

Heart Failure: Common Complications and Conditions

CCC: CCC-043 (ISC)

[Link to Codes](#)

MCG Health

Inpatient & Surgical Care
30th Edition

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Prevention

- Prevention issues and possible preventive measures include(1)(2)(3)(4)(5)(6)(7):
 - ☐ Maintaining awareness of and treating patient characteristics and situations that pose high risk for development of heart failure; examples include:
 - Worsening renal function(8)
 - Ischemic heart disease, including prior myocardial infarction(9)
 - Anemia(10)
 - Use of cardiotoxic drugs (eg, anthracycline chemotherapy, immune checkpoint inhibitor) or medications causing fluid retention (eg, corticosteroids, NSAIDs, alpha-1 blockers)(11)
 - Need for aggressive fluid resuscitation (eg, sepsis, hemorrhage)(11)
 - Structural heart disease; examples include:
 - Valvular heart disease
 - Left ventricular hypertrophy
 - Hypertrophic cardiomyopathy
 - Infiltrative cardiomyopathy (eg, cardiac sarcoidosis, amyloidosis, hemochromatosis)
 - Dilated cardiomyopathy
 - Congenital heart disease(5)(12)(13)
 - ☐ Providing meticulous perioperative care, with special attention to(14):
 - Fluid balance
 - Preoperative evaluation of left ventricular function
 - Recognition and treatment of underlying coronary artery disease
 - Optimization of heart failure therapy

- Continuation of beta-blocker therapy[A](15)

Clinical Indications for Ongoing Inpatient Care

- Ongoing inpatient care is indicated for **1 or more** of the following(1)(2)(3)(5)(16):
 - Hemodynamic instability (1)(2)(16)(17)(18)(19)
 - Acute myocardial ischemia causing or consequence of heart failure(1)(9)(16)(17)
 - New or worsening pulmonary edema(16)(17)
 - Hypoxemia (17)
 - Tachypnea (17)
 - Syncope
 - Altered mental status (18)
 - Severe electrolyte abnormalities requiring inpatient care (16)(17)
 - Increased creatinine with reduction of more than 50% in estimated glomerular filtration rate from baseline  eGFR - Adult Calculator(16)
 - Progressively (ongoing) rising creatinine with reduction of more than 25% in estimated glomerular filtration rate from baseline  eGFR - Adult Calculator(16)(17)
 - Anasarca or peripheral edema that is severe (eg, significant paroxysmal dyspnea, inability to ambulate or void, skin breakdown, concomitant ascites)(2)(20)
 - Pulmonary artery catheter monitoring needed[B](1)(18)

Alternatives to Inpatient Care

- Alternatives to inpatient stay extension include(1)(2)(23)(24)(25)(26)(27):
 - Outpatient care(28)(29)
 - Medications for heart failure (eg, renin-angiotensin inhibitor (angiotensin receptor-neprilysin inhibitor preferred), diuretics, beta-blocker, aldosterone antagonist, sodium-glucose cotransporter-2 inhibitor (eg, dapagliflozin, empagliflozin, sotagliflozin), vericiguat, or vasodilator (hydralazine, isosorbide)) [C][D][E](1)(5)(12)(26)(31)
 - Antihypertensive medication
 - Salt and fluid restriction
 - Patient education and weight monitoring
 - Cardiac rehabilitation(32)(33)(34)
 - Home care(35)(36)(37)
 - Medications for heart failure (eg, renin-angiotensin inhibitor (angiotensin receptor-neprilysin inhibitor preferred), diuretics, beta-blocker, aldosterone antagonist, sodium-glucose cotransporter-2 inhibitor (eg, dapagliflozin, empagliflozin, sotagliflozin), vericiguat, or vasodilator (hydralazine, isosorbide)) [C][D][E](1)(5)(12)(26)(31)
 - Antihypertensive medication
 - Lifestyle interventions[F](5)(38)(39)
 - Nursing visit for assessment
 - Laboratory testing
 - Multidisciplinary team care with intensive home care support(1)(40)(41)
 - Home-based cardiac rehabilitation(32)(42)
 - Patient education and weight monitoring
 - Palliative care(1)(5)(31)(43)

- Skilled nursing facility(44)(45)
 - Medications for heart failure (eg, renin-angiotensin inhibitor (angiotensin receptor-neprilysin inhibitor preferred), diuretics, beta-blocker, aldosterone antagonist, sodium-glucose cotransporter-2 inhibitor (eg, dapagliflozin, empagliflozin, sotagliflozin), vericiguat, or vasodilator (hydralazine, isosorbide)) [C][D][E](1)(5)(12)(26)(31)
 - Antihypertensive medication
 - Nursing assessments
 - Laboratory testing and correction of electrolytes
 - Oxygen therapy
 - Monitoring weight and fluid balance
- Recovery facility(45)
 - Medications for heart failure (eg, renin-angiotensin inhibitor (angiotensin receptor-neprilysin inhibitor preferred), diuretics, beta-blocker, aldosterone antagonist, sodium-glucose cotransporter-2 inhibitor (eg, dapagliflozin, empagliflozin, sotagliflozin), vericiguat, or vasodilator (hydralazine, isosorbide)) [C][D][E](1)(5)(31)
 - Antihypertensive medication
 - Nursing assessments
 - Laboratory testing and correction of electrolytes
 - Parenteral medication
 - Oxygen therapy
 - Monitoring weight and fluid balance

Discharge

- Extended stay beyond goal length of stay for primary condition may be needed until **ALL** of the following are present(1)(2)(46)(47):
 - Hemodynamic stability
 - Tachypnea absent
 - Oxygenation at baseline or acceptable for next level of care
 - Dyspnea at baseline or acceptable for next level of care
 - Cardiac rate and rhythm acceptable
 - No evidence of myocardial ischemia
 - Pulmonary edema absent or acceptable for next level of care
 - Peripheral or sacral edema absent or acceptable for next level of care
 - Mental status at baseline
 - Volume status acceptable on oral medication
 - Renal function at baseline or acceptable for next level of care
 - Electrolyte abnormalities absent or acceptable for next level of care
 - Precipitating factors absent or controlled
 - Medication regimen established for next level of care[C][D][E]
 - Patient or caregiver has received written discharge instructions or educational material addressing activity level, diet, discharge medications, follow-up appointment, weight and edema monitoring, dietary and fluid restriction instructions, and what to do if symptoms worsen.(2)(47)(48)

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Footnotes

[A] Long-term beta-blocker therapy may often be continued in hospitalized patients with acute exacerbations of COPD.(15) [A in Context Link 1]

[B] Routine use of pulmonary artery catheters is not recommended for children or adults admitted with acute heart failure.(1)(5) Pulmonary artery catheterization (right-sided heart catheterization) may be needed when the diagnosis is unclear (eg, suspected heart failure with left ventricular ejection fraction greater than 40%), for patients with ongoing symptoms or uncertain fluid status following initial diuretic treatment, or to guide device selection and utilization of mechanical circulatory support.(1)(21)(22) [B in Context Link 1]

[C] A specialty society clinical guideline, based upon a systematic review of the evidence, concludes that heart failure patients with evidence of significant fluid overload should be promptly treated with IV loop diuretics (eg, initial dose twice the home regimen in terms of oral to parenteral milligram equivalents) and titrated to resolution of clinical signs and symptoms of congestion (eg, serial doubling of dosage as bolus or continuous infusion).(1) This guideline further recommends increasing the diuretic dose or adding a second diuretic (eg, thiazide diuretic or aldosterone antagonist with diuretic properties) until an effective regimen is identified that is adequate to relieve congestion.(1) [C in Context Link 1, 2, 3, 4, 5]

[D] A specialty society guideline recommends 4 medication classes as guideline-directed medical therapy (GDMT) for adult patients with heart failure with reduced ejection fraction (HFrEF): beta-blockers, renin-angiotensin inhibitors (angiotensin receptor-neprilysin inhibitor preferred), aldosterone blockers, and sodium-glucose cotransporter-2 inhibitors.(1) This same guideline recommends the following for patients hospitalized with HFrEF absent clear contraindications: pre-existing GDMT should be continued and optimized (titration to therapeutic dose begun as inpatient), GDMT should not be discontinued due to mild decrease in renal function or blood pressure, GDMT should be initiated during hospitalization when clinical stability has been achieved (if all drug classes not on board), and, if GDMT is

discontinued, it should be reinstated as soon as possible.(1) A systematic review adds that rapid uptitration of GDMT should be added to patients with acute heart failure once congestive symptoms are controlled because, although diuretics improve symptoms and shorten hospital stays, they do not improve mortality or reduce adverse outcomes.(30) For heart failure with preserved ejection fraction (HFpEF), an expert panel recommends sodium-glucose cotransporter-2 inhibitors, aldosterone blockers, and either an angiotensin receptor-neprilysin inhibitor (preferred) or an angiotensin receptor blocker as GDMT, with the addition of beta-blockers reserved for specific indications, including comorbid atrial fibrillation, myocardial infarction within 3 years, or angina.(31) [D in Context Link 1, 2, 3, 4, 5]

[E] For children with heart failure with reduced ejection fraction, a specialty society guideline recommends routine use of renin-angiotensin inhibitors, with the addition of diuretics for patients with fluid retention and ventricular dysfunction; other drugs that are recommended as reasonable additional therapies include beta-blockers, digoxin, and ivabradine.(5) For children who have heart failure with preserved ejection fraction, the same guideline recommends diuretics to achieve euvolemia and recommends considering a sodium-glucose cotransporter-2 inhibitor for symptoms.(5) [E in Context Link 1, 2, 3, 4, 5]

[F] Lifestyle interventions include high-protein diets for malnutrition; weight-loss diets, exercise, and anti-obesity medications for obesity; exercise and movement (including cardiac rehabilitation); and evaluation and treatment for sleep-disordered breathing, depression, and anxiety.(5)(38)(39) [F in Context Link 1]

Definitions

Altered mental status

- Altered mental status (ie, different from baseline), as indicated by **1 or more** of the following(1)(2)(3)(4):
 - Confusional state (eg, disorientation, difficulty following commands, deficit in attention)
 - Lethargy (eg, awake or arousable, but with drowsiness; reduced awareness of self and environment)
 - Obtundation (ie, arousable only with strong stimuli, lessened interest in environment, slowed responses to stimulation)
 - Stupor (ie, may be arousable but patient does not return to normal baseline level of awareness)
 - Coma (ie, not arousable)

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Anasarca

- Anasarca is generalized edema that is widespread and may be more pronounced in dependent areas (eg, back while lying down, legs while sitting up).(1)

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Hemodynamic instability

- Hemodynamic instability, as indicated by **1 or more** of the following:

- Vital sign abnormality not corrected by appropriate treatment, as indicated by **1 or more** of the following[A]:
 - Tachycardia that persists despite appropriate treatment (eg, treatment of underlying cause, despite observation care)[A]
 - Hypotension that persists despite appropriate treatment (eg, treatment of underlying cause, despite observation care)[A]
 - Orthostatic hypotension that persists despite appropriate treatment (eg, treatment of underlying cause, despite observation care)[A]
- Severe hypotension in adult patient, as indicated by **1 or more** of the following:
 - Systolic blood pressure less than 80 mm Hg(1)[A]
 - Shock index greater than 1.0 (shock index is the heart rate divided by systolic blood pressure)[A](2)(3)(4)
 - Mean arterial pressure[B] less than 65 mm Hg  MAP Calculator[A](1)(6)
 - IV inotropic or vasopressor medication required to maintain adequate blood pressure or perfusion(3)(6)
 - Hypoperfusion due to hypotension, as indicated by **ALL** of the following:
 - Hypotension
 - Evidence of hypoperfusion, as indicated by **1 or more** of the following:
 - Lactate of 2.0 mmol/L (18 mg/dL) or more secondary to hypotension (ie, hypoperfusion)[C](3)(6)(8)
 - Metabolic acidosis (arterial or venous[D] pH less than 7.35) not otherwise explained(3)(6)(8)
 - Significant end organ dysfunction due to hypotension (eg, Altered mental status, myocardial ischemia, 2-fold or higher acute increase in serum creatinine)(3)(6)
- Severe hypotension in pediatric patient, as indicated by **1 or more** of the following:
 - Systolic blood pressure less than 80 mm Hg in child 6 to 17 years of age[A](14)
 - Systolic blood pressure less than 75 mm Hg in child 6 months to 5 years of age[A](14)
 - Shock index greater than 0.9 in child 13 to 17 years of age (shock index is the heart rate divided by systolic blood pressure)[A](2)(15)
 - Shock index greater than 1.0 in child 7 to 12 years of age (shock index is the heart rate divided by systolic blood pressure)[A](2)(15)
 - Shock index greater than 1.2 in child 4 to 6 years of age (shock index is the heart rate divided by systolic blood pressure)[A](2)(15)
 - IV inotropic or vasopressor medication required to maintain adequate blood pressure or perfusion(5)(6)
 - Hypoperfusion due to hypotension, as indicated by **ALL** of the following:
 - Hypotension
 - Evidence of hypoperfusion, as indicated by **1 or more** of the following:
 - Lactate of 2.0 mmol/L (18 mg/dL) or more secondary to hypotension (ie, hypoperfusion)[C](6)(8)
 - Metabolic acidosis (arterial or venous pH less than 7.35) not otherwise explained[D](5)(6)(14)
 - Significant end organ dysfunction due to hypotension (eg, Altered mental status, myocardial ischemia, 2-fold or higher acute increase in serum creatinine)(5)(6)(14)

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Footnotes

- A. Criteria based upon clinician-acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.
- B. The mean arterial pressure (MAP) takes into account both SBP and DBP readings.(3)(5)
- C. There are numerous causes of an elevated lactate level. The most common are cardiogenic or hypovolemic shock, severe heart failure, severe trauma, or sepsis. However, there are also other etiologies to consider such as vigorous exercise, seizures, liver disease, or medication use (eg, metformin, beta2-agonists); therefore, interpretation of elevated lactate levels requires consideration of the clinical context (eg, well-appearing post exercise vs hypotensive). The severity and persistence of the elevation can sometimes be helpful in this differentiation. In most instances of lactic acidosis, blood pH is less than 7.35, with a serum bicarbonate level of 20 mEq/L (mmol/L) or lower. However, a coexisting respiratory or metabolic alkalosis can mask these findings.(7)(8)
- D. Analyses have concluded that venous and arterial pH measurements are highly correlated, with small differences between them that are usually not clinically significant.(9)(10)(11)(12)(13) If a mixed acid-base disorder is suspected, an arterial blood gas is indicated.(10)

Hemodynamic stability

- Hemodynamic stability, as indicated by **1 or more** of the following:
 - Hemodynamic abnormalities at baseline or acceptable for next level of care
 - Patient hemodynamically stable, as indicated by **ALL** of the following(1)(2):
 - Tachycardia absent
 - Hypotension absent
 - No evidence of inadequate perfusion (eg, no myocardial ischemia)
 - No other hemodynamic abnormalities (eg, no Orthostatic hypotension)

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Hypotension

- Hypotension, as indicated by **1 or more** of the following:
 - Hypotension in adult patient, as indicated by **1 or more** of the following:
 - Systolic blood pressure less than 90 mm Hg[A][B](1)
 - Mean arterial pressure[C] less than 70 mm Hg[A][B]  MAP Calculator(1)(2)
 - Decrease in baseline systolic blood pressure of 30 mm Hg or more, with significant signs or symptoms due to lower blood pressure (eg, near syncope, syncope, chest pain)[A][B](1)
 - Hypotension in pediatric patient, as indicated by **1 or more** of the following:
 - Systolic blood pressure less than 110 mm Hg in child 13 to 17 years of age[A][D](3)
 - Systolic blood pressure less than 100 mm Hg in child 6 to 12 years of age[A][D](3)
 - Systolic blood pressure less than 95 mm Hg in child 3 to 5 years of age[A][D](3)
 - Systolic blood pressure less than 90 mm Hg in child 1 or 2 years of age[A][D](3)
 - Systolic blood pressure less than 80 mm Hg in infant 6 to 11 months of age[A][D](3)
 - Systolic blood pressure less than 70 mm Hg in infant 3 to 5 months of age[A][D](3)
 - Systolic blood pressure less than 65 mm Hg in infant 1 or 2 months of age[A][D](3)

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1. Schriger DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
2. Puskarch MA, Jones AE. Shock. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:34-41.e1.
3. Anderson CC, Kapoor S, Mark TE. Pediatric parameters and equipment. In: Anderson CC, Kapoor S, Mark TE, editors. The Harriet Lane Handbook: A Manual for Pediatric House Officers. 23rd ed. Elsevier; 2024:i-iii.

Footnotes

- A. Criteria based upon clinician-acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.
- B. Interpretation of blood pressure requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline blood pressure, medications, and clinical impact. For example, an elderly patient with heart failure may be prescribed medication with the intentional goal of a reduced pressure. If the patient's baseline SBP is 92 mm Hg to 96 mm Hg, absent signs or symptoms of hypotension, an emergency department SBP of 86 mm Hg should not automatically be categorized as hypotensive. This would hold for mean arterial pressure (MAP) as well. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term hypotension. Whether a blood pressure below the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment.
- C. The mean arterial pressure (MAP) takes into account both SBP and DBP readings.

- D. Interpretation of blood pressure requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline blood pressure, medications, and clinical impact. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term hypotension. Whether a blood pressure below the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment.

Hypotension absent

- Hypotension absent,^[A] as indicated by **1 or more** of the following:
 - Hypotension absent in adult patient, as indicated by **1 or more** of the following:
 - Systolic blood pressure greater than or equal to 90 mm Hg^{[A](1)}
 - Mean arterial pressure^[B] greater than or equal to 70 mm Hg  MAP Calculator^{[A](1)(2)}
 - Blood pressure at patient's baseline (eg, healthy adult with low systolic blood pressure), at intentional therapeutic goal (eg, patient with heart failure), or acceptable for next level of care (eg, blood pressure stable and no significant signs or symptoms due to low blood pressure)
 - Hypotension absent in pediatric patient, as indicated by **1 or more** of the following:
 - Systolic blood pressure greater than or equal to 110 mm Hg in child 13 to 17 years of age^{[A](3)}
 - Systolic blood pressure greater than or equal to 100 mm Hg in child 6 to 12 years of age^{[A](3)}
 - Systolic blood pressure greater than or equal to 95 mm Hg in child 3 to 5 years of age^{[A](3)}
 - Systolic blood pressure greater than or equal to 90 mm Hg in child 1 or 2 years of age^{[A](3)}
 - Systolic blood pressure greater than or equal to 80 mm Hg in infant 6 to 11 months of age^{[A](3)}
 - Systolic blood pressure greater than or equal to 70 mm Hg in infant 3 to 5 months of age^{[A](3)}
 - Systolic blood pressure greater than or equal to 65 mm Hg in infant 1 or 2 months of age^{[A](3)}
 - Blood pressure at patient's baseline (eg, healthy child with low systolic blood pressure), at intentional therapeutic goal, or acceptable for next level of care (eg, blood pressure stable and no significant signs or symptoms due to low blood pressure)

References

1. Schrager DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
2. Puskarch MA, Jones AE. Shock. In: Walls RM, editor. Rosen's Emergency Medicine: Concepts and Clinical Practice. 10th ed. Elsevier; 2023:34-41.e1.
3. Anderson CC, Kapoor S, Mark TE. Pediatric parameters and equipment. In: Anderson CC, Kapoor S, Mark TE, editors. The Harriet Lane Handbook: A Manual for Pediatric House Officers. 23rd ed. Elsevier; 2024:i-iii.

Footnotes

- A. Criteria based upon clinician-acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.
- B. The mean arterial pressure (MAP) takes into account both SBP and DBP readings.

Hypoxemia

- Hypoxemia, as indicated by **1 or more** of the following⁽¹⁾:

- Patient without baseline need for supplemental oxygen with oxygen saturation (SpO₂) of less than 90% or arterial blood gas partial pressure of oxygen (PaO₂) of less than 60 mm Hg (8.0 kPa) on room air^{[A][B]}
- Patient without baseline need for supplemental oxygen who now requires supplemental oxygen to keep SpO₂ greater than 89% or PaO₂ greater than 59 mm Hg (7.9 kPa)^[A]
- Patient with baseline need for supplemental oxygen who now requires increased supplemental oxygen to maintain oxygenation at baseline or acceptable level

References

1. Schrager DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
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Footnotes

- A. Pulse oximetry (SpO₂) may underestimate arterial saturation (SaO₂), especially in people with dark skin pigmentation, thick skin, cold body temperature, or who are wearing colored nail polish, and thus may not accurately detect hypoxemia.⁽²⁾ Where appropriate, pulse oximetry should be measured after warming fingers or removing nail polish. Pulse oximetry results should be assessed within the context of the patient's clinical presentation, and performance of an arterial blood gas considered for a more accurate assessment of oxygenation if indicated.⁽²⁾ Specific target values may require adjustment when care is delivered at high altitude.⁽³⁾
- B. Criteria based upon clinician-acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.

Orthostatic hypotension

- Orthostatic hypotension,^{[A][B]} as indicated by **1 or more** of the following⁽¹⁾⁽²⁾⁽³⁾:
 - Fall in SBP of 20 mm Hg or more 1 to 3 minutes after patient sits or stands from recumbent position
 - Fall in DBP of 10 mm Hg or more 1 to 3 minutes after patient sits or stands from recumbent position

References

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Footnotes

- A. Concomitant measurements of the heart rate are important to measure to help diagnose subtypes of orthostatic hypotension (eg, the lack of a compensatory increase in heart rate is typical of autonomic failure and an exaggerated tachycardia may be reflective of volume depletion). However, the heart rate is not a component of the definition of orthostatic hypotension, which relies upon blood pressure alone.(1)(2)(3)
- B. Criteria based upon clinician acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.

Severe electrolyte abnormalities requiring inpatient care

- Severe electrolyte abnormalities requiring inpatient care, as indicated by **ALL** of the following(1)(2)(3):
 - Electrolyte abnormality is not at acceptable patient baseline (eg, treatment effect).
 - Severe abnormality, as indicated by **1 or more** of the following:
 - Sodium[A] less than 130 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(4)(5)
 - Sodium[A] less than 135 mEq/L (mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures)(4)(5)
 - Sodium greater than 150 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(4)
 - Sodium greater than 145 mEq/L (mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures)(4)
 - Potassium less than 2.5 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(6)
 - Potassium less than 3 mEq/L (mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, ECG findings,[B] paresis, paralysis)(6)(7)
 - Potassium greater than 6.5 mEq/L (mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(6)
 - Potassium greater than 5 mEq/L (mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, ECG findings,[C] paresis, paralysis)(6)(7)(8)
 - Calcium[D] less than 7 mg/dL (1.75 mmol/L) or ionized calcium less than 3.2 mg/dL (0.8 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(9)(11)
 - Calcium[D] less than 8.6 mg/dL (2.15 mmol/L) or ionized calcium less than 4.65 mg/dL (1.16 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures, arrhythmia, cardiac conduction disturbance)(9)(11)
 - Calcium[D] greater than 14 mg/dL (3.5 mmol/L) or ionized calcium greater than 10.0 mg/dL (2.50 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(10)(11)
 - Calcium[D] greater than 12 mg/dL (3 mmol/L) or ionized calcium greater than 8.0 mg/dL (2.0 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, arrhythmia, cardiac conduction disturbance)(10)(11)
 - Phosphorus less than 1 mg/dL (0.32 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(12)
 - Phosphorus less than 1.5 mg/dL (0.48 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures)(12)
 - Phosphorus greater than 10 mg/dL (3.2 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(12)
 - Phosphorus greater than 4.5 mg/dL (1.45 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, crush injury, Altered mental status, seizures, arrhythmia, cardiac conduction disturbance)(12)
 - Magnesium less than 1 mg/dL (0.41 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(12)
 - Magnesium less than 1.5 mg/dL (0.62 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, seizures, arrhythmia, cardiac conduction disturbance)(12)

- Magnesium greater than 4.9 mg/dL (2 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(12)
- Magnesium greater than 3.0 mg/dL (1.23 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, Altered mental status, arrhythmia, cardiac conduction disturbance)(12)
- Uric acid greater than 20 mg/dL (1.19 mmol/L) not corrected to near normal or near chronic baseline despite observation care treatment(13)
- Uric acid greater than 8 mg/dL (0.48 mmol/L) with new (or presumed new) severe finding requiring inpatient management (eg, arrhythmia, cardiac conduction disturbance, seizure)(13)

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Footnotes

- A. In patients with hyperglycemia, a corrected serum sodium should inform decision making.(4)
- B. ECG manifestations of hypokalemia include ST-segment depression, flattened T-waves, and increased U-wave prominence.(7)
- C. ECG changes associated with hyperkalemia include peaked T-waves, prolonged PR interval, loss of P-waves, prolonged QRS interval, or sinus bradycardia. Other manifestations include second-degree or third-degree atrioventricular block or a junctional escape rhythm. The ultimate result of hyperkalemia can be ventricular fibrillation, pulseless electrical activity, or asystole. ECG changes are not a sensitive indicator of severe hyperkalemia; patients with severe hyperkalemia may have minimal or nondiagnostic abnormalities. While a normal ECG does not exclude hyperkalemia, it does confer a much lower risk of dangerous arrhythmia. Hyperkalemic patients with isolated T-wave abnormalities are at low risk of a serious adverse event overall, while patients with conduction abnormalities and other more severe ECG findings are at higher risk.(6)(7)(8)
- D. An ionized calcium level may be more accurate than a total serum calcium level, especially in the setting of acidosis, renal failure, multiple transfusions, hypoalbuminemia, or the presence of a paraprotein.(9)(10)

Tachycardia

- Tachycardia,[A][B] as indicated by **1 or more** of the following:
 - Heart rate greater than 100 beats per minute in adult[A][B](1)
 - Heart rate greater than 85 beats per minute in child 13 to 17 years of age[A][C](2)
 - Heart rate greater than 95 beats per minute in child 6 to 12 years of age[A][C](2)
 - Heart rate greater than 110 beats per minute in child 1 to 5 years of age[A][C](2)
 - Heart rate greater than 120 beats per minute in infant 3 to 11 months of age[A][C](2)
 - Heart rate greater than 150 beats per minute in infant 1 or 2 months of age[A][C](2)

References

1. Schriger DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
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- A. Criteria based upon clinician acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.
- B. Interpretation of heart rate requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline heart rate, medications, and clinical impact. For example, an elderly patient on a beta-blocker medication with a baseline resting heart rate of 60 beats per minute may be clinically tachycardic at a heart rate of 94 beats per minute. Likewise, a patient who is upset, in pain, or nervous in the emergency department with a heart rate of 106 beats per minute may meet the technical definition of tachycardia, but this tachycardia (absent associated findings such as chest pain or hypotension) may not be clinically important. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term tachycardia. Whether a heart rate above or below the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment.
- C. Interpretation of heart rate requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline heart rate, medications, and clinical impact. A patient who is upset, in pain, or nervous in the emergency department with an elevated heart rate may meet the technical definition of tachycardia, but this tachycardia (absent associated findings such as hypotension) may not be clinically important. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term tachycardia. Whether a heart rate above or below the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment.

Tachycardia absent

- Tachycardia[A][B] absent, as indicated by **1 or more** of the following:
 - Heart rate less than or equal to 100 beats per minute in adult[A][B](1)
 - Heart rate less than or equal to 85 beats per minute in child 13 to 17 years of age[A][B](2)
 - Heart rate less than or equal to 95 beats per minute in child 6 to 12 years of age[A][B](2)
 - Heart rate less than or equal to 110 beats per minute in child 1 to 5 years of age[A][B](2)
 - Heart rate less than or equal to 120 beats per minute in infant 3 to 11 months of age[A][B](2)

- Heart rate less than or equal to 150 beats per minute in infant 1 or 2 months of age^{[A][B](2)}

References

1. Schrager DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
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Tachypnea

- Tachypnea,^{[A][B]} as indicated by **1 or more** of the following:
 - Respiratory rate greater than 20 breaths per minute in adult^{[A][B](1)}
 - Respiratory rate greater than 18 breaths per minute in child 13 to 17 years of age^{[A][B](2)}
 - Respiratory rate greater than 22 breaths per minute in child 6 to 12 years of age^{[A][B](2)}
 - Respiratory rate greater than 25 breaths per minute in child 3 to 5 years of age^{[A][B](2)}
 - Respiratory rate greater than 30 breaths per minute in child 1 or 2 years of age^{[A][B](2)}
 - Respiratory rate greater than 40 breaths per minute in infant 6 to 11 months of age^{[A][B](2)}
 - Respiratory rate greater than 45 breaths per minute in infant 3 to 5 months of age^{[A][B](2)}
 - Respiratory rate greater than 55 breaths per minute in infant 1 or 2 months of age^{[A][B](2)}

References

1. Schrager DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
2. Anderson CC, Kapoor S, Mark TE. Pediatric parameters and equipment. In: Anderson CC, Kapoor S, Mark TE, editors. The Harriet Lane Handbook: A Manual for Pediatric House Officers. 23rd ed. Elsevier; 2024:i-iii.

Footnotes

- A. Criteria based upon clinician acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no

or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.

- B. Interpretation of respiratory rate requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline respiratory rate and whether the respiratory rate is indicative of significant underlying respiratory or other pathology. A mildly increased respiratory rate (eg, 20 to 22 breaths per minute in an adult), absent other indications of serious illness (eg, hypoxemia, metabolic acidosis, decreased tidal volume, pain), may be transitory and not clinically important. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term tachypnea. Whether a respiratory rate above the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment. In addition, the measurement of the respiratory rate is subject to error. A medical textbook states that because there can be significant breath-to-breath variation in respiratory rate, the rate should be assessed for at least 30 seconds, preferably for a full minute.⁽¹⁾ This same textbook also states that new technologies designed to measure the respiratory rate have not proved to be clinically useful.⁽¹⁾

Tachypnea absent

- Tachypnea[A][B] absent, as indicated by **1 or more** of the following:
 - Respiratory rate less than or equal to 20 breaths per minute in adult[A][B](1)
 - Respiratory rate less than or equal to 18 breaths per minute in child 13 to 17 years of age[A][B](2)
 - Respiratory rate less than or equal to 22 breaths per minute in child 6 to 12 years of age[A][B](2)
 - Respiratory rate less than or equal to 25 breaths per minute in child 3 to 5 years of age[A][B](2)
 - Respiratory rate less than or equal to 30 breaths per minute in child 1 or 2 years of age[A][B](2)
 - Respiratory rate less than or equal to 40 breaths per minute in infant 6 to 11 months of age[A][B](2)
 - Respiratory rate less than or equal to 45 breaths per minute in infant 3 to 5 months of age[A][B](2)
 - Respiratory rate less than or equal to 55 breaths per minute in infant 1 or 2 months of age[A][B](2)

References

1. Schriger DL. Approach to the patient with abnormal vital signs. In: Goldman L, Cooney KA, editors. Goldman-Cecil Medicine. 27th ed. Elsevier; 2024:32-35.
2. Anderson CC, Kapoor S, Mark TE. Pediatric parameters and equipment. In: Anderson CC, Kapoor S, Mark TE, editors. The Harriet Lane Handbook: A Manual for Pediatric House Officers. 23rd ed. Elsevier; 2024:i-iii.

Footnotes

- A. Criteria based upon clinician acquired numeric values (eg, vital signs, oxygen saturation) should be used if they are accurate reflections of the patient's condition. Transitory findings (eg, abnormal only upon initial emergency department intake or only one time out of multiple readings) that rapidly improve with no or minimal treatment usually do not reflect disease severity or risk for deterioration. This does not imply that an initial or one-time reading cannot ever be applicable. The goal is to separate erroneous or incidental findings from those that truly represent the patient's clinical picture.
- B. Interpretation of respiratory rate requires clinical judgment and consideration of several patient-specific factors, such as the patient's baseline respiratory rate and whether the respiratory rate is indicative of significant underlying respiratory or other pathology. A mildly increased respiratory rate (eg, 20 to 22 breaths per minute in an adult), absent other indications of serious illness (eg, hypoxemia, metabolic acidosis, decreased tidal volume, pain), may be transitory and not clinically important. The numeric values included in this definition are provided to allow for consistency in terms of a technical definition of the term tachypnea. Whether a respiratory rate above the technical threshold is clinically meaningful is a matter of persistence, context, and clinical judgment. In addition, the measurement of the respiratory rate is subject to error. A medical textbook states that because there can be significant breath-to-breath variation in respiratory rate, the rate should be assessed for at least 30 seconds, preferably for a full minute.⁽¹⁾ This same textbook also states that new technologies designed to measure the respiratory rate have not proved to be clinically useful.⁽¹⁾

Codes

ICD-10 Diagnosis: I09.81, I11.0, I13.0, I13.2, I50.1, I50.20, I50.21, I50.22, I50.23, I50.30, I50.31, I50.32, I50.33, I50.40, I50.41, I50.42, I50.43, I50.814, I50.82, I50.83, I50.84, I50.89, I50.9, T86.22 [Hide]

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