**\_ Lecture two: Anticoagulants used in hematology laboratory**

**Anticoagulants** : are the Chemical substances that prevent the blood from clotting when mixed with inappropriate concentration with the Blood Specimen. They are commonly called blood thinner.

***Anticoagulant materials in the laboratory Uses*:**

- Used in certain concentration per each ml of blood.

-They used for obtain plasma.

-Its uses only in vitro (outside of the body).

-They are toxic

**Common Anticoagulant Materials**

The common anticoagulant materials, which used in the daily lab’s work for hematological purposes, some are the following:

1. **EDTA= (Ethtylene diamine tetra-acetic acid)**
2. **Sodium Citrate: (Na3C6H507.2H20)**
3. **Buffered citrate (sodium citrate and citric acid)**
4. **oxalate**
5. **Sodium Fluoride**
6. **Heparin And Wintroub**



**VARIOUS TYPES OF ANTICOAGULANTS WITH VACUTAINER COLOR CODES**

1. **EDTA – ETHYLENE DIAMMINE TETRAACETIC ACID**

**Mechanism of action of EDTA** : It is widely used chemical anticoagulant in the laboratory. This anticoagulant removes free calcium ions, which is essential for coagulation by chelating them .

**Advantages of EDTA**

* It gives better preservation of the cellular morphology of blood cells .
* It can be used for platelets counting as it inhibits the clumping of platelets.

**Disadvantages of EDTA**:

* Not used for coagulation studies because it destroys factor V and VIII.(as it chalets calcium)
* the excess amount of EDTA in blood can cause shrinkage of RBCs & WBCs, the decrease (PCV) , Increase in MCHC (Mean Cell Hemoglobin Concentration).
* platelet adherence to Neutrophils.
* Platelet aggregation

**Uses of EDTA**

* Complete Blood Count (CBC)
* Blood film
* ESR by wintrobes method
* HbA1C test

**2.TRI-SODIUM CITRATE**

 **Sodium Citrate USES** ( **Advantages**):

* Acts as both a diluent and an anticoagulant
* Coagulation studies –**PT, TT and PTT**
* ESR estimation by Westergren

**Sodium Citrate Disadvantages:**

Citrated blood cannot be used for Packed Cell Volume (PCV), Hemoglobin (Hb) Estimation, Total Leukocyte Count TLC, and Differential Leukocyte Count (DLC) because citrate is used as a solution and it alters the concentration of blood.

**3.OXALATES**

**Oxalates – Mechanism of Action**

**Uses of Double Oxalates (Advantages) :**

* **Double oxalate is preferred as it prevents the swelling effect of Ammonium oxalate & shrinking effect of Potassium oxalate on the RBCs.**
* the Blood chemistry
* Packed cell volume (PCV),
* Erythrocyte Sedimentation Rate (ESR),
* Total Leukocyte Count (TLC),
* Specific gravity etc.

**Disadvantages of Oxalates :**

* **Oxalates not useful for making Peripheral Blood Smear?**. Because not preserve morphology of the White Blood Cells (WBCs).
* **Oxalates not used as a preservative in blood banks**.? The Calcium Oxalate precipitate in the blood is harmful and toxic agent

**4. SODIUM FLUORIDE**

It is the anticoagulant of choice for the estimation of blood sugar and other biochemical tests.

1. **BIOLOGICAL / NATURAL ANTICOAGULANT – HEPARIN**
* an excellent natural anticoagulant
* Prevents clotting by inactivating thrombin, thus preventing conversion of fibrinogen to fibrin.

**Advantages of heparin:**

1. It is a good anticoagulant and well preservers of the morphology of the Red Blood Cells (RBCs).;
2. The heparinized blood specimen is commonly used
* for Erythrocyte Sedimentation Rate (ESR),
* Packed Cell Volume (PCV),
* Osmotic Fragility Test,
* Immunophenotyping ,
* Red cell enzyme estimation
* and other Hematological tests

**Dis advantages of heparin:**

**Not recommended for cell counting**? because of its clumping effect on platelets leucocytes

**Frequently Asked Questions (FAQs)**

**What are anticoagulants used for in routine laboratory tests?**

Anticoagulants are used to prevent blood from clotting in laboratory samples, which can interfere with the accuracy of test results.

**What are the most commonly used anticoagulants in routine laboratory tests?**

EDTA, sodium citrate, and heparin.

**What does EDTA stand for, and what type of tests is it used for?**

EDTA stands for ethylenediaminetetraacetic acid, and it is used for collecting whole blood or plasma samples for hematology tests.

**What does sodium citrate do, and what tests is it used for?**

Sodium citrate acts as an anticoagulant by binding to calcium ions in the blood, and it is used for coagulation tests such as (PT) and (aPTT).

**What is heparin, and what type of tests is it used for?**

Heparin is an anticoagulant that works by inhibiting the action of thrombin, and **it is used for collecting plasma samples for chemistry tests**.

**Can different anticoagulants be used for the same test?**

No, different anticoagulants should not be used interchangeably for the same test as they can affect the test results.

**Can anticoagulants affect the accuracy of laboratory test results?**

Yes, using the wrong anticoagulant or improper handling of samples can affect the accuracy of laboratory test results.

**Can anticoagulants cause adverse effects in patients?** Yes, such as bleeding or hematoma at the site of blood collection.

**How long can samples collected in anticoagulants be stored?** Samples collected in anticoagulants can be stored for a limited period of time, typically a few hours to a few days, depending on the type of anticoagulant and the test being performed.

**Can anticoagulants be reused?** No, anticoagulants should not be reused as they are designed for single-use only and can increase the risk of contamination and inaccurate test results.

**Can anticoagulants interfere with other medications or medical conditions?**

Yes, some anticoagulants can interact with other medications or medical conditions, which is why it is important to inform the healthcare provider about any medications or medical conditions before blood collection.

**Can anticoagulants affect the color of the laboratory samples?**

Yes, anticoagulants can affect the color of laboratory samples, such as turning plasma samples pink or lavender due to the presence of EDTA.

**Can anticoagulants be added to urine samples?**

No, anticoagulants should not be added to urine samples as they can interfere with the test results.

**How can the risk of adverse effects from anticoagulants be minimized?**

The risk of adverse effects from anticoagulants can be minimized by following proper blood collection procedures and monitoring the patient for any adverse reactions.