

Determination of Erythrocyte Sedimentation Rate (ESR)

The definition of ESR: It is the measure of RBCs' settling in diluted plasma over a specified period of time. This is a numeric value in mm over a period of 60 minutes. It is not a specific test, but reflects change in plasma protein accompanying most of acute and chronic infection

Purpose: To determine the ESR of a given blood sample.

Principle: RBCs give rise to the more rouleaux formation in abnormal conditions like inflammatory conditions and the necrotic process, resulting in aggregation of the RBCs, which make them heavier and more likely to fall rapidly so that there are increased RBCs mass, which increases the ESR due to faster settling of RBCs.

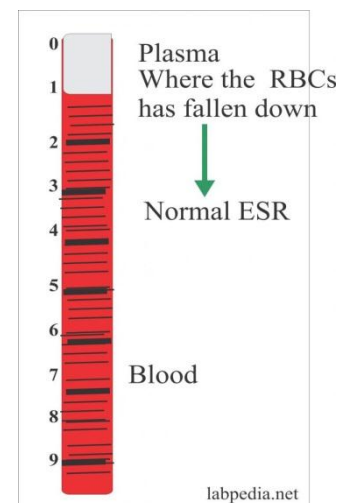
Method: Westergrens method

Requirements: ESR stand, ESR tube, blood sample

- 3.8% Sodium citrate as an anticoagulant in a ratio of 1:4 with blood

Protocol

- Withdraw 2 cc of blood from the patient's vein using the syringe.
- Put 0.4 cc of sodium citrate in a plain test tube.
- Immediately add 1.6 ml blood from the syringe to the plain tube making a dilution of 1:4 ratio and shake it for mixing.
- Fill the Westergreen pipette to exactly the 0 mark making certain that there are no air bubbles at all in the blood.
- Take reading after 5min as 'zero' hour reading and again note the reading after 1 hour and 2 hours.



Normal value: 0-mm at 1hr, 2-3mm at 24hrs, but if above this value at 24 hrs, it indicates some pathological defect.

Horse	10-30 min	Pig	8hr
Cattle	8-24hr	Cat	1hr
Sheep	24hr	Man	1hr
Goat	24hr	Dog 1hr, because of large sized erythrocyte	

Factors Affecting ESR:

1. Red blood cells:

In case of absence of rouleaux formation, it will lead to low ESR level conditions like:

1. Sickle cell anemia.
2. Spherocytosis.
3. Acanthocytosis.

2. Plasma:

In the case of increased protein will lead to increased rouleaux formation and increased ESR like:

1. Fibrinogen.
2. Immunoglobulins.

3. Mechanical:

It depends upon the test tubes' caliber, like Wintrobe tubes range from 0 to 100 mm and has different values compared to the Westergreen method.

4. Anticoagulants:

1. Sodium citrate and EDTA do not affect the ESR.

2. Sodium or potassium oxalate shrinks the RBCs.
3. Heparin also causes shrinkage of the RBCs and gives rise to increased false ESR value.

So EDTA is the choice of anticoagulant.

Note: ESR is a nonspecific test, but this is one of the best tests to find any kind of abnormality in the body. Whenever you find raised ESR, never ignore it but have a thorough workup of the patients. It definitely shows some underlying disease.

Causes Of Raised ESR:

1. Bacterial infections in the abdomen, pelvic inflammatory disease, syphilis, and pneumonia.
2. Chronic renal diseases.
3. Malignant diseases like Multiple myelomas, Hodgkin's disease, and advanced carcinomas.
4. Inflammatory diseases like temporal arteritis, rheumatoid arthritis, rheumatic fever, and systemic lupus erythematosus.
5. All autoimmune diseases.
6. Necrotic diseases like Acute myocardial infarction, gangrene, and necrotic tumors.
7. Tuberculosis.
8. Severe anemia like iron deficiency and B12 deficiency.
9. Kidneys diseases like nephritis and nephrosis.
10. Subacute bacterial endocarditis (SBE).
11. Gout and arthritis.
12. In acute myocardial infarction due to cell destruction.
13. Acute heavy metal poisoning.

Conditions leading to increased ESR value are:

1. Pregnancy after the 12 weeks of gestation.
2. Young children.
3. During the menstrual cycle.
4. Drugs like heparin, and oral contraceptives.
5. Anemia where the Hct is low.

Conditions where the ESR value is reduced:

1. High blood glucose (hyperglycemia).
2. In the case of raised phospholipids.
3. In the case of raised albumin.
4. In the case of raised WBCs.

References:

1. Jelalu Kemal .(2014).Laboratory Manual and Review on Clinical Pathology.. OMICS Group eBooks,USA.
2. <https://www.labpedia.net/erythrocyte-sedimentation-rate-part-1-esr-sedimentation-rate/>