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SEED HAEMATOLOGY

# Pre-analytics: create the correct preconditions to achieve high-quality analysis results – part II

Phlebotomy – the drawing of blood – is one of the most common invasive procedures in healthcare. Each step in the process of phlebotomy affects the quality of the specimen and is thus important for preventing laboratory error and patient injury.

This document provides guidance on blood sampling and reiterates the accepted principles for drawing and collecting blood [1].

## Final preparations before blood sampling [1]

**1. Patient preparation**

a. Inform the patient in an easy-to-understand way about the action and its purpose, this helps to reduce fears and stress.
b. Please consider the administration of medication and the observance of a certain diet. Additionally, the patient should be fasting for blood sampling (except for emergency diagnostics).
c. Choose the puncture site. If necessary, warm puncture site to increase circulation.

**2. Patient identification**

a. A correct patient identification is the highest priority: name, surname, date of birth, maybe ward, room number, etc.
b. The patient's identity should be verified by asking the patient to identify him- or herself, when it is practical to do so.

**3. Sample identification**

a. Samples without a clear identification should never be analysed. The barcode labels on the primary tubes enforce a safe identification.
b. Only use waterproof markers for the tubes.
c. Additives, such as anticoagulants, clot activators or gel, are labelled by a colour code of the sample tube.

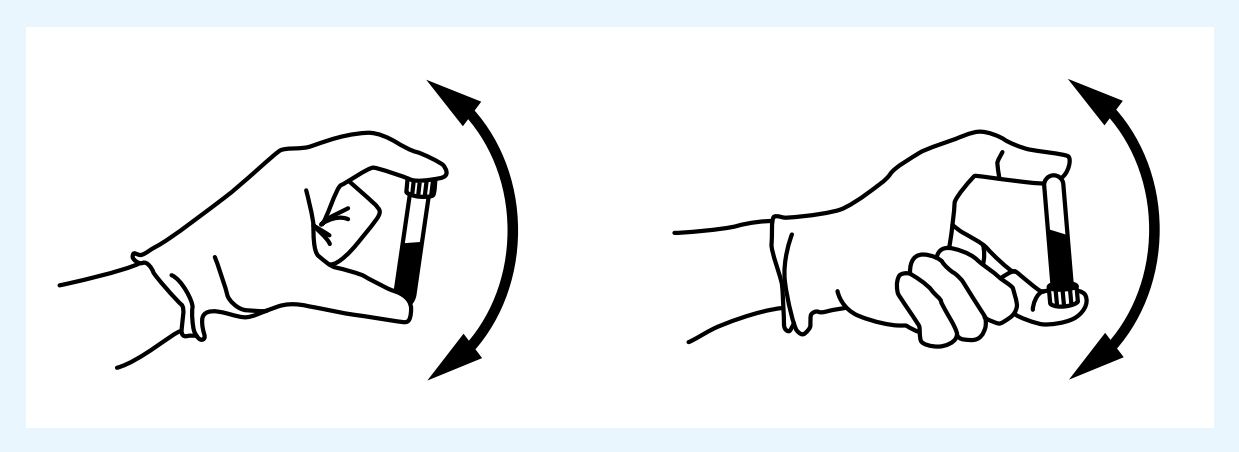

***Fig. 1*** *Ensure sufficient mixing of the tube right after filling.*

## Venous blood sampling [1]

Basically, all superficial veins of antecubital fossa or forearm are suitable.

1. Locate a vein of a good size that is visible, straight and clear.
2. Apply the tourniquet about 4 – 5 finger widths above the venepuncture site and re-examine the vein.
3. Unless drawing blood cultures, for prepping for a blood collection, clean the site with a 70 % alcohol swab for 30 seconds and allow to dry completely (30 seconds) – do not touch the puncture site anymore.
4. Remove the protective cover from the cannula and hold the cut of it upwards.
5. 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.
6. 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.
7. Withdraw the needle gently and apply gentle pressure to the site with a clean gauze or dry cotton-wool ball.
8. 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.
9. Anticoagulant tubes must be turned (see Fig. 1) immediately for the required number of times (as specified by the tube manufacturer).
10. Apply bandage.
11. Label the tube in such a way that the content is still visible and the fill level can be checked.

## Tips and tricks – venous blood sampling

- Wearing gloves during blood sampling is obligatory to protect oneself.
- Attention has to be paid to blood sampling from an intravenous catheter. This often results in a contamination of the specimen, e. g. with heparin or glucose, and false results as well as dilution effects can be frequently seen.
- Avoid prolonged blood stasis as this causes falsely elevated results due to haemoconcentration.
- All tubes containing additives (except sodium citrate) should be gently and sufficiently inverted to mix the contents [2], unless otherwise specified by the manufacturer. (Tubes containing sodium citrate should be inverted three to four times to mix the content.) In order to perform sufficient mixing, the vial should be held in upright position and gently inverted by 180° and back as shown in Fig. 1.
- It is important to follow the tube manufacturer's recommendations to fill the tubes to the respective marking to ensure proper additive-to-blood ratios, which helps minimising potential assay interference.

## Capillary blood

Capillary blood is blood that is obtained by skin puncture or incision that contains a mixture of undetermined proportions of blood from arterioles, venules and interstitial and intracellular fluids [3]. The relative composition depends, for instance, on the circulation of the puncture site.

Cell concentrations measured in capillary blood are not identical to those from venous blood. Some studies have shown no significant difference between an individual's capillary and venous blood values for haematocrit (HCT), red blood cells (RBC), white blood cells (WBC), mean cell volume (MCV) and platelets (PLT), others have reported discrepancies in the HCT [3].

Typically, skin puncture specimens may be collected through the collector top of a micro-collection device or by capillary action into a capillary tube. Micro-collection devices and capillary tubes with different bore sizes and capacities are available, depending on the laboratory testing requirements.

## Capillary blood sampling [1, 3]

1. Choose the puncture site. Promote circulation by warming, if applicable.
2. Disinfect the site with a 70 % alcohol swab for 30 seconds and allow to dry completely (30 seconds) – do not touch the puncture site anymore.
3. Fix the patient's finger or foot with the correct handgrip.
4. 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.
5. Wipe away the first drop of blood because it may be contaminated with tissue fluid or debris.
6. Touch with the tip of the micro-collection device (or the capillary tube) the second drop of blood, which is formed over the puncture area.
7. Blood will flow into the tube by capillary action (in case you are using a capillary tube, you have to hold it upright afterwards to allow the blood flow into the collection tube).
8. When the blood collection procedure is complete, apply firm pressure to the site to stop the bleeding.
9. Mix the sample thoroughly but gently according to the manufacturer's instructions.

## Tips and tricks – capillary blood sampling

- Certain disinfectants (e.g. perchloric acetic acid) can substantially change the cell morphology. Insufficient drying of the puncture site can lead to haemolysis or dilution of the sample.
- Be sure that before puncturing you have carefully wiped the relevant area and you have removed any cream which was used to increase the microcirculation.
- With skin punctures, the haematology specimen is collected first, followed by the chemistry and blood bank specimens. This order of drawing is essential to minimise the effects of platelet clumping [1].
- In case that the blood flow is not adequate, the phlebotomist might massage and squeeze the puncture site. Strong squeezing can also result in haemolysis [3].
- Tubes should be filled up to the recommended volume.
- Mix capillary sampling tubes sufficiently – do not shake! Adequate mixing is important to avoid the formation of platelet aggregates, microclots and haemolysis [3], which can influence the lab results.

## Conclusion

In part I of 'Pre-analytics: create the correct preconditions to achieve high-quality analysis results' we indicated the importance of the pre-analytical variables and their effects on haematology testing.

In this part we provided guidance on blood sampling and reiterated the accepted principles for drawing and collecting blood.

The 'take-home message' is that by minimising the incidence of pre-analytical errors, patient care could be optimised, laboratory costs reduced and the relationship between physician and laboratory enhanced.

## References

*[1]* ***WHO guidelines on drawing blood: best practices in phlebotomy*** *(2010): http://apps.who.int/iris/bitstream/10665/44294/1/9789241599221_eng.pdf (accessed on 09.02.2016).*

*[2]* ***Clinical and Laboratory Standards Institute (CLSI)*** *(2010): GP44 – A4: Procedures for the Handling and Processing of Blood Specimens for Common Laboratory Tests; Approved Guideline – Fourth Edition.*

*[3]* ***Clinical and Laboratory Standards Institute (CLSI)*** *(2008): H04 – A6: Procedures and Devices for the Collection of Diagnostics Capillary Blood Specimens; Approved Standard – Sixth Edition. Vol 28 No 25.*



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