INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

Volume: 2: Issue-1: Jan-Mar -2011 IJABPT *ISSN 0976-4550*

Review Article

GENERAL PROCEDURE OF PHLEBOTOMY: A REVIEW

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ABSTRACT: Phlebotomy – the drawing of blood – has been practiced for centuries and is still one of the most common invasive procedures in health care. However, practice varies considerably between countries and between institutions and individuals within the same country. By its nature, phlebotomy has the potential to expose health workers and patients to blood from other people, putting them at risk from blood borne pathogens. These pathogens include human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and dengue. If a blood sample is poorly collected, the results may be inaccurate and misleading to the clinician and the patient may have to undergo the inconvenience of repeat testing.
Key words: Phlebotomy, blood borne pathogens, human immunodeficiency virus (HIV).

INTRODUCTION

Phlebotomy – the drawing of blood – has been practiced for centuries and is still one of the most common invasive procedures in health care (*1*). However, practice varies considerably between countries between institutions and individuals within the same country (*2*). These differences include variations in blood-sampling technique, training, use of safety devices, disposal methods, reuse of devices and availability of hepatitis B vaccine. More than two kinds of laboratory errors are caused by pre analytical mistakes. Most of these mistakes are related to specimen collection and handling. Hence the correct technique of blood sample collection are important for medical professionals.

By its nature, phlebotomy has the potential to expose health workers and patients to blood from other people, putting them at risk from blood borne pathogens. These pathogens include human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and those causing viral haemorrhagic fevers (Crimean Congo haemorrhagic fever, Ebola, Lassa and Marburg) and dengue (*3*).

If a blood sample is poorly collected, the results may be inaccurate and misleading to the clinician and the patient may have to undergo the inconvenience of repeat testing. The three major issues resulting from errors in collection are,

- Haemolysis
- Contamination
- Inaccurate labelling

Factors that increase the risk of haemolysis include:

- Use of a needle of too small a gauge (23 or under), or too large a gauge for the vessel
- Pressing the syringe plunger to force the blood into a tube, thus increasing the shear force on the red blood cells
- Drawing blood specimens from an intravenous or central line
- Under filling a tube so that the ratio of anticoagulant to blood is greater than 1:9
- Reusing tubes that have been refilled by hand with inappropriate amounts of anticoagulants
- Mixing a tube too vigorously
- Failing to let alcohol or disinfectant dry
- Using too great a vacuum; for example, using too large a tube for a paediatric patient or using too large a syringe (10–20 ml).

Serious adverse events linked with phlebotomy are rare, but may include loss of consciousness with tonic clonic seizures. Less severe events include pain at the site of venepuncture, anxiety and fainting. The best documented adverse events are in blood transfusion services, where poor venepuncture practice or anatomical abnormality has resulted in bruising, haematoma and injury to anatomical structures in the vicinity of the needle entry. Nerve injury and damage to adjacent anatomical structures occurred infrequently, and syncope occurred in less than 1% of individuals (4).

Sites of blood sample collection:

- Venous blood
- Arterial blood
- Capillary blood

General procedure for blood sample collection

Step 1 – Assemble equipment

Collect all the equipment needed for the procedure and place it within safe and easy reach on a tray or trolley, ensuring that all the items are clearly visible.

The equipment required includes:

- A supply of laboratory sample tubes, which should be stored dry and upright in a rack; blood can be collected in sterile glass or plastic tubes with rubber caps— vacuum-extraction blood tubes; or glass tubes with screw caps
- A sterile glass or bleeding pack (collapsible) if large quantities of blood are to be collected
- Well-fitting, non-sterile gloves
- A tourniquet
- Alcohol hand rub
- 70% alcohol swabs for skin disinfection
- Gauze or cotton-wool ball to be applied over puncture site
- Laboratory specimen labels
- Writing equipment
- Laboratory forms
- Leak-proof transportation bags and containers
- A puncture-resistant sharps container

Ensure that the rack containing the sample tubes is close to you, the health worker, but away from the patient, to avoid it being accidentally tipped over.

Step 2 – Identify and prepare the patient

Where the patient is adult and conscious, follow the steps outlined below.

- Introduce yourself to the patient, and ask the patient to state their full name.
- Check that the laboratory form matches the patient's identity (i.e. match the patient's details with the laboratory form, to ensure accurate identification).

• Ask whether the patient has any allergies, phobias or has ever fainted during previous injections or blood draws.
• If the patient is anxious or afraid, reassure the person and ask what would make them more comfortable.
• Make the patient comfortable in a supine or sitting position.
• Place a clean paper or towel under the patient's arm.
• Discuss the test to be performed and obtain verbal consent. The patient has a right to refuse a test at any time before the blood sampling, so it is important to ensure that the patient has understood the procedure.

Step 3 – Select the site

General

• Extend the patient's arm and inspect the antecubital fossa or forearm.
• Locate a vein of a good size that is visible, straight and clear. The median cubital vein lies between muscles and is usually the most easy to puncture. Under the basilica vein runs an artery and a nerve, so puncturing here runs the risk of damaging the nerve or artery and is usually more painful. DO NOT insert the needle where veins are diverting, because this increases the chance of a haematoma.
• The vein should be visible without applying the tourniquet. Locating the vein will help in determining the correct size of needle.
• Apply the tourniquet about 4–5 finger widths above the venepuncture site and re-examine the vein.

Hospitalized patients

In hospitalized patients, do not take blood from an existing peripheral venous access site because this may give false results. Haemolysis, contamination and presence of intravenous fluid and medication can all alter the results (*5*). Nursing staff and physicians may access central venous lines for specimens following protocols. However, specimens from central lines carry a risk of contamination or erroneous laboratory test results. It is acceptable, but not ideal, to draw blood specimens when first introducing an in-dwelling venous device, before connecting the cannula to the intravenous fluids.

Step 4 – Perform hand hygiene and put on gloves

• Perform hand hygiene; that is
— wash hands with soap and water, and dry with single-use towels or if hands are not visibly contaminated, clean with alcohol rub – use 3 ml of alcohol rub on the palm of the hand, and rub it into fingertips, back of hands and all over the hands until dry.
• After performing hand hygiene, put on well-fitting, non-sterile gloves.

Step 5 – Disinfect the entry site

• Unless drawing blood cultures, or prepping for a blood collection, clean the site with a 70% alcohol swab for 30 seconds and allow to dry completely (30 seconds) (*6,7,8*).
Note: alcohol is preferable to povidone iodine, because blood contaminated with povidone iodine may falsely increase levels of potassium, phosphorus or uric acid in laboratory test results (*9,10*).
• Apply firm but gentle pressure. Start from the centre of the venepuncture site and work downward and outwards to cover an area of 2 cm or more.
• Allow the area to dry. Failure to allow enough contact time increases the risk of contamination.
• DO NOT touch the cleaned site; in particular, DO NOT place a finger over the vein to guide the shaft of the exposed needle. It the site is touched, repeat the disinfection.

Step 6 – Take blood

Venepuncture

Perform venepuncture as follows.

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

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

• Enter the vein swiftly at a 30 degree angle or less, and continue to introduce the needle along the vein at the easiest angle of entry.

• Once sufficient blood has been collected, release the tourniquet BEFORE withdrawing the needle. Some guidelines suggest removing the tourniquet as soon as blood flow is established, and always before it has been in place for two minutes or more.

• Withdraw the needle gently and apply gentle pressure to the site with a clean gauze or dry cotton-wool ball. Ask the patient to hold the gauze or cotton wool in place, with the arm extended and raised. Ask the patient NOT to bend the arm, because doing so causes a haematoma.

Step 7 – Fill the laboratory sample tubes

• When obtaining multiple tubes of blood, use evacuated tubes with a needle and tube holder. This system allows the tubes to be filled directly. If this system is not available, use a syringe or winged needle set instead.

• If a syringe or winged needle set is used, best practice is to place the tube into a rack before filling the tube. To prevent needle-sticks, use one hand to fill the tube or use a needle shield between the needle and the hand holding the tube.

• Pierce the stopper on the tube with the needle directly above the tube using slow, steady pressure. Do not press the syringe plunger because additional pressure increases the risk of haemolysis.

• Where possible, keep the tubes in a rack and move the rack towards you. Inject downwards into the appropriate coloured stopper. DO NOT remove the stopper because it will release the vacuum.

• If the sample tube does not have a rubber stopper, inject extremely slowly into the tube as minimizing the pressure and velocity used to transfer the specimen reduces the risk of haemolysis. DO NOT recap and remove the needle.

• Before dispatch, invert the tubes containing additives for the required number of times (as specified by the local laboratory).

Step 8 – Draw samples in the correct order

Draw blood collection tubes in the correct order, to avoid cross-contamination of additives between tubes. As colour coding and tube additives may vary, verify recommendations with local laboratories.

Step 9 – Clean contaminated surfaces and complete patient procedure

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

• Check the label and forms for accuracy. The label should be clearly written with the information required by the laboratory, which is typically the patient's first and last names, file number, date of birth, and the date and time when the blood was taken.

• Discard used items into the appropriate category of waste. Items used for phlebotomy that would not release a drop of blood if squeezed (e.g. gloves) may be discarded in the general waste, unless local regulations state otherwise.

• Perform hand hygiene again.

• Recheck the labels on the tubes and the forms before dispatch.

• Inform the patient when the procedure is over.

• Ask the patient or donor how they are feeling. Check the insertion site to verify that it is not bleeding, then thank the patient and say something reassuring and encouraging before the person leaves.

Step 10 – Prepare samples for transportation

- Pack laboratory samples safely in a plastic leak-proof bag with an outside compartment for the laboratory request form. Placing the requisition on the outside helps avoid contamination.
- If there are multiple tubes, place them in a rack or padded holder to avoid breakage during transportation.

Step 11 – Clean up spills of blood or body fluids

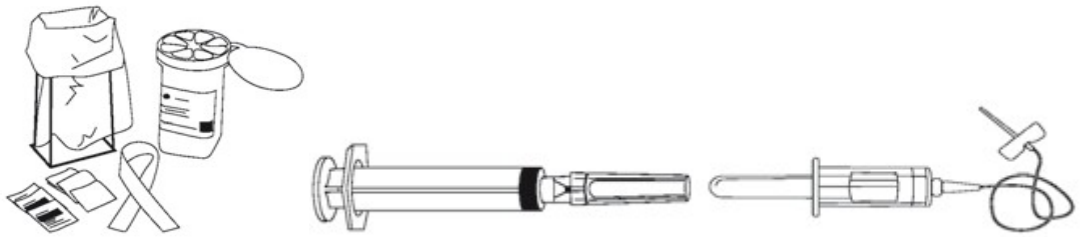
If blood spillage has occurred (e.g. because of a laboratory sample breaking in the phlebotomy area or during transportation, or excessive bleeding during the procedure), clean it up.

An example of a safe procedure is given below.

- Put on gloves and a gown or apron if contamination or bleaching of a uniform is likely in a large spill.
- Mop up liquid from large spills using paper towels, and place them into the infectious waste.
- Remove as much blood as possible with wet cloths before disinfecting.
- Assess the surface to see whether it will be damaged by a bleach and water solution.
- For cement, metal and other surfaces that can tolerate a stronger bleach solution, flood the area with an approximately 5000 parts per million (ppm) solution of sodium hypochlorite (1:10 dilution of a 5.25% chlorine bleach to water). This is the preferred concentration for large spills (*11*). Leave the area wet for 10 minutes.
- For surfaces that may be corroded or discoloured by a strong bleach, clean carefully to remove all visible stains. Make a weaker solution and leave it in contact for a longer period of time. For example, an approximately 525 ppm solution (1:100 dilution of 5.25% bleach) is effective.
- Prepare bleach solution fresh daily and keep it in a closed container because it degrades over time and in contact with the sun.

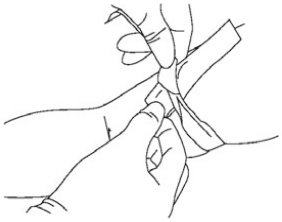
If a person was exposed to blood through non intact skin, mucous membranes or a puncture wound, give the information to higher authorities.

Diagrams of procedure of venepuncture in adults *(13):*

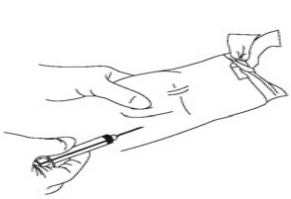
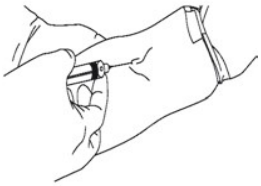


1. Assemble equipment, and include needle and syringe or vacuum tube, depending on which is to be used.

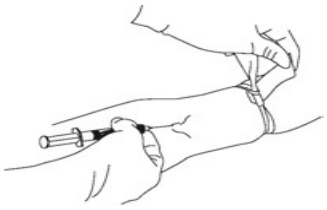
2. Perform hand hygiene (if using soap and water, dry hands with single-use towels).
3. Identify and prepare the patient.
4. Select the site, preferably at the antecubital area (i.e. the bend of the elbow). Warming the arm with a hot pack, or hanging the hand down may make it easier to see the veins. Palpate the area to locate the anatomic landmarks. DO NOT touch the site once alcohol or other antiseptic has been applied.

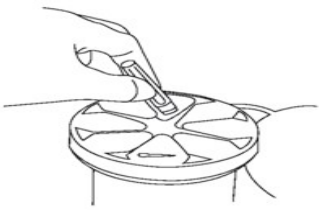


5. Apply a tourniquet, about 4–5 finger widths above the selected venepuncture site.
6. Ask the patient to form a fist so that the veins are more prominent.
7. Put on well-fitting, non-sterile gloves.

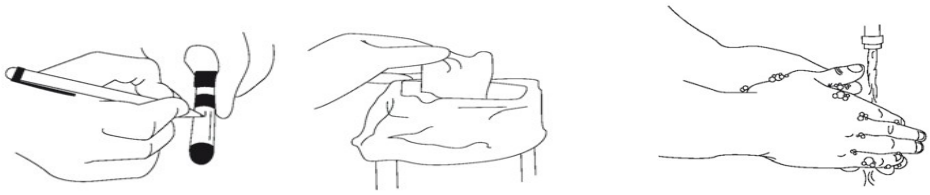
8. Disinfect the site using 70% isopropyl alcohol for 30 seconds and allow to dry completely (30 seconds).
9. Anchor the vein by holding the patient's arm and placing a thumb BELOW the venepuncture site.
10. Enter the vein swiftly at a 30 degree angle.





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 glass into the sharps container. Place items that can drip blood or body fluids into the infectious waste.

16. Remove gloves and place them in the general waste. Perform hand hygiene. If using soap and water, dry hands with single-use towels.

Prevention and management of incidents and adverse events
Recommendation on infection control

Infection control procedures that help to prevent health-care associated infections include:
• Hand hygiene
• Glove use
• Skin antisepsis
• Sterile, single-use blood-sampling devices
• Sharp instrument containers
• Disinfection of surfaces and chairs
• Cleaning and disinfection of tourniquets
• Transportation of laboratory samples in labelled, washable containers
The points listed below contribute to infection control.
• The workplace should be clean, tidy and uncluttered. There should be no sign of blood contamination on the chairs, counters or walls. The working surface should be visibly clean.
• Hand hygiene (hand washing or use of an alcohol rub) should be carried out before wellfitting, non-sterile gloves are put on and after they are removed (*12*).
• Only sterile, single-use blood-sampling devices should be used to take blood.
• Skin at the venepuncture site should be disinfected, taking into consideration the type of specimen, the age and the allergy history of the patient (*6,7,8*).
• Once the procedure has been completed and the blood sample or samples have been put into the laboratory sampling tubes, the used devices should be discarded immediately into a sharps container.
• Specimens should be transported in containers that help to prevent breakage or spillage of blood.

Blood spillage

Blood spillage may occur because a laboratory sample breaks in the phlebotomy area or during transportation, or because there is excessive bleeding during the procedure. In this situation, clean up the spillage and record the incident, using the following procedure.
1. Wear a pair of non-sterile gloves.
2. Use tongs or a pan and brush to sweep up as much of the broken glass (or container) as possible. Do not pick up pieces with your hands.

3. Discard the broken glass in a sharps container. If this is not possible due to the size of the broken glass, wrap the glass or container in several layers of paper and discard it carefully in a separate container. Do not place it in the regular waste container.
4. Use disposable paper towels to absorb as much of the body fluids as possible.
5. Wipe the area with water and detergent until it is visibly clean.
6. Saturate the area again with sodium hypochlorite 0.5% (10 000 ppm available chlorine). This is a 1:10 dilution of 5.25% sodium hypochlorite bleach, which should be prepared daily.
7. Rinse off the tongs, brush and pan, under running water and place to dry.
8. Remove gloves and discard them.
9. Wash hands carefully with soap and water, and dry thoroughly with single-use towels.
10. Record the incident in the incident book if a specimen was lost, or persons were exposed to blood and body fluids.

REFERENCES

1. Lavery I, Ingram P(2005). Blood sampling: best practice. Nursing Standard: 19,55–65.
2. Shahangian S et al (2005). Results of a survey of hospital coagulation laboratories in the United States. Archives of Pathology and Laboratory Medicine: 129,47–60.
3. Wagner D et al (2004). Nosocomial acquisition of dengue. Emerging Infectious Diseases: 10,1872–1873.
4. Galena H (1992). Complications occurring from diagnostic venepuncture. Journal of Family Practice: 34(5),582–584.
5. Norberg A et al (2003). Contamination rates of blood cultures obtained by dedicated phlebotomy vs intra venous catheter. Journal of the American Medical Association: 289(6),726–729.
6. From AAALAC's perspective, alcohol as a disinfectant. AAALAC International, 2001.
7. Calfee D, Farr B (2002). Comparison of four antiseptic preparations for skin in the prevention of contamination of percutaneously drawn blood cultures: a randomized trial. Journal of Clinical Microbiology: 40(5),1660–1665.
8. De Vries J, van Dorp W, van Barneveld P (1997). A randomized control trial of alcohol 70% versus alcoholic iodine 2% in skin disinfection before insertion of peripheral infusion catheters. Journal of Hospital Infection:36,317–320.
9. Chiavetta J et al (2000). Estimated risk of transfusion transmitted infection in the Canadian blood supply (1987–1996). Vox Sanguinis: 78(Suppl 1),360.
10. Moor ACE et al (1999). Transfusion-transmitted diseases: risks, prevention and perspectives.European Journal of Haematology: 62(1),1–8.
11. Rutala W, Weber D, Committee HICPA. Guidelines for disinfection and sterilization in healthcare facilities 2008. Atlanta, GA, Centers for Disease Control and Prevention.
12. WHO guidelines on hand hygiene in healthcare. Geneva, World Health Organization, 2009.
13. WHO guidelines on drawing blood: best practices in phlebotomy. World Health Organization, 2010

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