Specimen Collection
&
Processing

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Specimen Collection & Processing

Physicians use lab. tests to:

1- Diagnose disease.

2- Monitor its progress or its response to treatment.

3- Screen for the disease in seemingly healthy individuals.

Many factors besides disease affect the composition of body fluids; these factors may be either pre-analytical or analytical. The variability of test results due to biological factors (pre-analytical) is often greater than the variability due to analytical factors.

Specimen Collection:

Specimen containers must be labelled with the patient's name, hospital or identification number, location in the hospital, date & time of collection.

Before collecting any blood specimen, a phlebotomist should put on disposable latex rubber gloves. If a patient is known to have an infectious disease, the phlebotomist should wear a face mask, glasses or goggles, & gown in addition to gloves.

-Blood:

Blood for analysis may be obtained from:

1. **Veins by venipuncture.**
2. **Arteries (arterial puncture).**
3. **Capillaries (skin puncture).**

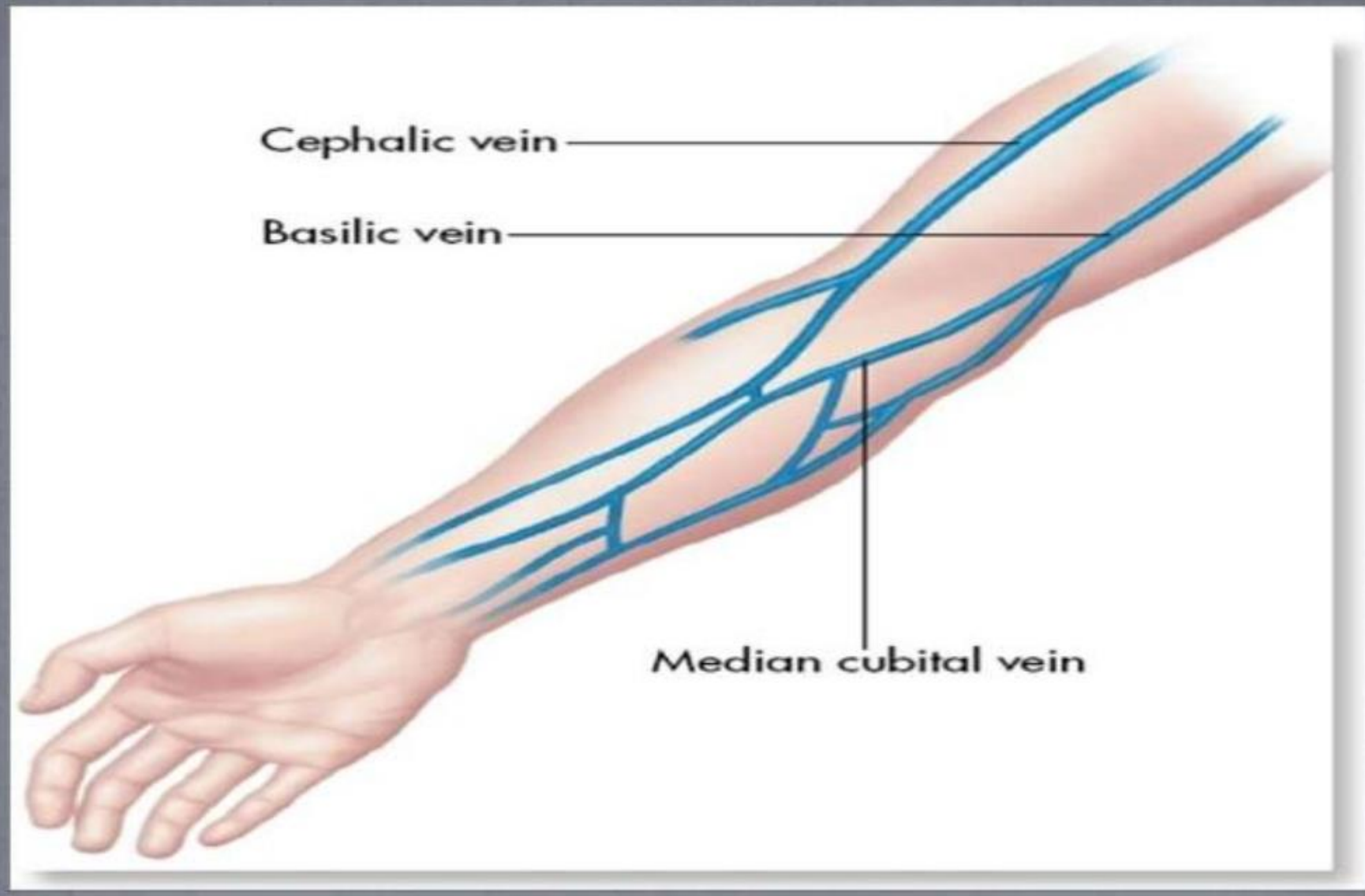
1) **Veins by venipuncture** → specimen of choice.

* The patient should be fasting if fasting is necessary to ensure medically useful results.

* The patient should be comfortably seated or supine for 20 min. before the specimen is drawn.

* An arm with an inserted I.V. line should be avoided, as should an arm with extensive scarring or hematoma of the intended collection site.

If a women has had a mastectomy, arm veins on that side of the body should not be used because the surgery may have caused lymphostasis, affecting the blood composition .The median cubital vein is the preferred site for collecting v. blood in adults because the v. is both large & close to the surface of the skin.



Common Sites for Venipuncture

* An arm containing a cannula or AV fistula should not be used without consent of the pt's physician.

* Specimens obtained from the opposite are or below the infusion site in the same arm may be satisfactory for most tests except for those analytes that are contained in the infused solutions (e.g. glucose or electrolytes).

* Cleaning of the puncture site should be done with a circular motion & from the site outward with 70% isopropanol. The skin should be allowed to dry in the air, traces of alcohol may cause hemolysis & invalidate test results.

* A tourniquet is applied (10 – 15) cm above the intended puncture site & should not be left in position for more than 1 min. , the pt should not be allowed to pump her or his fist while the tourniquet is in place because it causes an increase in the plasma potassium, phosphate & lactate. Alternatively, a blood pressure cuff may be used (inflate to ~ 60 mmHg).

* The most commonly used needle sizes are gauges 19 – 22 . the larger the gauge size , the smaller the bore.

2) Arteries (arterial puncture) → used mainly for blood gas analysis.
Preferred sites are, in order:
1.The radial Arteries at the wrist.
2.The brachial Arteries in the elbow.
3.The femoral Arteries in the groin.
In the neonate, an indwelling catheter in the umbilical Artery is best to obtain specimens .
In the older child or adult in whom it is impossible to perform an arterial puncture, a capillary puncture may be performed to obtain arterialized capillary blood (acceptable values for pH , & pCO_2 , but not always for pO_2). Site: earlobe. In the young child or infant: the heel.
No tourniquet is required for a puncture. The needle & syringe should be flushed out with a heparin solution both to ensure adequate anti-coagulation & to eliminate trapping of air in the needle & in the dead space of the nozzle.

Plastic syringes should be avoided because, unlike glass syringes, the plunger will not rise as a result of a. blood pr. alone.
Some plastics may also be permeable to gases.
Evacuated blood tubes should not be used for the collection of specimens for blood gas analysis because the residual air in the tube may cause erroneous results when it equilibrates with the blood.

3) **Capillaries (skin puncture)**→ in young children.

If only a small volume of blood is required for the blood test (e.g. a blood glucose test) , venipuncture is unnecessary .However , a skin puncture is time consuming , & there is a greater risk of infection than from a venipuncture .

1- In the adult or grown child blood may be obtained by puncturing the tip of a finger or by piercing an earlobe.

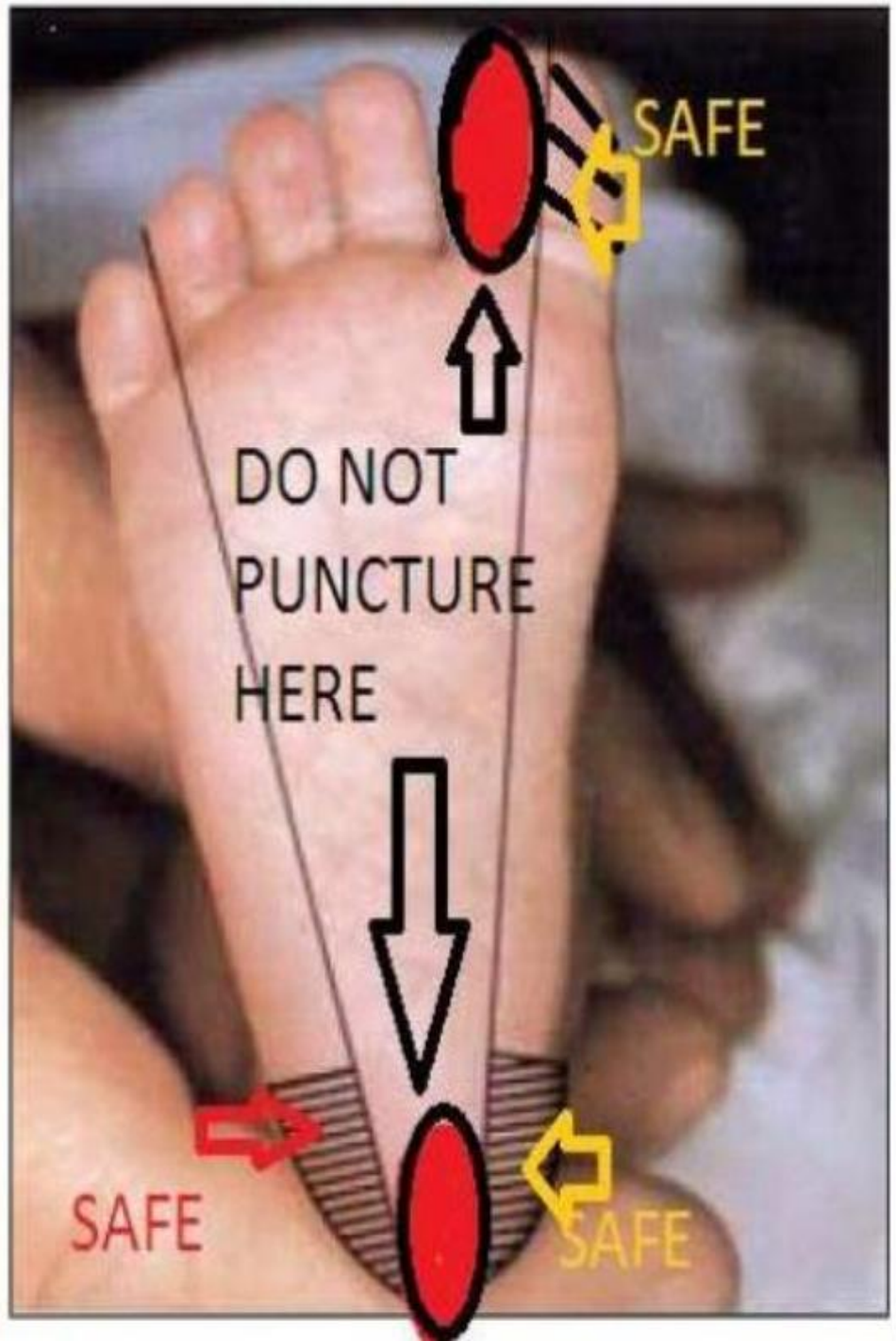
The 3rd or the 4th finger of the non writing hand (the best is the ulnar side of the ring finger) is quickly punctured by a sharp stab with a lancet & the depth of the incision should be ‹ 2.5 mm to avoid contact with bone.

Massage of the finger to stimulate blood flow should be avoided, because it causes the outflow of debris & of tissue fluid, which does not have the same composition as plasma.

To improve circulation of the blood, the finger may be warmed by application of a warm , wet washcloth for 3 min. before pricking .The 1^{ST} drop of blood is wiped off & subsequent drops are transferred to the appropriate collection tube by gentle contact.

2-In an infant younger than 1 year of age : the lateral or medial planter surface of the foot should be used for skin puncture.

3-In older children: the planter surface of the big toe may also be used.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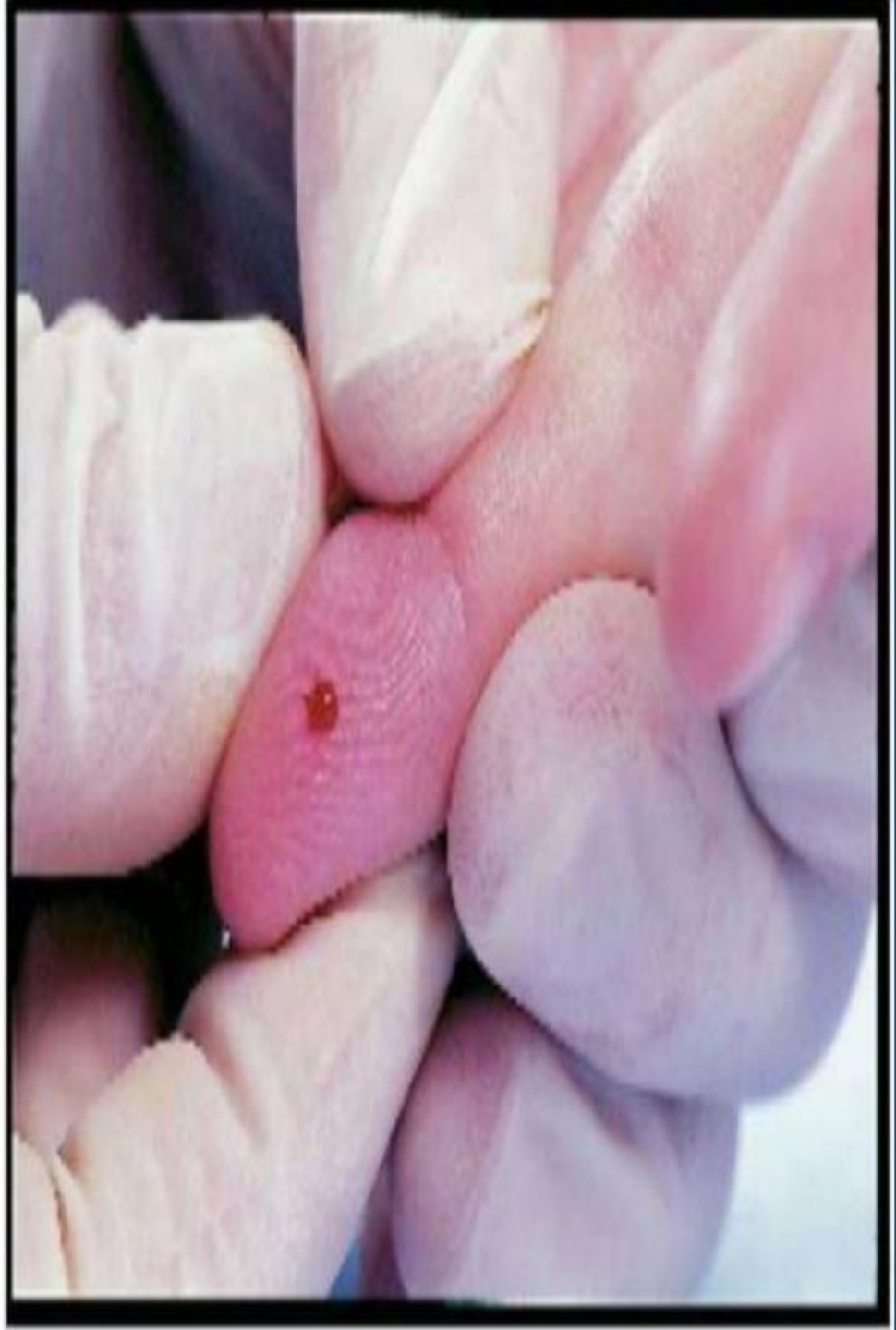

For collection of blood specimens on filter paper for neonatal screening , the filter paper is gently touched against a large drop of blood , which is allowed to soak into the paper to fill the marked circle . Only a single application per circle should be made . Avoid milking or squeezing of the foot. The filter paper should be air – dried . Blood should not be transferred onto filter paper after it has been collected in capillary tubes because partial clotting may have occurred.

Anticoagulants & Preservatives for Blood

If whole blood or plasma is desired for testing, an anticoagulant must be added to the specimen during the collection procedure. Whole blood is rarely required for clinical tests; indeed , only for blood gas, ammonia, & some trace elements determinations is it the preferred specimen, although it may also be used for glucose, urea nitrogen, lactate determination & for all tests in certain bedside or physician office analyzers.

Serum from coagulated blood is the specimen of choice for many assay systems , but plasma obtained with an appropriate anticoagulant may be an equally valid specimen, & in certain circumstances preferred to serum.

Plasma use expedites analysis in medical emergencies because harvest of serum requires 15 – 30 min. wait for completion of coagulation before centrifugation. Furthermore, plasma yield from a given volume of whole blood is always greater than the yield of serum. A disadvantage is the formation of fibrin clots or fragments when plasma is stored & the subsequent risk of clogging sample probes of automated analytical instruments.

Anti-coagulant

1. Heparin:

Is the most widely used anticoagulant for clinical chemical analysis. It causes the least interference with tests. It is a mucoitin polysulfuric acid & is available as sodium, potassium, lithium, & ammonium salts.
It accelerates the action of antithrombin III , which neutralizes thrombin & thus prevents the formation of fibrin from fibrinogen .

2. Ethylenediaminetetraacetic acid (EDTA):

This chelating agent is particularly useful for haematology. exam . because it preserves the cellular compounds of blood. It is used as the disodium, dipotassium, & tripotassium salts , the last 2 being more soluble .

EDTA prevents coagulation by binding calcium, which is essential for the clotting mechanism.

Its chelation of calcium makes it unsuitable for specimen for calcium & iron analysis .

3. Sodium fluoride:

It is usually considered as a preservative for blood glucose, however, it also acts as a weak anticoagulant (binds calcium but after several hours), therefore, it is used together with another anticoagulant such as potassium oxalate. Fluoride ions prevent glycolysis by inhibiting enolase, an enzyme that requires magnesium.

4. Citrate:

Sodium citrate solution is widely used for coagulation studies because the effect is easily reversible by addition of calcium. It has little applications in the clinical lab.

Because citrate chelates calcium, it is unsuitable for specimens for measurement of this element.

5. Oxalates:

Sodium, potassium, ammonium, & lithium oxalates inhibit blood coagulation by forming rather insoluble complexes with calcium ions.

Potassium oxalate is the most widely used . At high conc., hemolysis is likely to occur (oxalates cause shrinkage by drawing water into the plasma).

6. Iodoacetate:

Sodium iodoacetate is an antiglycolytic agent & a substitute for sodium fluoride. Because it has no effect on urease, it can be used when glucose & urea tests are performed on a single specimen.

Thank you for your attention