Phlebotomy
&
Donor Reactions

Phlebotomy

What is Phlebotomy

- Greek words ***phleba-,*** meaning **"vein"** and ***-tomy,*** meaning **"to make an incision of"**
- Done by a trained phlebotomist.

Indications for blood sampling and blood collection

- **Laboratory tests** for clinical management and health assessment**.**
- **Arterial blood gases** for patients on mechanical ventilation, to monitor blood oxygenation;
- **Neonatal and paediatric blood sampling**
  - heel-prick (i.e. capillary sampling);
  - scalp veins in paediatrics

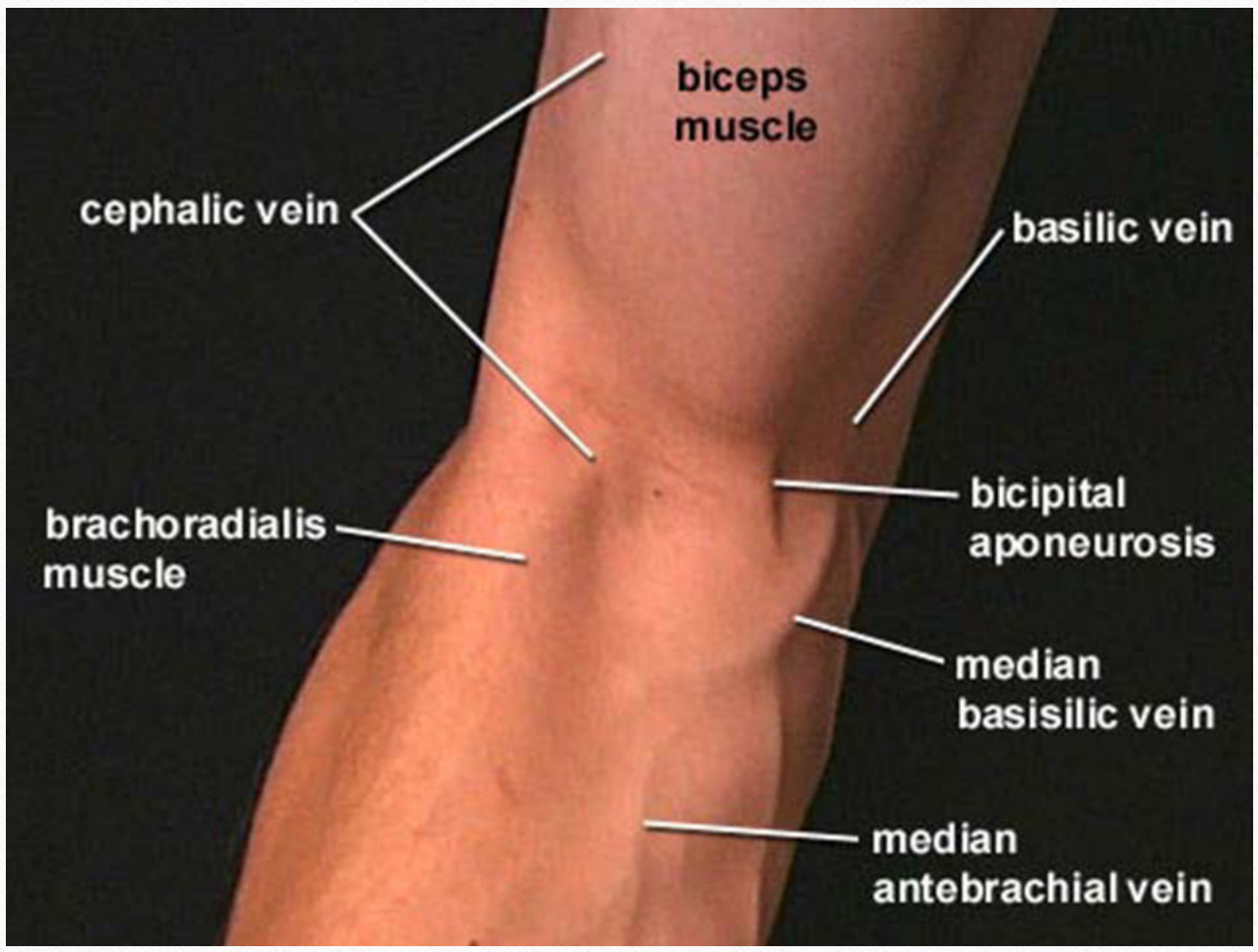
- **Capillary sampling** (i.e. finger or heel-pricks or, rarely, an ear lobe puncture) e.g
  - testing of Hemoglobin levels before blood donation,
  - blood glucose monitoring, and
  - rapid tests for HIV, malaria and syphilis.
- **Blood collection**
  - Routine Blood Donation
  - Therapeutic Phlebotomy

Preliminary Steps

- Phlebotomist should introduce him/herself to the donor in a cheerful manner
- Responsibility of the phlebotomist to make certain that all blood unit numbers on the donor record, collection bags, and specimen tubes match and are applied properly
- Donor identification is the single most important process of the phlebotomy procedure

Site of Phlebotomy

- Usually cubital fossa is chosen as the vein as it is palpable and required volume of blood can be easily drawn from this vein
- Examination of the area chosen for the Venipuncture
- Should have no local infections



Site examination

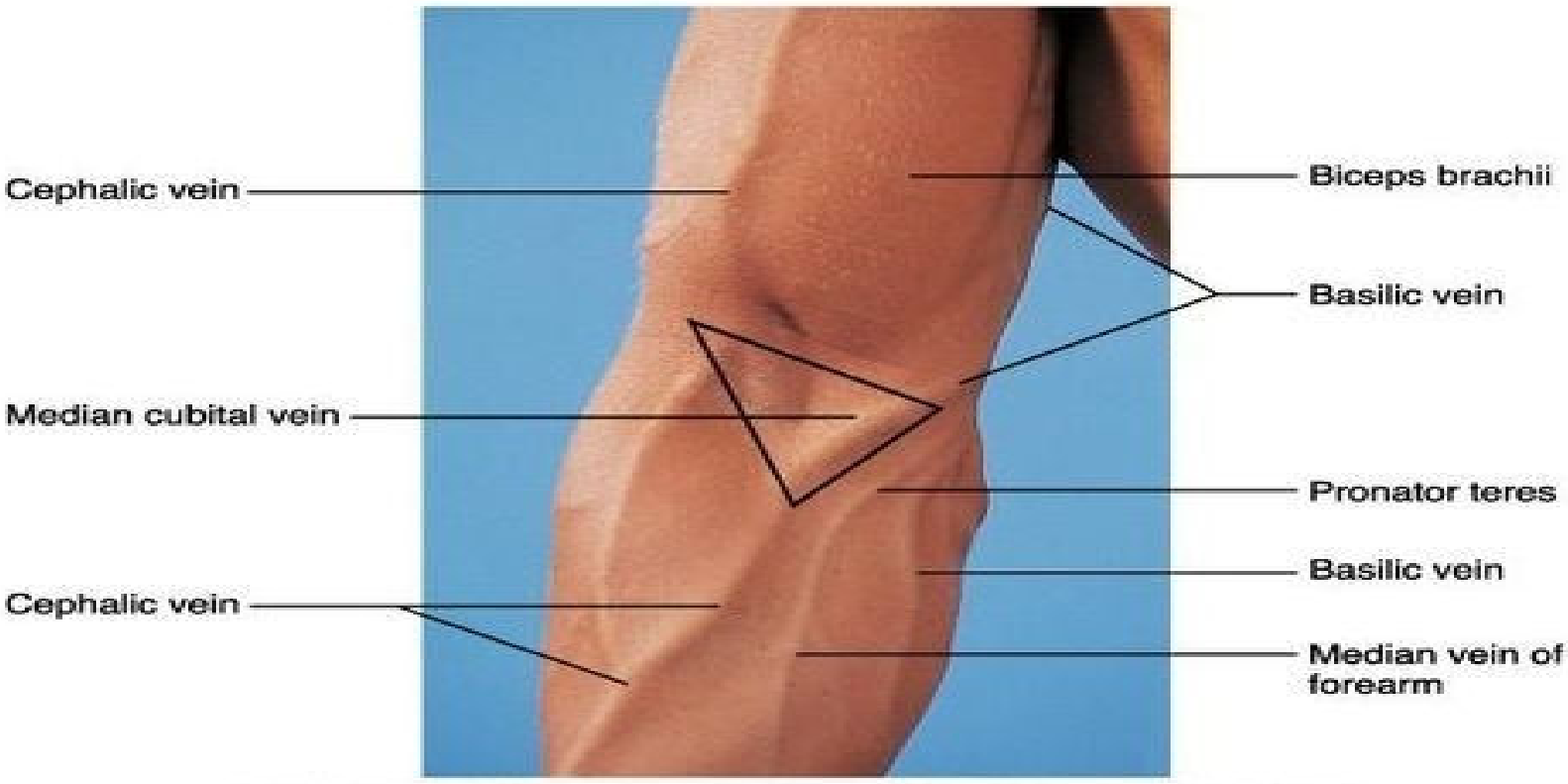
- Check the site as professional donors/drug abusers will have multiple punctures
- Collection is a sterile process so surgical environment should be maintained
- Both the phlebotomist and the donor should follow the hand washing procedures

Vein Selection

- Often the best veins to use are not the ones seen most easily.
- Differences in the anatomy of arms among donors may cause problems in proper vein selection.

– Vein location may differ from donor to donor.

– It is essential for the phlebotomist to know the general anatomy of the arm.



Differences b/w Artery and Vein

Location	Deep into the tissue, less accessible, and harder to locate	Relatively close to the skin
Palpation	Pulsate when skin is pulled back, due to response of muscular walls to heartbeat, carrying blood throughout body	• When palpated, feel relatively smooth, pliable, resilient, and "springy" • Do NOT pulsate
Color	Blood is usually bright cherry red	Blood is usually a dark red color
Elasticity	Highly elastic to support the great pressure inside. As blood travels into smaller arteries, pressure decreases until there is very little pressure at the capillary level	Less elastic than the arteries, because of less pressure
Valves	No valves	Valves prevent blood from flowing backward, away from the heart

Donor care

- Before, during and after donation
- Donating blood should be a pleasant experience
- The venue must be a safe place for the donor
- The venue must be comfortable - temperature, surroundings
- Staff must be trained in interpersonal skills

Adverse reactions

- Facilities to deal with any reactions before, during or after donation

Pre- Donation Checks of Equipment

- All equipment and materials must be
  - Correct
  - Clean
  - Calibrated
  - Checked for performance
- Ready for use

Equipments & Material Required in Donation Room

- Donor Couch
- Blood Bags
- Blood collection mixer
- Needle destroyer
- Tube sealer
- Alcohol Swabs
- Stripper
- Spirit & iodine
- BP instruments

Donor Identification

Correct identification of the donor

- At reception
- Immediately before venipuncture

Cross- check the donor with available records

- Name, address, date of birth

Re-check the donor's identity

Phlebotomy

- To be performed by a trained person
- Usually cubital fossa is chosen as the vein is palpable and required volume of blood can be easily drawn from this vein
- Examination of the area chosen for the venipuncture
- Should have no local infections

Preparation of the area

- BP cuff should be tied and pressure maintained at 40-60 mm Hg
- Tourniquet should be used carefully, as the pressure applied cannot be gauged.
- No local anaesthetic drug need to be administered

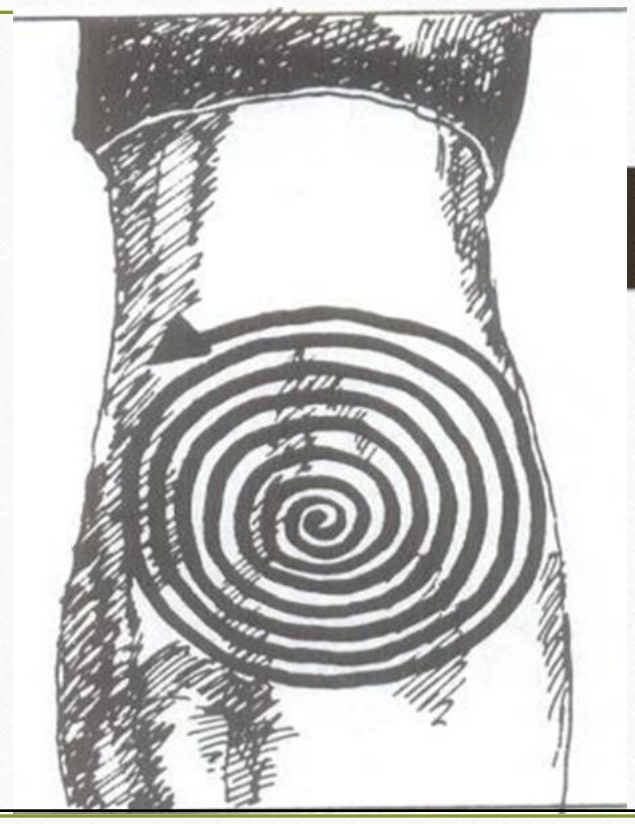
Donor Arm Cleaning

Important to minimise risk of bacterial contamination during vene puncture

- Follow the SOP for Methodology and selection of cleansing agent
- Trained staff
- Assessment of Compliance and effectiveness

Cleaning the area

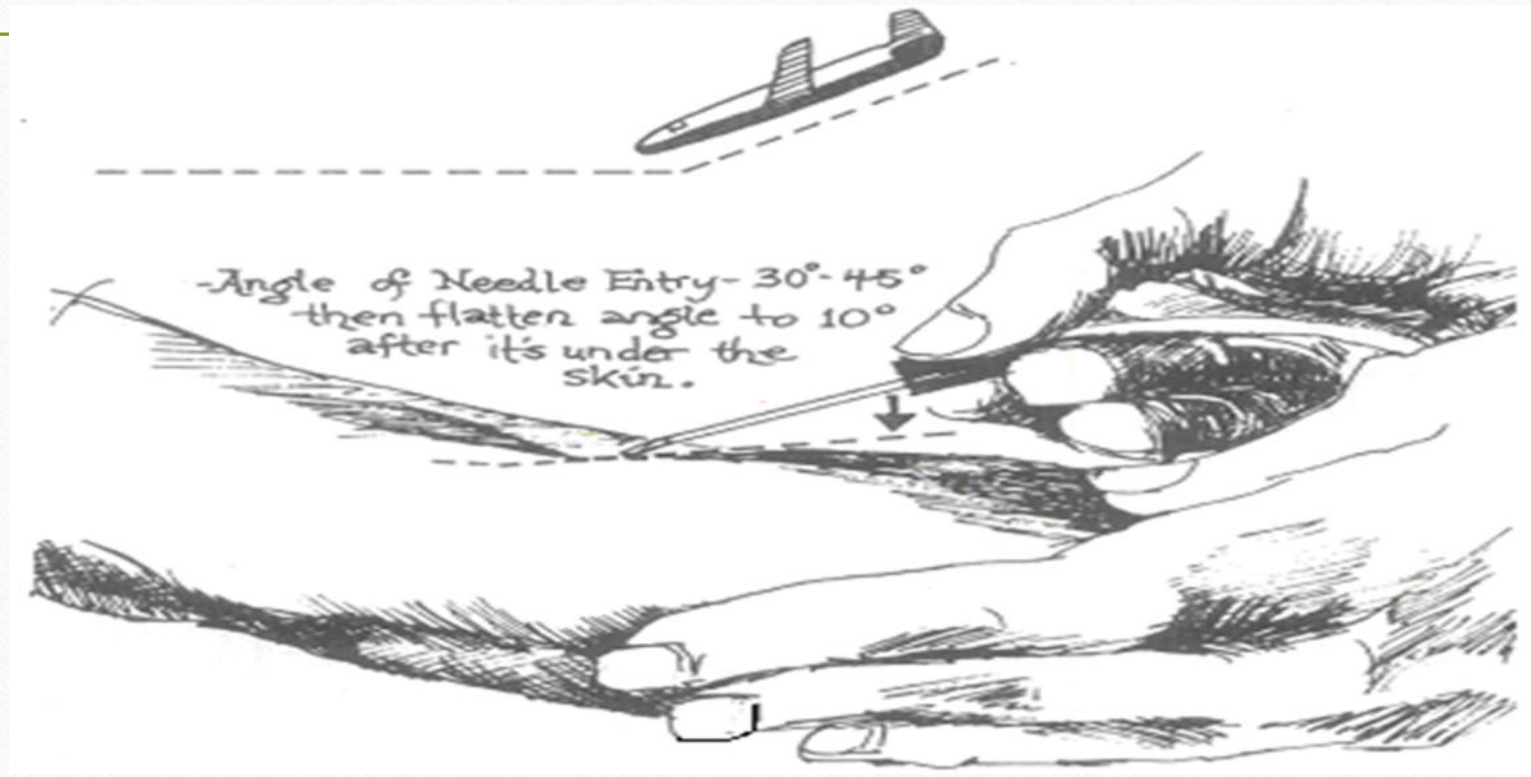
- Deflate the cuff and clean the area selected
- Spirit /alcohol swab and iodine should be used to do this
- Savlon etc. is not recommended.
- Clean 4-5cms area in a concentric centrifugal pattern
- Do not touch the cleaned area after preparation.



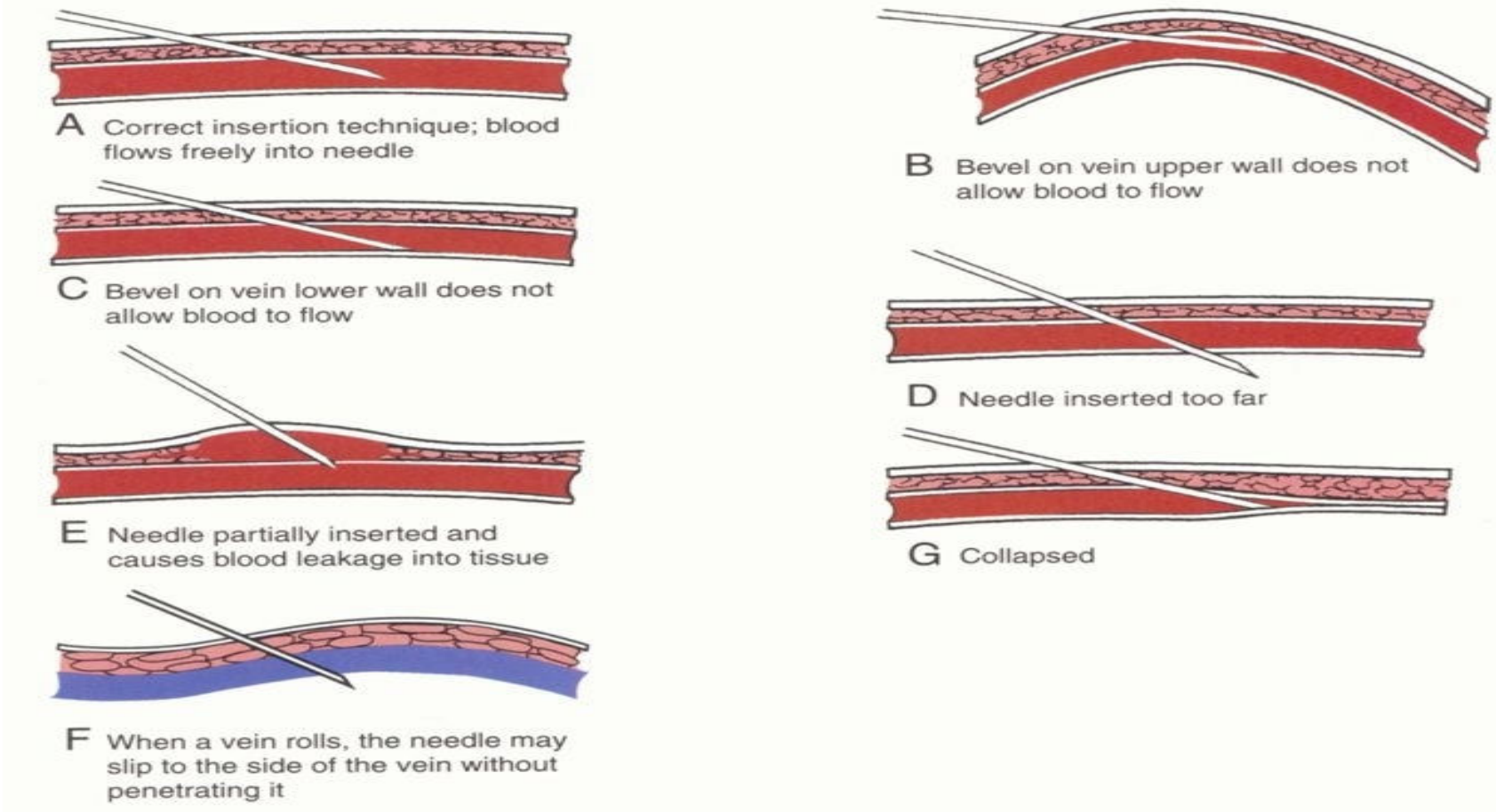
Procedure

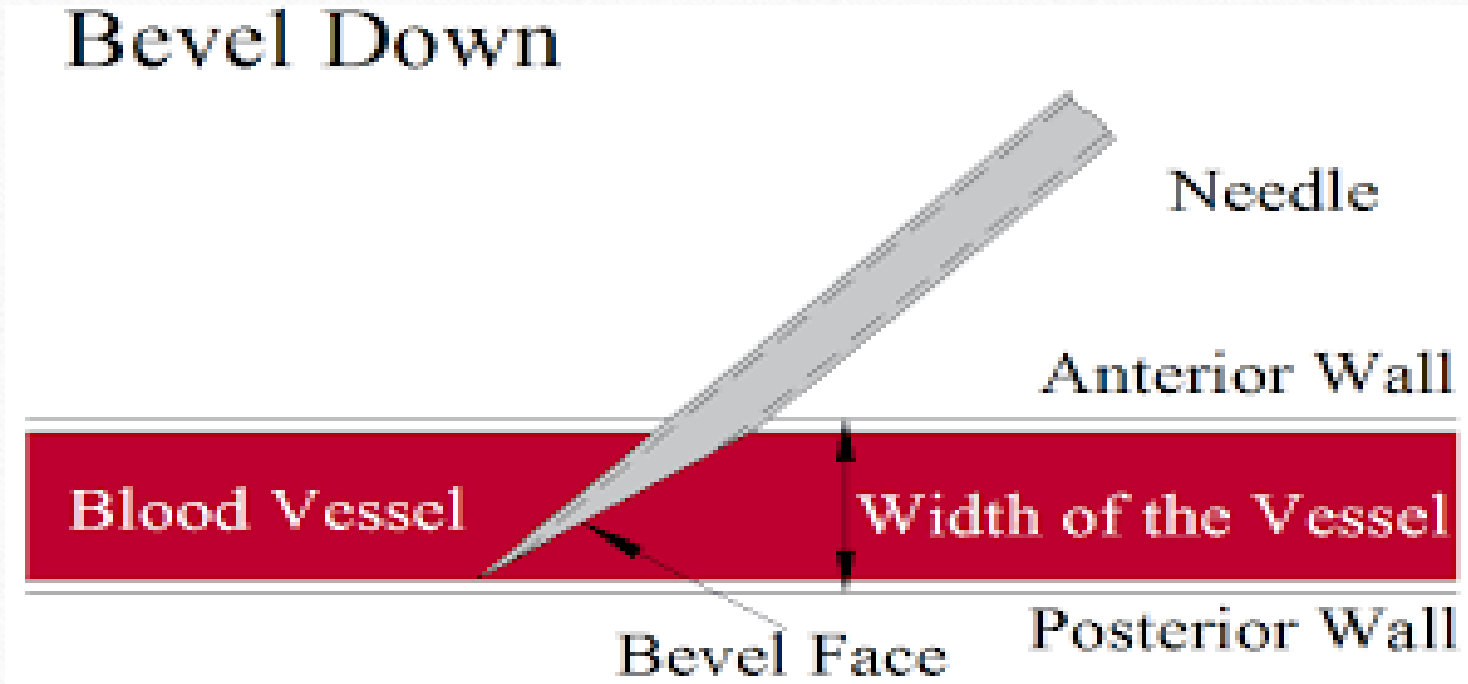
- Apply tourniquet or blood pressure cuff at 60 mm Hg to upper arm.
- Have donor open and close fist several times, holding gripper tightly
- Remove needle protector
- Using thumb of free hand placed well below prepared area…
  - pull skin taut.
  - inform donor that you are ready to perform venipuncture.
- Holding needle at a 30- to 45-degree angle, pierce skin with a quick thrust.
- When bevel is completely under skin, lower angle of needle to 10-15° and advance into vein

- Release clamp to let blood flow
- Instruct donor to relax hand and give gripper a slow, firm squeeze every 5-10 seconds.
- Secure needle and tubing by placing tape
- Loosen tourniquet or lower blood pressure cuff to 40-60 mm Hg.
- Record necessary information on bag and donor records according to facility policies and procedures



Needle Position:





- The procedure takes about 5-10minutes
- Donor should not be left unattended
- Bag should be periodically mixed so that uniform mixing of anticoagulant with blood occurs
- 1ml of blood=1.05gm
- 350ml=367gms+weight of the bag

Monitoring Blood Collection

- Constant monitoring during donation
- Smooth Blood flow
- Gentle mixing of blood
- Collection time -**5-10 min**
- **Appropriate Volume collected = ±10 % of desired volume**
- Sample collection

  -Identity checks

  -Correct handling

  -Labeling

After the procedure

- Deflate the cuff once the procedure is over
- Clamp the tubing
- Place the sterile swab and withdraw the needle
- Apply pressure and let the donor lie down for 5 minutes

- Do not recap the needle
- Stripping of tubings should be done to mix the blood in tubing with anticoagulated blood in the bag
- Collect Pilot samples for serology & grouping
- Seal tube at least 5 segments

Post Donation Care

- Donor should be constantly observed
- Apply medicated adhesive when oozing stops
- Check for any haematoma
- Check for any hypovolemic signs

Post Donation Care (contd…)

- Make them rest for 8-10 minutes before they go to refreshment area
- It is mandatory to provide light refreshments to the donors
- They should be observed for another 10 minutes while in refreshment area.
- Make sure they are completely alright

Post-donation instructions

Instructions to the donor after the donation

1.Drink more fluids than usual in the next 4 hours. Do not remain hungry.

2.Do not smoke for half an hour.

3.Do not take alcoholic drinks for atleast 6 hours.

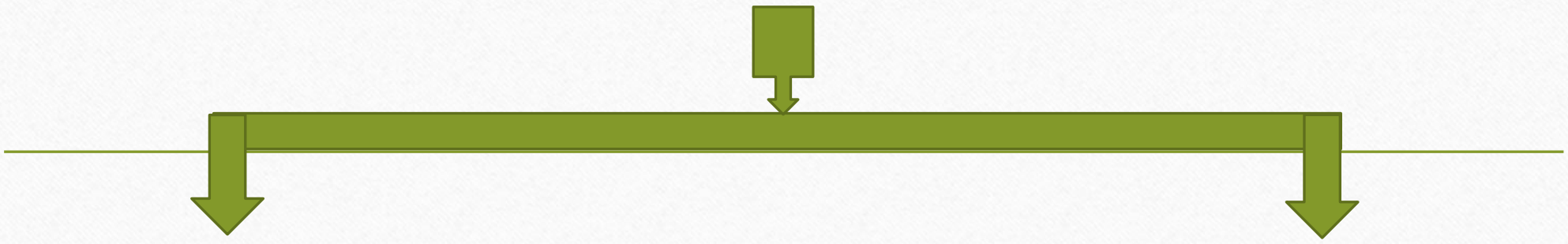
4.If there is bleeding from phlebotomy site, raise the arm and apply pressure.

5. If there is feeling of faintness or dizziness, donor should be in lie-down position or sit with head between knees. If symptoms persist, ask for help, return to the bloodbank or consult a doctor.

6. Remove the bandage/band-aid after 5-6 hours

ADVERSE DONOR REACTIONS

Donor Reaction



Localized Reaction

1. Bruise or Hematoma
2. Phlebitis and Cellulitis
3. Nerve Injury
4. Puncture of artery
5. Upper extremity Deep Vein Thrombosis

Systemic Reaction

1. Vasovagal Attack
2. Tetany
3. Air Embolism

Bruise or Hematoma

- One of the most common complications
- May be immediate of or Delayed
- Majority of cases restricted to small area in antecubital fossa

Bruise or Hematoma

Management-

Immediate Case-

1. Deflate blood pressure cuff. Withdraw the needle from the vein if enlarging hematoma.
2. Place 3-4 gauze pieces over the hematoma apply digital pressure for 7-10 mins keeping donors arm above heart level.
3. Apply ice to the area for 5mins.

Delayed-

1. Ice compression and analgesic if necessary
2. Keeping hand in rest. Avoid working by affected hand.
3. Observation and informing donor regarding compartment syndrome & refer if necessary

Outcome-

Generally resolve completely within 7-14 days and do not prevent donors from donating again

Phlebitis and Cellulitis

- Incidence- 1 in 50000 to 1 in 100000
- Mild phlebitis at the venepuncture site is common, self-limited and usually of little consequence.

- **Presentation-**

  Mild discomfort, small swelling, pain, local linear or surrounding erythema

- **Complication-**

  Despite a seemingly benign appearance, it may extend to local abscess formation or septic phlebitis

Phlebitis and Cellulitis

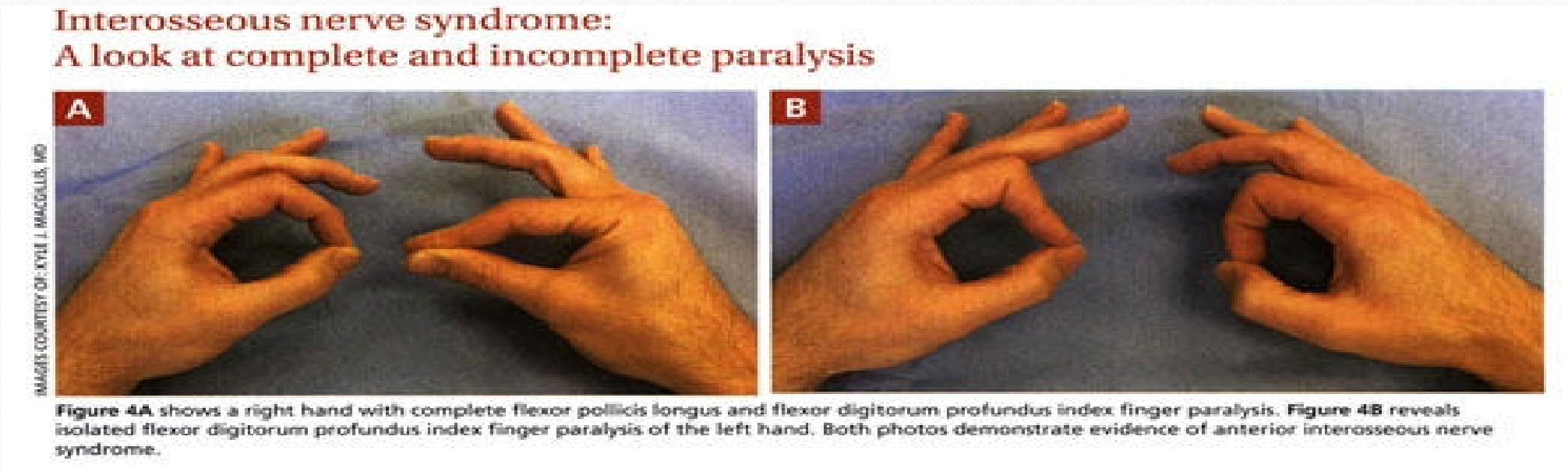
Management-

- Warm Compression
- Oral Analgesic and anti inflammatory agents
- Administration of oral antibiotics

Nerve Injury

- Incidence- Approx. 2/10,000 donations
- Cutaneous branches of the **medial and ulnar nerves** are injured occasionally by large bore phlebotomy needle.
- Direct nerve damage from the phlebotomy needle is not very common.
- Injuries are generally transient and rarely a source of donor distress.

Nerve Injury


Interosseous nerve syndrome:
A look at complete and incomplete paralysis

IMAGES COURTESY OF KYLE J. MACGILLIS, MD

Figure 4A shows a right hand with complete flexor pollicis longus and flexor digitorum profundus index finger paralysis. **Figure 4B** reveals isolated flexor digitorum profundus index finger paralysis of the left hand. Both photos demonstrate evidence of anterior interosseous nerve syndrome.

Presentation- Immediate severe shooting and radiating pain (earliest presentation), paraesthesias, sensory changes in forearm, wrist, hand. rarely loss of arm strength

- Outcome- 70% of nerve injury usually disappear within a month, almost all resolve within one year.

  Rare cases of complex regional pain syndrome (Reflex sympathetic dystrophy) has been reported.

- Prevention- To reduce the risk of direct nerve injury need should be inserted only once and no further manipulation or attempt (single prick strategy)

Puncture of Artery

- Incidence- 1/10,000 donations
- More common among inexperienced phlebotomists than those with experience.
- Presence of bright red blood, rapid collection (within seconds), and a pulsating needle suggest arterial puncture are indicators of arterial puncture

Puncture of Artery

Management-

Needle should be taken out early and local pressure should me applied for an extended period.

Complications-

Hematomas, compartment syndrome, delayed nerve injury may happen

- Most donors recover quickly and completely.

Follow up-

Should be evaluated for pseudoaneurysm by ultrasound and doppler studies.

Upper Extremity Deep Vein Thrombosis

- Very rare delayed type of complication
- Symptoms-
  - Pain in the upper limb
  - Swelling of the arm
  - Prominent palpable, cord like thickening of the thrombosed vein

Investigation- Ultrasonography doppler study should be used as an screening tool

Upper Extremity Deep Vein Thrombosis

Management- Thrombolysis is done by unfractionated heparin.

Anticoagulants is used like Dabigatran, Rivaroxaban, Apixaban, Wafarin in uncomplicated cases.

Systemic Reactions

Vasovagal Reaction

- Most common systemic reaction
- Incidence- 250/10000 donations
- Predisposing factors-
  - First time donors
  - Donors with low weight
  - H/o previous adverse reaction
  - Donor in Fasting state > 4hours
  - Inadequate sleep last night

Symptoms

- **Chills or cold extremities,**
- **Feeling of warmth**
- **Light- Headedness**
- **Nausea**
- **Pallor**
- **Weakness**
- **Hyperventilation**
- **Declaration of nervousness (Anxiety)**
- **Sweating**

Signs

- Hypotension
- Tachycardia or Bradycardia
- Syncope
- Seizure Activity (Tonic- Clonic Convulsion)
- Twiching

- 3 types according to severity-
    1. Mild
    2. Moderate
    3. Severe

Mild vasovagal reaction

Present with one or more

Nausea, dizziness, hyperventilation, vomiting, twitching and muscle spasm, sweating etc.

- Usually brought about by the sight of blood or needle.

Management-

- **Remove tourniquet and withdraw needle**
- **Raise Donor's leg above the level of head of Head**
- **Loosen tight clothing and secure airway**
- **Monitor vital signs**
- **Cold compress to the neck or forehead**

Moderate vasovagal reaction

- **Mild vasovagal reaction + loss of consciousness**
- **May be associated with decreased pulse rate, may hyperventilate, may exhibit a fall in systolic pressure to 60mm Hg.**

Management

- **Check Vital signs frequently**
- **Raise Donor's leg above the level of head of Head**
- **Administer 95% oxygen and 5% carbon-di-oxide**

Severe vasovagal reaction

A donor experiencing convulsion defines a severe reaction. May be caused by-

1. **Cerebral Ischemia,**
2. **Marked hyperventilation,**
3. **Epilepsy**

May be associated with vasovagal syncope, reduced blood flow to brain owing to shock symptoms.

- Management-
  - Prevention of further injury due to fall
  - Ensure an adequate airway
  - Use anticonvulsant to manage Seizure
  - Administer 95% oxygen and 5% carbon di oxide
  - Monitoring vitals
  - In case of Cardiac and respiratory difficulties perform CPR

Tetany

- Occasionally observed in blood donors
- Incidence- 1/1000 donors
- Predominantly seen in nervous subjects
- Thought to be due to hyperventilation which causes excited donor to lose excess of carbon dioxide.
- Presents with twitching, muscular spasm, carpopedal spasm, laryngismus, stridulus and positive Chvostek's sign.

- **Management-**
  - Make the donor as comfortable as possible
  - Rebreathing in a proper bag which brings prompt relief
  - Inhaling 5% carbon dioxide from a cylinder
  - Ask the donor to breath slowly and shallow

Air Embolism

- Rare incident now-a-days
- When blood is taken into plastic bags that contain no air, no possibility if air embolism
- When blood is taken into glass bottle air embolism may happen.
- It may happen in some instruments of Apheresis.
- Prime cause of air embolism in this circumstance is obstruction to the air vent of the bottle.

Allergic Reaction

- Donor may be hypersensitive to sterilizers specially ethylene oxide, ethly alcohol etc.

Symptoms and signs- Hives, difficulty in breathing, wheezing, hypotension or hypertension, tachycardia or bradycardia, facial swelling or flushing, burning eyes, angioedema etc. Even anaphylaxis may happen.

Management-

Inj. Promethzine (Any antihistaminic)

Inj. Hydrocortisone if necessary

Citrate Induced Hypocalcemia

Citrate anticoagulants, used in apheresis donor collections, exerts effect by binding to calcium avoid clotting of blood.

Symptoms-

1. Perioral or peripheral paresthesias or both,
2. Unusual taste,
3. Transient nausea,
4. Light-headedness,
5. Muscle Cramps
6. Dysphagia

Citrate Induced Hypocalcemia

Signs-

1. Carpopedal Spasm,
2. Tetany (May be present if associated with hyperkalamia)
3. Change in pulse,
4. Tremor,
5. Chvostek's sign,
6. Seizure (Grand mal, Petit mal)
7. Laryngospasm

- **Management-**
  - Reducing citrate infusion rate
  - Administering calcium tablets for mild to moderate cases
  - For severe cases termination of collection and-
    - Shifting the donor to Emergency Department
    - Vitals monitoring, ECG
    - Electrolyte monitoring
    - Calcium gluconate injection if necessary (Inj Calcium Gluconate 10% IV over 10 to 15mins)

Prevention of Donor Reaction

Post Donation Care

- Pressure should be applied on the venepuncture site for sometime
- Venepuncture dressing should be kept for 24 hours
- Strenuous exercise should be avoided for next 24hours
- Plenty of fluids to be taken
- Heavy weights should not be lifted using the venepuncture arm
- Prolonged standing should be avoided for rest of the day
- Any illness within 2 weeks to be reported at the Transfusion medicine department
- Avoid smoking and alcohol
- Refrain from works specially pilots, drivers, police and surgeon
- If feeling faint or vertigo Donor should sit down and lower his head

Some strategies can be taken-

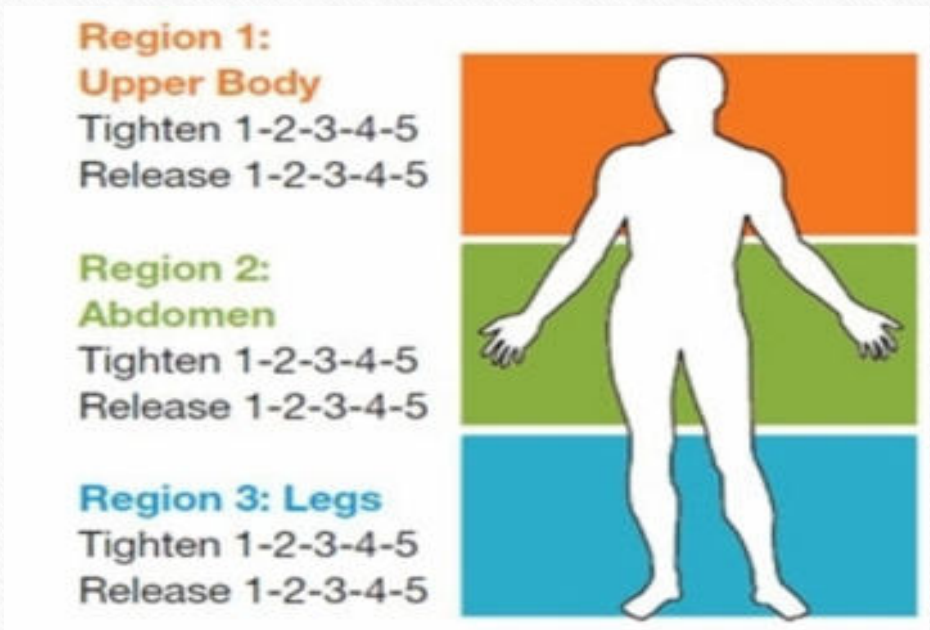
- **Predonation Education-** specially among first time donors by motivational audio-visual aids regarding need for blood in the community
- **Drive set up and environment-** A well planned, adequately staffed and organized lay out of blood donation area or donation camp.
- **Staff supervision & phlebotomist skill-** An experienced phlebotomy staff and adequate supervision is important to reduce adverse incidents.

- **Distraction-** Fear and associated anxiety is an important factor associated with donor reaction. Distraction techniques have shown to reduce the no of donor reactions.

- **Water Ingestion-**
- 350-500ml drinking water 30minutes before whole blood donation
- The mechanism related to increased gastric distension which increases sympathetic tone and overall peripheral resistance, BP and cerebral Blood flow.

- **Applied Muscle Tension (AMT)-** AMT in combination with water hydration is a fairly new concept in preventing presyncopal and syncopal reactions.

AMT involves Repetitive contraction of major muscle groups of the arms and legs and there by promoting venous return and cardiac output which affects cerebral blood flow.



Salty Snacks-

- The amount of salt we consume daily affects the volume of our extracellular fluid.
- Increased dietary Sodium improves orthostatic tolerance in blood donors.
- The addition of salty snacks before and immediately after donation is a low cost attractive approach to prevent donor reaction.

DONOR HAEMOVIGILANCE

- Haemovigilance Programme of India has been formed jointly by National Institute of Biologicals & Indian Pharmacopoeia Commission Collaboration on 10th December, 2012 and Donor Hemovigilance was started on 14th June 2015.
- Every blood bank have to keep records of donor reaction in their own registry and in every month they have to register it in Blood Donor Vigilance Programme Of India maintained by National Institute of Biologicals.

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