Erythrocyte sedimentation rate (ESR)

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Erythrocytes sedimentation rate (ESR)

It is defined as the rate of sedimentation of erythrocytes in a column of anti-coagulated blood at certain time.

A whole blood sample is allowed to stand for a certain time in a perpendicular tube, The erythrocytes are settling down, leaving a clear layer of plasma at the top of the tube. The length of the plasma layer in mm represents a measure of the ESR and expressed as mm/time.

Theories of sedimentation:

- **Rouleaux formation theory:**
  The red cells of healthy horses has a natural tendency to form chain like arrangement and thus results in rapid settling of red cells.
- **Electrical theory.**
- **Plasma protein theory.**

Methods of estimations:

- Wintrobe method.
- Westergreen method.

Anticoagulant

The type of the anticoagulant used for ESR is different according to the method used. EDTA is used for ESR determined by wintrobe method. However, Sodium Citrate (3.8%) is used for ESR that determined using the westergreen method, sodium citrate is used in the ratio of 1:4.

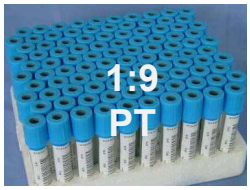
Sodium citrate

Dose: Sodium citrate 3.8% (1:4 or 1:9)

Mode of action: Binding ionized calcium.

Advantages

- ✓ Blood transfusion.
- ✓ ESR (1:4).
- ✓ Prothrombin time (1:9)
- ✓Bacteriological culture.



Advantages

- Not suitable for hematological analysis.

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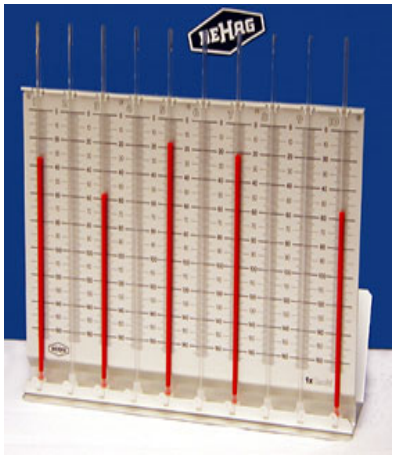
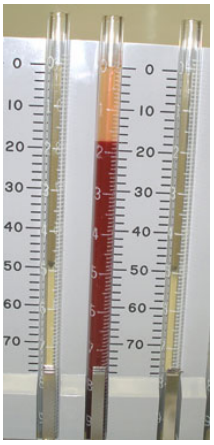


Westergreen method



Wintrobe method

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Suitable time for ESR:

Equine: 10 minutes and 20 minutes

Cattle: after 24 hrs

Dogs: 1hour and 2hour

Sheep: 7hrs and 24hrs

Buffaloes: 1 hour

Factors influence the ESR:

1. **Physical factors:** Temperature, change in size of RBCs and Rouleux formation
2. **Chemical factors:** Anticoagulant.
3. **Physiological factors:** Sex, age, pregnancy, exercise altitude and digestion.
4. **Technical factors:** Position of the tube (Sedimentation is rapid in an inclined position)

5. Pathological factors

Accelerated ESR observed in cases of:

1. All acute generalized infection.
2. Acute localized inflammatory process of serous membranes such as pleura, pericardium and peritoneum.
3. Chronic localized infection.
4. Toxemia.
5. Severe anemia.
6. Malignant neoplasia.
7. At the beginning of abscess formation.
8. Inflammation of draining cavities such as uterus and head sinuses.

Retarded ESR in cases of:

1- Hemoconcentration following dehydration.

2- Chronic obstructive pulmonary disease.

3- Pulmonary diseases that associated with hypoxia.

4- Congestive heart failure.

5- Polycythemia.

DIPHASIC SEDIMENTATION

Occasionally in ESR determination there is no definite line between the settled erythrocytes and the plasma. Reticulocytes and immature erythrocytes exhibit less tendency to form clumps or chains (rouleaux) than mature erythrocytes; thus ESR is retarded or exhibits a diphasic pattern.

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DIPHASIC SEDIMENTATION

This phenomenon occurs as a result for the presence of reticulocytes or other young form of erythrocytes which having abnormal shape. This trailing out of erythrocytes occurs because these cells are larger and don't actively participate in rouleux formation.

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