

LABORATORY VALUES INTERPRETATION RESOURCE

Updated 2022

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POINT OF CARE

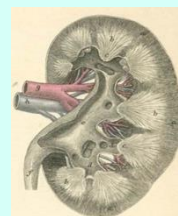
Complete Blood Count



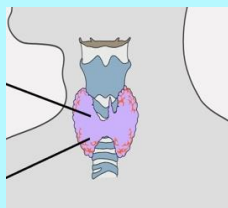
Electrolyte Panel



Kidney Function



Endocrine



Arterial Blood Gases



Liver Function/ Hepatic Panel



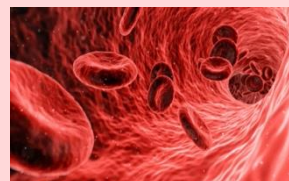
Lipid Panel



Coagulation Tests & Assays



Muscular Disorders & Cardiovascular-Specific Labs



COMPLETE BLOOD COUNT (CBC) (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

White Blood Cells (per mm³)

Newborn: 9,000-30,000

Child ≤ 2 years: 6,200-17,000

Child > 2 years/adult: 5,000-10,000

Possible Critical Values: < 2,500 or > 30,000

Red Blood Cells (10⁶/μL)

Newborn: 4.8-7.1

2-8 weeks: 4.0-6.0

2-6 months: 3.5-5.5

6 months-1 year: 3.5-5.2

1-18 years: 4.0-5.5

Adult:

○ Male: 4.7-6.1

○ Female: 4.2-5.4

Platelets (per mm³)

Premature infant: 100,000-300,000

Newborn: 150,000-300,000

Infant: 200,000-475,000

Child/adult: 150,000-400,000

Possible Critical Values: < 50,000 or > 1 million

Hemoglobin (g/dL)

Newborn: 14-24

0-2 weeks: 12-20

2-6 months: 10-17

1-6 years: 9.5-14

6-18 years: 10-15.5

Older adult: values are slightly decreased

Possible Critical Values: < 5 or > 20

Adult:

Male: 14-18

Female: 12-16

Pregnant: > 11

Hematocrit

Newborn: 44-64%

2-8 weeks: 39-59%

2-6 months: 35-50%

6 months-1 year: 29-43%

1-6 years: 30-40%

6-18 years: 32-44%

Older adult: values may be slightly decreased

Possible Critical Values: < 15% or > 60%

Adult:

○ Male: 45-52%

○ Female: 37-47%

○ Pregnant: > 33%

Typical Clinical Presentations with Abnormal CBC Levels

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

WBC (Leukocytes)

Trending ↑	Trending ↓
• Fever • Fatigue • Bleeding • Bruising • Frequent infections	• Frequent and/or persistent infections • Inflammation or ulcers in and around the mouth • Headache • Stiff neck • Sore throat • Night sweats

PLATELETS (Thrombocytes)

Trending ↑	Trending ↓
• Headache • Dizziness • Weakness • Chest pain • Tingling in hands/feet	• Petechiae • Ecchymosis • Oral bleeding • Hematuria • Epistaxis

RBC (Erythrocytes)

Trending ↑	Trending ↓
• Weakness • Fatigue • Headache • Lightheadedness • Dyspnea	• Orthostatic hypotension • Weakness • Fatigue • Dyspnea on exertion • Pallor • Dizziness • Chest pain • Leg cramps with exercise

HEMOGLOBIN

Trending ↑	Trending ↓
• Fatigue • Headache • Dizziness • Visual changes • Transient ischemic attack (TIA) • Dysrhythmias • Bruising • Bleeding • Additional Pediatric Considerations:	• Pallor • Tachycardia • Orthostatic hypotension • Dysrhythmias • Impaired endurance and activity tolerance • Additional Pediatric Considerations:
Newborns: ○ Jitteriness ○ Cyanosis ○ Hypotonia ○ Respiratory distress	
Infants may present with lethargy and poor feeding	

HEMATOCRIT

Trending ↑	Trending ↓
• Fatigue • Headache • Dizziness • Visual changes • TIA • Dysrhythmia • Bruising • Bleeding	• Orthostatic hypotension • Dizziness • Headache • Pallor • Cold hands/feet • Angina • Dysrhythmia • Dyspnea

COMPLETE BLOOD COUNT (CBC) (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↑ WBC (leukocytosis):

- Closely assess and monitor for signs/symptoms of multisystem complication in patients presenting with hyperleukocytosis (WBC > 100,00 mm³), as these patients are at increased risk for cardiac, pulmonary, renal, and neurologic involvement as it relates to leukostasis.
- Consider the timing of physical therapy session due to early-morning low level and late-afternoon high peak.

For patients with trending ↓ WBC (leukopenia):

- Refer to facility guidelines for neutropenic precautions and adjust therapeutic activities accordingly.
- Monitor for signs and symptoms of infection during physical therapy intervention.
- Monitor for fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE (rate of perceived exertion) scale or breathlessness scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Provide fall prevention screening and intervention as patients may be at risk for falls related to the underlying diagnosis and treatment.
- Use caution during neurogenic bowel or bladder programs, S4-S5 testing (spinal cord injury/tumors) and rectal exams, as patients may be at an increased risk for infection.
- Notify the interprofessional team immediately if a patient with a cancer diagnosis is neutropenic and has a fever (> 100.4° F or 38° C). This is considered an oncologic emergency.
- Discuss with the interprofessional team risk vs. benefit if planning to utilize dry needling, given patients with neutropenia are at high risk for infection.

For patients with trending ↑ platelets (thrombocytosis & thrombocythemia):

- Screen for venous thromboembolism (VTE) using patient diagnosis-specific evidence-based tool due to increased risk with elevated levels.
- Monitor for signs and symptoms of VTE and consider referral to a medical provider as appropriate. Refer to Coagulation Tests and Assays section.
- Collaborate with the interprofessional team regarding risk vs. benefit of physical therapy intervention with abnormal findings.

For patients with trending ↓ platelets (thrombocytopenia):

- Educate patient/caregiver regarding risks and strategies to prevent falls. There is an increased risk of spontaneous bleeding resulting from a fall.
- Monitor for fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Use caution during neurogenic bowel or bladder programs, S4-S5 testing (spinal cord injury/tumors) and rectal exams, as patients may be at an increased risk for bleeding.
- Discuss with the interprofessional team risk vs. benefit if planning to utilize dry needling, given patients with thrombocytopenia are at high risk for bleeding.
- Refer to the recommendations by the National Hemophilia Foundation's Physical Therapy Guidelines when working with persons with bleeding and clotting disorders.

For patients with trending ↑ RBC (erythrocytosis):

- Monitor for fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Screen for VTE using patient diagnosis-specific evidence-based tool due to increased risk with elevated levels.
- Monitor for signs and symptoms of VTE and consider referral to a medical provider as appropriate. Refer to Coagulation Tests and Assays.

For patients with trending ↓ RBC (anemia):

- Monitor vital signs and cardiac rhythm during physical therapy intervention.
- Monitor for fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Monitor for leg cramps during physical therapy intervention.
- Assess and monitor for cognitive impairment due to increased risk for altered mental status. Consider referral to other providers as appropriate.
- Provide fall prevention screening and intervention as needed due to increased fall risk.

COMPLETE BLOOD COUNT (CBC) (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↓ RBC (anemia): *continued*

- Monitor for signs and symptoms of orthostatic hypotension during positional changes and throughout the physical therapy intervention. Discuss concerns for orthostatic hypotension with interprofessional team if noted during assessment/intervention.
- Monitor for orthostatic hypotension. Educate patient/caregiver on recognizing symptoms, avoiding quick postural changes, and monitoring blood pressure in the presence of orthostasis or dizziness.

For patients with trending ↑ hemoglobin (polycythemia):

- Monitor vital signs and cardiac rhythm during physical therapy intervention.
- Provide fall prevention screening and intervention as needed due to increased fall risk.
- Implement activity pacing strategies to reduce the load and prevent undue stress on the cardiovascular system.

For patients with trending ↓ hemoglobin (anemia):

- Collaborate with the interprofessional team regarding risks vs. benefits and the need or timing of transfusion before mobilization.
- Assess and monitor all vital signs, especially SpO₂, to predict tissue perfusion. SpO₂ may not accurately represent the physiologic state in patients with severe anemia.
- Monitor patients with pre-existing cerebrovascular, cardiac, or renal conditions for ineffective tissue perfusion (discoloration, poor peripheral pulses, decreased temperature, and angina) related to decreased hemoglobin levels.
- Provide fall prevention screening and intervention as needed due to increased fall risk.
- Monitor for orthostatic hypotension. Educate patient/caregiver on recognizing symptoms, avoiding quick postural changes, and monitoring blood pressure in the presence of orthostasis or dizziness.
- Implement activity pacing strategies to reduce the load and prevent undue stress on the cardiovascular system.
- Monitor for fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.

For patients with trending ↓ hemoglobin (anemia): *continued*

- Additional Pediatric Considerations:
 - Monitor for signs/symptoms of anemia in premature and low birth weight infants.
 - Monitor for signs/symptoms of developmental delay in infant/child with anemia.

For patients with trending ↑ hematocrit (polycythemia):

- Screen for VTE using the patient diagnosis-specific evidence-based tool due to increased risk with elevated levels. Monitor for signs and symptoms and consider referral to a medical provider as appropriate. Refer to Coagulation Tests and Assays section.

For patients with trending ↓ hematocrit (anemia):

- Assess and monitor all vital signs, especially SpO₂, to predict tissue perfusion. SpO₂ may not accurately represent the physiologic state in patients with severe anemia.
- Provide fall prevention screening and intervention as needed due to increased fall risk.
- Monitor for orthostatic hypotension. Educate patient/caregiver on recognizing symptoms, avoiding quick postural changes, and monitoring blood pressure in the presence of orthostasis or dizziness.
- Monitor cardiac rhythm and for signs/symptoms of decreased activity tolerance during physical therapy intervention.
- Monitor patients with pre-existing cerebrovascular, cardiac, or renal conditions for ineffective tissue perfusion (discoloration, weak peripheral pulse, decreased temperature, and angina) related to decreased hematocrit levels.

ELECTROLYTE PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Sodium (Na) (mEq/L) Premature infant: 132-140 Newborn: 134-144 Infant: 134-150 Child: 136-145 Adult/elderly: 136-145 Possible Critical Values: < 120 or > 160	Phosphate (PO₄) (mg/dL) Newborn: 4.3-9.3 Child: 4.5-6.5 Adult: 3.0-4.5 Older adult: values slightly lower than adult Possible Critical Values: < 1	Chloride (Cl) (mEq/L) Premature infant: 95-110 Newborn: 96-106 Child: 90-110 Adult: 98-106 Possible Critical Values: < 80 or > 115
Calcium (Ca) (mg/dL) Infant < 10 days old: 7.6 -10.4 10 days old–2 years: 9-10.6 Child > 2 years: 8.8-10.8 Adult: 9-10.5 Possible Critical Values: < 6 or > 13	Potassium (K) (mEq/L) Newborn: 3.9-5.9 Child: 3.4-4.7 Infant: 4.1-5.3 Adult/elderly: 3.5-5.0 Possible Critical Values: ○ Newborn: < 2.5 or > 8.0 ○ Adult: < 2.5 or > 6.5	Magnesium (Mg) (mEq/L) Newborn: 1.4-2 Child: 1.4-1.7 Adult: 1.3-2 Possible Critical Values: < 0.5 or > 3

Typical Clinical Presentations with Abnormal Electrolyte Levels

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

SODIUM (Na)

Trending ↑ - Thirst - Confusion - Irritability - Hyperreflexia - Seizure - Additional Pediatric Considerations: - Infant: high-pitched cry, tachypnea - Child: restlessness, weakness, fever	Trending ↓ - Headache - Lethargy - Hyporeflexia - Seizure - Coma - Orthostatic hypotension - Pitting edema - Confusion - Weakness - Nausea
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CALCIUM (Ca)

Trending ↑ - Hyporeflexia - Muscle weakness - Ventricular dysrhythmia - Lethargy - Constipation - Nausea/vomiting - Additional Pediatric Considerations: - Hypotonia - Poor feeding - Abdominal pain - Psychiatric symptoms (older children and adolescents)	Trending ↓ - Confusion - Muscle cramps - Hyperreflexia - Dysrhythmia - Paresthesia - Agitation - Seizure - Fatigue - Additional Pediatric Considerations: - Impaired skin and bone growth, poor feeding
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PHOSPHATE (PO₄)

Trending ↑ - Often asymptomatic - Confusion - Muscle weakness - Muscle cramps - Paresthesia - Subcutaneous nodules	Trending ↓ - Often asymptomatic - Confusion - Fatigue - Muscle weakness (proximal skeletal myopathy) - Dysphagia - Bone and muscle pain
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POTASSIUM (K)

Trending ↑ - Muscle weakness or paralysis - Muscle tenderness - Paresthesia - Dysrhythmia - Bradycardia	Trending ↓ - Extremity weakness - Hyporeflexia - Paresthesia - Leg cramps - Dysrhythmia - Hypotension
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CHLORIDE (Cl)

Trending ↑ - Lethargy - Weakness - Edema - Hypertension - Tachycardia - Tachypnea - Dyspnea	Trending ↓ - Agitation - Irritability - Muscle cramping - Hypertonia - Hyperreflexia - Tetany - Hypotension
Trending ↓ Additional Pediatric Considerations: Failure to thrive, lethargy, and poor cognitive function and at risk for deficient language skills.	

MAGNESIUM (Mg)

Trending ↑ - Nausea/vomiting - Hyporeflexia - Hypotonia - Somnolence - Bradycardia - Dysrhythmia - Hypotension - Respiratory depression - Additional Pediatric Considerations: - Decreased GI motility	Trending ↓ - Hypertonia - Hyperreflexia - Tremors - Muscle cramping - Seizures - Apathy - Nystagmus - Dysrhythmia - Additional Pediatric Considerations: - Jitteriness
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ELECTROLYTE PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↑ sodium (hypernatremia):

- Assess and monitor cardiac rhythm, vital signs, and symptoms closely. Patients at risk for tachycardia and hypotension may have decreased activity tolerance.
- Assess and monitor for cognitive and neurologic impairment. Consider referral to other providers as appropriate.
- Collaborate with the interprofessional team about fluid intake, especially for patients with difficulty communicating needs.
- Consider seizure precautions.
- Additional Pediatric Considerations:
 - Monitor infants and children with neurodevelopmental impairment for excessive urine output (frequently soaked diapers) as they may be unable to communicate thirst.

For patients with trending ↓ sodium (hyponatremia):

- Assess and monitor for cognitive impairment due to increased risk for altered mental status. Consider referral to other providers as appropriate.
- Provide fall prevention screening and intervention as needed due to increased fall risk.
- Monitor for orthostatic hypotension. Educate patient/caregiver on recognizing symptoms, avoiding quick postural changes, and monitoring blood pressure in the presence of orthostasis or dizziness.
- Consider seizure precautions.

For patients with trending ↑ potassium (hyperkalemia):

- Collaborate with the interprofessional team in the presence of critical hyperkalemia.
- Patients with levels > 5 mEq/L are at increased risk for dysrhythmia and acute cardiac events: Monitor cardiac rhythm, vital signs, and symptoms closely, considering possible decreased activity tolerance.
- Assess and monitor for an acute decline in muscle strength and performance that occurs in an ascending pattern and may progress to flaccid paralysis.

For patients with trending ↓ potassium (hypokalemia):

- Collaborate with the interprofessional team in the presence of critical hypokalemia.
- Patients with levels < 2.5 mEq/L are at increased risk for dysrhythmia and acute cardiac events: Monitor cardiac rhythm, vital signs, and symptoms closely, considering possible decreased activity tolerance.
- Assess and monitor for an acute decline in muscle strength and performance that occurs in an ascending pattern and may progress to flaccid paralysis.

For patients with trending ↑ calcium (hypercalcemia):

- Assess and monitor cardiac rhythm, vital signs, and symptoms closely. Patients at risk for cardiac events may have decreased activity tolerance.
- Assess and monitor for acute decline in muscle strength and performance.
- Patients undergoing cancer treatment are at risk for hypercalcemia. Alert the interprofessional team if there are concerning signs or symptoms, this is deemed an oncologic emergency.
- Consider seizure precautions.
- Additional Pediatric Considerations:
 - Assess and monitor for developmental delay.

For patients with trending ↓ calcium (hypocalcemia):

- Monitor cardiac rhythm, vital signs, and symptoms closely, considering possible decreased activity tolerance.
- Assess and monitor for acute decline in muscle strength and performance.
- Cognitive and sensory impairments may decrease independence and safety and increase fall risk. Provide patient/caregiver education to mitigate risk. Consider referral to other providers as appropriate.
- Long-term deficiency can lead to cataracts and impaired vision. Consider associated fall risk.
- For patients with osteopenia, utilize safe handling precautions (hand placement, minimize torque, maintaining alignment) due to increased fracture risk.
- Consider seizure precautions.

ELECTROLYTE PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↑ chloride (hyperchloremia):

- Assess and monitor cardiac rhythm, blood pressure, and respiratory status. Patients at risk for tachycardia, hypertension, dyspnea, and tachypnea may have decreased activity tolerance.
- Assess and monitor for an acute decline in muscle strength and performance.
- Assess and monitor the level of consciousness. Consider referral to other providers as appropriate.

For patients with trending ↓ chloride (hypochloremia):

- Assess for neuromuscular impairments and associated decreased muscle strength and performance.
- Monitor vital signs including blood pressure and patient symptoms due to risk for hypotension.

For patient with trending ↑ phosphate (hyperphosphatemia):

- Assess for neuromuscular impairments and associated decreased muscle strength and performance.
- Cognitive, sensory, and motor impairments may decrease safety and independence and increase fall risk. Provide patient and caregiver education to mitigate risk. Consider referral to other providers as appropriate.

For patients with trending ↓ phosphate (hypophosphatemia):

- Cognitive and neuromuscular impairments may decrease safety and independence and increase fall risk. Provide patient/caregiver education to mitigate risk. Consider referral to other providers as appropriate.
- Monitor pain level. Provide multimodal treatment and patient education.

For patients with trending ↑ magnesium (hypermagnesemia):

- Monitor cardiac rhythm, SpO₂, and vital signs closely, considering possible decreased activity tolerance. Patients may be at risk for acute cardiopulmonary events.
- Assess for neuromuscular impairments and associated decreased muscle strength and performance.

For patients with trending ↓ magnesium (hypomagnesemia):

- Monitor cardiac rhythm, vital signs, and symptoms closely, considering possible decreased activity tolerance. Patients may be at risk for dysrhythmias and acute cardiac events.
- Assess for neuromuscular impairments and associated decreased muscle strength and performance.
- Consider seizure precautions.

KIDNEY FUNCTION (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Blood Urea Nitrogen (BUN) (mg/dL)

Newborn: 3-12

Infant/child: 5-18

Adult: 10-20

Possible Critical Value: > 100 indicates serious renal function impairment

- Adult BUN/creatinine ratio is 6-25 mg/dL.
- Older adults may be slightly higher.
- For pediatrics: BUN will be stable in chronic renal disease and rise with acute kidney injury.

Serum Creatinine (mg/dL)

Newborn: 0.3-1.2

Infant: 0.2-0.4

Child: 0.3-0.7

Adolescent: 0.5-1.0

Adult:

- Male: 0.6-1.2
- Female: 0.5-1.1

Possible Critical Value:

- > 4 indicates serious renal function impairment
- ≥ 0.3 mg/dL or $\geq 50\%$ increase from baseline indicates acute kidney injury in the pediatric population but is a less sensitive indicator to identify reduced glomerular filtration.

Typical Clinical Presentations with Abnormal Kidney Function Tests

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

BUN

Trending ↑		Trending ↓
• Edema • Hypertension • Fatigue • Weakness • Oliguria • Polydipsia	• Bruise (easily) • Pruritis • Poor appetite • Nausea/vomiting • Confusion • Muscle cramps	• Nausea/vomiting • Headache • Confusion • Weakness • Fatigue

SERUM CREATININE

Trending ↑	Trending ↓
• Edema • Dyspnea • Abdominal/back pain • Arthralgia • Myalgia • Myopathy • Fatigue/malaise • Insomnia • Headache • Confusion • Pruritis	• Fatigue (this is uncommon; can be a precursor to autoimmune disease)

For patients with trending ↑ BUN:

- Assess the integumentary system, inspecting for edema, skin lesions, and wounds.
- Assess and monitor for cognitive impairment due to increased risk for altered mental status.
- Consider referral to other providers as appropriate.
- Adjust mode of communication and education as needed for patients with impaired cognition.
- Monitor fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Educate regarding lifestyle modification to promote health, wellness, and movement.
- Provide fall prevention screening and intervention as indicated due to increased fall risk associated with strength and cognitive impairments.

For patients with trending ↓ BUN:

- Collaborate with the interprofessional team about fluid intake and recording output.

For patients with trending ↑ serum creatinine:

- Monitor for fatigue during physical therapy intervention and educate regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Auscultate lungs due to fluid retention and utilize the dyspnea scale for safe exercise prescription.
- Collaborate with the interprofessional team regarding fluid intake and/or restriction.
- Assess and monitor for cognitive impairment due to increased risk for altered mental status change. Consider referral to other providers as appropriate.
- Adjust mode of communication and education as needed for patients with impaired cognition.
- Monitor pain level. Provide multimodal treatment and patient education.

For patients with trending ↓ serum creatinine:

- Monitor for fatigue. Modify the physical therapy intervention to include education regarding interval training and energy conservation. Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation

ENDOCRINE FUNCTION (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Glucose (mg/dL)

Premature infant: 20-60

Neonate: 30-60

Infant: 40-90

Child < 2 years: 60-100

Child > 2 years to adult:

- Fasting (no caloric intake for at least 8 hours): 70-110
- Casual (any time of day regardless of food intake): < 200

Adult: 74-106

Older adult:

- 60-90 years: 82-115
- > 90 years: 75-121

1-Hour Glucose Screen for Gestational Diabetes: < 140

2-Hour Postprandial Glucose (PPG):

- 0-50 years: < 140
- 50-60 years: < 150
- > 60 years: < 160

Glycemic targets for Hospitalized Patients:

- Target glucose range (majority of critically ill and noncritically ill patients): 140-180
- More stringent goals without significant hypoglycemia: 110-140

Levels of Hypoglycemia:

- Level 1: < 70
- Level 2: < 54
- Level 3: severe hypoglycemic event characterized by altered mental and/or physical status that requires assistance for resolution

Possible Critical Values:

- Newborn: > 30 or < 300
- Infant: < 40
- Child/adult: < 50 or > 400

HbA1C

Normal: < 5.7%

Pre-diabetes mellitus: 5.7%-6.4%

With diabetes mellitus: > 6.5%

Healthy older adults: < 7.0-7.5%

Older adults with multiple comorbidities, physical, or cognitive impairments: < 8.0-8.5%

Criteria for the Diagnosis of Pre-Diabetes and Diabetes:

There are several methods for determination.

Pre-diabetes:

- FPG 100-125 mg/dL OR 2-hour plasma glucose 140-199 mg/dL during oral glucose tolerance test OR HbA1c 5.7%-6.4%

Diabetes:

FPG ≥ 126 mg/dL OR 2-hr plasma glucose ≥ 200 mg/dL during oral glucose tolerance test OR HbA1c ≥ 6.5% OR a patient with classic symptoms of hyperglycemia OR hyperglycemic crisis, random plasma glucose ≥ 200 mg/dL.

Thyroid Stimulating Hormone (TSH)

Newborn: 3-18 mIU/L

Child/adult: 0.4-4.5 mU/L

Free T4 (ng/dL)

Child:

- 0-4 days: 2-6
- 2 weeks-20 years: 0.8-2

Adult: 0.75-1.5

Thyroxine (T4) (mcg/dL)

Child:

- 1-3 days: 11-22
- 1-2 weeks: 10-16
- 1-12 months: 8-16
- 1-5 years: 7-15
- 5-10 years: 6-13
- 10-15 years: 5-12

Adult < 60 years:

- Male: 4-12
- Female: 5-12
- Pregnancy: 9-14

Adult > 60 years: 5-11

Triiodothyronine (T3) (ng/dL)

Child:

- 1-3 days: 100-740
- 1 month-5 years: 105-270
- > 5 years: 80-215

Adult:

- 20-50 years: 70-205
- > 50 years: 40-180

ENDOCRINE FUNCTION (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Typical Clinical Presentations with Abnormal Endocrine Function

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

GLUCOSE

Trending ↑ (Hyperglycemia)

Types 1 and 2:
Polyuria
Polydipsia
Blurred vision
Weakness
Fatigue
Dizziness

Type 1:
Ketonuria
Weight loss
Excessive hunger
Type 2 is often asymptomatic, detected through labs, non-healing wounds, or infection

Diabetic ketoacidosis:
Nausea/vomiting
Fruity breath
Confusion
Weak/rapid pulse
Kussmaul respiration

Chronic hyperglycemia:
Chronic kidney disease
Peripheral neuropathy
Retinopathy
Cardiovascular disease (myocardial infarction, stroke)
Peripheral vascular disease
Non-traumatic amputations

Trending ↓ (Hypoglycemia)

Perspiration
Weakness
Pallor
Nervousness
Seizure
Lethargy
Irritability
Tachycardia
Palpitation
Altered mental status
Hunger
Headache
Shaking
Blurred vision
Loss of consciousness

THYROID FUNCTION TEST

Trending ↓ TSH, Trending ↑ T3 and T4 (Hyperthyroidism)

Tremors
Nervousness
Muscle weakness
Muscle atrophy
Chronic peri arthritis
Fatigue
Tachycardia
Atrial fibrillation
Respiratory muscle weakness
Tachypnea
Hypotension
Weight loss
Dysphagia
Polyuria
Diarrhea
Photophobia
Heat intolerance
Goiter

Additional Pediatric Considerations:
Newborns:
Irritability
Wide-eye stares
Poor feeding and weight gain
Insomnia
Hepatosplenomegaly
Jaundice
Craniosynostosis
Children:
Developmental delays
Behavior changes
Poor academic performances
Poor weight gain
Increased appetite
Frequent stools
Vomiting

Trending ↓ T4, Normal or Trending ↑ TSH (Primary Hypothyroidism) Trending ↓ T4 and TSH (Secondary Hypothyroidism)

Proximal muscle weakness
Myalgia/trigger points
Poor wound healing
Delayed glucose uptake and absorption
Weight gain
Constipation
Bruising easily
Dyspnea
Respiratory muscle weakness
Severe atherosclerosis
Angina
Hypertension
Fatigue
Slow mental function
Headache
Anxiety/depression
Cold intolerance
Carpal tunnel syndrome

Additional Pediatric Considerations:
Newborns:
Decreased cognitive functioning if left untreated
Protuberant tongue
Widened posterior fontanel
Dry skin
Hypotonia
Bradycardia
Cool extremities
Difficulty feeding
Hoarse cry
Children:
Delayed puberty
Poor growth velocity
Decreased pulse strength
Bradycardia
Delayed bone age on a radiograph

ENDOCRINE FUNCTION (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↑ glucose (hyperglycemia):

- Due to the increased risk of hyperglycemia, monitor glucose levels in patients receiving immunosuppressants following organ transplantation, as well as with patient who are initiating or altering antiretroviral therapy.
- Assess for peripheral arterial disease prior to initiation of compression or sharp debridement.
- Assess the integumentary system for edema, skin lesions, and wounds.
- Assess for loss of protective sensation.
- Educate regarding appropriate footwear and foot self-care.
- Educate regarding lifestyle modifications including exercise (aerobic, muscle/bone strengthening), glucose control, as well as monitoring blood glucose before, during, and after exercise.
- Due to the risk of ketoacidosis, it is recommended to collaborate with the interprofessional team to test for ketones if blood glucose is > 250 mg/dL. Intense exercise in the presence of moderate to large amounts of ketone (per facility guidelines) in the urine may exaggerate hyperglycemia.
- Additional Pediatric Considerations:
 - Collaborate with the interprofessional team regarding blood glucose targets prior to physical activity to mitigate hypoglycemic response. Blood glucose targets for pediatrics should be 126-180 mg/dL prior to initiation of exercise, however, should be individualized based on the type, intensity, and duration of activity.

For patients with trending ↓ glucose (hypoglycemia):

- Consult the interprofessional team if blood glucose is < 100 mg/dL prior to physical therapy intervention. May need to ingest 15-30g of fast-acting carbohydrate prior to the activity.
- Educate patient/caregiver to monitor blood glucose before, during, and after exercise. It may also include strategies to prevent, detect, and treat hypoglycemia.
- Monitor blood glucose prior to the activity as some patients may experience hypoglycemia unawareness.
- Provide fall prevention screening and intervention as indicated due to increased fall risk.
- Assess and monitor for cognitive impairment due to increased risk for altered mental status. Consider referral to other providers as appropriate.
- Monitor patients who cannot articulate their symptoms have hypoglycemia unawareness, lack access to analog insulins, advanced insulin delivery technology, and/or continuous glucose monitoring. Less stringent HbA1c goals (such as 7.5%) may be appropriate.

For patients with trending ↓ TSH, trending ↑ T3 and T4 (hyperthyroidism):

- Monitor cardiac rhythm due to increased risk for atrial fibrillation with trending up T4 levels.
- Monitor for symptoms of palpitations and nervousness. Consider modification of physical therapy intervention and referral to other providers, as appropriate.
- Educate patients to avoid exercise in hot settings, including outdoors and indoor pools.
- Assess for multisystem impairments as a hypermetabolic state may result in dysrhythmia, hypotension, weakness, muscle atrophy, and unintentional weight loss. Educate about signs and symptoms and safe exercise prescriptions. Consider referral to other providers as appropriate.
- Additional Pediatric Considerations:
 - Monitor for signs/symptoms of developmental delay in infants/children with hyperthyroidism.

For patients with trending ↓ T4, normal or trending ↑ TSH (primary hypothyroidism); trending ↓ T4 & TSH (secondary hypothyroidism):

- Monitor for signs of hyperthyroidism if the patient is on thyroid replacement therapy.
- Assess the integumentary system, inspecting for edema, skin lesions, and wounds. Dry, edematous skin is prone to breakdown.
- Provide fall prevention screening and intervention as indicated for older adult patients, as long-term thyroid replacement therapy may increase the risk for osteoporosis.
- Assess for multisystem impairments as a hypometabolic state may result in elevated blood pressure, respiratory impairment, weakness, myalgia, cold intolerance, poor glycemic control, and weight gain. Educate regarding safe exercise prescription. Consider referral to other providers as appropriate.

ARTERIAL BLOOD GASES (ABGs) (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

pH Newborn: 7.32-7.49 2 months-2 years: 7.34-7.41 Child/adult: 7.35-7.45 pH (venous): 7.31-7.41 Possible Critical Values: < 7.25 or > 7.55	PaCO₂ (mmHg) Child < 2 years: 26-41 Child/adult: 35-45 PaCO ₂ (venous): 40-50 Possible Critical Values: < 20 or > 60	HCO₃ (mEq/L) Newborn/infant: 16-24 Child/adult: 21-28 Possible Critical Values: < 15 or > 40	PaO₂ (mmHg) Newborn: 60-70 Adult: 80-100 PaO ₂ (venous): 40-50 Possible Critical Value: < 40 Base excess: ± 3
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Anion Gap (mEq/L)

16 ± 4 if potassium is used in the calculation

12 ± 4 if potassium is not used in the calculation

Typical Clinical Presentations with Abnormal ABGs

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

RESPIRATORY ALKALOSIS

↑pH, ↓PCO₂, normal HCO₃

- Lightheaded
- Dyspnea
- Paresthesia
- Chest tightness
- Seizure

RESPIRATORY ACIDOSIS

↓pH, ↑PCO₂, normal HCO₃

- Anxiety
- Confusion
- Fatigue/lethargy
- Tachypnea
- Coma
- Seizure

METABOLIC ALKALOSIS

↑pH, normal PCO₂, ↑HCO₃

- Confusion
- Delirium
- Dysrhythmias
- Hypotension
- Muscle cramping

METABOLIC ACIDOSIS

↓pH, normal PCO₂, ↓HCO₃

- Dyspnea (Kussmaul breathing)
- Fatigue
- Nausea/vomiting
- Tachyarrhythmias
- Hypotension

ANION GAP

Dependent on the underlying disorder

Physical Therapy Clinical Implications

For patients with respiratory alkalosis and respiratory acidosis:

- Monitor vital signs, breathing patterns, and respiratory status for any signs of clinical deterioration.
- Consider the underlying cause, ABG trend, and medical stability when developing a plan of care.

For patients with metabolic alkalosis:

- Monitor vital signs and cardiac rhythm throughout the physical therapy intervention.
- Assess and monitor for cognitive impairment due to increased risk for altered mental status. Consider referral to other providers as appropriate.
- Adjust the mode of communication as needed for patients with impaired cognition.

For patients with metabolic acidosis:

- Monitor breathing pattern, respiratory status, vital signs, and cardiac rhythm during physical therapy intervention; take a symptom-based approach to treatment.
- Consider using the Borg RPE scale or dyspnea scale in addition to vital sign monitoring with activity progression and symptom presentation.
- Collaborate with the interprofessional team to determine if a patient on dialysis is appropriate for intradialytic intervention.

For patients with abnormal anion gap:

- Consider the underlying cause of the elevated anion gap. Collaborate with the interprofessional team to determine if a patient is appropriate for intradialytic physical therapy intervention.

LIVER FUNCTION/HEPATIC PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Serum Albumin (g/dL)	Serum Prealbumin (mg/dL)	Serum Bilirubin (mg/dL)	Ammonia or NH ₃ (µg/dL)
Premature Infant: 3-4.2	< 5 days: 6-21	Newborn: 1.0-12.0	Newborn: 90-150
Newborn: 3.5-5.4	1-5 years: 14-30	Child/adult/older adult: 0.3-1.0	Children: 40-80
Infant: 4.4-5.4	6-9 years: 15-33	Possible Critical Values:	Adult/older adult: 10-80
Child: 4-5.9	10-13 years: 22-36	○ Newborn: > 15	
Adult/older adult: 3.5-5	14-19 years: 22-45	○ Infant: > 25	
Possible Critical Value:	Adult/older adult: 15-36	○ Adult: > 12	
< 1.5	Possible Critical Value:		
	< 10.7 (adult)		

Typical Clinical Presentations with Abnormal Liver Panel

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

SERUM ALBUMIN & PREALBUMIN

Trending ↑

- Orthostatic hypotension
- Dizziness
- Fatigue

Trending ↓

- Non-healing wound
- Peripheral edema and ascites
- Hypotension

SERUM BILIRUBIN

Trending ↑

- Yellow discoloration of body tissue (jaundice), including skin, mucus membranes, and sclera of eyes occurs when total serum bilirubin exceeds 2.5 mg/dL.
- Jaundice usually progresses in a cephalocaudal direction.
- Urine turns darker and stools pale. A return to normal color indicates a resolution of jaundice.
- Abdominal pain and bloating.
- Neurologic: confusion, sleep disturbances, muscle tremors, hyperactive reflexes, asterixis.
- **Additional Pediatric Considerations:**
 - Acute bilirubin encephalopathy caused by hyperbilirubinemia:
 - Early signs: lethargy, hypotonia, poor suck
 - Intermediate signs: hypertonia, high-pitched cry, fever, irritability
 - Advanced signs: apnea, fever, seizures, coma, hypertonicity

AMMONIA

Trending ↑

- Hepatic encephalopathy
- Speech impairment
- Daytime sleepiness
- Breakdown of fine motor skills
- Peripheral nerve impairment
- **Additional Pediatric Considerations:**
 - Signs/symptoms of hyperammonemia usually begin 24-48 hours after feeding begins in infants and can include
 - Lethargy, somnolence
 - Refusal to feed
 - Vomiting
 - Tachypnea with respiratory alkalosis
 - Seizures
 - Infantile, childhood, and adult onset of hyperammonemia may present with chronic neurocognitive deficits and can include
 - Developmental delay
 - Ataxia
 - Spasticity
 - Learning disabilities
 - Cognitive deficits
 - Unexplained seizures

LIVER FUNCTION/HEPATIC PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↑ albumin and prealbumin:

- Provide fall prevention screening and intervention as needed due to increased fall risk.
- Monitor for orthostatic hypotension. Educate patient/caregiver on recognizing symptoms, avoiding quick postural changes, and monitoring blood pressure in the presence of orthostasis or dizziness.

For patients with trending ↓ albumin and prealbumin:

- Assess integumentary system, inspecting for edema, ascites, skin lesions, and wounds.
- Consider the risk and benefits of different wound/edema management strategies based on impaired wound healing and possible poor nutrition.
- Provide patient education on the following topics: skin inspection, footwear inspection, skin protection, including frequent position changes, and the importance of proper nutrition to promote wound healing. This education is of particular importance when other comorbidities are present, including diabetes, peripheral neuropathy, and the aging integumentary system.
- Collaborate with the interprofessional team regarding nutritional needs to ensure optimal wound healing, muscle strengthening, and improved functional capacity.
- Additional Pediatric Considerations:
 - Monitor newborn infants for necrotizing enterocolitis (NEC) and neonatal sepsis.

For patients with trending ↑ bilirubin (hyperbilirubinemia):

- Adjust the mode of communication and education as needed for patients with impaired cognition.
- Promote weight-bearing activities and screen for fall risk, as patients with advanced disease are at risk for osteoporosis and bleeding due to deficiencies in fat-soluble vitamins.
- Heed caution in providing high-intensity exercise during jaundice or any active liver disease. Utilize a symptom-based approach.
- Additional Pediatric Considerations:
 - Phototherapy of neonatal hyperbilirubinemia and incorporation of neuroprotective care measures into practice and handling may include:
 - Assess/monitor temperature throughout treatment.
 - Maintain eye protection.
 - Ensure most of the skin is exposed under the light source unless facilitating transfers to a mother for breastfeeding.
 - Cluster therapy interventions with nursing care times.
 - Promote developmentally appropriate positioning without impacting the infant's exposure to the light source.

For patients with trending ↑ ammonia (hyperammonemia):

- Assess and monitor for cognitive impairment due to increased risk for altered mental status. Consider referral to other providers as appropriate.
- Adjust the mode of communication and education as needed for patients with impaired cognition.
- Provide fall prevention screening and intervention as needed due to increased fall risk with encephalopathy. Patients are at higher risk for injurious falls with bleeding complications due to reduced liver production of coagulation factors.
- Additional Pediatric Considerations:
 - Monitor for developmental delay.

LIPID PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

High-Density Lipoprotein (HDL) (mg/dL)

Child/adult:

- Male: > 45
- Female: > 55

Low-Density Lipoprotein (LDL) (mg/dL)

Child:

- Desirable: < 110
- Borderline high risk: 110-129
- High risk: > 130

Adult:

- Optimal: < 100
- Near optimal: 100-129
- Borderline high: 130-159
- High: 160-189
- Very high: > 190

Very Low-Density Lipoprotein (VLDL) (mg/dL)

Child/adult: 7-32

Triglycerides (mg/dL)

Child/adolescent:

- 0-5 years
 - Male: 30-86
 - Female: 32-99
- 6-11 years
 - Male: 31-108
 - Female: 35-114
- 12-15 years
 - Male: 36-138
 - Female: 41-138
- 16-19 years
 - Male: 40-163
 - Female: 40-128

Adult:

- Male: 40-160
- Female: 35-135

Level classification:

- Desirable: < 150
- Borderline high: 150-199
- High: 200-499
- Very high: > 500

Total Cholesterol (mg/dL)

Newborn: 53-135 Child: 120-200
Infant: 70-175 Adult: < 200

Desirable:

- Child: < 170 Adult: 140-199
- Borderline high:
 - Child: 170-199 Adult: 200-239
- High:
 - Child: > 200 Adult: > 240

Adult optimal low CVD risk:

- < 140

Adult total cholesterol/HDL ratio:

- Recommended: > 5:1
- Optimal: > 3:1

Typical Clinical Presentations with Abnormal Lipid Panel

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

High-Density Lipoprotein (HDL)

Trending ↑

- No specific presentation identified.

Trending ↓

- No specific presentation identified.

Low-Density Lipoprotein (LDL)

Trending ↑

- Lipid deposits on skin, eyes (arcus corneae), or tendons (tendinous xanthomas)

Trending ↓

- No specific presentation identified.

Very Low-Density Lipoprotein (LDL)

Trending ↑

- No specific presentation identified.

Trending ↓

- No specific presentation identified.

Triglycerides

Trending ↑

- Lipid deposits on skin, eyes (arcus corneae), or tendons (tendinous xanthomas)
- Paresthesia

Trending ↓

- No specific presentation identified.

Total Cholesterol

Trending ↑

- Lipid deposits on skin, eyes (arcus corneae), or tendons (tendinous xanthomas)

Trending ↓

- No specific presentation identified.

LIPID PANEL (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Physical Therapy Clinical Implications

For patients with trending ↓ HDL:

- Educate regarding lifestyle modification to promote health, wellness, and movement. Low HDL levels can be raised by diet management, exercise, weight loss, and smoking cessation.

For patients with trending ↑ LDL:

- Monitor for cardiovascular disease (heart disease, stroke, peripheral arterial disease). Educate regarding lifestyle modification to promote health, wellness, and movement.
- Monitor for neurodegenerative disease (Alzheimer's disease) due to increased risk. Consider referral to other providers as appropriate.
- Assess integumentary system, inspecting for lipid deposits and signs of circulatory compromise.

For patients with trending ↓ LDL:

- Educate regarding lifestyle modification to promote health, wellness, and movement. Diet, exercise, and physical activity may lower levels and decrease CVD risk.

For patients with trending ↑ VLDL:

- Monitor for cardiovascular disease risk. VLDL levels of more than 25% to 50% of total cholesterol are associated with increased risk. Educate regarding lifestyle modification to promote health, wellness, and movement. Consider referral to other providers as appropriate.
- Consider referral to other providers as appropriate due to risk for multisystem presentations/conditions (pancreatitis, cardiovascular disease, integumentary impairments).

For patients with trending ↑ triglycerides (hypertriglyceridemia):

- Consider referral to other providers as appropriate due to risk for multisystem presentations/conditions (pancreatitis, hepatosplenomegaly, integumentary impairments).
- Assess the integumentary system for abnormalities, including lipid deposits and signs of circulatory compromise.
- Assess and monitor for cognitive impairment due to increased risk of detrimental neurologic implications of long-term elevated levels. Consider referral to other providers as appropriate.

For patients with trending ↑ cholesterol (hypercholesterolemia):

- Monitor for cardiovascular disease (heart disease, stroke, peripheral arterial disease). Educate regarding lifestyle modification to promote health, wellness, and movement.
- Monitor for neurodegenerative disease (Alzheimer's disease) due to increased risk. Consider referral to other providers as appropriate.
- Assess the integumentary system for abnormalities, including lipid deposits and signs of circulatory compromise.

COAGULATION TESTS AND ASSAYS (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Plasma D-Dimer

< 250 ng/mL or < 0.4 mcg/mL

Anti-Factor Xa Assay (IU/mL)

Prophylactic Ranges:

- Children < 8 weeks
 - UHF: not listed
 - LMWH: 0.1-0.3
- Adults/children > 8 weeks
 - UFH: 0.2-0.5
 - LMWH: 0.1-0.4

Therapeutic Ranges:

- Children < 8 weeks
 - UFH: 0.5-0.7
 - LMWH: 0.5-1.0
- Adults/children > 8 weeks
 - UFH: 0.5-1.2
 - LMWH: 0.3-0.7

Activated Partial Thromboplastin Time (seconds)

Infant:

- 1 day: 34.3-44.8
- 3 days: 29.5-42.2
- 1-12 months: 35.1-46.3

Child:

- 1-5 years: 33.6-46.3
- 6-10 years: 31.8-43.7
- 11-16 years: 33.9-46.1

Adult:

- 30-40

Therapeutic ranges for the effectiveness of anticoagulants: 1-5.2 times the normal range

Possible Critical Value: > 70 (increased risk for spontaneous bleeding)

Prothrombin Time (seconds)

Infant:

- 1 day: 14.4-16.4
- 3 days: 13.5-16.4
- 1-12 months: 11.5-15.3

Child:

- 1-5 years: 12.1-14.5
- 6-10 years: 11.7-15.1
- 11-16 years: 12.7-16.1

Adult:

- 11-12.5

Therapeutic ranges for the effectiveness of anticoagulants: 1.5-2.5 times the normal range

High risk for bleeding into tissue: > 20 seconds (utilize caution and discuss with the interprofessional team)

International Normalized Ratio (INR)

Infant:

- Day 1: 1.15-1.35
- Day 3: 1.05-1.35
- 1-12 months: 0.86-1.22

Child:

- 1-5 years: 0.92-1.14
- 6-10 years: 0.87-1.2
- 11-16 years: 0.97-1.3

Adult:

- 0.8-1.1

Preferred Pediatric Range according to indication for anticoagulation:

- DVT prophylaxis: 1.5-2.0
- Pulmonary hypertension: 1.5-2.5
- Cardiomyopathy, atrial fibrillation, DVT, pulmonary embolism, aortic valve replacement: 2.0-3.0
- Kawasaki disease: 2.0-3.0
- Fontan procedure: 2.0-2.5
- Prosthetic mitral valve: 2.5-3.5

Preferred Adult Range according to indication for anticoagulation:

- DVT prophylaxis: 1.5-2.0
- History of TIA or CVA and aortic valve replacement: 2.5-3.5
- Pulmonary embolism: 2.5-3.5
- DVT, atrial fibrillation, mitral or aortic valve replacement, orthopedic surgery: 2.0-3.0

Possible Critical Value INR: > 5.5

Typical Clinical Presentations with Elevated Levels

Items below are for adults and pediatrics (birth to 18 years) unless otherwise specified.

Anti-Factor Xa Assay, Activated Partial Thromboplastin Time, Prothrombin Time, and International Normalized Ratio (INR)

Elevated Levels:

- Increased bleeding tendency
- Bruising
- oozing from wounds
- Mucosal bleeding

Physical Therapy Clinical Implications

Due to increased risk of bleeding:

- Provide fall prevention screening and intervention as needed due to increased risk of injury with falls.
- Apply prolonged pressure to the site if bleeding occurs.
- Examine skin for bruising, petechiae, or blood in the urine.
 - Bruising may result from a blood pressure cuff or other medical devices.
- Monitor for changes in neurological condition due to increased risk of intracranial bleeding.

Educate the patient that falls or contact sports may increase trauma-induced bleeding risk.

Collaborate with the interprofessional team if levels are outside the therapeutic range to determine safe exercise prescription and intensity of activity.

MUSCULAR DISORDERS (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Creatine Kinase (CK)

Infants: two to three times adult values

Men: 38-174 U/L

Women: 26-140 U/L

MM (CK₃): 96%-100% or 0.96-1.00

MB (CK₂): 0%-6% or 0.00-0.06

BB (CK₁): 0% or 0.00

Typical Clinical Presentations with Abnormal CK Values

- Weakness
- Muscle pain
- Myoglobinuria (tea-colored urine)

Physical Therapy Clinical Implications

For patients with trending ↑ CK:

- Discuss overall medical management with the interprofessional team to determine the optimal timing for initiation of physical therapy.
- Avoid overexertion and use a symptom-based approach to treatment in patients with rhabdomyolysis, prioritize preserving range of motion.
- Monitor the patient for complications of rhabdomyolysis, including compartment syndrome (pulses, neurological function, and reports of increasing pain).
- Consider overall medical status, including vital signs and other medical conditions, location of a dialysis catheter, and type of dialysis provided in patients with renal failure.
- Monitor vital signs and cardiac rhythm during physical therapy intervention because rhabdomyolysis can be associated with electrolyte disturbances.
- Collaborate with the interprofessional team regarding cardiac evaluation and stability. Monitor vital signs and cardiac rhythm throughout the physical therapy intervention.

CARDIOVASCULAR-SPECIFIC LABS (For reference information, refer to the APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy, Laboratory Values Interpretation Resource. Updated 2022.)

Troponin T (cTnT), Troponin I (cTnI) (ng/mL)

Cardiac troponin T: < 0.1 Cardiac Troponin I: < 0.03

High-Sensitivity Cardiac Troponin (hsTnT) (ng/L)

Women: < 14 Men: < 22

Natriuretic Peptides (Brain natriuretic peptide [BNP], N-terminal fragment of pro-brain natriuretic peptide [NT-pro-BNP]) (pg/mL)

BNP: < 100 NT-pro-BNP: < 300
 BNP > 400 (heart failure likely)

Physical Therapy Clinical Implications

For patients with trending ↑ troponins:

- Initiate physical therapy intervention when troponins are stable and/or down-trending.
- Monitor closely for indicators of unstable cardiac status including medical team diagnosis, pending diagnostic testing, dysrhythmias, unstable vital signs, and supportive medications.
- Monitor vital signs continuously. Refer to Adult Vital Sign Interpretation in Acute Care Guide 2021 pg. 15, (Acute coronary syndrome/myocardial infarction) and for a list of reasons to stop physical therapy Intervention including respiratory rate of > 40, a drop in HR > 10 bpm, a drop in SBP of > 10 mmHg, and a SpO₂ of < 90%.

For patients with trending ↑ natriuretic peptides:

- Monitor for worsening signs and symptoms of heart failure. Signs of exertional intolerance include the onset of an S3 heart sound, chest pain, inability to speak comfortably, new onset/worsening pulmonary crackles, and change in heart rhythm (ECG, auscultation, and/or pulse.)
- Monitor for signs and symptoms of hypotension.
- Consider using the Borg RPE scale or a dyspnea scale for patients with heart failure.
- Refer to the Adult Vital Sign Interpretation in Acute Care Guide 2021, page 16 (Heart failure) and Physical Therapist Clinical Practice Guidelines for the Management of Individuals with Heart Failure.

APTA Academy of Acute Care Physical Therapy and the APTA Academy of Pediatric Physical Therapy

LABORATORY VALUES INTERPRETATION RESOURCE Updated 2022

Workgroup Leaders:

Ma Rodelyn Berdin, PT, DPT

Tom Waugh Fellow of the Texas Physical Therapy Association

Jill Cannoy, PT, DPT

Board-Certified Clinical Specialist in Pediatric Physical Therapy

Ann Fick, PT, DPT, MS

Board-Certified Clinical Specialist in Cardiovascular and Pulmonary Physical Therapy

Megan Geno Dakhlian, PT, DPT

Board-Certified Clinical Specialist in Pediatric Physical Therapy

Andrea Hergenroeder, PT, PhD

Board-Certified Clinical Specialist in Cardiovascular and Pulmonary Physical Therapy

Kimberly Levenhagen, PT, DPT

Wound Care Certified
 Certified Lymphedema Therapist
 Fellow of the National Academy of Practice

Morgan Lopker, PT, DPT

Board-Certified Clinical Specialist in Geriatric Physical Therapy

Traci Norris, PT, DPT

Board-Certified Clinical Specialist in Geriatric Physical Therapy
 Certified Exercise Expert for the Aging Adults

James Tompkins, PT, DPT

Fellow of the American College of Healthcare Executives

Workgroup Members:

Leonard Arguelles, PT, DPT

Board-Certified Clinical Specialist in Cardiovascular and Pulmonary Physical Therapy

Traci Betts, PT, DPT

Board-Certified Clinical Specialist in Cardiovascular and Pulmonary Physical Therapy

Neha Bodas, PT, DPT, MS

Certified Wound Specialist

Kathryn Brito, PT, DPT

Board-Certified Clinical Specialist in Cardiovascular and Pulmonary Physical Therapy

Jamie Dyson, PT, DPT

Bailey Endres, PT, DPT

Erin Gates, PT, DPT

Tricia Leen Healy, PT, DPT

Eleni Moulis, PT, DPT

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