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Review Article

BASIC PROCEDURE OF VENEPUNCTURE IN PAEDIATRIC AND ADULT PATIENTS: A REVIEW

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ABSTRACT: Venepuncture is the preferred method of blood sampling for term neonates and causes less pain than heel-pricks. The choice of site and procedure (venous site, finger-prick or heel-prick – also referred to as "capillary sampling" or "skin puncture") depends on the volume of blood needed for the procedure and the type of laboratory test to be done. Venepuncture is the method of choice for blood sampling in term neonates; however, it requires an experienced and trained phlebotomist. If a trained phlebotomist is not available, the physician may need to draw the blood sample. The blood from a capillares is similar to an arterial blood in oxygen content, and is suitable for only a limited number of tests because of its higher likelihood of contamination with skin flora and smaller total volume.
Key words: Venepuncture, neonates, finger-prick

INTRODUCTION

Venepuncture

Venepuncture is the preferred method of blood sampling for term neonates and causes less pain than heel-pricks (1).

Materials required:

- Use a winged steel needle, preferably 23 or 24 gauge, with an extension tube (a butterfly):
- Avoid gauges of 25 or more because it may be associated with an increased risk of haemolysis.
- Use a butterfly with either a syringe or an evacuated tube with an adaptor; a butterfly can provide easier access and movement, but movement of the attached syringe may make it difficult to draw blood.
- Use a syringe with a barrel volume of 1–5 ml, depending on collection needs; the vacuum produced by drawing using a larger syringe will often collapse the vein.
- When using an evacuated tube, choose one that collects a small volume (1 ml or 5 ml) and has a low vacuum; this helps to avoid collapse of the vein and may decrease haemolysis.
- Where ever possible, use safety equipment with needle covers or features that minimize blood exposure. Auto-disable (AD) syringes are designed for injection, and are not appropriate for phlebotomy.

Preparation

Ask whether the parent would like to help by holding the child. If the parent wishes to help, provide full instructions on how and where to hold the child; if the parent prefers not to help, ask for assistance from another phlebotomist.
Immobilize the child as described below.

- Designate one phlebotomist as the technician, and another phlebotomist or a parent to immobilize the child.
- Ask both adults to stand on opposite sides of an examination table.
- Ask the immobilizer to:
- Stretch an arm across the table and place the child on its back, with its head on top of the outstretched arm
- Hold the child close, as if the person were cradling the child
- Grasp the child's elbow in the outstretched hand
- Use the other arm to reach across the child and grasp its wrist in a palm-up position (reaching across the child anchors the child's shoulder, and thus prevents twisting or rocking movements; also, a firm grasp on the wrist effectively provides the phlebotomist with a "tourniquet")
- If necessary, take the following steps to improve the ease of venepuncture:
- Ask the parent to rhythmically tighten and release the child's wrist, to ensure that there is an adequate flow of blood.
- Keep the child warm, which may increase the rate of blood flow by as much as sevenfold (2), by removing as few of the child's clothes as possible and, in the case of an infant, by:
- Swaddling in a blanket
- Having the parent or care giver hold the infant, leaving only the extremity of the site of venepuncture exposed.
- Warm the area of puncture with warm cloths to help dilate the blood vessels.
- Use a transilluminator or pocket pen light to display the dorsal hand veins and the veins of the antecubital fossa.

Drawing blood

• Follow the procedures given:

- Aseptic precautions
- Advance preparation
- Patient identification and positioning
- Skin antisepsis (but DO NOT use chlorhexidine on children under 2 months of age).
- Once the infant or child is immobilized, puncture the skin 3–5 mm distal to (i.e. away from) the vein (3); this allows good access without pushing the vein away.
- If the needle enters alongside the vein rather than into it, withdraw the needle slightly without removing it completely, and angle it into the vessel.
- Draw blood slowly and steadily.

Capillary sampling

Choice of procedure and site

The choice of site and procedure (venous site, finger-prick or heel-prick – also referred to as "capillary sampling" or "skin puncture") depends on the volume of blood needed for the procedure and the type of laboratory test to be done. Venepuncture is the method of choice for blood sampling in term neonates (4, 5); however, it requires an experienced and trained phlebotomist. If a trained phlebotomist is not available, the physician may need to draw the blood sample.

The blood from a capillares is similar to an arterial blood in oxygen content, and is suitable for only a limited number of tests because of its higher likelihood of contamination with skin flora and smaller total volume.

Finger and heel-prick

Whether to select a finger-prick or a heel-prick will depend on the age and weight of the child. Patient immobilization is crucial to the safety of the paediatric and neonatal patient undergoing phlebotomy, and to the success of the procedure. A helper is essential for properly immobilizing the patient for venepuncture or finger-prick.

Patient identification

- For paediatric and neonatal patients, use the methods described below to ensure that patients are correctly identified before withdrawing blood.
- Use a wrist or foot band only if it is attached to the patient. DO NOT use the bed number or a wrist band that is attached to the bed or cot.
- If a parent or legal guardian is present, ask that person for the child's first and last name.
- Check that the name, date of birth, hospital or file numbers are written on the laboratory form and match them to the identity of the patient.

Indications for skin puncture:

Skin puncture is a practical alternative to venepuncture if the desired test can be done on a small amount of blood.

Following are the indications

- Adults and children who doesn't have accessible veins
- Available veins are fragile (eg: old age) and must be saved for other procedures like chemotherapy
- Sever burns
- Extreme obesity
- Patient has thrombotic or clot forming tendencies
- Obtaining blood for glucose estimation by glucometer
- Skin puncture is the preferred way to obtain blood from infants and very young children
- Capillary blood is the preferred specimen for newborn screening

Capillary puncture should not be performed under the following conditions

- Through the posterior curvature of the heel, because it can injury the bone
- Heel of a child who has just began walking
- Patient who has callous development
- Fingers of neonates, because it can cause nerve damage
- Previous puncture sites
- Inflamed, swollen or edematous tissues
- Cyanotic or poorly perfused tissues
- Localized areas of infection

Choice of site

Adult patients

The finger is usually the preferred site for capillary testing in an adult patient. The sides of the heel are only used in paediatric and neonatal patients. Ear lobes are sometimes used in mass screening or research studies.

Paediatric and neonatal patients

Selection of a site for capillary sampling in a paediatric patient is usually based on the age and weight of the patient. If the child is walking, the child's feet may have calluses that hinder adequate blood flow. Table shows the conditions influencing the choice of heel or finger-prick.

Conditions influencing the choice of heel or finger-prick

Condition	Heel-prick	Finger-prick
Age	Birth to about 6 months	Over 6 months
Weight	From 3–10 kg, approximately	Greater than 10 kg
Placement of lancet	On the medial or lateral plantar surface	On the side of the ball of the finger perpendicular to the lines of the fingerprint
Recommended finger	Not applicable	Second and third finger (i.e. middle and ring finger); avoid the thumb and index finger because of calluses and avoid the little finger because the tissue is thin

Selecting the length of lancet

Adult patients

A lancet slightly shorter than the estimated depth needed should be used because the pressure compresses the skin thus, the puncture depth will be slightly deeper than the lancet length. In one study of 52 subjects, pain increased with penetration depth, and thicker lancets were slightly more painful than thin ones (6). However, blood volume increased with the lancet penetration and depth.

Lengths vary by manufacturer (from 0.85 mm for neonates up to 2.2 mm). In a finger-prick, the depth should not go beyond 2.4 mm, so a 2.2 mm lancet is the longest length typically used.

Paediatric and neonatal patients

In heel-pricks, the depth should not go beyond 2.4 mm. For premature neonates, a 0.85 mm lancet is available.

- The distance for a 7 pound (3 kg) baby from outer skin surface to bone is:
- Medial and lateral heel – 3.32 mm
- Posterior heel – 2.33 mm (this site should be avoided, to reduce the risk of hitting bone)
- Toe – 2.19 mm.
- The recommended depth for a finger-prick is:
- For a child over 6 months and below 8 years – 1.5 mm;
- For a child over 8 years – 2.4 mm.
- Too much compression should be avoided, because this may cause a deeper puncture than is needed to get good flow.

Order of draw

With skin punctures, the haematology specimen is collected first, followed by the chemistry and blood bank specimens. This order of drawing is essential to minimize the effects of platelet clumping. The order used for skin punctures is the reverse of that used for venepuncture collection. If more than two specimens are needed, venepuncture may provide more accurate laboratory results.

Procedure for capillary sampling

Adult patients

Prepare the skin

- Apply alcohol to the entry site and allow to air dry
- Puncture the skin with one quick, continuous and deliberate stroke, to achieve a good flow of blood and to prevent the need to repeat the puncture
- Wipe away the first drop of blood because it may be contaminated with tissue fluid or debris (sloughing skin).
- Avoid squeezing the finger or heel too tightly because this dilutes the specimen with tissue fluid (plasma) and increases the probability of haemolysis (7).
- When the blood collection procedure is complete, apply firm pressure to the site to stop the bleeding.

Paediatric and neonatal patients

Immobilize the child

First immobilize the child by asking the parent to:

- Sit on the phlebotomy chair with the child on the parent's lap
- Immobilize the child's lower extremities by positioning their legs around the child's in a cross-leg pattern
- Extend an arm across the child's chest, and secure the child's free arm by firmly tucking it under their own
- Grasp the child's elbow (i.e. the skin puncture arm) and hold it securely
- Use his or her other arm to firmly grasp the child's wrist, holding it palm down.

Prepare the skin

• Prepare the skin as described above for adult patients.

•DO NOT use povidone iodine for a capillary skin puncture in paediatric and neonatal patients; instead, use alcohol, as stated in the instructions for adults.

Puncture the skin

I. Puncture the skin as described above for adult patients.
II. If necessary, take the following steps to improve the ease of obtaining blood by finger-prick in paediatric and neonatal patients
III. Ask the parent to rhythmically tighten and release the child's wrist, to ensure that there is sufficient flow of blood;
IV. Keep the child warm by removing as few clothes as possible, swaddling an infant in a blanket, and having a mother or caregiver hold an infant, leaving only the extremity of the site of capillary sampling exposed.
V. Avoid excessive massaging or squeezing of fingers because this will cause haemolysis and impede blood flow (7).

Give follow-up care

There are two separate steps to patient follow-up care – data entry (i.e. completion of requisitions) and provision of comfort and reassurance.
Data entry or completion of requisitions
• Record relevant information about the blood collection on the requisition and specimen label; such information may include:
  a. Date of collection
  b. Patient name
  c. Patient identity number
  d. Unit location (nursery or hospital room number)
  e. Test or tests requested
  f. Amount of blood collected (number of tubes)
  g. Method of collection (venepuncture or skin puncture)
  h. Phlebotomist's initials

Comfort and reassurance
Show the child that you care either verbally or physically. A simple gesture is all it takes to leave the child on a positive note; for example, give verbal praise, a handshake, a fun sticker or a simple pat on the back.
A small amount of sucrose (0.012–0.12 g) is safe and effective as an analgesic for newborns undergoing venepuncture or capillary heel-pricks (8).

Unsuccessful attempts in paediatric patients

Adhere strictly to a limit on the number of times a paediatric patient may be stuck. If no satisfactory sample has been collected after two attempts, seek a second opinion to decide whether to make a further attempt, or cancel the tests.

Complications

Complications that can arise in capillary sampling include:
• Collapse of veins if the tibial artery is lacerated from puncturing the medial aspect of the heel
• Osteomyelitis of the heel bone (calcaneus) (9)
• Nerve damage if the fingers of neonates are punctured (10)
• Haematoma and loss of access to the venous branch used
• Scarring
• Localized or generalized necrosis (a long-term effect)
• Skin breakdown from repeated use of adhesive strips (particularly in very young or very elderly patients) – this can be avoided if sufficient pressure is applied and the puncture site is observed after the procedure.

NOTE:
• DO NOT use a surgical blade to perform a skin puncture.
• DO NOT puncture the skin more than once with the same lancet, or use a single puncture site more than once, because this can lead to bacterial contamination and infection.

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