

Hematologic Diagnostic Procedures

Hematologic assessment and diagnostic procedures evaluate blood function by testing indicators such as erythrocytes (RBCs), leukocytes (WBCs), platelets, and coagulation times. By testing the blood, diagnosis of a disease and efficacy of treatment can be determined.

Bone marrow is responsible for the production of many blood cells including RBCs, WBCs, and platelets. A bone marrow biopsy provides diagnostic information about how the bone marrow is functioning.

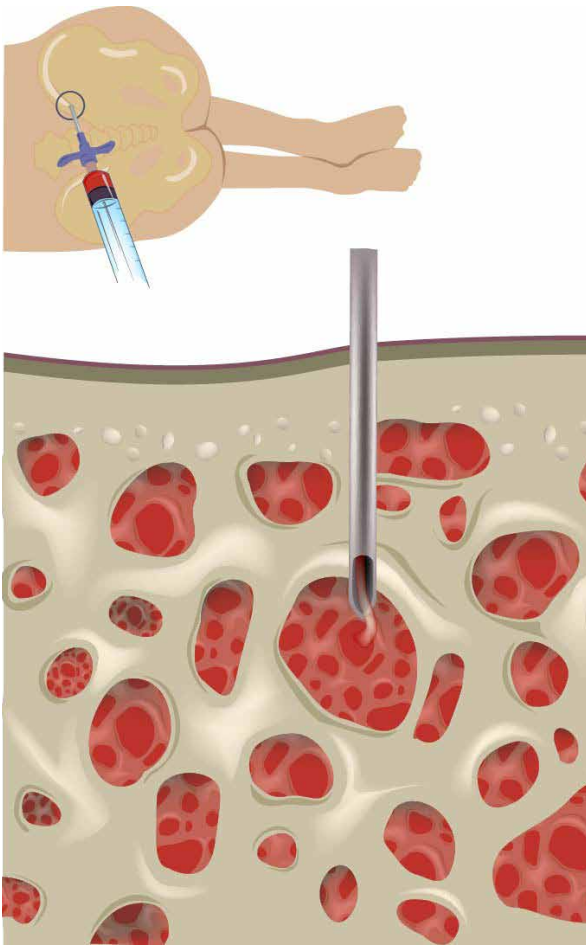
39.1 Expected reference ranges for blood diagnostic procedures

	EXPECTED REFERENCE RANGE	INTERPRETATION OF FINDINGS
RBC	Females: 4.2 to 5.4 million/uL Males: 4.7 to 6.1 million/uL	Elevated level: erythrocytosis, polycythemia vera, severe dehydration Decreased level: anemia, hemorrhage, kidney disease
WBC	5,000 to 10,000/mm ³	Elevated level: infection, inflammation. Decreased level: immunosuppression, autoimmune disease
MCV	80 to 95 fL	Elevated level: macrocytic (large) RBCs, megaloblastic anemia. Decreased level microcytic (small) RBCs, iron deficiency anemia.
MCH	27 to 31 pg/cell	Elevated/decreased level: same as above for MCV
TIBC	250 to 460 mcg/dL	Elevated level: iron deficiency anemia, polycythemia vera Decreased level: malnutrition, cirrhosis, pernicious anemia
IRON	Females: 60 to 160 mcg/dL Males: 80 to 180 mcg/dL	Elevated level: hemochromatosis, iron excess, liver disorder, or lead toxicity. Decreased level: iron deficiency anemia, chronic blood loss, inadequate dietary intake of iron.
PLATELETS	150,000 to 400,000 mm ³	Increased level: malignancy, polycythemia vera, rheumatoid arthritis. Decreased level: enlarged spleen, hemorrhage, leukemia
HGB	Females: 12 to 16 g/dL Males: 14 to 18 g/dL Elderly: levels slightly decreased	Elevated level: erythrocytosis, COPD, severe dehydration Decreased level: anemia, hemorrhage, kidney disease
HCT	Females: 37 to 47% Males: 42 to 52% Elderly: levels slightly decreased	Elevated /decreased level: same as above for Hgb
APTT	30 to 40 seconds (1.5 to 2.5 times the control value if receiving heparin therapy)	Increased time: vitamin K deficiency, disseminated intravascular coagulation (DIC), liver disease, heparin administration Decreased time: extensive cancer
PT	11 to 12.5 seconds, 85 to 100%, or 1:1.1 client-control ratio	Increased time: of clotting factors II, V, VII, or X, liver disease, warfarin therapy, disseminated intravascular coagulation Decreased time: vitamin K excess, pulmonary embolus, thrombophlebitis
INR	0.8 to 1.1 (desired goal of 2 to 3 on warfarin therapy)	Measures the mean of PT to provide a universally recognized value. Elevated level: warfarin therapy Decreased level: cancer disorders
D-DIMER	Less than 0.4 mcg/mL	Positive result: disseminated intravascular coagulation, malignancy Negative result: can rule out pulmonary embolus or deep vein thrombosis
FIBRINOGEN LEVELS	200 to 400 mg/dL	Elevated level: acute inflammation, acute infection, heart disease Decreased levels: liver disease, advanced cancer, malnutrition
FIBRIN DEGRADATION PRODUCTS	Less than 10 mcg/mL	Elevated level: disseminated intravascular coagulation, massive trauma resulting in fibrinolysis Decreased level: anticoagulation therapy

Blood collection/testing

- Blood diagnostic procedures that nurses should be knowledgeable about include the following. (39.1)
 - Serum RBC count
 - Serum WBC count
 - Mean corpuscular volume (MCV)
 - Mean corpuscular Hgb (MCH)
 - Total iron-binding count (TIBC)
 - Iron
 - Platelets
 - Hemoglobin (Hgb)
 - Hematocrit (Hct)
 - Coagulation studies
 - Prothrombin time (PT)
 - Partial thromboplastin time (aPTT)
 - International normalized ratio (INR)
 - D-dimer
 - Fibrinogen levels
 - Fibrin degradation products
- CBC is a series of tests that includes RBC, WBC, MCV, MCH, Hgb, and Hct.

39.2 Bone marrow biopsy



CONSIDERATIONS

PREPROCEDURE

NURSING ACTIONS: Use standard precautions in collecting and handling blood for specimen collection.

INTRAPROCEDURE

NURSING ACTIONS

- Select the appropriate vial for the prescribed test.
- Collect a sufficient quantity of blood and fill to the indicated mark on the vial.
- Properly label the specimen. Deliver the specimen to the laboratory according to facility protocol for appropriate storage and analysis.
- For coagulation studies, draw blood at specific times and immediately send to the laboratory. Adjust the dose of anticoagulant therapy based on the results and prescription.

POSTPROCEDURE

NURSING ACTIONS

- Results of hematologic tests are usually available preliminarily within 24 to 48 hr, with final results in 72 hr.
- If results are out of the expected reference range, it is the nurse's responsibility to report the results to the provider for further intervention.

Bone marrow aspiration/biopsy

- A biopsy is the extraction of a very small amount of tissue, such as bone marrow, to definitively diagnose cell type and to confirm or rule out malignancy. A bone marrow tissue sample is removed by needle aspiration for cytological (histological) examination. (39.2)
- Biopsies are commonly performed with local anesthesia or conscious sedation in an ambulatory setting, intraoperatively, or during endoscopic procedures.

INDICATIONS

A bone marrow biopsy is commonly performed to diagnose causes of blood disorders, such as anemia or thrombocytopenia; to diagnose diseases of the bone marrow, such as leukemia, and infection; or to stage lymphoma or other forms of cancer.

CONSIDERATIONS

PREPROCEDURE

NURSING ACTIONS

- Ensure that the client has provided informed consent.
- Place the client in a prone or side-lying position to expose the iliac crest for the procedure.

CLIENT EDUCATION: Explain the procedure to the client. The biopsy site will be anesthetized with a local anesthetic, and the client might feel pressure and brief pain during the aspiration.

INTRAPROCEDURE

NURSING ACTIONS

- Inform the client that the test will last about 20 min.
- Administer a sedative if prescribed.
 - Older adult clients are at greater risk for complications associated with sedation for biopsy procedures due to chronic illnesses. 
 - The nurse should take an older adult's kidney function into consideration when using analgesics for sedation.
- Cleanse the site with an antiseptic solution.
- Maintain sterility of equipment and supplies.
- Assist the provider with the procedure as needed.

POSTPROCEDURE

NURSING ACTIONS

- Apply pressure to the biopsy site to control bleeding.
- Place a sterile dressing over the biopsy site.
- Maintain the client on bed rest for 30 to 60 min.
- Monitor for evidence of infection (fever, increased WBCs, pain, and swelling at the site) and bleeding.
- Apply ice to the biopsy site to minimize bleeding and bruising.
- Postprocedure discomfort is usually relieved by mild analgesics.
- Avoid aspirin and other medications that affect clotting.

CLIENT EDUCATION

- Teach the client to report excessive bleeding and evidence of infection to the provider.
- Teach the client to check the biopsy site daily. Keep the dressing clean, dry, and intact.
- If sutures are in place, remind the client to return in 7 to 10 days to have them removed.

INTERPRETATION OF FINDINGS

After a procedure is completed, the tissue sample is sent to pathology for interpretation.

COMPLICATIONS

Infection

Infection can occur at the aspiration site.

NURSING ACTIONS: Monitor the site and keep the dressing clean and dry.

Bleeding

Bleeding can occur from the site.

NURSING ACTIONS: Report bleeding to the provider immediately.

PRACTICE Active Learning Scenario

A nurse is caring for a client who is having a bone marrow biopsy. What actions should the nurse take? Use the ATI Active Learning Template: Diagnostic Procedure to complete this item.

NURSING INTERVENTIONS (PRE, INTRA, POST): Describe two for each of the pre-, intra-, and postprocedure periods.

POTENTIAL COMPLICATIONS: Identify two.

CLIENT EDUCATION: Describe two discharge teaching points.

Application Exercises

1. A nurse in a clinic is caring for a client who has suspected anemia. Which of the following laboratory test results should the nurse expect?

- A. Iron 90 mcg/dL
- B. RBC 6.5 million/uL
- C. WBC 4,800 mm³
- D. Hgb 10 g/dL

2. A nurse is caring for a client who is receiving warfarin for anticoagulation therapy. Which of the following laboratory test results indicates to the nurse that the client needs an increase in the dosage?

- A. aPTT 38 seconds
- B. INR 1.1
- C. PT 22 seconds
- D. D-dimer negative

3. A nurse is providing teaching for a client who is scheduled for a bone marrow biopsy of the iliac crest. Which of the following statements made by the client indicates an understanding of the teaching?

- A. "This test will be performed while I am lying flat on my back."
- B. "I will need to stay in bed for about an hour after the test."
- C. "This test will determine which antibiotic I should take for treatment."
- D. "I will receive general anesthesia for the test."

Application Exercises Key

1. A. An iron level of 90 mcg/dL is within the expected reference range and is not an expected finding of anemia.
B. RBC count of 6.5 million/uL is above the expected reference range. A decreased RBC count is an expected finding of anemia.
C. WBC count of 4800 mm³ is below the expected reference range and is not an expected finding of anemia.
D. **CORRECT:** Hgb of 10 g/dL is below the expected reference range and is an expected finding of anemia.
 NCLEX® Connection: Reduction of Risk Potential, Laboratory Values
2. A. aPTT is monitored for clients receiving heparin therapy. An aPTT of 38 seconds is within the expected reference range for clients not receiving heparin therapy.
B. **CORRECT:** INR of 1.1 is within the expected reference range for a client who is not receiving warfarin. However, this value is subtherapeutic for anticoagulation therapy. The nurse should expect the client to receive an increased dosage of warfarin until the INR is 2 to 3.
C. PT of 22 seconds is above the expected reference range for a client receiving warfarin therapy. This result indicates the client is at an increased risk for bleeding.
D. A negative D-dimer test indicates the absence of a pulmonary embolus or deep vein thrombosis and is not used to determine the dosage needs for warfarin therapy.
 NCLEX® Connection: Reduction of Risk Potential, Laboratory Values
3. A. The nurse should inform the client that he will be placed in a prone or side-lying position during the test in order to expose the iliac crest.
B. **CORRECT:** The nurse should inform the client of the need to stay on bed rest for 30 to 60 min following the test to reduce the risk for bleeding.
C. The nurse should inform the client that a culture and sensitivity test determines the type of antibiotics needed to treat an infection.
D. The nurse should inform the client that he will receive a sedative prior to the test and that a local anesthetic will be used at the site.
 NCLEX® Connection: Reduction of Risk Potential, Diagnostic Tests

PRACTICE Answer

Using the ATI Active Learning Template: Diagnostic Procedure

NURSING INTERVENTIONS (PRE, INTRA, POST)

Preprocedure

- Ensure that the client has signed the informed consent form.
- Position the client in a prone or side-lying position.
- Explain the procedure to the client. Inform the client that she might feel pressure and brief pain during the bone marrow aspiration.

Intraprocedure

- Administer sedative medication.
- Assist with the procedure.
- Inform the client that the procedure lasts about 20 min.
- Cleanse the site with an antiseptic solution.
- Maintain sterility of equipment and supplies.

Postprocedure

- Apply pressure to the biopsy site.
- Place a sterile dressing over the biopsy site.
- Monitor for evidence of infection and bleeding.
- Apply ice to the biopsy site.
- Administer mild analgesics. Avoid aspirin or medications that affect clotting.

 NCLEX® Connection: Reduction of Risk Potential, Diagnostic Tests

POTENTIAL COMPLICATIONS

- Bleeding and infection
- Older adults at greater risk for complications associated with anesthesia

CLIENT EDUCATION

- Report excessive bleeding and evidence of infection to the provider.
- Check the biopsy site daily. Keep the dressing clean, dry and intact.
- If there are sutures, return in 7 to 10 days for removal.