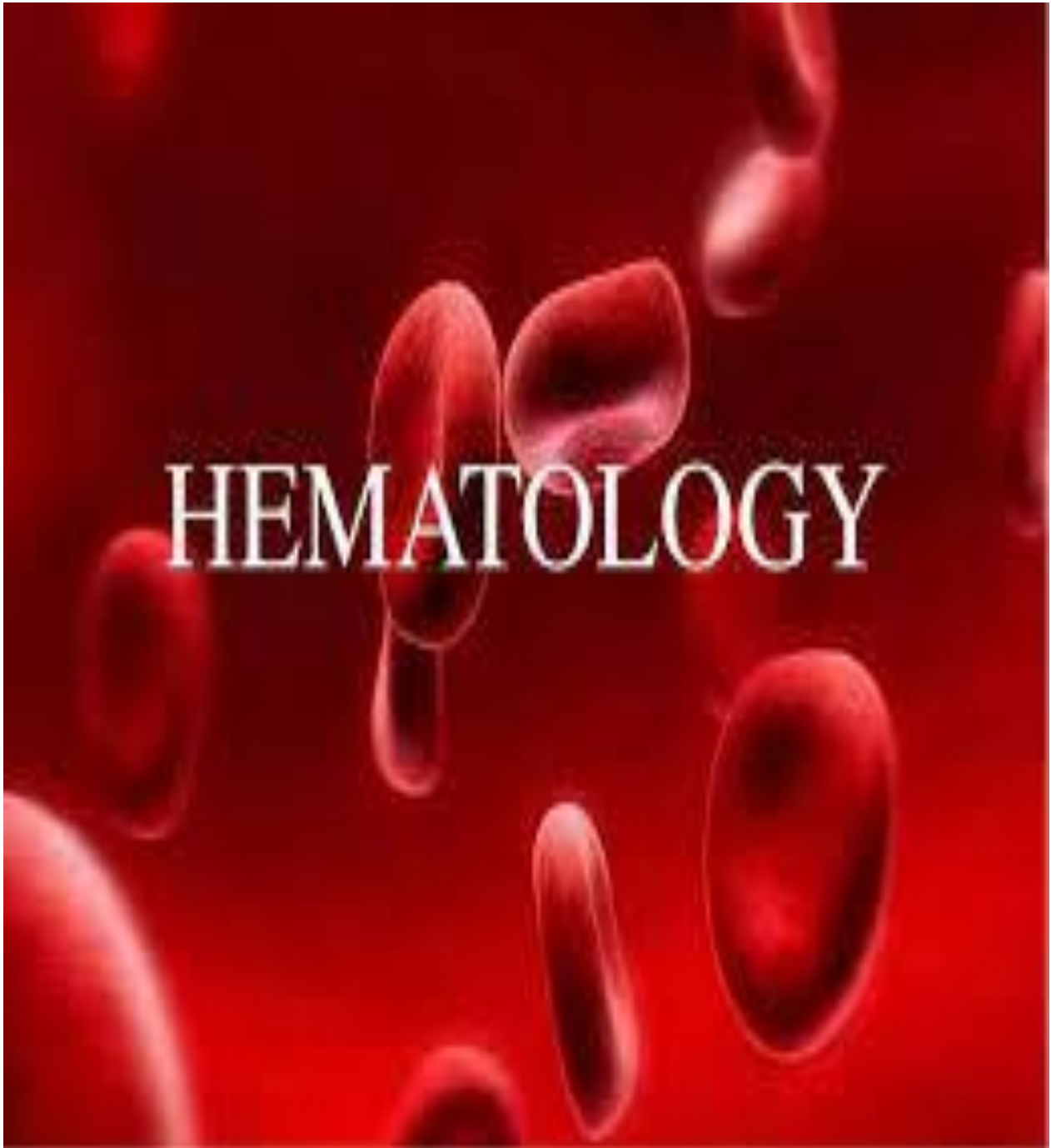




Department of Anesthesia Techniques
Title of the lecture: - Hematology

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HEMATOLOGY

Is the study of blood and blood disorders. Hematological tests can help diagnose anemia, infection, hemophilia, blood-clotting disorders, and leukemia. Several physiologic and physical factors can affect the results of hematologic assays and make it difficult to establish reference values. Physiologic factors include age, breed and strain, gender, season and time of day, nutrition, disease, stress, and trauma. Important physical factors include site of blood withdrawal, presence and type of anticoagulant, and sample handling and preparation.

The Blood

Blood is a specialized body fluid. It is a mixture of cellular component suspended in plasma, it is a type of connective tissue because it is made in bone marrow. It has four main components: plasma, red blood cells, white blood cells, and platelets. Blood has many different functions, including:

- transporting oxygen and nutrients to the lungs and tissues
- forming blood clots to prevent excess blood loss
- carrying cells and antibodies that fight infection
- bringing waste products to the kidneys and liver, which filter and clean the blood
- regulating body temperature

The blood is transported throughout the body by the circulatory system. Blood functions in two directions: arterial and venous. Arterial blood is the means by which oxygen and nutrients are transported to tissues while venous blood is the means by which carbon dioxide and metabolic by-products are transported to the lungs and kidneys, respectively, for removal from the body.



Blood Components

There are four basic components that comprise human blood: plasma, red blood cells, white blood cells and platelets.

▪ ***Plasma***

The liquid component of blood is called plasma, a mixture of water, sugar, fat, protein, and salts. The main job of the plasma is to transport blood cells throughout your body along with nutrients, waste products, antibodies, clotting proteins, chemical messengers such as hormones, and proteins that help maintain the body's fluid balance.

▪ ***Red Blood Cells (also called erythrocytes or RBCs)***

Red cells are the most abundant cell in the blood, the shape of a red blood cell is a biconcave disk with a flattened center. Production of red blood cells is controlled by erythropoietin, a hormone produced primarily by the kidneys. Red blood cells start as immature cells in the bone marrow and after approximately seven days of maturation are released into the bloodstream. Red blood cells have no nucleus and can easily change shape, helping them fit through the various blood vessels in your body. Red cells contain a special protein called hemoglobin, which helps carry oxygen from the lungs to the rest of the body and then returns carbon dioxide from the body to the lungs so it can be exhaled.

▪ **White Blood Cells (also called leukocytes)**

White blood cells protect the body from infection. They are much fewer in number than red blood cells, accounting for about 1 percent of your blood. There are five major types of white blood cells:

- neutrophils
- lymphocytes
- eosinophils
- monocytes
- basophils



▪ Platelets (also called thrombocytes)

Platelets help the blood clotting process (or coagulation) by gathering at the site of an injury, sticking to the lining of the injured blood vessel, and forming a platform on which blood coagulation can occur.

Collection of blood samples

Usually 5ml of blood is collected from a vein or an artery for a comprehensive hematological investigation. Capillary blood may be used for hemoglobin estimation, cell count, blood group, bleeding time and coagulation time, or for micro chemical investigation.

1- AVENOUS BLOOD

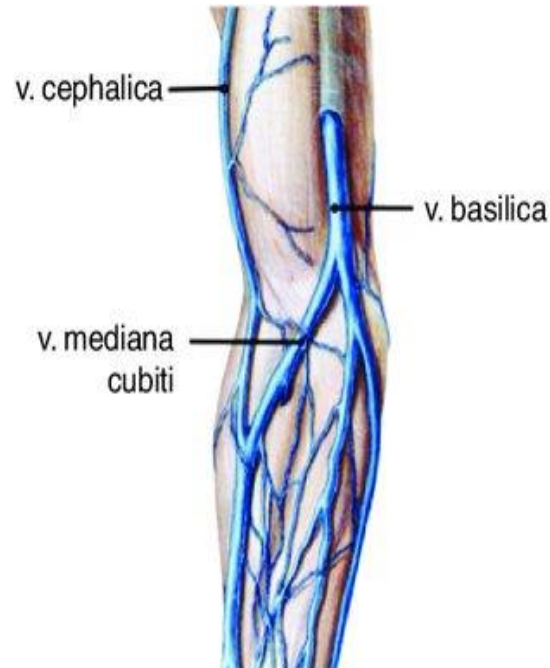
Venous blood is deoxygenated blood that flows from tiny capillary blood vessels within the tissues into progressively larger veins to the right side of the heart.

Selecting vein site: Usually vein is used to collect blood by venipuncture procedure. In adults: most venipuncture procedure use arm vein.
On arm, one of three arm veins is used:

Median cubital vein "located on the middle",

Cephalica vein or basilica vein "located on both sides".

Median cubital vein is the best choice (why?) because it has good blood flow than cephalic and basilica which has slower blood flow.



However if venipuncture procedure is unsuccessful in median capital; cephalic or basilica is used.

*Artery blood is rarely used in special cases as when blood gases, pH, PCO₂, PO₂ and bicarbonate is requested. It is usually performed by physicians.

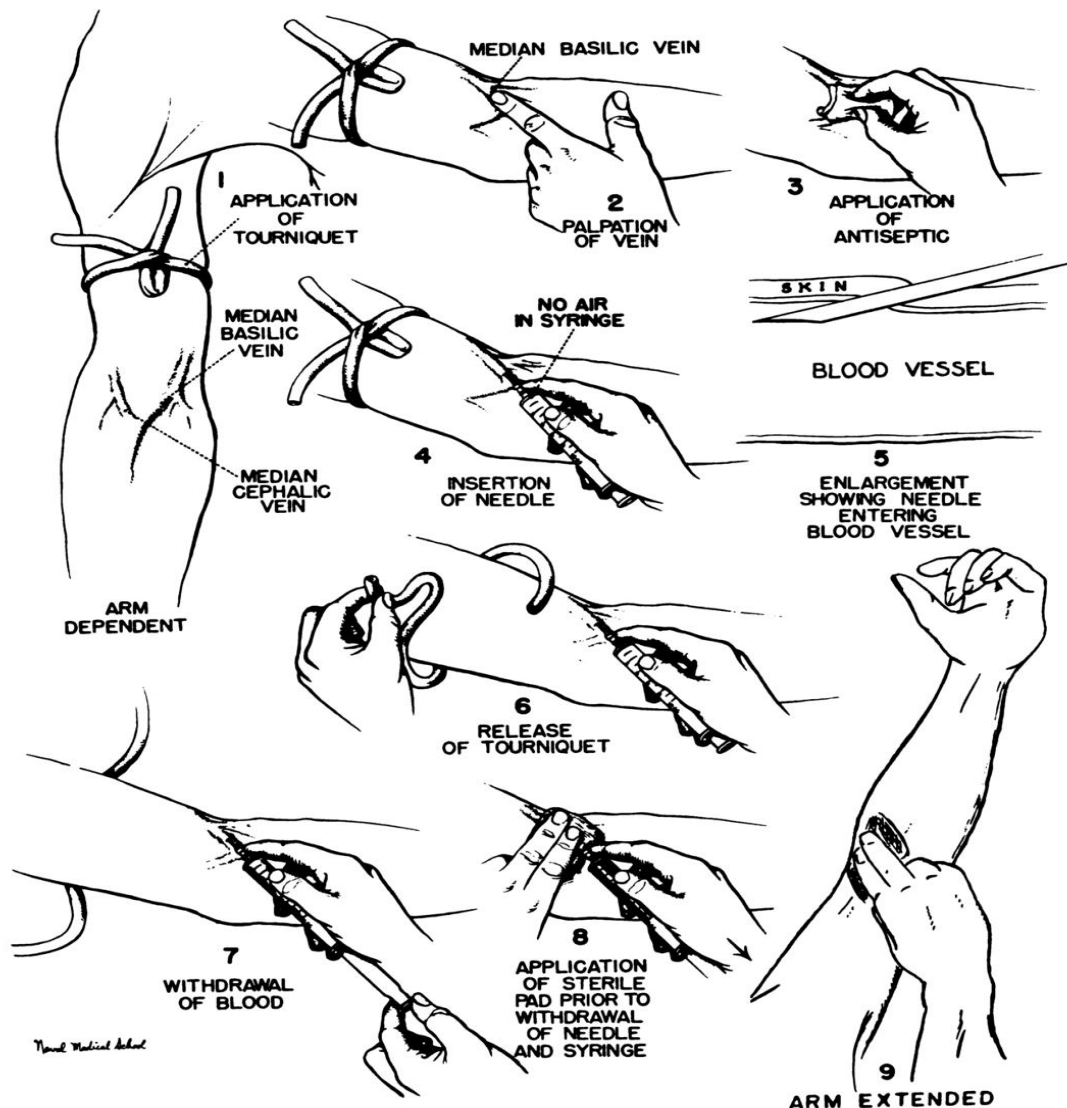
Vein puncture procedure

- 1- Use a sterile, dry, 5 or 10ml syringe with a wide bore and short bevel needle.
- 2- Support the arm on edge of table locate a vein visually in antecubital fossa.
- 3- Clean with a swab of cotton dipped in alcohol and allowed it to dry.
- 4- Apply tourniquet firmly around upper arm and ask the patient to open and close the fist repeated.
- 5- Puncture the vein a few millimeters a head of skin puncture sit & a little from the side of the vein



- 6- Draw the blood and release tourniquet with draw the needle after the blood gets.
- 7- Put afresh cotton swab over the skin puncture & ask the patient to flex the arm at the elbow for 1-2 min. till the bleeding stop. Remove the needle from the syringe & expel the blood gently in to a prepared container of anticoagulant and shake well.

TECHNIQUE OF VENIPUNCTURE





2- CAPILLARY BLOOD

Capillary blood is obtained from capillary beds that consist of the smallest veins (venules) and arteries (arterioles) of the circulatory system. The venules and arterioles join together in capillary beds forming a mixture of venous and arterial blood.

The ball of the finger or the lobe of the ear are usual site, in the infant the heel of big toe.

Clean the area with alcohol. Apply a gentle pressure on the side of the ball of the finger. Prick the skin sharply & quickly to a depth of about 2mm & release the pressure

Specimen type	Method of collection	Common use
Venous	Direct puncture of vein by venipuncture; vascular access device	Routine laboratory tests
Arterial	Direct puncture of artery; vascular access device	Arterial blood gases
Capillary	Dermal puncture of fingertip or heel	<ul style="list-style-type: none">• Infants and young children• Elderly patients with fragile veins• Severely burned patients• Point-of-care testing



Preparation of Blood Sample: One of three different specimens may be used:

- **Whole blood**

It must be analyzed within limited time (**why?**)

- Over time, cells will lyse in whole-blood which will change the concentration of some analytes as potassium, phosphate and lactate dehydrogenase.

- Some cellular metabolic processes will continue which will alter analyte concentration. like glucose and lactate.

- **Plasma:** The purpose of plasma in the blood is to transport all the proteins, nutrients, antibodies, hormones etc. all over the body. As the plasma races around the body, cells will deposit their waste into the plasma, which contributes to another job of the plasma: waste removal.

Procedure of plasma preparation

- Draw blood from patient. Select container with an appropriate anticoagulant.
- Mix well with anticoagulant.
- Allow to stand for 10min.
- Centrifuge the sample to speed separation and affect a greater packing of cells.
- The supernatant is the plasma which can be now collected for testing

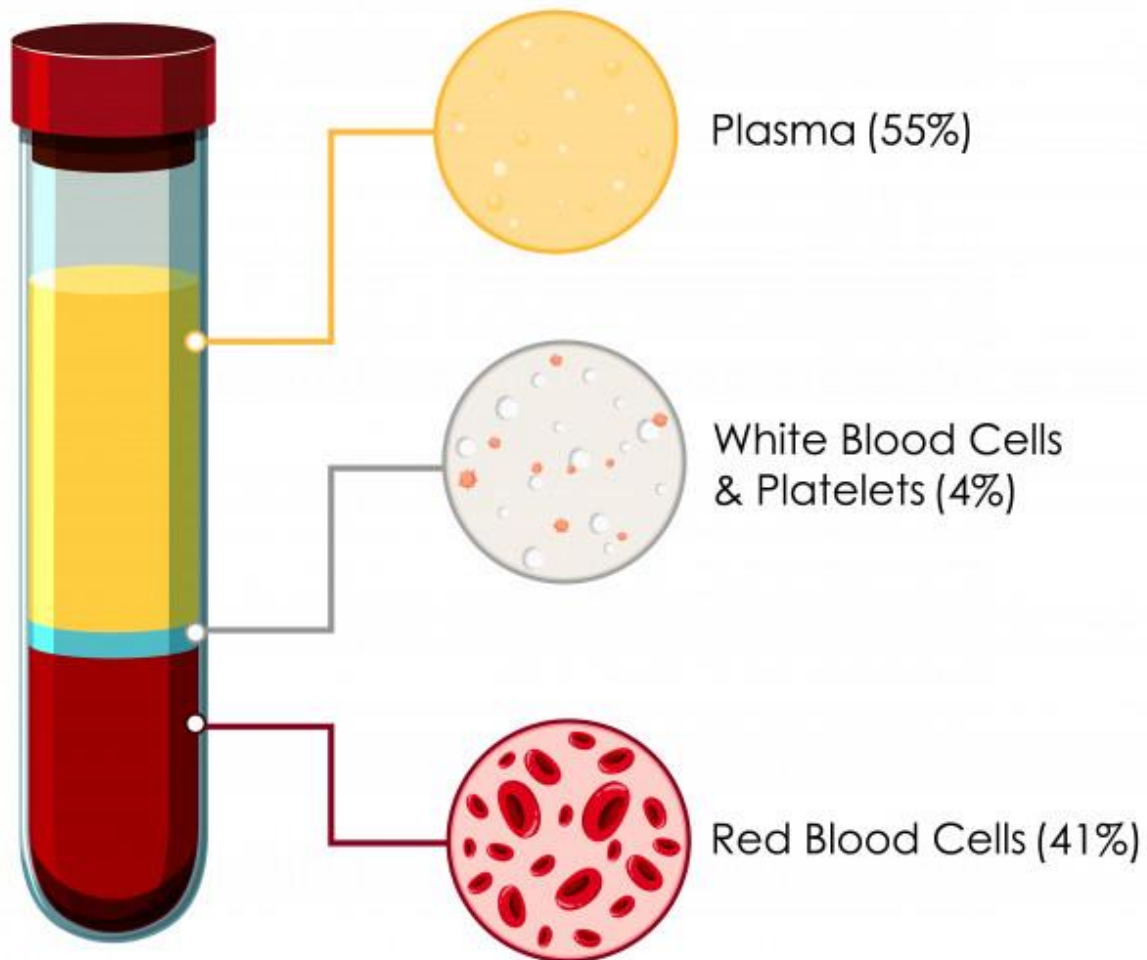
- **Serum:** serum is plasma minus the clotting factors and blood cells.

Procedure of Serum preparation

- Draw blood from patient. Select container with no anticoagulant.
- Allow to stand for 20-30min for clot formation.
- Centrifuge the sample to speed separation and affect a greater packing of cells. Clot and cells will separate from clean serum and settle to the bottom of the vessel.



COMPOSITION OF BLOOD





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