Hematology

Hematology, [also spelled](http://en.wikipedia.org/wiki/American_and_British_English_spelling_differences#Simplification_of_ae_and_oe) haematology is the study of [blood](http://en.wikipedia.org/wiki/Blood), the blood-forming organs, and blood diseases. Hematology includes the study of [etiology](http://en.wikipedia.org/wiki/Etiology), [diagnosis](http://en.wikipedia.org/wiki/Medical_diagnosis), treatment, [prognosis](http://en.wikipedia.org/wiki/Prognosis), and [prevention](http://en.wikipedia.org/wiki/Preventive_medicine) of blood diseases that affect the production of blood and its components, such as [blood cells](http://en.wikipedia.org/wiki/Blood_cells), [hemoglobin](http://en.wikipedia.org/wiki/Hemoglobin), [blood proteins](http://en.wikipedia.org/wiki/Blood_proteins), and the mechanism of [coagulation](http://en.wikipedia.org/wiki/Coagulation).

Plasma

The virtually cell-free supernatant of blood containing anticoagulant obtained after centrifugation.

Serum

The undiluted, extracellular portion of blood after adequate coagulation is complete.

Main hematological tests

1-Complete blood picture (Hemoglobin, white blood cell count, Red blood cell count, Hematocrit and Platelet count)

2- Differential leukocyte counts (neutrophils, lymphocytes, monocytes, eosinophils and basophils)

3- Erythrocyte sedimentation rate

4- Reticulocyte Count

5- Prothrombin Time

Anticoagulants

It is a substance that prevents [coagulation](http://en.wikipedia.org/wiki/Blood_coagulation) (clotting) of blood. Some anticoagulants are used in medical equipment, such as [test tubes](http://en.wikipedia.org/wiki/Test_tube), [blood transfusion](http://en.wikipedia.org/wiki/Blood_transfusion) bags, and [renal dialysis](http://en.wikipedia.org/wiki/Renal_dialysis) equipment.

There are different types of anticoagulants are.

1- Ethylene diamine tetra-acetic acid (EDTA)  
EDTA remove calcium from blood which is essential for the coagulation called as chelating agent. It also inhibits fibrinogen to fibrin. It is used in a concentration of 1 - 2 mg of the anhydrous salt per ml of blood. It preserves cellular elements more than 3 hours, therefore it is widely used for determination of hemoglobin concentration, WBCs count, RBCs count, PCV, ESR and platelets count.

Disadvantages of EDTA:

1) Excessive concentrations of EDTA will cause shrinkage of RBC's and erroneous PCV, MCV and MCHC results. Thus, it is important to fill tubes with the required quantity of blood. Hemoglobin concentration is not affected.

2) Despite the suitability of EDTA, after several hours lymphocytes may develop vacuoles and tend to resemble monocytes; also, not all the vacuoles in the monocytes may be genuine.

3) EDTA interferes with blood chemistry tests as follows:

a) Falsely decreases alkaline phosphatase by binding Mg++.

b) Decreases the C02 combining power of blood.

c) Interferes with Jaffe reaction for creatinine test.

d) Alters Na+, K+ and Ca++ concentrations in plasma.

2- Double oxalate  
It is a mixture of 3 parts of ammonium oxalate and 2 parts of potassium oxalate. It is used in concentration of 2 mg for the 1 ml of blood. Oxalates acts by removing calcium ions from the plasma as in the insoluble oxalate. It is used for determination of Haemoglobin, ESR estimation, RBCs count and leucocytes count.  
Disadvantages of Double oxalate:

1- It does not prevent platelet aggregation *in vitro* as effectively as EDTA.

2- It is poisonous and should not be used for blood transfusion.

3- This oxalate mixture cannot be used in measurements of the levels of plasma potassium, alkaline phosphatase, amylase, LDH, uric acid, or urea.

3- Trisodium citrate  
It converts the ionized calcium into non-ionized form. It is used in a concentration of 2 - 3 mg for 1 ml of blood; it is used to perform coagulation test, blood transfusion and ESR estimation.

Disadvantages of Trisodium citrate:

1) It interferes with many chemical tests.

2) Used alone it preserves blood for only a few hours.

3) It has a tendency to shrink cells.

4- Heparin  
This anticoagulants is used when plasma is required urgently for certain emergency estimation of blood gases and electrolytes. It inhibits present thrombin from prothrombin. It is used in concentration of 1 - 2 mg per ml of blood.

Disadvantages of heparin:

1) It causes clumping of leukocytes.

2) It interferes with the staining of leukocytes.

3) It is the most expensive of the anticoagulants.

4) Blood will clot in 8-12 hours because clotting is only delayed and not prevented.

5) It is not suitable for agglutination tests, coagulation studies (prothrombin time tests) or plasma fibrinogen determination.

6) It may interfere with some automated biochemical analyses of plasma.

5- Acid citrate dextrose (ACD)  
Sodium citrate - 1.32 gm.  
Citric acid - 0.48 gm.  
Dextrose - 1.40 gm.  
Distilled water- 100 ml.   
Above mixture is used the 4 ml blood for 1 ml ACD mixture. It precipitates the calcium ions. It is used in the Blood Bank for collecting blood for transfusion. It is also used for enzyme study, red cells preservation and for hemolytic process. It is not suitable for Haemoglobin and blood cells count because it is used as liquid that dilute the cellular elements.  
  
6- Sodium fluoride  
Sodium fluoride is an inhibitor. It is used for determination of blood sugar. It preserve blood for 24 hours at room temperature and 4 to 6 day in refrigerator.

Disadvantages of Sodium fluoride:

1) It is poisonous.

2) Its inhibition of urease and glycolytic enzymes may interfere with urea and glucose determinations that employ enzyme activity.

3) Alkaline phosphatase, amylase and uric acid cannot be determined in blood containing sodium fluoride.