

**SOME ANTICOAGULANTS USED IN  
HAEMATOLOGY LABORATORY**

**SEMINAR PRESENTED**

**BY**

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**TO THE**

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**JCS MEDICAL DIAGNOSTIC  
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# SUMMARY

Anticoagulants are chemical substances that prevent blood from clotting. An anticoagulant is used in hematology laboratory where whole blood or plasma is required which depends upon the tests to be done and then the type of anticoagulant to be used. Every anticoagulant is added in a fixed proportion to blood. Some of the anticoagulants used in hematology laboratory include: Ethylenediamine tetraacetic acid (EDTA), sodium citrate, heparin, oxalates, citrate phosphate dextrose, citrate phosphate dextrose plus adenine and Heller and Pahl mixture etc. and they are used depending on the type of investigation to carry out. Ethylenediamine tetraacetic acid and sodium citrate prevent coagulation by removing calcium which is one of the essential factors in coagulation from the blood by precipitation. EDTA is used in concentration of 1-2 mg/ml of blood. Sodium citrate is mostly used for erythrocyte sedimentation rate. Heparin is an anti-thrombin thereby preventing the conversion of prothrombin to thrombin. Heparin is used in concentration of 0.1 - 0.2 mg/ml of blood. Oxalate binds with calcium ions present in the blood and forms insoluble precipitate of calcium oxalates.

# ANTICOAGULANTS

Anticoagulants are substances that prevent blood from clotting. Anticoagulant also occur naturally in leeches and blood-sucking insects (mosquitoes) where they help keep the bite area unclotted long enough for the animal to obtain some blood. Anticoagulant is used in the haematology laboratory where whole blood or plasma is required which depends upon the tests to be done and the type of anticoagulant to be used.

# **SOME OF ANTICOAGULANTS USED IN HAEMATOLOGY LABORATORY**

## **ETHYLENE DIAMINE TETRA ACETIC ACID (EDTA)**

Is a widely used chemical anticoagulant in the laboratory. EDTA has become the standard hematology anticoagulant because of its very efficient and complete anticoagulation and its lack of effect on the size (morphology) or number of blood cells in the specimen. its disodium or dipotassium salt are used at a concentration of 1-2 mg/ml of blood.

# **MODE OF ACTION**

EDTA acts by removing Calcium from blood by converting it from the ionized to non ionized form i.e. a chelating agent.

EDTA is used for hematological investigations for the following tests: Haemoglobin determination, Full blood counts, Blood film study, Haematocrit (PCV), platelet count and differential white cell count.

# **ADVANTAGES AND DISADVANTAGES OF EDTA**

## **ADVANTAGES**

- it give better preservation to the cellular morphology of blood cells when observes even after 3 hour of blood collection.
- It can be used for platelets counting as it inhibits the clumping of platelets.

## **DISADVANTAGES**

- Excess EDTA in the blood may lead to shrinkage of red blood cells And white blood cells
- The excess amount of EDTA may cause the decrease in packed cell volume (PCV) and increase in mean cell heamoglobin concentration (MCHC)

## **SODIUM CITRATE**

This is non-toxic anticoagulant. It is used in coagulation studies and westergren method of erythrocyte sedimentation rate.

# **MODE OF ACTION AND ITS USE**

## **MODE OF ACTION**

Its action is in the reaction of citrate ions with calcium ions to form a unionized calcium compound, hence preventing coagulation.

## **USE**

- a) Used in coagulation studies
- b) Used for erythrocytes sedimentation rate.

For ESR 0.4ml of sodium citrate is added to 1.6ml of venous blood while for coagulation test 1ml of sodium citrate is added to 9ml of blood.

# HEPARIN

Heparin is an excellent natural anticoagulant extracted from mammalian liver or pancreas. It is not a poisonous anticoagulant and can be used in urgent blood transfusion at a concentration of 1500-3000iu per 500ml of blood. But mostly it is used for treatment of coagulation diseases such as deep venous thrombosis (DVT).

It is used at concentration of 0.1-0.2 mg/ml of blood.

# **MODE OF ACTION, ADVANTAGES AND DISADVANTAGES**

## **MODE OF ACTION**

- Heparin is an anti-thrombin thereby prevents the conversion of prothrombin to thrombin.

## **Advantages**

- It does not affect erythrocytes and is less likely to cause haemolysis than EDTA.

## **Disadvantages**

- It is expensive and has short half-life and it is only used where other anticoagulants are not available.
- It cause leucocyte clumping and blood films stained with romanowsky stains to give a faint blue coloration in the background

# OXALATES

They can be used as single oxalates as sodium oxalate or potassium oxalate or ammonium oxalate. They are commonly used as Double oxalate because when used alone. The Potassium oxalate causes shrinkage of red cell and Ammonium oxalate causes swelling of red cells . It is used in concentration of 2mg/ml of blood. They can be used in coagulation studies, Haematocrit, haemoglobin estimation, red blood count and red cell indices.

# **MODE OF ACTION**

It acts as a chelating agent and binds with the calcium ions present in the blood and forms insoluble precipitates of calcium oxalates.

# **CITRATE- PHOSPHATE DEXTROSE (CPD)**

This is a Solution Containing Citric acid, sodium citric, monobasic sodium phosphate, and dextrose used in preservation of whole blood or red blood cells for up to 21 days.

# **CITRATE- PHOSPHATE- DEXTROSE PLUS ADENINE (CPDA)**

This is a solution, containing citric acid, sodium citrate, monobasic sodium phosphate dextrose, and adenine, used for the preservation of whole and red blood cells for up to 35 days; it extends red cell survival by providing adenine needed for the maintenance of red cell ATP levels.

# HELLER AND PAWL MIXTURE

This is a combination of potassium and Ammonium. Ammonium oxalate 1.2g and potassium oxalate 0.8g mix them together to get 2g dissolve and make up to 100ml with distilled water. Dispense 0.4ml of the mixture into blood collection bottle; evaporate to dryness at 60°C this is used for 4ml of blood.



Trisodium Citrate Tubes for Coagulation



Lithium Heparin Blood Collection Tube

# CPDA



Vacuum Tube Sodium Citrate 3.2%, 4

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