

Lab.1 [Introduction]

Clinical biochemistry: it is a branch of clinical medicine in which chemical and biochemical methods are applied to the study of disease.

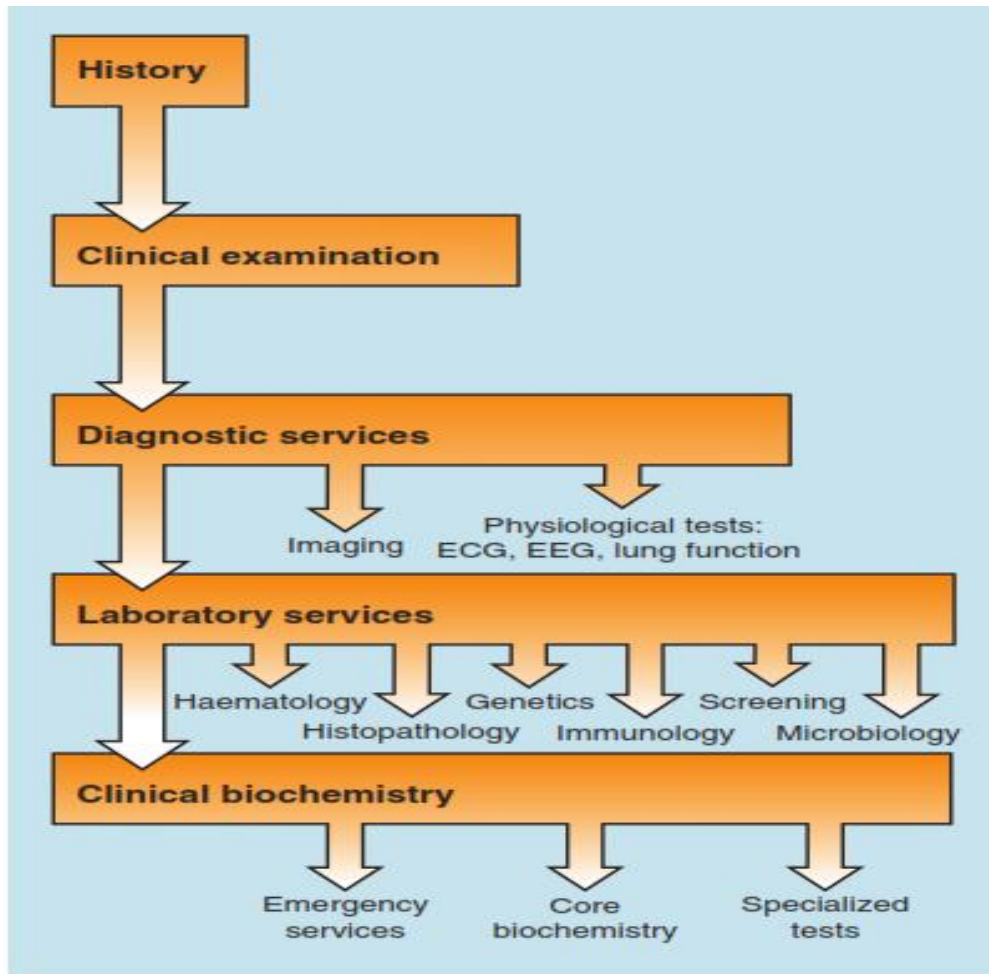
Biochemical tests:

Laboratory and diagnostic tests are tools to gain additional information about the patients and they are not therapeutic, however,

Lab. Test + patient history + physical examination = confirm a diagnosis & provide valuable information about a patients status.

What is the approaches of biochemical tests??

- 1) diagnosis
- 2) monitoring of treatment
- 3) screening of the disease
- 4) assessing the prognosis
- 5) clinical trials of new drugs



Core biochemical tests:

Sodium, potassium and bicarbonate

Urea and creatinine

Calcium and phosphate

Total protein and albumin

Bilirubin and alkaline phosphatase

Alanine aminotransferase (ALT) and aspartate aminotransferase (AST)

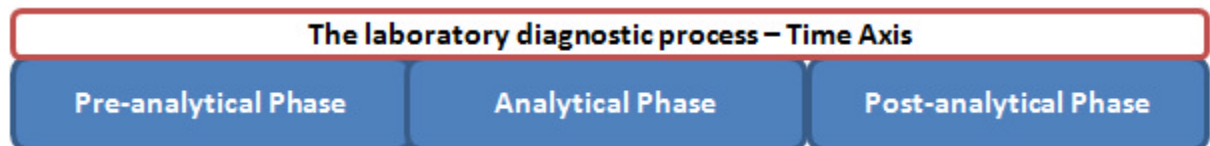
Free thyroxine (FT) and Thyroid Stimulating Hormone (TSH)

Creatine kinase (CK)

Glucose, amylase.

Specialized tests	Emergency tests
Hormones	Urea and electrolytes
Specific proteins	Blood gases
Trace elements	Amylase
Vitamins	Glucose
Drugs	Salicylate
Lipids and lipoproteins	Paracetamol
DNA analysis	Calcium

The diagnostic testing process include 3 phases:



Preamalytical phase: is involves an individual’s preparation for collection of the biological material.

Analytical phase: is involves performance of procedure, collection and transport of specimens.

Postanalytical phase: include interpretation of test results and informing the patient, identification of critical values.

Controllable Factors before the Biological Material Collection or during sampling:

- 1) **Age related differences**: these include for e.g :bilirubin in the neonate and plasma ALP activity, higher in children and the elderly.
- 2) **Sex related differences**: for e.g: plasma urate which is higher in males, and HDL cholesterol, which is higher in premenopausal women than in men.
- 3) **Ethnic differences**: for e.g: CK may be higher in black than in white people.
- 4) **Oral medication**: blood should be taken for a drug assay at a standard time after the dose e.g: **thiazide** diuretics cause significant hypokalemia due to rapid clearance of K from ECF, **Oral contraceptive pill** cause increase in hormone binding protein and lipids, **morphine** cause an increase in liver and pancreatic enzyme.

Other interfering factors include:

1) sampling error 2) patient factor errors

2) Sampling error:

- 1) Incorrect specimen collection, handling, storage or labeling.
- 2) Haemolysed specimens
- 3) Delayed specimen delivery
- 4) Old or deteriorating specimens

3) Patient factors:

- 1) incorrect pretest diet
- 2) current drug therapy
- 3) patient illness
- 4) dehydration
- 5) position of patient at time of specimen collection
- 6) stress

Types of biological specimen:

- 1) blood (whole, plasma, serum)
- 2) urine
- 3) stool
- 4) saliva, sputum
- 5) biological fluids (peritoneal, synovial, cerebrospinal, amniotic, hair, skin, tissue, semen)
- 6) bone marrow

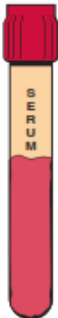
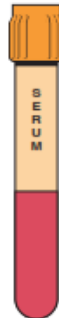
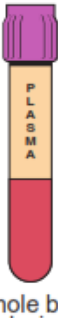
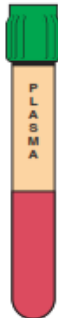
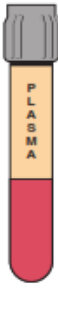
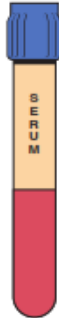
Blood specimen collection instructions:

- 1) Patient preparation by considering whether fasting is required [e.g: fasting blood glucose FBG, triglyceride TG] or withholding medication until blood is drawn.
- 2) Record the time of day that the blood is drawn (some analytes such as cortisol, ACTH) vary according to diurnal pattern??
- 3) Note the patient position for certain tests. In the standing position, water transfers from the intravascular to the interstitial space, which subsequently leads to an increase in high-molecular substances, primarily proteins, lipoproteins and protein-bound substances such as calcium cation and hormones (cortisol, thyroxine), or some drugs. In general, biological material should always be collected in the same position, preferably the standard sitting position.
- 4) Collect the blood in the proper color-coded test tube.
- 5) Use of Tourniquet: if tourniquet applied for > 1 min. produces laboratory value increase in protein 5%, iron (6-7%), cholesterol (5%) and decrease in K⁺ (6%), and may cause venous stasis

Types blood collection tubes:

Blood collection tubes have color-coded stoppers to indicate the presence or absence of different types of additives (preservative or anticoagulant). A preservative prevent change in the specimen and anticoagulant inhibits clot formation or coagulation.

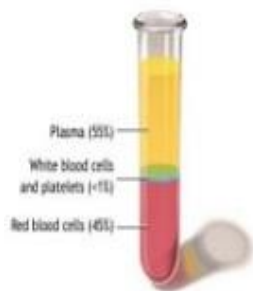
- 1) White-top (plane) tubes :contain no additives, usually to obtain serum from a blood sample.
- 2) Lavender-top tubes :contain EDTA-K used for haematological studies
- 3) Yellow-top tubes contain sodium fluoride(as preservative) for blood glucose measurement because fluoride inhibit blood glucose conversion to lactic acid.(inhibit glycolysis)
- 4) Green-top tubes: these contain heparin used for haematological test.

Plain tube: no anticoagulant Clot forms	Plain tube: contains SST gel	EDTA anticoagulant	Lithium heparin anticoagulant	Fluoride oxalate	Trace element	Heparinized syringe
						
• General	• General	• Whole blood analysis • Red cell analysis • Lipids and lipoproteins	• General	• Glucose • Lactate • Alcohol	• Copper • Zinc	• Arterial blood sampling

2. Plasma vs. serum

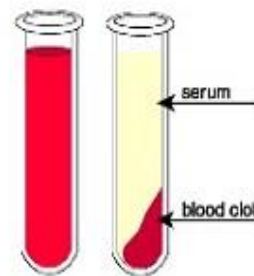
• **Plasma** is the liquid, cell-free part of blood, that has been **treated with anti-coagulants**.

Anticoagulated



Serum is the liquid part of blood **AFTER coagulation**, therefore devoid of clotting factors as fibrinogen.

Clotted



• serum = plasma - fibrinogen

Venipuncture: or called phlebotomy

Is the process of obtaining a blood sample from a vein using a needle attached to a syringe or syringe stopper evacuated tube. Venipuncture allow collection of larger quantities of blood for testing usually, the antecubital vein, the vein of choice because of ease of access.

Urine specimen:

Urine test are easy to obtain and provide valuable information about many body system functions such as kidney function, glucose metabolism and various hormone level .Urine specimen containers may include a preservative to inhibit bacterial growth, or acid to stabilize certain metabolites. They need to be large enough to hold a full 24-hour collection. Random urine samples are collected into small 'universal' containers.

Stool specimen:

The examination of feces provides important information that aids in the diagnosis of various GI disorders. Fecal tests may include microbiological, chemical or parasitic examination.

Guidelines:

- 1) Collect a stool specimen in a clean container that has a fitted cover
- 2) Do not mix urine and toilet paper with the stool specimen
- 3) Correctly label and deliver stool specimens to the lab. Within 30 min. after collection, otherwise, the specimen should be refrigerating.

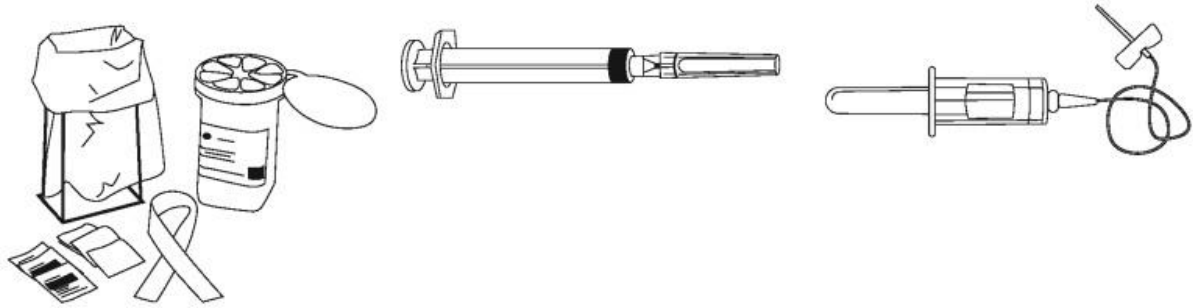
Types of puncture:

Arterial Puncture: it is reserved for blood gases evaluation and emergency situation and performed by those with special training because arterial puncture is dangerous and difficult.

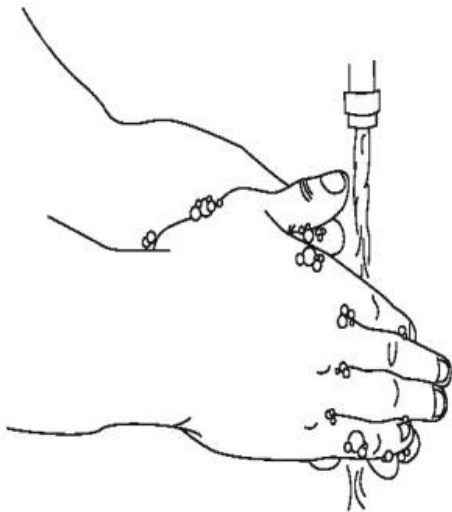
Venous Puncture: it is affected by metabolic activity of the tissues.

Capillary Puncture(skin puncture): it contain arterial and venous blood plus tissue fluid , its composition differ from venous blood, capillary glucose is often higher while Ca, K, & total protein are lower than in venous blood. More appropriate site is fingerstick or heel puncture in infants.





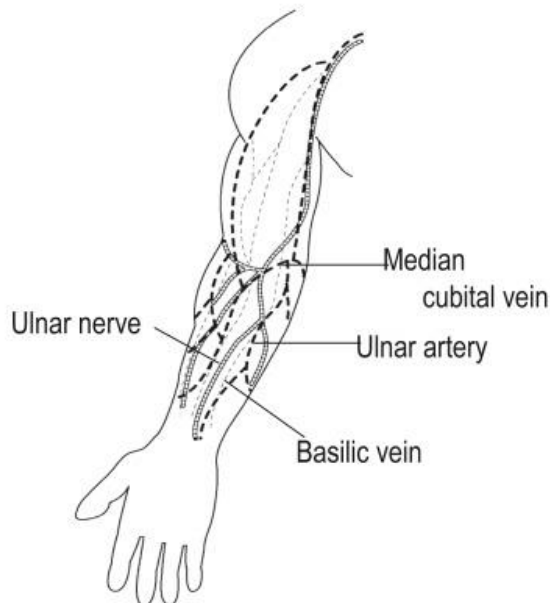
1. Assemble equipment and include needle and syringe or vacuum tube, depending on which is to be used.



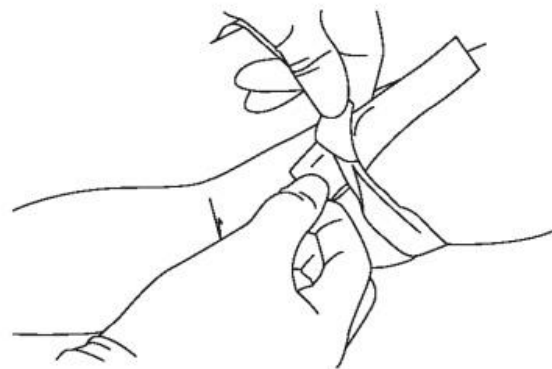
2. Perform hand hygiene (if using soap and water, dry hands with single-use towels).



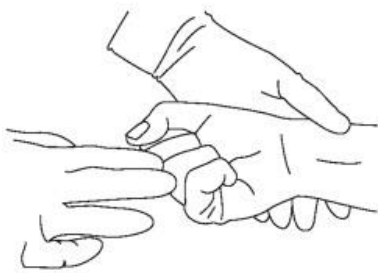
3. Identify and prepare the patient.



4. Select the site, preferably at the antecubital area (i.e. the bend of the elbow). Warming the arm with a hot pack, or hanging the hand down may make it easier to see the veins. Palpate the area to locate the anatomic landmarks. DO NOT touch the site once alcohol or other antiseptic has been applied.



5. Apply a tourniquet, about 4–5 finger widths above the selected venepuncture site.



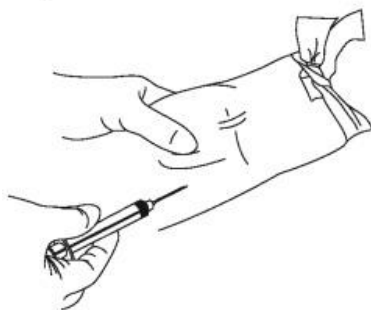
6. Ask the patient to form a fist so that the veins are more prominent.



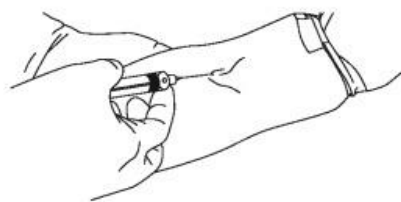
7. Put on well-fitting, non-sterile gloves.



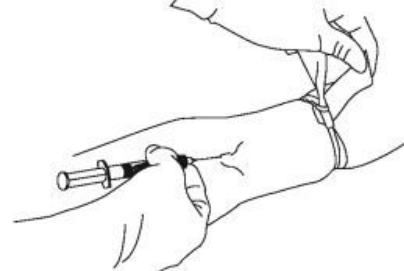
8. Disinfect the site using 70% isopropyl alcohol for 30 seconds and allow to dry completely (30 seconds).



9. Anchor the vein by holding the patient's arm and placing a thumb **BELOW** the venepuncture site.



10. Enter the vein swiftly at a 30 degree angle.



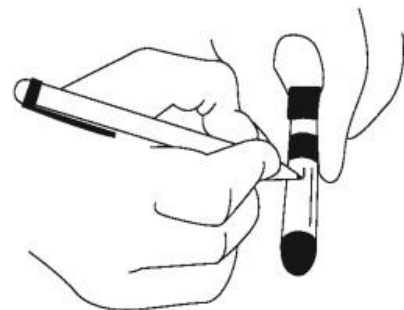
11. Once sufficient blood has been collected, release the tourniquet **BEFORE** withdrawing the needle.



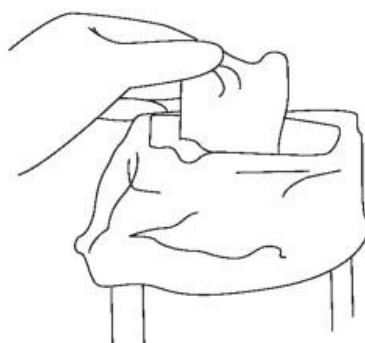
12. Withdraw the needle gently and then give the patient a clean gauze or dry cotton-wool ball to apply to the site with gentle pressure.



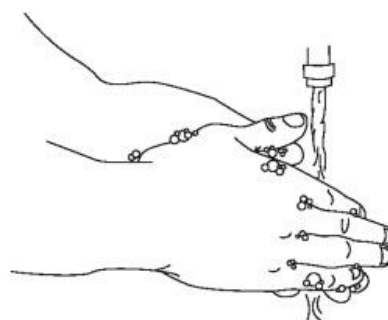
13. Discard the used needle and syringe or blood-sampling device into a puncture-resistant container.



14. Check the label and forms for accuracy.



15. Discard sharps and broken



16. Remove gloves and place



Important guidelines:

- 1) To obtain valid results do not apply the tourniquet for longer than 1 min. (prolong tourniquet application can cause blood stasis and hemoconcentration).
- 2) Do not shake the blood specimen , hemolysis may result from vigorous shaking and invalid test results.
- 3) After the specimen is drawn, apply pressure to the vein puncture site to avoid the bleeding.

- 4) If the patient fasted before the blood test, reinstitute appropriate diet.

