

EXERCISE 5: ERYTHROCYTES SEDIMENTATION RATE - ESR, SED RATE

Textbook: None
Skills: 10 points

Objectives:

1. State the principle of the Erythrocytes Sedimentation Rate - ESR.
2. State the factors which may affect the results obtained in the ESR
3. Describe 4 sources of error which may cause erroneous results in the ESR.
4. State the clinical significance of the ESR.
5. List and describe the 3 stages which occur during the sedimentation of the red blood cells.

Discussion

The *principle* of the ESR is based on the fact that when well-mixed venous blood is placed in a vertical tube, the red blood cells (RBCs) will settle out of the plasma and fall towards the bottom of the tube. This settling out of cells may be observed in EDTA samples which have been allowed to sit in a test tube rack for a long period of time. The length of the fall of the top of the column of red blood cells in a given interval of time is the erythrocyte sedimentation rate - ESR.

There are several factors which will affect the results of this test:

1. **Plasma factors:** an abnormal increase in some plasma proteins may prevent the RBCs from falling, causing a falsely decreased ESR. Some abnormal plasma proteins cause the RBCs to clump quickly and fall at an abnormally increased rate, resulting in a falsely increased ESR.
2. **Red Blood Cell factors:** Anemia causes a falsely increased ESR because the change in the RBC to plasma ration favors rouleaux formation, causing the RBCs to fall quickly. Rouleaux is condition in which the RBCs clump together like stacks of coins. Microcytes (abnormally small RBCs) will fall more slowly than macrocytes (abnormally large RBCs). RBCs with an abnormal or irregular shape, such as sickle cells (sickle shaped RBCs) or spherocytes (round RBCs, do not have biconcave shape), hinder rouleaux formation and cause a falsely decreased ESR.
3. **Mechanical and Technical factors:** Proper technique and correct use of the equipment is critical for valid results.

The sedimentation rate of RBCs takes place in three stages:

First Stage - Rouleaux formation, the sedimentation rate is slight.

Second Stage - sedimentation occurs at a fairly rapid rate.

Third Stage - sedimentation rate is slow because of the accumulation of RBCs in the bottom of the tube.

Clinical Significance

The ESR is a nonspecific indicator of inflammation and necrosis. It reflects mainly the increase in production of a certain protein produced in response to necrosis or inflammation. These changes occur in many acute and chronic infections, tumors and degenerative diseases. In pregnancy the ESR increases moderately. Markedly elevated ESRs are seen in blood protein disorders such as multiple myeloma or macroglobulinemia. Moderate elevations are common in active inflammatory diseases such as rheumatoid arthritis, chronic infections,

collagen disease and neoplastic disease. The use of the ESR at the present time is as an indication of the presence of these types of active disease. This test may help detect the existence of disease but not its severity. Another laboratory test called the C-Reactive Protein (CRP) test is a much better indicator of inflammation and necrosis than the ESR. CRP is the protein which is actually produced and this test can detect and quantitate the amount of protein present and is not affected by anemia or abnormal serum proteins. However, the ESR remains a very popular test to indicate the presence of inflammation and necrosis.

Normal Values

Men 0-10 mm per hour

Women 0-15 mm per hour

Sources of Error

1. If the concentration of the anticoagulant is greater than recommended, the ESR will be erroneously high. This is especially critical if the black top, which contains the diluent for the test, is used. EDTA samples may be used for the ESR and are diluted prior to performing the test.
2. If the ESR stands for more than 60 minutes, the results will be falsely elevated. If the test is timed for less than 60 minutes, falsely low values are obtained.
3. An increase or decrease in room temperature may lead to increased or decreased ESR results. The temperature should be within the range of 20-25 C.
4. The tubes must be maintained in an upright position during the test. All sedimentation racks used should be equipped with leveling screws and a spirit bubble. Tilting of the ESR tube increases the sedimentation rate.
5. Bubbles in the blood tube when filling will lead to erroneous results.
6. Fibrin clots present in the blood invalidate the test results.
7. The ESR should be set up within two hours of blood collection. EDTA specimens stored at 4 C for 12 hours or less may be used. The specimen must be allowed to reach room temperature before the test is performed.

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Name _____

Patient Name	
Patient ID Number	
Start Time	
Stop Time	
Results (use correct units)	

Do these results fall within the normal range (circle one): **YES NO**

