Wound and Skin Care: Common Complications and Conditions

MCG Health
Inpatient & Surgical Care
30th Edition

CCC: CCC-033 (ISC)
Link to Codes

Prevention

- Prevention issues and possible preventive measures include(1):
  - Wound infection(2)(3)(4)(5)(6):
    - Risk factors include(7):
      - Wound contamination within operative field (eg, perforated hollow viscus, open fracture)(8)
      - Malnutrition
      - Poor circulation or perfusion (eg, leg surgery and peripheral vascular disease)(9)
      - Poor oral health (eg, extensive dental caries)(3)
      - Diabetes, especially if poorly controlled(6)(10)(11)
      - Immunosuppressed patient(9)
      - Current history of smoking(6)(9)
      - Liver disease with ascites, hypoalbuminemia, or hyperbilirubinemia
      - Malignancy
      - Radiation therapy(9)
      - Wound dehiscence(12)
    - Preventive measures include(13)(14):
      - Hand hygiene(15)
      - Contact precautions for patient infected or colonized by methicillin-resistant *Staphylococcus aureus*
      - Antimicrobial prophylaxis as appropriate(16)(17)
      - Perioperative skin or vaginal decontamination (eg, with chlorhexidine)(6)(8)(18)(19)
      - Preoperative intranasal mupirocin for patient who is nasal carrier of *Staphylococcus aureus*(6)(20)

- Hair removal (if needed) with clippers or chemical depilation rather than razor before surgery(21)
- Avoid perioperative hypothermia(13)
- Nutrition support (eg, assessment and treatment of malnourished patient, carbohydrate supplement prior to surgery)(18)
- Debridement and irrigation as soon as possible for open fracture(6)
- Negative pressure wound therapy in high-risk patient(22)(23)
- Reconstructive wound closure in high-risk patient(9)

- Wound dehiscence[A](24)(25)(26)(27):
  - Risk factors include:
    - Infection at or near site of surgery
    - Wound hematoma or seroma
    - Obesity
    - Increased intra-abdominal pressure (eg, heavy coughing, retching, ascites, bowel distention, straining)
    - Preoperative radiation therapy(28)
  - Preventive measures include:
    - Use of sutures, rather than tissue adhesives, for incision closure
    - Mesh closure, when appropriate
    - Anterior fascial retention sutures for patient at high risk
    - Thorax support vest after sternotomy(29)
    - Reconstructive wound closure in high-risk patient(9)
    - Avoid surgical incision on areas of prior radiation.(30)
- Wound seroma[B](25)(31):
  - Risk factors include:
    - Elevation of skin flaps
    - Division of numerous lymphatic channels (ie, axillary or groin dissection)(32)
    - Repair of large ventral hernia(33)
    - Prior radiation therapy
    - Extensive use of cautery(25)
  - Preventive measures include(32):
    - Intraoperative placement of suction drains for patient at high risk(34)
    - Closure of subcutaneous fat, quilting technique, or tension suturing(31)(33)(35)
    - Negative pressure wound therapy over closed incisions for patient at high risk(36)(37)(38)
- Wound hematoma[C](25)(39):
  - Risk factors include:
    - Inadequate hemostasis
    - Depletion of clotting factors (eg, hemorrhage)
    - Coagulopathy (eg, clotting abnormality, anticoagulation, antiplatelet use)
  - Preventive measures include:
    - Preoperative correction of clotting abnormalities
    - Preoperative discontinuation of medications known to alter coagulation (eg, aspirin, anticoagulants)
    - Prophylactic compression(40)
- Pressure injuries(41)(42):
  - Risk factors include(43)(44)(45):

- Spinal cord injury(46)(47)
- Urinary or fecal incontinence
- Sensory or motor neurologic deficits
- Immobility(48)
- Peripheral vascular disease
- Diabetes(11)
- Malnutrition(49)(50)
- Morbid obesity(51)
- Presence of medical devices(52)(53)(54)
- Critical illness(50)(55)(56)

- Preventive measures include(43)(57)(58):
  - Daily examination of trochanteric, ischial, sacral, and heel areas(59)
  - Pressure-reduction mattress(56)(60)
  - Repositioning patient[D](63)
  - Elevating heels off bed
  - Padding bony prominences(64)(65)(66)
  - Repositioning of medical devices and padding pressure points(52)(54)
  - Nutritional supplements(49)(67)
  - Skin care, including emollients or barrier ointments as appropriate(52)(59)

- Burns(68)(69)(70)(71):
  - Risk factors include:
    - Proximity to medical devices that produce hot or cold temperatures
    - Radiation treatment
    - Utilization of devices that produce an electrical current or steam(48)(71)
    - Smoking (particularly with oxygen use)
  - Preventive measures include:
    - Removal of medical devices when possible, or providing barriers between patients and medical devices
    - Cooling protocols
    - Storing medications or solutions that can cause burns in closed containers away from patient
    - Grounding electrical devices
    - Regular maintenance of devices
    - Smoking restriction and cessation counseling

- Allergic or adverse reactions(30)(72)(73)(74)(75):
  - Risk factors include:
    - Significant history of allergy
    - Use of agents known to induce antibody-mediated reactions(75)(76)
    - Specific viral illnesses (eg, Epstein-Barr, COVID-19)(77)
    - Presence of HLA alleles for specific drugs (eg, HLA-B 1502 with hypersensitivity to carbamazepine, HLA-B 5701 with hypersensitivity to abacavir)(77)
    - Multiple drug regimens with cross-reactivity
  - Preventive measures include:
    - Avoidance of known allergens when possible

- Minimizing number of exposures to new medications or environmental triggers(74)
- Early recognition of allergic reaction and immediate removal or discontinuation of causative agent

Clinical Indications for Ongoing Inpatient Care

- Ongoing inpatient care is indicated for **1 or more** of the following(1)(25)(41)(76)(78)(79):
  - Hemodynamic instability
  - Severe pain requiring acute inpatient management
  - Ability to maintain oral hydration not clear(75)
  - Needed urgent or emergent treatment, procedure, or wound care not feasible at next level of care(80)
  - Altered mental status
  - Clinically significant infection, as indicated by **1 or more** of the following:
    - Vital sign abnormality
    - Suspected necrotizing fasciitis
    - Evidence of tissue necrosis
    - Erythema diameter expanding around wound despite treatment
    - Unexplained metabolic acidosis (eg, lactic acidosis)
    - Evidence of end organ dysfunction (eg, rising creatinine, myocardial ischemia, rising liver function tests)
    - Bacteremia (if blood cultures performed)
    - Known or suspected infection with multiple drug-resistant organism and need to observe initial response to treatment(81)
    - Rapidly expanding lesions
    - High-risk location (eg, perineum, sternum, orbit)(82)
  - Hematoma, as indicated by **1 or more** of the following:
    - Acute anemia due to rapid development of hematoma
    - Location necessitating drainage or monitoring (eg, neck hematoma causing airway compression, retroperitoneal)
    - Coagulopathy not readily reversible (eg, liver disease)
  - Significant burn, as indicated by **1 or more** of the following(68):
    - Vital sign abnormality
    - Full-thickness burn greater than 10% of body surface area
    - Any burn greater than 15% of body surface area
    - Serious burn of hand, foot, genitals, face, or joint
    - Burn accompanied by other significant medical problems or injuries (eg, arrhythmia, inhalation injury, trauma)
    - Serious chemical burn
    - High-voltage electrical burn (eg, 1000 volts or more)
    - Circumferential burn
  - Urgent or emergent procedure or treatment required not immediately available at next level of care, as indicated by **1 or more** of the following:
    - Pressure injury closure procedures. See Pressure Injury Closure by Musculocutaneous or Free Flap: Sacral, Ischial, or Trochanteric Region ISC guideline as appropriate.
    - Skin grafting
    - Ophthalmic surgical procedure (eg, amniotic membrane grafting)(75)
    - Serial ocular examinations
    - Drainage of infected material[E]

- Dressing change under general anesthesia
- Diverting colostomy (eg, severe sacral pressure injury)
- Dehiscence requiring frequent monitoring or immediate treatment(83)
- Fasciotomy
- Ligation of bleeding vessels
- Percutaneous placement of closed-suction drains, with pressure dressing
- Intravenous immunosuppressive therapy and monitoring

Alternatives to Inpatient Care

- Alternatives to inpatient stay extension include(2)(41)(78)(79)(84):
  - Home care
    - Nursing visits
    - Debridement of necrotic tissue (sharp, mechanical, or chemical debridement)
    - Dressing changes and wound care
    - Topical emollients and immunosuppressants
    - Parenteral or oral antibiotics
    - Pruritus and pain management
    - Nutritional supplements(85)
    - Pressure, temperature, and moisture control for pressure injuries
    - Electrical stimulation for pressure injuries(85)
    - Ultraviolet therapy
    - Drain care
    - Vacuum-assisted wound closure(86)
  - Recovery facility
    - Debridement of necrotic tissue (sharp, mechanical, or chemical debridement) for primary healing or in preparation for secondary wound coverage
    - Pressure, temperature, and moisture control for pressure injuries
    - Parenteral or oral antibiotics
    - Nutritional supplements(85)
    - Electrical stimulation for pressure injuries(85)
    - Topical emollients and immunosuppressants
    - Dressing changes and wound care
    - Pruritus and pain management
    - Drain care
    - Dressing changes, including sterile occlusive dressing and binder for wound dehiscence
    - Vacuum-assisted wound closure(86)

Discharge

- Extended stay beyond goal length of stay for primary condition may be needed until **ALL** of the following are present(1)(78)(79):
  - Hemodynamic stability
  - Volume status acceptable (eg, not dehydrated, able to maintain hydration)
  - Mental status at baseline

- Hypoxemia absent
- Tachypnea absent
- Fistulas, tunneling, or underlying deep tissue infection absent or appropriate for next level of care
- Ulcer surgical repair not needed or healing without complications
- Afebrile or fever improved and appropriate for next level of care
- Infection resolved or treatment instituted (eg, antibiotics) and performable at next level of care
- Pain absent or managed
- Wound closed, continuity adequately restored, or wound manageable at lower level of care
- No drain needed or drain care manageable at lower level of care
- Wound hematoma or seroma resolving
- Dressing care manageable at lower level of care
- Coagulopathy absent, resolved, or treatable at lower level of care
- Medical comorbidities resolved or treatable at lower level of care

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Footnotes

[A] Wound dehiscence is the separation and disruption of the wound within the fascial layer.(1) [A in Context Link 1]

[B] Wound seroma is a collection of liquefied fat, serum, and lymphatic fluid under the surgical incision.(1)(25)(31) [B in Context Link 1]

[C] Wound hematoma is a collection of blood in the wound.(1) [C in Context Link 1]

[D] There is a paucity of evidence regarding the ideal frequency and types of positions suitable for the prevention of pressure injuries despite evidence that immobility is a major risk factor for their development.(61)(62) [D in Context Link 1]

[E] Deep infections and some other major wound infections may require an invasive procedure for drainage, such as reoperation, hardware removal, or radiologically guided abscess drainage.(78)(79) [E 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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Bacteremia

- Bacteremia refers to blood culture isolation of a bacterial species that is likely to be pathologic and not a contaminant.(1)(2)

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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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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)

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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 absent

- Hypoxemia absent, as indicated by **1 or more** of the following(1):
  - Arterial oxygen saturation (SpO_2) of 90% or greater or arterial partial pressure of oxygen (PaO_2) of 60 mm Hg (8.0 kPa) or greater on room air[A][B]
  - Oxygen requirements are stable and arranged for at next level of care.

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Footnotes

A. Specific target values (ie, 90% or 60 mm Hg (8.0 kPa)) may require adjustment when care is delivered at high altitude.(2)

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.

Immunosuppressed

- Immunosuppressed refers to a degree of immunocompromise that is clinically significant (eg, affects choice of antimicrobial agent due to possibility of atypical organism, necessitates additional isolation, or leads to clinically relevant increase in likelihood of severe infection)[A]; examples include(1)(2)(3)(4):
  - Neutropenia (absolute neutrophil count less than 500/mm^3 (0.5 x10^9/L), or expected to decrease to this level within the next 48 hours)
  - Drug-induced immunosuppression (ie, current usage); examples include:
    - Systemic corticosteroids[B](6)(7)(8)(9)
    - Immunosuppressive agent (eg, tacrolimus, azathioprine, methotrexate, cyclosporin)
    - Immunomodulatory therapy (eg, tumor necrosis factor inhibitor, interleukin inhibitor, monoclonal antibodies)
  - Poorly controlled diabetes mellitus (eg, HbA1c of 8.5% (69 mmol/mol) or higher)[C][D](10)(11)(12)(13)
  - Chronic kidney disease (ie, estimated GFR less than 60 mL/min/1.73m^2 (1.0 mL/sec/1.73m^2)) or end-stage renal disease (hemodialysis or peritoneal dialysis)[E](15)(16)(17)(18)(19)(20)
  - Cirrhosis[F](21)(22)(23)(24)(25)
  - Bone marrow suppression or dysfunction (eg, chemotherapy, radiation therapy, bone marrow fibrosis or infiltration with malignant cells)
  - Humoral (antibody, B-lymphocyte) immune dysfunction or deficiency (eg, common variable immune deficiency, specific antibody deficiency, chronic lymphocytic leukemia)(26)(27)
  - Cell-mediated (eg, T-lymphocyte, natural killer cell) immune dysfunction or deficiency (eg, severe combined immune deficiency, DiGeorge syndrome, Wiskott-Aldrich syndrome)
  - Phagocytic cell (neutrophil, macrophage) dysfunction (eg, chronic granulomatous disease, leukocyte adhesion deficiency)
  - Acquired immunodeficiencies (eg, HIV/AIDS, hematopoietic and lymphoid malignancies)
  - History of solid organ or hematopoietic stem cell transplant[G]
  - Asplenia (surgical or congenital) or functional hyposplenia (eg, sickle cell disease)[H](28)
  - Complement deficiency (eg, hereditary, due to protein loss (nephrotic syndrome))

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Footnotes

A. Examples are given for some of the mechanisms of immunocompromise; however, the list is not all-encompassing. The intent is to illustrate the degree of immunocompromise that may be clinically significant. The presence of a listed potentially immunocompromising factor does not always indicate clinically significant immunosuppression. For example, some findings, such as neutropenia, are usually indicative of significant immunocompromise, whereas others (eg, presence of diabetes, renal failure, or asplenia) may not necessarily indicate clinically important immunocompromise. The judgment as to the presence of clinically significant immunocompromise in a particular patient is also influenced by several variables, such as the nature of the suspected infection and the specific details of the patient's presentation, condition, and comorbidities. Patients may have more than one potential source of immunocompromise, increasing the likelihood of significant dysfunction (eg, poorly controlled diabetes and chronic kidney disease).
B. The minimum dose of systemic corticosteroid use associated with an increased risk of serious infection is not defined, but there is increasing risk with higher doses and longer duration of treatment.(5) Observational studies of patients with rheumatologic disease indicated, after statistical adjustment, that infection risk was increased with prolonged use of as little as 5 mg of prednisone-equivalent per day dosing, and also found that higher doses and longer duration increased risk.(6)(7)(8) An evidence-based specialty society guideline defines clinically important immunocompromise in adult pneumonia patients as those patients with an impaired immune response who are judged to be at elevated risk of infection by atypical or opportunistic organisms, so that there is a need to alter empirical antimicrobial therapy.(9) This same guideline states that corticosteroid use would lead to such an immune system impairment at doses of 20 mg of prednisone-equivalent per day or more for 14 days or more, or a course of treatment with a cumulative dose of 600 mg or more of prednisone-equivalent.(9)
C. It is generally agreed that the presence of diabetes is associated with an increased risk of infection, including infection leading to hospitalization.(2)(10)(11)(12)(13) At least some of this risk is attributed to the deleterious effects of diabetes on the immune system.(2)(10)(11)(12)(13) It has been found that the impact of diabetes can be higher in certain types of infections (eg, higher impact in cellulitis, osteomyelitis) and with a longer total duration of the diagnosis.(10)(11)(13)
D. There is no universally agreed upon HbA1c level that indicates "poor control." It has been found that the higher the HbA1c, the larger the impact on the immune system.(10)(11)(12)(13) Goal HbA1c can vary to some degree depending on the patient. Otherwise healthy adults and adolescents may have a target HbA1c of less than 7% (53 mmol/mol), whereas those who have complex comorbidities, impairment in cognition or activities of daily living, or a history of severe hypoglycemia may have a target of less than 8% (64 mmol/mol).(14) However, these targets are put forth with reduction of microvascular and macrovascular effects of diabetes in mind, not immune system effects.(14) In this way, there is no simple cutoff between adequate and poor control. Cohort studies, after statistical adjustment, have found that HbA1c levels above 8.0% to 8.5% (64 to 69 mmol/mol) are independently associated with hospitalization due to infection.(10)(11)(12)(13)
E. Patients with chronic kidney disease or end-stage renal disease have impaired immune system function, measured, for example, by higher rates of infection requiring hospitalization.(15)(16)(17) The degree of renal impairment correlates with the severity of immunocompromise.(15)(16)(17) The degree of proteinuria (eg, urine albumin to creatinine ratio) is also independently correlated with the severity of immune system dysfunction. These 2 factors are additive, in that patients with both reduced GFR and significant proteinuria are the most severely affected.(15)(16)(17) Patients with end-stage renal disease, in general, have more profound immune system dysfunction, with inadequate dialysis even more detrimental.(18)(19)(20)
F. Patients with cirrhosis of the liver are functionally immunocompromised due to a variety of mechanisms. This immunocompromise correlates with the severity of the cirrhosis and is called cirrhosis-associated immune dysfunction (CAID). Immune dysfunction is also worsened during periods of acute exacerbation of chronic liver disease.(21)(22)(23)(24)(25) CAID is particularly associated with bacterial infections, affecting both the frequency and severity of infection.(23)(24)(25)
G. Susceptibility to infection varies with the immunosuppressive agents used.(4)
H. Patients with asplenia or hyposplenia are at higher risk of infection with encapsulated organisms, such as *Streptococcus pneumoniae*, meningococcal infection, encapsulated strains of *Haemophilus influenzae*, and certain tick-borne diseases.(2)(28)

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

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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 pain requiring acute inpatient management

- Severe pain requiring inpatient management, as indicated by **1 or more** of the following(1)(2)(3)(4):
  - Inpatient parenteral analgesic agent treatment required,[A] as indicated by **ALL** of the following:
    - Pain insufficiently responsive to nonpharmacologic and oral pharmacologic analgesia (eg, NSAID, oral opioid)
    - Need for parenteral treatment persists despite observation care (eg, adjustments in dosage, frequency, medication, route).
  - Pain control regimen for next level of care not established, as indicated by **ALL** of the following:
    - Regimen used to achieve sufficient pain control is not readily performable at next level of care.
    - Unable to convert patient to regimen performable at next level of care despite observation care (eg, adjustments in dosage, frequency, medication, route)
  - Suspected new or deteriorating disease process as etiology (eg, new site of metastatic disease) requiring inpatient evaluation and treatment (eg, urgent radiation therapy)(7)
  - Palliative procedure planned that necessitates inpatient care for assessment and monitoring needs (eg, celiac block, stent to relieve obstruction)

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Footnotes

A. Many validated instruments are available to quantify pain.(4)(5) A visual analog or numerical rating scale graded from 0 to 10 is often used; moderate pain correlates with a score of 4 to 6 and severe pain is 7 to 10.(4) Different scales may be more appropriate for different disease processes or patient populations.(5)(6)

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.
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 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. 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 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.

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)

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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. 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)

Vital sign abnormality

- Vital sign abnormality, as indicated by **ALL** of the following(1)(2):
  - Vital sign findings not as expected for chronic patient condition or baseline (eg, intentionally low blood pressure in heart failure)
  - Vital sign abnormality, as indicated by **1 or more** of the following:
    - Tachycardia
    - Hypotension
    - Orthostatic hypotension

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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. 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.

Codes

ICD-10 Diagnosis: B02.9, B85.0, B85.1, B85.3, B85.4, B86, B88.8, B88.9, E09.628, I87.011, I87.012, I87.013, I87.019, I87.031, I87.032, I87.033, I87.039, L01.00, L01.01, L01.02, L01.03, L01.09, L01.1, L08.0, L08.89, L08.9, L10.0, L10.1, L10.2, L10.3, L10.4, L10.5, L10.89, L10.9, L12.0, L12.1, L12.30, L12.31, L12.35, L12.8, L12.9, L13.8, L13.9, L14, L20.84, L20.89, L20.9, L23.0, L23.1, L23.3, L23.4, L23.5, L23.6, L23.7, L23.89, L23.9, L24.0, L24.1, L24.2, L24.4, L24.5, L24.6, L24.7, L24.81, L24.89, L24.9, L25.1, L25.2, L25.3, L25.4, L25.5, L25.8, L25.9, L26, L27.0, L27.1, L27.2, L27.8, L27.9, L28.0, L28.1, L28.2, L29.0, L29.1, L29.2, L29.3, L29.81, L29.89, L29.9, L30.0, L30.1, L30.2, L30.3, L30.8, L30.9, L43.2, L49.0, L49.1, L49.2, L49.3, L49.4, L49.5, L49.6, L49.7, L49.8, L49.9, L50.0, L50.1, L50.6, L50.8, L50.9, L51.0, L51.1, L51.2, L51.3, L51.8, L51.9, L52, L53.1, L53.2, L53.3, L53.8, L53.9, L54, L56.0, L56.1, L56.2, L58.0, L58.1, L58.9, L59.8, L59.9, L64.0, L65.1, L65.8, L65.9, 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