Current Status: *Active* **PolicyStat ID:** *10404198*

Origination: *11/30/2021*
Effective: *11/30/2021*
Last Approved: *11/30/2021*
Last Revised: *11/30/2021*
Next Review: *11/30/2023*
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Area: *Laboratory-Hematology*
Key Words:
Applicability: *Royal Oak*

Erythrocyte Indices-RO

Document Type: Procedure

I. PURPOSE AND OBJECTIVE:

This procedure provides instructions on calculating the red blood cell (RBC) indices after performing steps used in the CBC Corrections-RO procedure.

II. ACRONYMS:

A. Hematocrit (HCT)
B. Hemoglobin (HGB)
C. Red Blood Cell (RBC)
D. Mean Corpuscular Hemoglobin Concentration (MCHC)
E. Standard Deviation (SD)
F. Laboratory Information System (LIS)

III. PRINCIPLE:

The values for RBC, hemoglobin and hematocrit can be used to obtain erythrocyte indices that define the size and hemoglobin content of the erythrocyte.

IV. SPECIMEN COLLECTION AND HANDLING:

Type	A. Whole blood collected in a 4 mL vacutainer. This is the preferred sample. -OR- B. Capillary blood collected in a microtainer.
AnticoagulanT	K_2EDTA
Amount:	A. Whole blood: 1. Minimum sample size is 2.0 mL. 2. Optimum sample size is 4.0 mL

	B. Capillary blood: 1. Minimum sample size is 300 µL. 2. Optimum sample size is 500 µL.
Special Handling	A. Specimens must be well mixed for minimum of 2 minutes before being analyzed. B. Samples containing hemolysis, lipemia, icteria, cold agglutinins or cryoglobulins may give false results. (See CBC Corrections-RO Procedure.)
Timing	Specimen is stable for 8 hours at room temperature; 24 hours at 4°C.
Criteria for Unacceptable Specimens	Specimens containing clots, hemolysis or inappropriate volume are unacceptable and must be redrawn.

V. QUALITY CONTROL:

A. Quality control of the manual method used to determine Hematocrit is essential. A discussion of the recommended quality control for HCT can be found in the Microhematocrit-RO procedure.

B. For automated Sysmex cell counts, XbarM statistic is calculated to monitor the stability of instrument calibration.

C. The RBC indices are the most stable of the routine hematologic parameters and can be used as a quick quality control check of consecutive specimens. In particular, the MCHCs usually bounce ± 2SD around the mean for the general patient population. A group of specimens (10-12 samples) that have MCHCs **always** above or below the mean could indicate either a significant change in the patient population or a change in instrument calibration.

D. In addition, it is essential to review results for appropriateness and to check any unusual results for causes of spurious values. (For example, an MCV of 153 fL with MCHC of 43.0 is unrealistic. The specimen should be checked for the presence of cold agglutinins.) See IX, Notes D and E.

VI. PROCEDURE:

A. Perform the following tests in duplicate: hematocrit.

B. Record average.

VII. CALCULATIONS AND INTERPRETATIONS:

A. **Mean corpuscular volume (MCV)** is the volume of the average RBC of a given sample of blood. Results are expressed in femtoliters (fL), formerly known as cubic microns or μ^3.

$$MCV = \frac{Hct\ \% \times 10}{RBC\ (trill/L)}$$

B. **Mean corpuscular hemoglobin (MCH)** is the average weight of hemoglobin contained in an average erythrocyte. Results are expressed as picograms (pg) which is the same as micromicrograms (µµg).

$$\text{MCH} = \frac{\text{Hgb (gm/dL) x 10}}{\text{RBC (trill/L)}}$$

C. **Mean corpuscular hemoglobin concentration (MCHC)** is the average concentration of hemoglobin in a given volume of packed red cells. Results expressed as % or gm/dL.

$$\text{MCHC} = \frac{\text{Hgb (gm/dL) x 100}}{\text{Hct \%}}$$

VIII. EXPECTED VALUES:

Refer to Hematology Normal Values-RO procedure for current normal ranges.

IX. NOTES:

A. Normal values were derived from a 1997 study of "normal" executive health employees. These values were verified in 1999, 2004 and 2013.

B. Normals are the same for manual and automated procedures.

C. Indices are reported as whole numbers only. The LIS rounds them appropriately.

D. Sysmex hematology analyzers measure the RBC, hemoglobin and HCT.

E. The accuracy of calculated indices is totally dependent on the accuracy of directly measured parameters.

F. An MCHC of (≥37.0) does not occur except in some cases of hereditary spherocytosis or when specimen interferences produce spurious results.

G. MCHCs over 37.0 gm/dL may be a result of **falsely high** HGBs or **falsely low** HCTs. The possible causes of **falsely high** HGBs or **falsely low** HCTs are listed below:

1. **Falsely high HGB:**

$$\frac{\textbf{Increased Hgb}}{\textbf{Hct}} = \textbf{Increased MCHC}$$

   a. Possible causes:

      i. *Lipemia

      ii. Increased bilirubin

      iii. Abnormal proteins

2. **Falsely low HCT:**

$$\frac{\textbf{Hgb}}{\textbf{Decreased Hct}} = \textbf{Increased MCHC}$$

   a. Possible causes:

      i. *Cold agglutinin

      ii. Gross hemolysis

iii. Instrument failure

iv. Incorrect RBC count

3. *See CBC Corrections-RO procedure for correcting results with these interferences.

H. If a specimen with a MCHC greater than 37.5 does not correct with warming or plasma replacement procedures as described in "CBC Corrections-RO", check smear for spherocytes.

I. If specimen is from a pediatric patient or a microtainer sample and has a MCHC of ≥ 37.5, report results with comment "QNS to repeat".

X. REFERENCES:

A. Miale J. Laboratory medicine hematology. 6th Ed. St. Louis: CV Mosby, 1982.

B. Henry J.B. Clinical diagnosis and management by laboratory methods. 17th Ed. Philadelphia: WB Saunders, 1984:589.

Attachments

No Attachments

Approval Signatures

Step Description	Approver	Date
	Ann Marie Blenc: System Med Dir, Hematopath	11/30/2021
Hematology Medical Director Designee	Ann Marie Blenc: System Med Dir, Hematopath	11/30/2021
Policy and Forms Steering Committee Approval (if needed)	Gail Juleff: Project Mgr Policy	11/29/2021
Policy and Forms Steering Committee Approval (if needed)	Michele Sedlak: Medical Technologist Lead	11/29/2021
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Applicability

Royal Oak