Chequers Academy

There will be a QUIZ about this topic during the practical session.

Venepuncture

Anatomy & Physiology

Updated Nov 24 - JM

Anatomy and Physiology

Understanding anatomy and physiology is fundamental for anyone training to become a phlebotomist. Here's why this knowledge is crucial:

- Targeting the Correct Vein - Knowledge of anatomy helps in identifying the vein's location and ensuring that the puncture is safe and effective.

- Avoiding Complications - By understanding the physiology of blood flow and the structure of veins, arteries, and surrounding tissues, you can:
    - Avoid hitting arteries, which can cause excessive bleeding.
    - Prevent nerve damage by steering clear of areas with dense nerve endings.
    - Achieve a higher success rate.

- Minimising Patient Discomfort - Proper knowledge of the body allows for accurate and efficient venipuncture, minimising pain and improving the patient's experience.

- Recognising Special Conditions - Awareness of physiological variations (e.g., thin veins in elderly patients, or conditions like oedema) helps you adapt techniques accordingly.

- Safety and Infection Control - Understanding circulatory physiology aids in maintaining aseptic techniques and reduces the risk of complications like hematomas or infections.

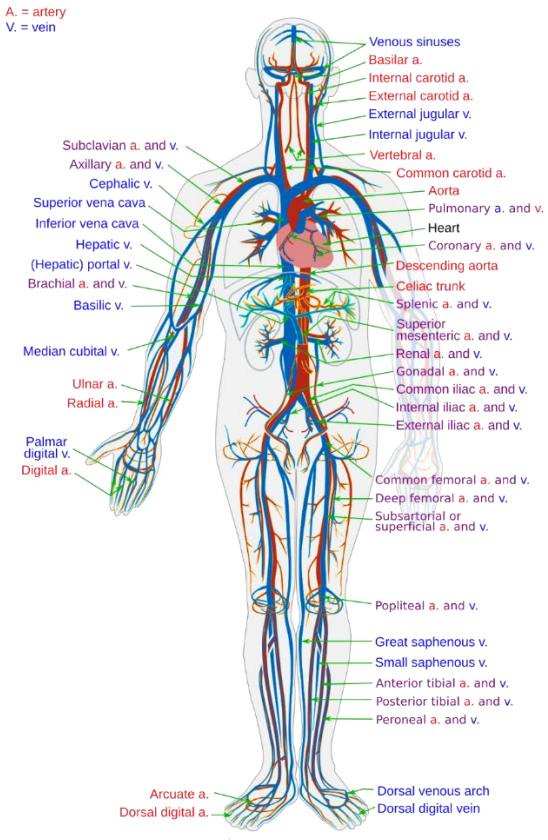
- Understanding the Role of Blood in the Body - Blood samples are drawn to analyse bodily functions. Knowing the physiology of blood helps phlebotomists understand:
    - Why specific tests require certain sample volumes.
    - The implications of proper tube mixing to preserve blood integrity.

- Communication with Patients - A foundational understanding of anatomy and physiology enables you to explain procedures to patients effectively and communicate with other healthcare professionals about patient conditions.

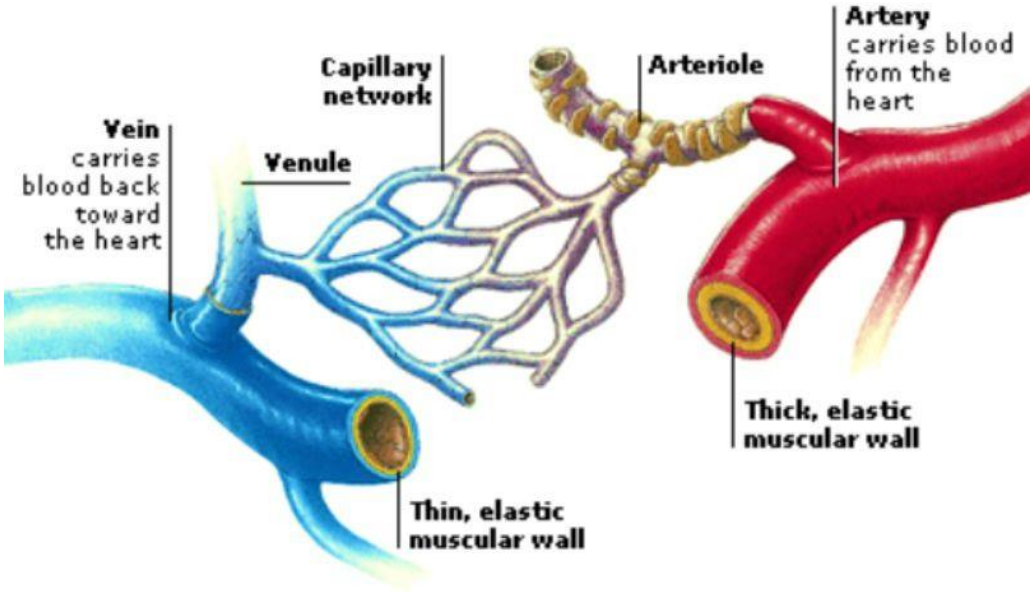
Mastering anatomy and physiology empowers you as a phlebotomist to perform your role with confidence, precision, and a commitment to patient safety.

The Circulatory System

Arteries and veins form the part of the circulation system that transports oxygenated blood (arteries - represented as red) around our body and deoxygenated blood (veins - represented as blue) to the lungs for excretion.

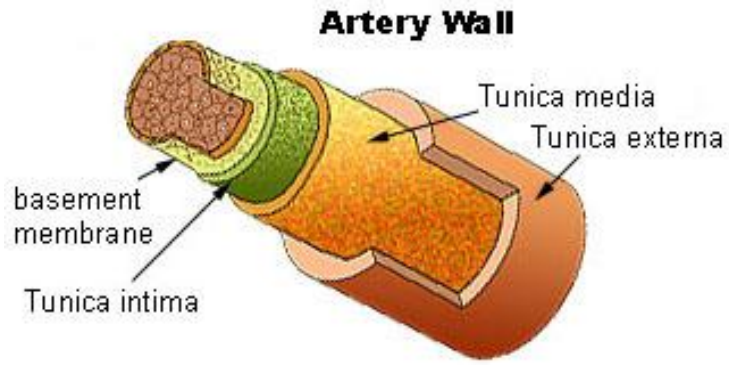


The image above illustrates the major blood vessels in the body, however this is part of a wider system consisting of smaller blood vessels and capillaries (tiny vessels only one cell thick).



You do not need to learn the names of all the blood vessels however it is important that you understand the difference between a vein and an artery, and that you are familiar with the main veins involved in phlebotomy.

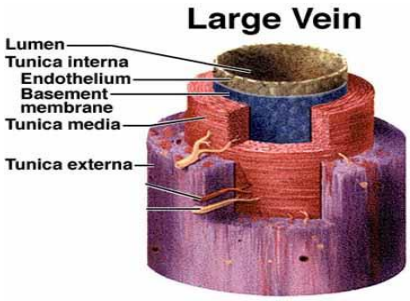
Arteries



- The vessels carrying blood AWAY from the heart.
- All arteries, except the PULMONARY arteries, carry oxygenated (bright red) blood.
- They have thick muscular walls to enable them to cope with the flow of blood under high pressure. The pressure maintains the flow of blood without the need for valves.
- Arteries tend to be deeper in the body than veins.

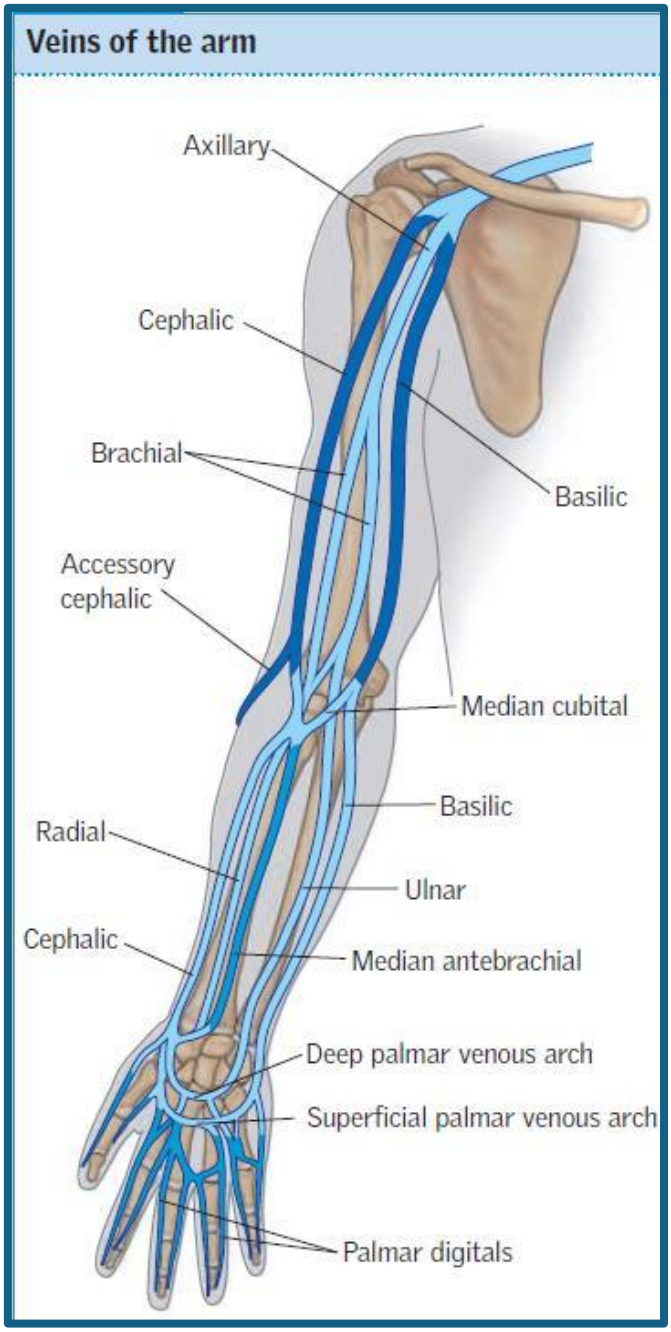
- Arteries are usually NOT used for venepuncture as they are deeper and are more painful to obtain than superficial veins. Arterial bloods can be taken, but require specialist training which is not covered in this course.

Veins



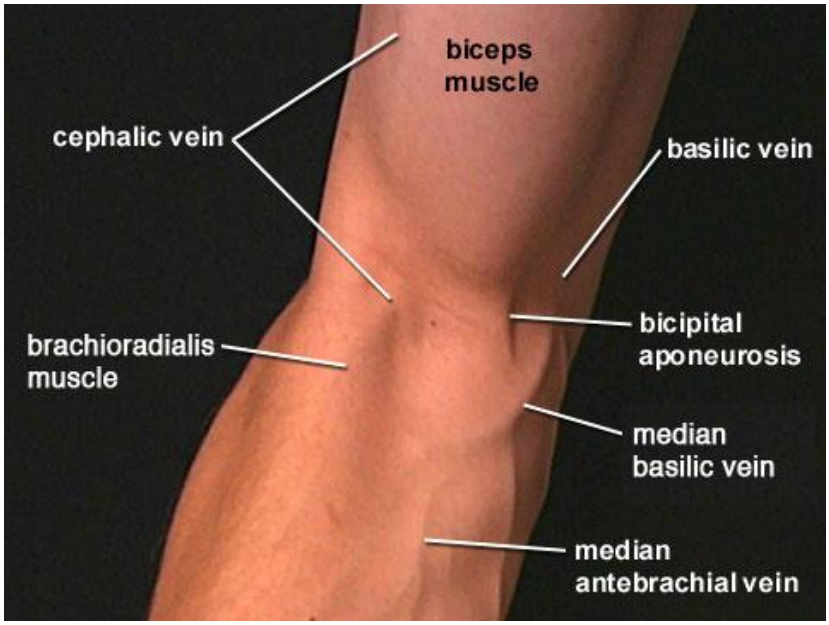
- Veins are the vessels that are RETURNING from the peripheries to the heart.
- All veins, except for the pulmonary veins, carry deoxygenated (blue) blood and carbon dioxide.
- Veins are less elastic than arteries as these vessels carry relatively low pressure blood.
- Veins have valves to prevent the back flow of blood, which can occur with low pressure. The breakdown of these valves causes varicose veins due to back flow of blood pooling. They are found in most veins generally, and where two veins unite.
- Many veins are superficial, meaning that they are close to the skin and therefore are easier to see, palpate and to draw blood from.

Veins of the Arm



Venepuncture is usually performed in the antecubital fossa area of the arm, however in some cases it may be preferable to utilise the veins in the hand/wrist. Usually this is due to poor veins in the antecubital fossa, or to cite a cannula, where there is less chance of occlusion due to bending of the elbow. Below is an overview of the veins that you may see and draw blood from in practice.

Antecubital Fossa Veins



Median Vein

There may be more than one 'median' vein in the antecubital fossa. They are formed by the convergence and divergence of branches of the 3 forearm veins.

PRO's

- Large veins
- Do not "shut down" as quickly as the more peripheral veins

CON's

- Can be very positional due to elbow flexion/extension
- Causes pain and can be uncomfortable for the patient
- Close to brachial artery

Cephalic Vein

Forms from a meeting of veins at the base of the thumb and passes upward along the radial (lateral) aspect of the forearm to enter the lateral part of the antecubital fossa.

PRO's

- A large vein

- Easy to stabilise
- May be palpated above antecubital fossa

CON's

- Can be more difficult to cannulate than the metacarpel veins
- Close to radial artery therefore increased risk of radial nerve damage
- May be obscured by tendons controlling thumb
- Puncture sites may increase complications due to wrist motion

Basilic Vein

Forms from a meeting of veins on the postero-medial aspect of the wrist and passes upward slightly posterior to the ulnar (medial) border of the forearm but winds round over the ulnar to enter the medial aspect of the antecubital fossa.

PRO's

- A large vein that is frequently overlooked
- It is straight, long and easily palpated

CON's

- Can be painful
- Awkward position - may increase complications due to joint flexion
- The vein tends to roll away when you attempt to cannulate it
- Sites prone to phlebitis (inflammation of the vein)

Metacarpal Veins

PRO's

- Easily accessible
- Easily visualised and palpated
- Splinted by metacarpal bones
- Veins lie flat

CON's

- May dislodge due to movement of the wrist
- Dressing may be compromised by hand washing
- May be more difficult if the skin is thin and friable, e.g. older patients, medication
- Flow can be affected by wrist flexion or extension, i.e. a positional cannula

Criteria for Choosing a Site for Venepuncture

The condition and accessibility of superficial veins

- Veins may be:
    - tortuous (twisted)
    - sclerosed (narrow)
    - fibrosed (hard)
    - thrombosed (clotted),
    - inflamed or fragile and unable to provide sufficient blood for sampling.

- If the patient complains of excessive pain or soreness over a particular site, this should be avoided, as should areas that are bruised or adjacent to infection sites.

- Preference should be given to a vein which is unused, easily detected by inspection and/or palpation, patent and healthy.
- These veins feel soft, bouncy and will refill when depressed.

Anatomical Considerations

- The vein layout of each individual differs, but care must always be taken to avoid adjacent structures e.g. arteries and nerves.

- Accidental puncture of an artery may cause painful spasm and could result in prolonged bleeding.

- If a nerve is touched, this can result in severe pain and the attempted venepuncture should be stopped.

- Palpation is of value in distinguishing structures clinically, e.g the presence of a pulse indicates an artery, and resistance indicates a tendon. Deeper veins may also be detected by palpation.

- The sites of choice are branches of: the Basilic vein, the Cephalic vein, and the Median cubital vein in the antecubital fossa. These are sizeable veins capable of providing copious and repeated blood specimens.

- The brachial artery and median nerve are very close by and must not be damaged. The choice of vein, however, must be that which is best for the individual patient.

The Clinical Status of the Patient

- Injury or disease may prevent the use of a limb for venepuncture.

- Amputation, fracture or stroke are good examples of conditions that affect venous access. Use of a limb may be contraindicated because of an operation on one side of the body e.g. mastectomy.

- An oedematous limb should be avoided as there is danger of complications such as phlebitis and cellulitis as a result of the static fluid in the limb.

- Areas with skin conditions should be avoided and attention given where the patient has a history of blood clots.

Physiological Factors That Influence the Dilation of Veins

- Anxiety – this may be reduced by presenting a confident manner together with a good explanation of the procedure. Careful preparation and an unhurried approach will help relax the patient and their veins!

- Temperature – the temperature of the environment will influence venous dilation. If the patient is cold, no veins may be evident on first inspection. Application of heat, e.g. in the form of soaking arms in warm water and encouraging the patient to wear warm clothing in anticipation of a blood test, will increase the size and viability of the veins. * ensure that the water is warm and not hot enough to burn the patient.

- Mechanical irritation – good technique prevents trauma and reduces the likelihood of vein collapse.

- The clinical state of the patient – a reduction in body fluids e.g due to dehydration and poor peripheral circulation as in heart failure, also affect the size of the veins.