

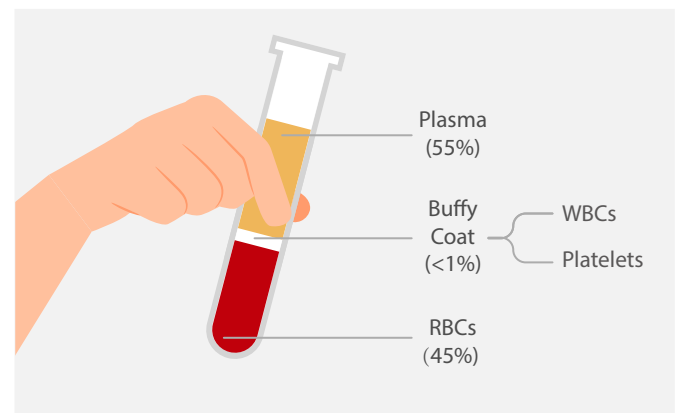
Quick Facts About Erythrocyte Sedimentation Rate (ESR) Part A



What is erythrocyte sedimentation rate



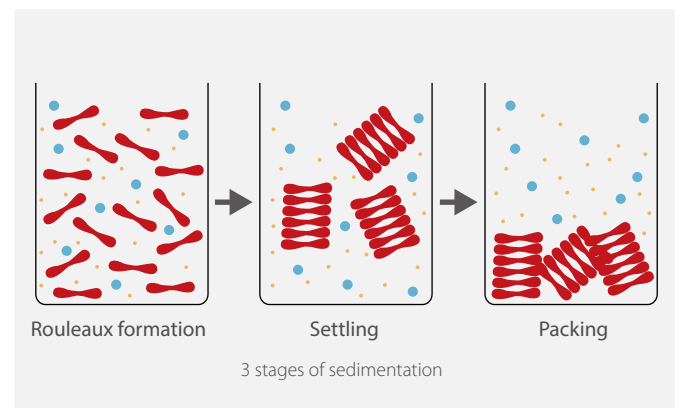
The erythrocyte sedimentation rate (ESR), which is determined by the Westergren method, measures how quickly red blood cells (RBCs) settle at the bottom of a blood sample tube in millimeters (mm) in one hour.

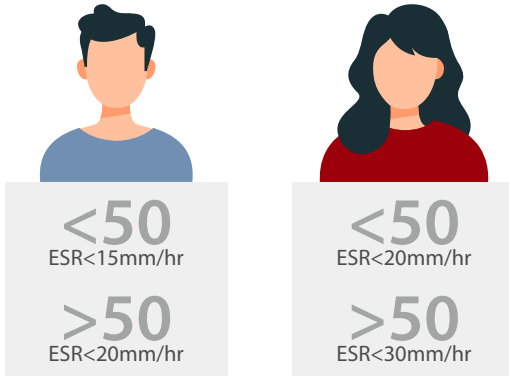


0 mins > 15 mins > 30 mins > 60 mins

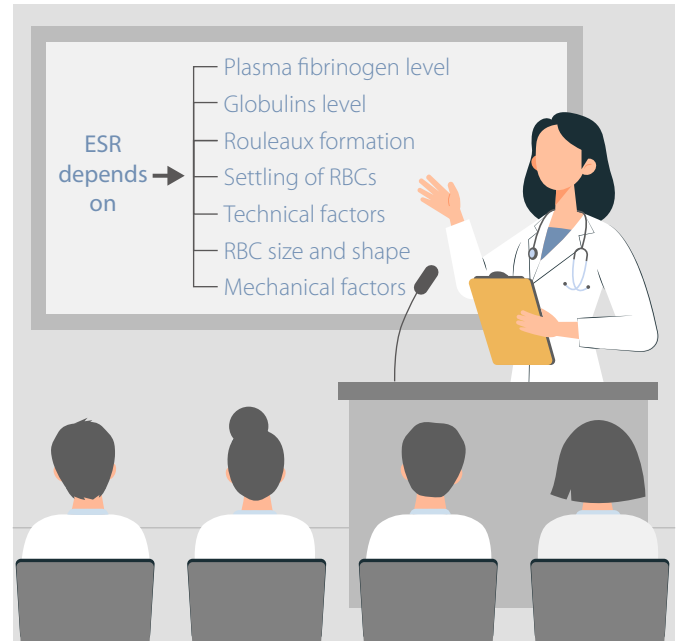
When blood is left alone in an upright test tube, the sedimentation increases over time, but the ESR stays the same, which indicates how quickly the sedimentation happens.

Westergren tube + Anticoagulant
Deoxygenated blood



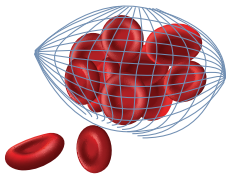


ESR increases as one gets older

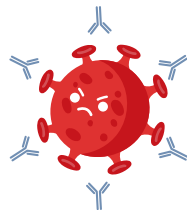


Factors that affect sedimentation

Any factor that increases rouleaux formation raises the ESR



Increase in plasma fibrinogen levels
 ↓
 Sedimentation ↑
 ↓
 ESR ↑

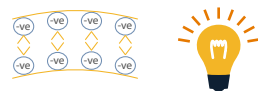
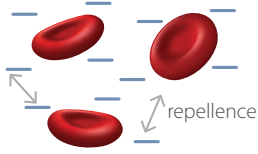


Increase in immunoglobulin levels
 ↓
 Sedimentation ↑
 ↓
 ESR ↑

e.g., Increase in fibrinogen/immunoglobulin levels

Any factor that resists sedimentation decreases the ESR

Opposites attract, similars repel

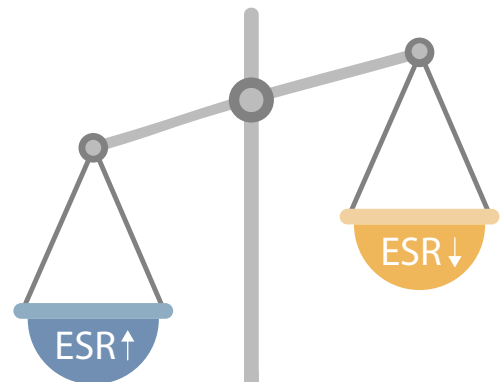


Why are there negative charges on RBCs? This is because RBCs have a cell membrane (a lipid bilayer), and the negative charges come primarily from the carbohydrates of the cell membrane.

Rouleaux formation decreases due to the negative charges on the surface of RBCs → Sedimentation ↓ → ESR ↓

e.g. Negative charges on the surface of RBCs

Conditions affecting the ESR



Rheumatoid arthritis
 ↓
 Fbg, IgG ↑

Infection e.g., tuberculosis
 ↓
 Fbg, IgG ↑

Anemia
 ↓
 -ve charge on RBC ↓

Multiple myeloma
 ↓
 Rouleaux, IgG ↑

Waldenstrom macroglobulinemia
 ↓
 IgM ↑

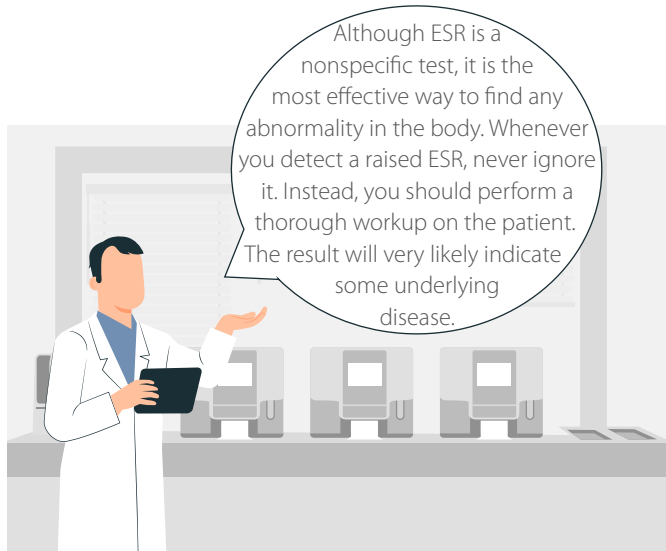
Hyperviscosity syndrome
 ↓
 -ve or RBC ↑

Polycythemia
 ↓
 -ve or RBC ↑

Sickle cell
 ↓
 Rouleaux ↓

Microcytosis
 ↓
 Rouleaux ↓

Spherocytosis
 ↓
 Rouleaux ↓



Mindray is soon going to launch a new hematology series that incorporates both CBC and ESR analysis. Stay tuned for its global launch lunch event on March 1st!

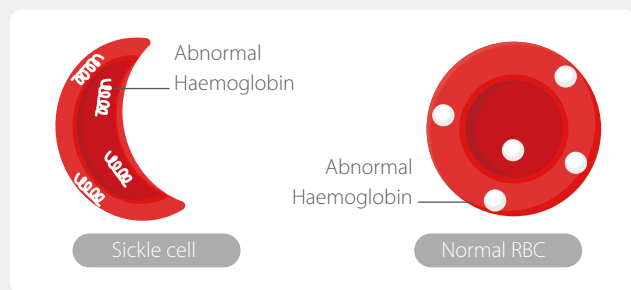
Before we move onto the next lesson, here are some take-home messages for you.

In general, ESR has higher sensitivity and negative predictive value (NPV) but lower specificity and positive predictive value (PPV).

References

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- [2]. <https://labtestsonline.org.uk/tests/erythrocyte-sedimentation-rate-esr>
- [3]. <https://labs.selfdecode.com/blog/erythrocyte-sedimentation-rate-esr-high-low-levels-how-to-decrease-it/>
- [4]. ICSH recommendations for measurement of erythrocyte sedimentation rate. International Council for Standardization in Haematology (Expert Panel on Blood Rheology). J Clin Pathol. 1993 Mar;46(3):198-203. [PMC free article] [PubMed]

- ESR is a very important means to rule out giant cell arteritis.
- In sickle cell disease
 - asymptomatic → ESR ↓
 - painful crises → inflammation → Fibrinogen ↑ → ESR ↑
- In sickle cell trait → no sickle cells → normal ESR



- Both ESR and CRP will be detected to elevate in the case of any inflammation.
- ESR starts to rise 24-48 hours after onset of inflammation.
- ESR elevation is one of the minor criteria for diagnosis of rheumatic fever.

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