

Erythrocyte Sedimentation Rate (ESR)

ESR: Is the distance (in millimeter) that erythrocytes fall per unit of time (usually 1 hour) .if anticoagulant blood is allowed to stand vertically in a tube undisturbed ,the RBCs will gradually fall to the upper portion .The distance that the cell fall in 1 hour can be measured and is called the Sedimentation rate . This sedimentation occurs in three stages :

1. Formation of rouleaux ; rouleaux is formed with minimal sedimentation. This phase lasts about 10 minutes .
2. Period of fast settling ;at this stage the settling rate is constant and lasts about 40 minutes.
3. The remaining amount of time is a period of packing of the rouleaux at the bottom of the tube .

rouleaux The Stacking up Of 'red' blood cell caused by extra or abnormal Proteins in the blood that decrease the normal distance red cells maintain between each other. (Fig: I)

Factors affecting ESR

1. Size of RBC: in vitamin B12 deficiency RBC are large in size Macrocytes, and the sedimentation rate increased, While in iron deficiency the RBCs are small in size. Microcytes and the sedimentation rate decreased.
2. Number of RBCs:. In anemia; ESR increased while in polycythemia; ESR. decreased,
3. plasma protein concentration: The more plasma protein present, the more rapidly rouleaux phenomena will occur and the more elevated the sedimentation rate will be.
4. Hemoglobin content .
5. blood viscosity
6. Rouleaux formation .

The Principle

The blood is diluted with anticoagulant diluting fluid; in the westergren tubes .set up vertically , for one hour and then Read the highest of the clear plasma above the upper limit of the column, of sediment red cells in millimeter.

Objective

To estimate the ESR of blood sample.

Apparatus and reagents

Westergren Method

1. **Westergren tube** :It is 300 mm in length are marked from 0 (top) to 200 (bottom) ;open at both ends diameter of 2.5 mm.
2. **Westergren rack** :with adjustable leveling screws are available for holding the sedimentation tubes vertical position
3. (3.8%) trisodium citrate solution as anticoagulant diluting fluid.
4. venous blood sample
5. test tubes
7. pipette 0.5 ml .

Procedure

- 1.Place 0.5 ml of 3.8% Trisodium citrate in test tube.
2. Add 2 ml of blood sample to the test tube .(1 part of 3.8% Trisodium citrate to 4 part of blood).
- 3.Mix the contents of test tube gently.
- 4.Fill the westergren tube to 0 mark .

5. Set up the Westergren tube right in a stand with a spring clip on top and rubber at bottom.

6. Read the highest of the clear plasma above the upper limit of the column of sediment red cells in mm/hr

Clinical Applications

ESR Increased in:

1. chronic condition such as Rheumatoid arthritis and Tuberculosis .
2. A cancer of a certain type of white cells Multiple myeloma, where the plasma proteins are abnormal.
3. Acute infections .
4. Anemia.
5. kidney disease..
6. Autoimmune and inflammatory diseases .
7. Pregnancy .

ESR Decreased in:

Any disease that changes the shape and size of red blood cells decrease the ESR; also the diseases that cause the body to make less protein or extra RBCs decrease the ESR, such as :

1. Sickle cell disease..
2. Polycythemia
3. Congestive heart failure .

Normal Value

Children : 0- 10 mm/hr

Women : 0-20 mm/hr

Men 0-15 mm/hr

Increase by 5 to 10 mm/hr in persons older than 50 years of age .

Precautions

- 1.As blood is taken by vein puncture prolonged venous congestion must be avoided .
- 2.They set up with in three hours of blood collection .
- 3.Tests must not be Performed in direct sunlight
- 4.They performed in 18-22 C° .
- 5.blood containing slightest trace of clot must be discarded.
6. Hemolysed blood must not be used.