical interventions with indications, techniques, and complications of their own.

2.1 Escalation Triggers and How to Make the Call

Escalation means bringing more expertise, more resources, or a higher level of care to a patient whose needs exceed what is currently available. It is not a single event. The same patient may need a senior review, then a rapid response team, then an ICU bed, then an interventional specialist. Each step has its own threshold, and each delay compounds the last.

Clinicians tend to escalate late for predictable reasons: a borderline vital sign that seems to improve on repeat

measurement, reluctance to disturb a senior colleague at night, uncertainty about whether the problem is "bad enough", and the hope that the next intervention will work. Organizations that perform well remove the need to make this judgment alone. They define objective calling criteria, protect the right of any team member to call without penalty, and treat a call that turns out to be unnecessary as a success of the system rather than a failure of the caller.

Five kinds of trigger

The decision to escalate rests on five categories of information, any one of which is sufficient.

TABLE 2.1 Escalation triggers

Trigger type	Examples	Why it matters
Absolute physiology	SpO ₂ below 90% despite oxygen, systolic BP below 90 mmHg, respiratory rate above 30/min or below 8/min, heart rate above 130/min or below 40/min, new GCS fall of 2 or more, seizure	Thresholds associated with high short-term risk of arrest or ICU admission
Trajectory	Rising oxygen requirement, increasing respiratory rate over hours, falling urine output, lactate not clearing, vasopressor dose climbing	Compensation is failing before absolute thresholds are crossed
Uncertainty	Cause of deterioration unknown; patient not responding to treatment for the working diagnosis	The differential includes conditions the current team cannot exclude
Resource mismatch	Need for procedures, monitoring, staffing, or drugs unavailable on the current unit	Correct care cannot be delivered in the current location
Concern	Nurse, family, or clinician worried even if numbers are acceptable	Experienced concern detects deterioration early and is an accepted calling criterion

Absolute thresholds vary between institutions and should follow the local rapid response criteria. The trajectory and concern categories deserve particular weight because they identify patients early, while interventions are still simple.

Making the call: a structured request

An effective escalation call answers the receiver's questions before they are asked. SBAR (Situation, Background, Assessment, Recommendation) is the most widely used structure. The final element is the one

most often omitted: a clear statement of what the caller needs and how quickly.

FIRST ACTIONS Escalation call structure

- **Situation:** who you are, which patient, and the problem in one sentence ("I am calling about Bed 14, a 64-year-old with pneumonia whose oxygen requirement has risen from 2 to 10 L/min in two hours").
- **Background:** the relevant diagnosis, interventions so far, code status.
- **Assessment:** current vital signs and your interpretation ("I think he is tiring and may need ventilatory support").
- **Recommendation/Request:** what you need and when ("I need you to see him within 15 minutes; I am also calling the rapid response team").
- Close the loop by reading back the plan and agreeing on a time for reassessment.

If the response does not match the urgency, the caller should escalate again, to a more senior clinician or directly to the rapid response or medical emergency team. A graded assertiveness approach helps: state the concern, state the risk, propose an action, and if the response is still inadequate, state that you are escalating further. Hierarchy should never be the reason a deteriorating patient waits.

2.2 Crisis Resource Management and Team Roles

Crisis resource management (CRM) describes the non-technical skills that allow a group of competent individuals to function as a competent team under pressure. It originated in aviation and anesthesia and is now central to resuscitation training. Technical skill determines what a team can do; CRM determines whether it does it in the right order, without omission or duplication.

The team leader

The leader's main task is to think rather than to perform procedures. A leader who is intubating or placing a central line cannot see the monitor, track elapsed time, or notice that no one has checked the glucose. In small teams the leader may have to do both, but should hand off hands-on tasks as soon as additional staff arrive.

Effective leaders declare themselves ("I am leading this resuscitation"), assign roles by name, summarize aloud at intervals, and invite input. A brief pause every few minutes for a shared mental model ("What we know so far is...; what we are doing next is...; does anyone have concerns?") catches errors that individuals working heads-down will miss.

TABLE 2.2 Resuscitation team roles

Role	Core responsibilities
Team leader	Overall direction, prioritization, decision-making, periodic summary, communication with family and consultants
Airway	Airway patency, oxygenation, ventilation, preparation for intubation, capnography
Compressions / circulation	CPR quality, pulse checks, access, fluid and blood administration
Medications	Drug preparation, labeling, dosing, administration, timing of repeat doses
Monitor / defibrillator	Rhythm interpretation, pad placement, charging, shocks, pacing
Recorder	Times of events, drugs, shocks, rhythm changes, prompts to the leader
Runner / liaison	Equipment, specimens, blood bank, calls to other services

Closed-loop communication

Instructions given to "someone" are frequently not carried out. Closed-loop communication has three steps: the sender directs a specific instruction to a named person, the receiver repeats it back, and the receiver confirms when it is done. For medications, the readback should include drug, dose, and route ("Epinephrine 1 mg IV, giving now... epinephrine given"). The method adds seconds and prevents dose and drug errors that can cost lives.

Speaking up

Any team member who notices a problem must be able to raise it. Standard phrases such as "I need you to stop and look at this" or "I have a safety concern" help junior staff interrupt a senior colleague. Leaders should actively invite challenge, especially before irreversible steps: induction of anesthesia, thrombolysis, termination of resuscitation.

CLINICAL PEARL Cognitive offloading

Assign one person to watch the clock and announce intervals aloud: two-minute CPR cycles, time since the last epinephrine dose, time since induction. Timekeeping is one of the first tasks lost when the leader becomes task-saturated.

information is lost. Unstructured verbal handoffs omit key facts, and written summaries are often out of date. Structured tools improve completeness. The I-PASS bundle, which combines a mnemonic with training and a written component, was associated with fewer medical errors and preventable adverse events in a multicenter pediatric study.

2.3 Structured Handoff

Each transfer of responsibility (shift change, ED to ICU, ICU to ward, theater to recovery) is a point where

TABLE 2.3 Structured handoff elements

Element (I-PASS)	Content	Common omission
Illness severity	Stable, "watcher", or unstable	Failing to flag the patient who is borderline
Patient summary	Diagnosis, key events, current treatment	Pending results and recent changes
Action list	Tasks with owners and deadlines	Who is responsible for each task
Situation awareness and contingency	What might happen and what to do if it does	"If the BP falls below..., then..."
Synthesis by receiver	Receiver summarizes and asks questions	Skipped when busy

The resuscitation handover

Handover of a critically ill patient at the bedside, for example from paramedics to the emergency team or from the ED to the ICU, should take place with the team quiet and listening. A useful sequence is a brief "hands-off" period in which only the person handing over speaks, covering mechanism or presentation, findings, interventions, and response, followed by questions. Interventions such as transferring the patient to the bed can continue if they do not compete for attention. Ask the handing-over clinician for one sentence: "What are you most worried about?"

Contingency planning

The most valuable part of a handoff is the contingency plan. "If his oxygen requirement exceeds 60% on high-flow, call the ICU and prepare for intubation" is more useful than a list of current settings. Explicit contingencies make it easier for the receiving clinician to act early without re-deriving the reasoning.

2.4 Transport and Transfer

Moving a critically ill patient, whether to CT, the cath lab, the ICU, or another hospital, temporarily removes them from the safest environment available. Adverse events during intrahospital transport, including desaturation, hypotension, accidental extubation, and loss of vascular access, are common. Transport decisions must weigh the information or treatment gained against the risk of the journey.

Before transport: the questions to answer

- Will the test or destination change management enough to justify the risk?
- Is the patient as stable as they can reasonably be made before leaving?
- Is the airway secure for the duration of the journey, including possible delays?
- Is there adequate oxygen, battery power, and drug supply for at least twice the expected duration?
- Does the accompanying team have the skills to manage foreseeable deterioration?
- Has the receiving team accepted the patient and been told when to expect them?

Securing the airway before transport is often appropriate when deterioration in an uncontrolled environment, such as a CT scanner or ambulance, is likely. The threshold for intubation before transfer is lower than the threshold in a fully equipped ICU.

CHECKLIST Pre-Transport Checklist

- ☐ Airway secure; tube position confirmed and documented; capnography attached
- ☐ Ventilator settings checked on the transport ventilator; oxygen supply sufficient
- ☐ At least two functioning IV lines; infusions labeled and running on charged pumps
- ☐ Monitoring: ECG, SpO₂, non-invasive or arterial BP, EtCO₂ if ventilated
- ☐ Emergency drugs drawn up (sedation, vasopressor, push-dose agent as per local practice)
- ☐ Notes, imaging, and blood results available or transmitted
- ☐ Receiving team informed of estimated time of arrival and current status
- ☐ Family informed where possible

Interfacility transfer

When a patient needs a service unavailable at the current hospital, such as neurosurgery, cardiac surgery, burn care, or ECMO, the question is not whether to transfer but how quickly and how safely. Delays usually arise from searching for a bed, waiting for consultant-to-consultant calls, or attempting definitive investigations before referral. Most regions have transfer coordination systems that should be used early.

Stabilization before transfer focuses on what can be achieved without delaying definitive care. A patient with an expanding epidural hematoma needs airway protection and blood pressure control, then rapid transport, not a period of observation. A patient with a ruptured aortic aneurysm needs the minimum resuscitation consistent with survival, then the operating room. "Stabilize then transfer" should be read as "stabilize enough to survive the journey."

TABLE 2.4 Transfer modes

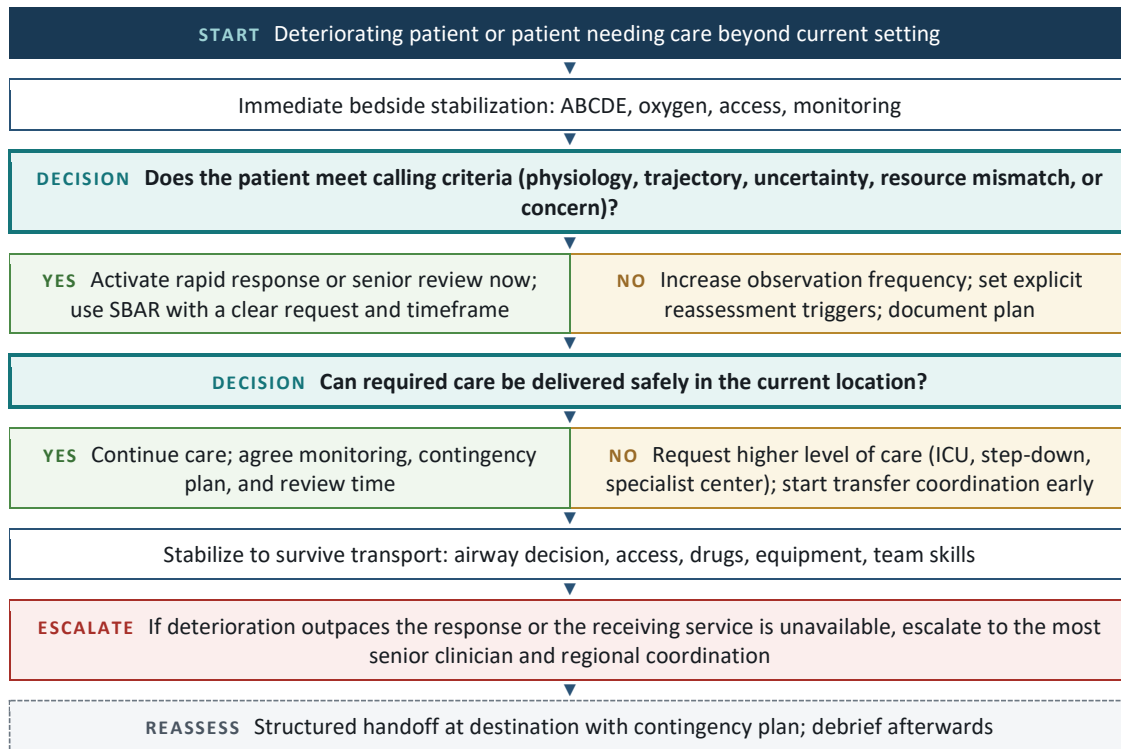
Mode	Advantages	Limitations
Ground critical care ambulance	Widely available, space for team and equipment	Slower over long distances; traffic
Rotor-wing	Rapid over moderate distances; avoids roads	Weather-dependent; limited space and noise; restricted procedures in flight
Fixed-wing	Long distances	Requires ground transfers at each end; altitude effects on air-filled spaces

2.5 Documenting Resuscitations and Critical Events

Documentation of a resuscitation serves three purposes: it allows the next clinician to continue care, it records decisions and their rationale, and it supports quality review. A designated recorder should note times of key events as they happen. A retrospective summary written later should include the presenting problem, key findings, interventions with times, the response, the rationale for major decisions (including decisions not to intervene), communication with family, and the plan.

Documentation of an airway intervention should include the indication, preoxygenation method, drugs and doses, device and blade, view obtained, number of attempts, confirmation method (waveform capnography), complications, and the plan for future airway management, including whether this was a difficult airway that the patient should be told about.

When a resuscitation is stopped, the note should record the duration, the rhythms, the interventions, the reasons for stopping, who was involved in the decision, and the time of death.

ALGORITHM 2.1 Escalation and Transfer Pathway

Educational framework. Adapt to patient-specific findings and institutional protocols.

Common Pitfalls

- Waiting for a second set of abnormal vital signs before calling, when the trajectory is already clear.
- Calling without a specific request, so the receiver offers advice instead of attending.
- A leader performing procedures and losing situational awareness.
- Handoffs that list data but omit illness severity and contingency plans.
- Transferring an unstable patient without anticipating airway or hemodynamic deterioration en route.

Clinical Pearls

- The rapid response team should be called for concern alone; most calling criteria include it explicitly.
- Brief, scheduled team summaries ("pause and summarize") are among the most effective error-catching tools in resuscitation.
- For transfer, carry double the oxygen and drug supply you expect to need.

CASE 2 The Night Call That Was Not Made

Presentation. A 71-year-old man is admitted to a medical ward with community-acquired pneumonia. At 02:00 the nurse notes his respiratory rate has increased from 22 to 30/min over four hours.

Vital signs. Heart rate 112/min, blood pressure 104/62 mmHg, respiratory rate 30/min, SpO₂ 91% on 6 L/min nasal cannula, temperature 38.4 °C.

Relevant history. COPD, type 2 diabetes. Received ceftriaxone and azithromycin six hours ago.

First actions. The resident is called but advises repeating the blood gas in two hours. The nurse, concerned by drowsiness and the trend, activates the rapid response team under the "staff concern" criterion. The team adjusts oxygen to a target SpO₂ of 88–92%, starts noninvasive ventilation, sends blood cultures and lactate, and gives a fluid bolus with reassessment.

Reassessment. At one hour on NIV, respiratory rate is 24/min, pH 7.33, and he is more alert. Bedside ultrasound shows a moderate effusion.