

### **Erythrocyte Sedimentation Rate (ESR)**

The erythrocyte sedimentation rate (ESR) is the rate of sedimentation of RBCs and is used often as a nonspecific measure in monitoring disease activity and assisting in the diagnosis of many inflammatory disorders. The ESR is described as occurring in 3 phases: RBC aggregation, precipitation, and packing.

RBC aggregation is a critical factor for the sedimentation and is facilitated by the presence of certain plasma proteins called agglomerins, which include fibrinogen, IgM, and  $\alpha$ 2-macroglobulin. Any factors affecting these 3 phases, including those in the number and shape of RBCs, plasma viscosity and mechanical/technical factors, can affect the sedimentation rate. The ESR is expressed as millimeters per hour . ESR varies between age groups and sexes. The ESR increases with age and is higher in women than men.

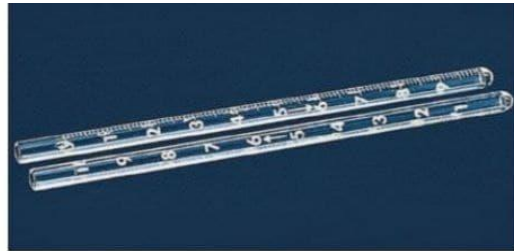
#### **Normal Range**

Normal values for ESR, as derived using the Westergren method, are as follows:

- Male:  $\leq 15$  mm/hr
- Female:  $\leq 20$  mm/hr
- Child:  $\leq 10$  mm/hr
- Newborn: 0-2 mm/hr

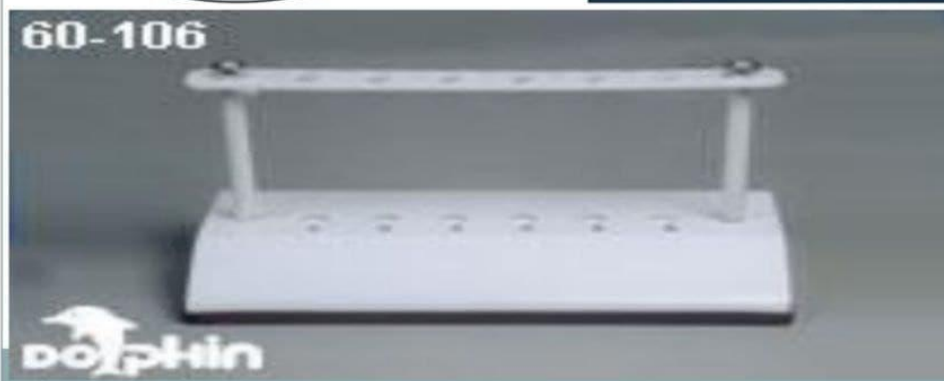
#### **Manual methods for estimation of ESR**

- ❖ Wintrobe's Method
- ❖ Westergen's Method
- ❖ Zeta Sedimentation ratio
- ❖ Micro ESR Method

**1-Wintrobe's Method:****WINTROBE METHOD****Wintrobe tube:**

- 110 mm long, narrow, thick walled tube with 3mm internal bore.
- Graduated from 0-10 cm with graduation both in ascending and descending order on 2 sides of tube.
- The scale with the markings from 0-10 from above downwards is used in ESR determination and from below upward is used for Hematocrit (PCV) determination.

**WINTROBE TUBE WITH STAND**  
110mm long  
Internal diameter 2.5 mm  
Calibrated both sides  
0- 10  
10 -0



**Procedure:**

1. mix the anticoagulated blood thoroughly.
2. fill the wintrobe tube by using Pasteur pipette up to mark 0.
3. place the tube vertically in a stand.
4. note the ESR at the end of 1 hour.

**2- Westergren's Method:**

Recommended by ICSH

**\*\*Westergren pipette**

- ❖ 30 cm in length
- ❖ 2.5 mm internal diameter
- ❖ Marking on the tube is from 0 to 0 – 0 - 200 mm.
- ❖ Clean and dry
- ❖ Anticoagulant used 3.8% trisodiumcitrate dihydrate solution (1:4)

**Procedure:**

- 1-Fill the Westergren pipette by inserting in a vacutainer tube containing 1.6 ml blood and 0.4ml anticoagulant.
- 2-Keep the pipette upright in the ESR stand lying on the leveled surface.
- 3- Read the upper level of RBC column exactly after one hour.

**ESR increased in these conditions:****1-Physiological states of increased ESR:**

- ❖ After meals.
- ❖ After hot baths.
- ❖ During menstruation.
- ❖ After physical exercises.
- ❖ Increases with age.

**2-Pathological states of increased ESR:**

- ❖ Infectious diseases.
- ❖ Neoplastic, invasive tumors.
- ❖ Anemia.
- ❖ Chronic and acute diseases of liver.
- ❖ Diseases of connective tissues.

**ESR decreased in these conditions:**

- ❖ Polycythemia.
- ❖ Congestive heart failure.
- ❖ Hypofibrinogenemia.
- ❖ The presence of red blood cell abnormalities (poikilocytosis, spherocytes, and sickle cells).