LABMOEBACK SU 2024

Procedures Manual

First Edition

COMPLETE BLOOD COUNT PROCEDURE

A Complete Blood Count (CBC) is a common blood test that evaluates the overall health of an individual by measuring various components of the blood, including red blood cells, white blood cells, hemoglobin, hematocrit, and platelets.

I. PRINCIPLE

The principle of a Complete Blood Count (CBC) involves collecting a small blood sample and analyzing it with automated machines that count and measure the different types of cells present. By doing so, the CBC provides essential information about a person's blood health and can help identify various medical conditions.

CLINICAL REASONS FOR PERFORMING THE TEST

- To monitor blood disorders
- To evaluate the overall health
- To be able to diagnose infections
- To be able to detect anemia
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II. SPECIMEN REQUIREMENTS

- **Container Type:** Lavender top EDTA Microtainer
- **Optimal Collection Volume:** 4.0 mL whole blood in Lav top EDTA tube
- **Collection Instructions:** Gently invert sample tube 5-6 times after collection.
- **Processing Instructions:**
    1. Keep specimen as whole blood for testing.
    2. Store samples refrigerated prior to testing.
    3. Allow refrigerated samples to come to ambient temperature, and mix well before analysis.

CRITERIA FOR SPECIMEN COLLECTION, LABELING, REJECTION, STORAGE, TRANSPORT

- Collection: Apply the tourniquet, select an appropriate vein, perform the venipuncture, and fill the tube to the required volume.
- Labeling: Patient's full name, date of birth, medical record number, date and time of collection, and the collector's initials.
- Rejection: Improper Labeling, Clotted Specimen, Hemolyzed Sample, Contamination
- Transport: Secure, leak-proof transport container; room temperature during transportation; and transport it quickly as possible

PROCEDURES FOR SUBMISSION TO CENTRAL LABS

- Ensure proper labeling and documentation
- Use appropriate transport containers (e.g., primary containers and secondary containers)
- Submit it properly with log submissions and confirmation receipt

PROCEDURES FOR MICROSCOPIC EXAMINATIONS

- Preparation of Blood Smear
- Staining the Slide (Fixation and Staining)
- Set up the microscope and view the slide

III. REAGENTS OR MEDIA, SUPPLIES, EQUIPMENT

Reagents:

- EDTA (Ethylenediaminetetraacetic Acid) Anticoagulant
- Staining Reagents (Wright's Stain or Giemsa Stain)
- Isotonic Diluent

Supplies:

- Blood Collection Tubes (Lavender-top tubes with EDTA)

- Microscope Slides
- Gloves and Lab Coats
- Disposable Needles and Syringes
- Alcohol Swabs
- Bandages and Gauze Pads

Equipment:

- Hematology Analyzer
- Microscope
- Centrifuge
- Hemocytometer
- Incubator
- Blood Mixer

PREPARATION OF REAGENTS, STAINS, OR OTHER MATERIALS USED IN TESTING

1. **EDTA**
   - Prepare a 10% EDTA solution by dissolving 1 g of EDTA in 10 mL of distilled water.
2. **Staining Reagents**
   - Wright's Stain- Prepare a 10% EDTA solution by dissolving 1 g of EDTA in 10 mL of distilled water.
   - Giemsa Stain- Dissolve 1 g of Giemsa powder in 100 mL of buffered water (pH 7.0).
3. **Isotonic Diluent**
   - Dissolve 9 g of sodium chloride (NaCl) in 1 L of distilled water.

STORAGE REQUIREMENTS

1. **Whole Blood Sample**
   - Store at 2–8°C (36–46°F) if testing is not performed immediately.
2. **Anticoagulants**
   - Store at room temperature (15–30°C or 59–86°F) or refrigerated (2–8°C).
3. **Isotonic Diluent**
   - Store at room temperature (15–30°C or 59–86°F) or refrigerated (2–8°C)

IV. CALIBRATION

- The calibration procedure is performed following the manufacturer's instructions.

V. QUALITY CONTROL

IDENTIFY CONTROL MATERIALS TO USE

1. **Commercially Available Control Blood (Multilevel Controls)**
   - These controls mimic patient samples and contain known quantities of red blood cells (RBCs), white blood cells (WBCs), platelets, hemoglobin, and hematocrit, among other parameters.
2. **Whole Blood Control (Stabilized Human Blood)**
   - Used to monitor daily performance and verify calibration of the analyzer.
3. **Electronic Controls (Electronic Check Systems)**
   - Useful for daily checks and for verifying that the analyzer's counting mechanisms are working properly.
4. **Lyophilized Controls (Freeze-Dried Controls)**
   - Provide long shelf life and stability under varying storage conditions.

PREPARATION, HANDLING, AND STORAGE

Preparation:

- Selection of Control Materials
- Reconstitution
- Mixing

Handling:

- Labeling
- Temperature Control
- Mixing Before Use
- Avoid Contamination

Storage:

- Refrigeration
- Stability and Expiration**.**
- Inventory Management

FREQUENCY OF TESTING

- Repeat as clinically indicated and resources permit.

EXPECTED RESULTS INS CBC

Red blood cell count	**Male:** 4.35 trillion to 5.65 trillion cells/L **Female:** 3.92 trillion to 5.13 trillion cells/L
Hemoglobin	**Male:** 13.2 to 16.6 grams/dL (132 to 166 grams/L) **Female:** 11.6 to 15 grams/dL (116 to 150 grams/L)
Hematocrit	**Male:** 38.3% to 48.6% **Female:** 35.5% to 44.9%
White blood cell count	3.4 billion to 9.6 billion cells/L
Platelet count	**Male:** 135 billion to 317 billion/L **Female:** 157 billion to 371 billion/L

CORRECTIVE ACTIONS

1. Identify the Problem
2. Immediate Corrective Actions
3. Troubleshooting
4. Root Cause Analysis
5. Implement Corrective Measures
6. Verification and Documentation
7. Monitoring and Follow Up

RECORDING AND STORAGE OF QC DATA

Recording:

- Daily QC Logs

Storage:

- Physical Storage

- Electronic Storage

ALTERNATIVES

- Internal Quality Control Using Patient Samples

- Statistical Quality Control

VI. STEP BY STEP INSTRUCTIONS

QUANTITATIVE TESTING

1. Preparation
2. Instrument Setup
3. Sample Loading
4. Running the Test
5. Post-Analytical Procedures
6. Recording and reporting
7. Quality Assurance

QUALITATIVE TESTING

1. Preparation
    - Gather Materials and Equipment
2. Specimen Collection
    - Identify the Patient
    - Verify patient identity using two identifiers (e.g., name and date of birth)
    - Collect Specimen
    - Label the Specimen
3. Test Procedure
    - Set Up the Test Area
    - Ensure a clean, well-lit, and organized workspace.
    - Wear appropriate PPE.
    - Prepare the Test Kit
    - Open the test kit and lay out all components on a flat surface.
    - Check the expiration date of the test kit and reagents.
    - Apply the Specimen
    - Follow the manufacturer's instructions for applying the specimen to the test device.
    - Add Reagents (if applicable)
4. Timing
5. Reading the Results
6. Disposal
7. Quality Control

INTERPRETATION

1. Preparation
2. Identify the Result Area
3. Control Line Check
4. Test Line Interpretation
5. Timing
6. Recording Results
7. Clinical Correlation

VII. REPORTING RESULTS

PREFERENCE INTERVALS

- **Within Preference Interval**: Indicate that the result is within the range that typically does not require intervention.
- **Above Preference Interval**: Highlight results that exceed the recommended range, suggesting potential clinical concerns or the need for further action (e.g., additional testing, changes in treatment).
- **Below Preference Interval**: Note results that fall below the recommended range, indicating possible issues that may need addressing.

PROCEDURES FOR REPORTING ABNORMAL RESULTS

1. Review the CBC Results
2. Evaluate the Clinical Context
3. Document the Findings
4. Interpret the Results
5. Determine the Need for Communication
6. Communicate with Healthcare Providers
7. Provide Recommendations
8. Monitor and Follow Up

REPORTING FORMAT

1. Patient and Test Information
2. CBC Components and Reference Ranges
3. Sample Collection and Handling
4. Result Presentation and Formatting
5. Quality Control and Assurance
6. Result Interpretation and Clinical Significance
7. Pediatric and Geriatric Considerations
8. Report Conclusion and Summary
9. Reporting Abnormal Results
10. Disclaimer and Contact Information

VIII. PROCEDURE NOTES

SPECIAL PRECAUTIONS

1. Sample Collection
    - Use of Personal Protective Equipment (PPE)
    - Sterile Equipment
    - Proper Collection Technique
    - Labeling Samples
2. Handling Samples
    - Minimize Hemolysis
    - Storage Conditions
    - Transporting Samples
        - Ensure that samples are transported to the laboratory promptly and securely to avoid delays that may affect test integrity.
3. Laboratory Testing Procedures
    - Quality Control
    - Use of Appropriate Reagents
    - Avoiding Cross-Contamination
4. Interpretation of Results
    - Reference Ranges
    - Clinical Correlation
    - Documenting Abnormal Findings
5. Reporting Results
    - Timeliness
    - Confidentiality
    - Use of Clear Language
6. Post-Testing Procedures
    - Proper Disposal of Biohazardous Waste
    - Cleaning and Disinfection
    - Documentation
7. Training and Competency

POSSIBLE SOURCES OF ERROR

1. Pre-Analytical Errors
    - Sample Collection Errors:
        - Improper Technique
        - Site Selection
    - Sample Handling:
        - Delay in Processing
        - Temperature Variations
    - Sample Volume:
        - Inadequate Volume
    - Labeling Errors:
        - Mislabeling
2. Analytical Errors
    - Instrument Calibration:
        - Equipment Malfunction
        - Reagent Quality
    - Technical Skill:
        - Operator Error
        - Inconsistent Techniques
    - Interference from Hemolysis:
        - Hemolysis
    - Clotting:
        - Clotted Samples
        - Post-Analytical Errors
    - Data Entry Errors:
        - Transcription Mistakes
        - Software Issues
    - Reporting Errors:
        - Incomplete Reports
        - Misinterpretation4. Biological Variability
    - Physiological Factors:
        - Diurnal Variation
        - Hydration Status
    - Medication Effects
        - Pathological Conditions

ANSWERS TO COMMON PROBLEMS

1. Pre-Analytical Problems

- Problem: Hemolysis of Blood Sample
  - Solution: Ensure proper technique during venipuncture to avoid excessive force while drawing blood. Use the correct gauge needle (usually 21-gauge or larger) and avoid using a tourniquet for too long. If hemolysis occurs, consider discarding the sample and collecting a new one.
- Problem: Inadequate Sample Volume
  - Solution: Verify that the correct volume of blood is collected in the tube. If the sample is inadequate, redraw the blood, ensuring the correct technique is followed.
- Problem: Delayed Processing of Samples
  - Solution: Prioritize timely transport of samples to the laboratory. If a delay is unavoidable, store the sample at the recommended temperature (e.g., refrigerated) until processing can occur.
- Problem: Mislabeling of Samples
  - Solution: Implement a double-check system where the person collecting the sample verifies the patient's information and labels the tube immediately after collection.

2. Analytical Problems

- Problem: Instrument Malfunction
  - Solution: Regularly calibrate and maintain laboratory instruments according to the manufacturer's guidelines. If malfunction is suspected, perform quality control checks and troubleshoot using the operator's manual.
- Problem: Operator Error
  - Solution: Provide ongoing training for laboratory personnel. Conduct competency assessments to ensure staff are familiar with testing protocols.
- Problem: Clotted Samples

- Solution: Ensure proper mixing of the anticoagulant with blood by gently inverting the tube several times after collection. If a clot is detected, discard the sample and collect a new one.

· Problem: Interference from Hemolysis

- Solution: If hemolysis is noted, discard the sample and collect a new one. Also, verify that the sample is processed promptly and handled gently to avoid further hemolysis.

3. Post-Analytical Problems

· Problem: Data Entry Errors

- Solution: Implement a double-check system for entering results into the laboratory information system. Regularly audit data entries to identify and rectify any discrepancies.

· Problem: Incomplete or Incorrect Reporting

- Solution: Develop standardized report templates that include all necessary information. Train personnel to ensure that all relevant data is captured accurately.

· Problem: Misinterpretation of Results

- Solution: Encourage clear communication between laboratory staff and healthcare providers. Provide context and recommendations when reporting abnormal results to prevent misinterpretation.

IX. LIMITATIONS OF METHODS

1. Instrumentation Limitations
2. Technical Limitations

X. BACK UP PLAN

- Always know how to manually do this procedure when the time comes any of the machines will have a malfunction. Know to count manually and correctly.

XI. REFERENCES

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EFFECTIVE DATE
DECEMBER 2024

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