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VACUETTE[®] Blood Collection Techniques



Dr. Martin Dittmann

An Informative Guide
to Blood Collection

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Preface

Even today, formal education and studies rarely cover blood collection technique, even though this is an area which is particularly critically observed by patients. It is therefore of some importance, that the best possible and most steady technique is applied in every situation.

Before taking a blood sample, it is extremely important to be fully familiar with the collection system being used. It does not just make an unprofessional impression to fiddle about with the blood collection equipment, it will make the patient feel increasingly anxious, which will have a negative influence on the condition of the veins. In order to know how it really is, it is recommendable for new phlebotomists to begin by taking a blood sample from him or herself!

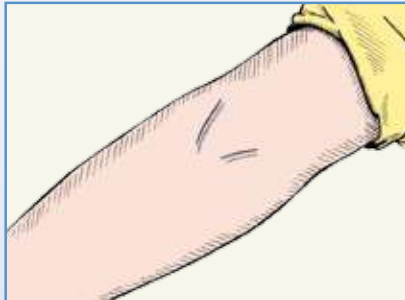
This guide should help you to quickly get used to the technique, and to avoid unnecessary errors. The required skills can only be obtained by consistent training.

Equipment Required for Blood Collection

- | | |
|--|--|
|  Blood collection system: VACUETTE® |  Swab |
|  Tourniquet |  Disinfectant |
|  Disposable gloves |  Plasters |

Vein Selection: Priority List

1. Median antecubital veins



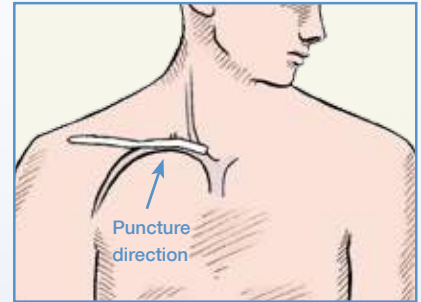
2. Dorsal hand veins



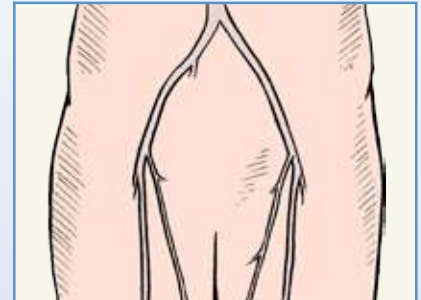
3. Foot veins



4. Subclavian vein



5. Femoral vein or artery



Inspection

Before deciding on a puncture site, an inspection of all possible areas is imperative. The order of inspection should correspond to the list of priority sites, whereby the first and second sites should be suitable in 95% of the cases. The back of the foot can be quite painful, and is not popular amongst patients. Puncture of the subclavian vein or the femoral vein / artery requires a special blood collection technique, and should only be considered if there is no better alternative, and should only be carried out by experienced personnel.

Measures to Improve Prominence of Vein

1. Incline the arm in a downward position



2. Stroke the vein in a distal direction



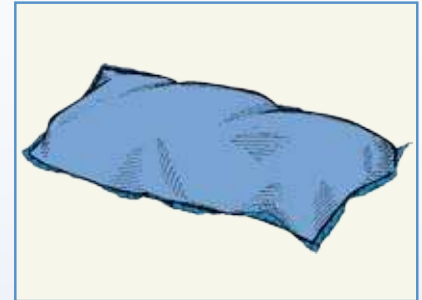
3. Clench the fist



4. Tap the vein



5. Warm the area (bathe arm or use a heating pad)



6. Skin patch with local anaesthetic



Applying the Tourniquet

A standard tourniquet or blood pressure cuff is applied about one hand breadth above the anticipated puncture site.

The stasis should not cause the patient any pain, and systolic blood pressure should be reduced by around 20 - 30 mm Hg, so that arterial blood flow remains as normal. For a normal healthy person with a systolic blood pressure of 120 - 130 mm Hg, the pressure from the tourniquet should be around 100 mm Hg, and should not last for longer than one minute (to avoid falsifying laboratory results).

If a longer stasis is required, then the tourniquet should be loosened occasionally, if the skin becomes discoloured. Once the skin around the puncture site has returned to its normal colour, the tourniquet can be reapplied.

If the tourniquet has been applied too tightly, the extremities will take on a blue colour, and it should be released immediately until the skin returns to its normal colour. The ideal stasis is as short as possible, and should not last longer than one minute. If the blood flow is insufficient for specimen collection, the tourniquet can be reapplied lightly during the collection procedure.

Disinfecting the Puncture Site

The puncture site should be disinfected thoroughly. It is not enough to wipe over the puncture site with disinfecting solution once, and venipuncture may not be carried out immediately, because some time is necessary for the disinfection to take effect.

The skin should be cleansed with a disinfection solution using a circular motion moving outwards.

For standard blood collection, reduction of bacteria in skin flora takes place after about 15 - 30 seconds* when an alcoholic solution is used.



If puncture is planned with an intravascular catheter, the effect takes place after about 1 minute and furthermore, the puncture site should be covered up with a sterile swab, and mouth protection, cap as well as a sterile laboratory coat must be worn.

It is obligatory to wear disposable gloves for every venipuncture (NB: risk of infection with hepatitis, HIV).

*If applicable, please refer to the manufacturer's instructions



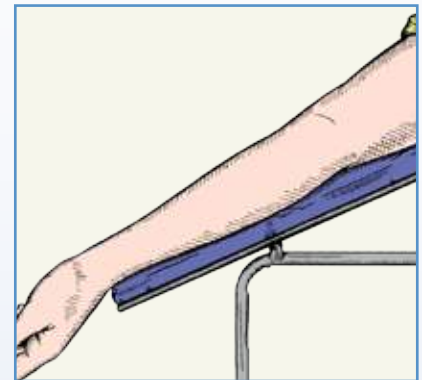
Routine Puncture Sites

Puncture site: median antecubital veins

This is the most popular site for venipuncture!

It is always worth taking time to inspect both arms, to be able to choose the arm with the most prominent veins.

If the patient has a particular preference for a puncture site, then this should be heeded whenever possible.



It is of utmost importance, that the patient is relaxed and sitting comfortably (or if convenient lying). The arm should be extended across a suitable padded armrest.

The vein calibre of a healthy, relaxed adult varies in diameter from 5 - 10 mm.

Light hand pressure on the upper arm should cause the veins to dilate significantly. Palpation of the vein can at this point be carried out without wearing gloves.

The arm should be placed on the cushion so that the area for venipuncture is hyperextended.

Puncture site: Dorsal hand veins

A right handed person should use his/her left hand to take the patient's hand intended for venipuncture, pulling the skin in a downward direction until taut.



The needle or blood collection set is inserted into the middle of the targeted vein, at an angle of 10 - 20 degrees. As soon as the blood flow starts, the tourniquet can be released.

Ideally, a blood pressure cuff can be used to measure the reduction of the systolic blood pressure by 30 mm Hg.



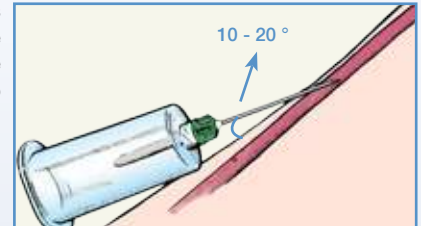
The forefinger should be used to check the prominence of the vein, and to make sure that veins are not under too much pressure (arterial puncture). The area is then thoroughly disinfected.



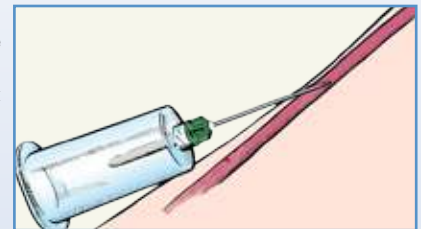
Using the left hand, the skin below the tourniquet is pulled to the sides of the underarm.



This reduces the chance of veins rolling away from the needle. The puncture is carried out with the right hand, at an angle of 10 to 20 degrees.



After 10 - 15 mm, the vein lumen should have been reached. If the needle penetrates any further, this would probably mean that the target has been missed.





The puncture hand should continue to hold the puncturing device. After some practice, it is possible to sense a “click” when the vein wall has been penetrated.

Unnecessary hand changes should be avoided. Any jerky movements with the needle in the vein may cause additional pain. With the left hand an evacuated tube is inserted into the holder.

As soon as blood begins to flow, the tourniquet is released. In case the blood flow lightens considerably, the tourniquet can be reapplied briefly.



Alternative Puncture Sites

Puncture: Foot veins

The tourniquet is positioned a handbreadth above the site for venipuncture. After tightening the skin, a blood collection set is used to penetrate the vein (at an angle of 10 to 20 degrees).

If the blood flows into the thin plastic tubing on the end of the blood collection set, the needle position is correct.

Puncture: Subclavian veins

Puncture of the subclavian vein is almost always in conjunction with the set-up of a central catheter.

Puncture of the subclavian vein purely for blood collection reasons is very unusual and is subject to very restricted indications.

The range between the sternoclavicular joint and shoulder joint is divided into three equal areas. The patient is asked to relax as best as possible. The patient's head is then turned slightly to the opposite side, without stretching.

An assistant pulls the arm on the venipuncture side towards the caudal, making sure that the patient does not become tense. After applying a little local anaesthetic, the needle is inserted in the transition area between the first to the second directly on the clavicle.

The needle must always be in direct contact with the clavicle. The needle should be lowered to skin of the chest immediately up on penetration, with the needle tip pointing towards the jugulum. For a patient of normal weight, the subclavian vein is reached after 2 to 3.5cm (max.). If this is not the case, then the penetration was not directly on the clavicle.

The subclavian vein is always open, even when a patient is in shock.

As is the case with all punctures of the upper caval vein, depending on skill as well as chance, there is always a risk of pneumothorax.

For this reason, the puncture should only be carried out by personnel experienced and competent enough to deal with any complications that could arise (e.g. closed pleural drainage).

Puncture: Femoral artery or vein

Puncture of the femoral artery is simple, if the infrainguinal artery has been palpated. Anchor the artery between the forefinger and middle finger of the left hand. After applying a local anaesthetic solution to the skin, the needle is inserted in the vessel vertically. By lightly moving the needle, it can be determined if the centre of the artery has been reached. If the needle deviates in direction, this can now be corrected, so that the tip is directly on the artery. The needle tip is then tilted towards the cranial (75 degrees), penetrating the vessel wall, so that pulsating light red blood flows.

The procedure for puncture of the femoral vein, which is directly next to the artery, is practically identical. However, in this case the blood is not quite so red and does not pulsate in the same way.

Factors Leading to Difficult Vein Conditions

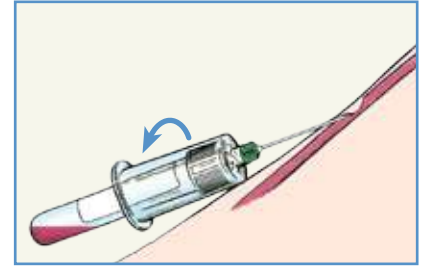
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|------------------------------|-------------------------------------|
| ⤵ Anxiety | ⤵ Delicate veins (children / woman) |
| ⤵ Cold | ⤵ Poor hydration |
| ⤵ Vasoconstriction of veins | ⤵ Pre-shock or shock |
| ⤵ Thin veins | ⤵ Brittle veins |
| ⤵ Repeatedly punctured veins | ⤵ Long term treatment with steroids |
| ⤵ Sclerosed veins | ⤵ Cachexia |
| ⤵ Rolled veins | |

The above list of possible unfavourable factors is by no means complete. It is a well-known fact, that there are a number of adverse situations that can make blood collection difficult.

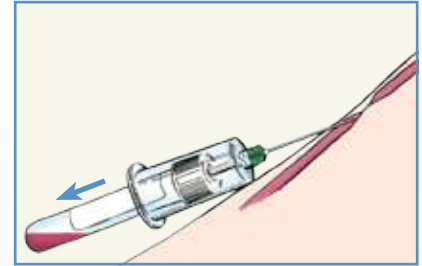
Every step that can lead to vasoconstriction on a patient is a hindrance. Comments such as "You've got bad veins" are not very helpful, and serve more to express helplessness of the blood collector. The first priority is to reduce the patient's anxiety, which is the main cause of vasoconstriction. A calm atmosphere is of prime importance. A hectic mood, a cold room or personnel with cold hands can lead to vasoconstriction. If a patient would prefer to lie down or if a particular venipuncture site is preferred, these wishes should be fulfilled whenever possible.

Nevertheless, even if the puncture is carried out correctly, suction of the needle tip to the vein wall may still occur. This can be corrected by rotating the needle slightly in the vein lumen.

If this is insufficient, the evacuated tube must be pulled out of the holder until the cap is no longer penetrated by the rear end of the needle.



The suction from the vein is then released, and the tip of the needle is freed from the vein wall. The same evacuated tube can now be successfully reapplied. If this still does not work, then use of a blood collection set is to be recommended.

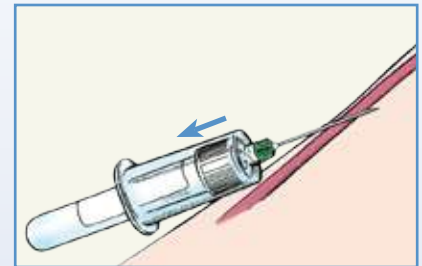


Helpful Hints for Blood Collection

After removing the rear protective cover, the double-ended blood collection needle is threaded into the holder. The front protective cap is removed before puncture. For hygienic reasons as well as to protect against infection, gloves are required.

The blood collection equipment is held between forefinger, middle finger and thumb.

The hand carrying out the venipuncture is not to be swapped during the procedure, in order to ensure that the system is securely attached to the patient's hand or arm. After penetrating the vein, the free hand is used to push the evacuated tube into the holder.



If the needle is in the correct position, blood flows into the tube. If there is no blood flow, a frequent cause is that the needle tip is no longer in the vein lumen. Lightly pulling back the needle and correcting the needle tip can remedy this.

Blood Collection From a Venous or Arterial Catheter

Blood collection with a catheter is a possibility, but is only recommended on certain conditions, using a venous catheter. Good patency and optimal care are the essential requirements for this.

Depending on the length and type of catheter, 5 - 10ml blood are taken and disposed of either using a syringe or a **VACUETTE®** Blood Collection Tube (Discard Tube). This ensures that the line is free of flush-out solutions etc. If the manual aspiration using a syringe was without problems, then the following blood collection using an evacuated tube should also be straightforward. The evacuated tube is connected directly to the catheter via a Luer adapter.

After collection, the catheter should be rinsed thoroughly using a physiological saline solution (20ml NaCl 0.9%) to prevent any blockages.

Procedure After Blood Collection

Nothing is more unsightly than a bruise after blood collection. The phlebotomist is, to a certain extent, judged on successful penetration, and the extent of any bruising afterwards.

This complication can largely be avoided. Before removing the needle from the vein, the tube is removed from the holder. The tourniquet should already have been released completely - this should be made sure of!



This is followed by compression using a sterile swab.

If the compression is too heavy when the needle is still being pulled out of the vein, the vein wall could be slit, injuring the vein. This can lead to a large haematoma at the puncture site. The compression must be carried out directly after removing the needle. Taking normal coagulation time into account, 2 - 4 minutes time for compression is necessary to prevent a haematoma from forming.

This must be explained to the patient, as it is he/she who profits from this measure.

If the patient is too weak, the phlebotomist or assistant should make sure that compression is carried out adequately.

A sterile adhesive plaster should only be applied, when compression is complete. If the antecubital area has been punctured, the arm should be held upwards, without bending. A bent arm could once again cause stasis, and thus lead to formation of a haematoma.



For patients undergoing anticoagulation therapy, good manual compression is essential. Rather a minute too long than a minute too short!

Physical exertion should not follow blood collection too soon, e.g. sawing, hammering, even climbing stairs. This could lead to formation of a haematoma.

Blood Collection With Small Children

Technically speaking, blood collection with children from around 2 years and onwards is not that different to blood collection with adults.

The collection equipment must be suitable for the smaller dimensions of the vessels. Above all, a calm and friendly atmosphere is extremely important for the young patients.

Children are far more cooperative, if the procedure has been explained to them.

Application of a local anaesthetic patch on the area intended for venipuncture about an hour beforehand is very important for ensuring that the puncture procedure is as harmonious as possible. The situation can be made easier, if the child is sitting on the mother's lap or on the lap of an assistant. Puncture on the back of the hand or in the antecubital area is to be carried out using a small bore vein set. Evacuated tubes with a reduced volume are used. It is very important to hold the arm steady, as reflex movements to escape must be reckoned with.

Puncture in the antecubital area

For venipuncture in the antecubital area, the assistant holds the upper arm of the child, the grip acting at the same time as a tourniquet. If the arm circumference is already too big, a child's tourniquet can be used. With the left hand, the phlebotomist pulls the skin in this area taut. With the right hand, the needle of a blood collection set is inserted into the vein at an angle of approx. 15 degrees. The vein area should no longer be sensitive to pain due to the application of a local anaesthetic patch. When the vein has been reached, and blood flow can be seen in the plastic tubing of the collection set, the grip with the left hand can be released. The tube holder can then be connected to the blood collection set, and a **VACUETTE**[®] tube with reduced vacuum can be inserted. The assistant or accompanying parent makes sure that the child remains as calm and quiet as possible during the whole procedure.

Dorsal vein puncture

The stasis should be carried out by the assistant, preferably gripping firmly around the arm a handbreadth above the wrist. The fingers are held with the left hand, and pulled downwards, so that the skin on the back of the hand is taut. The needle should be inserted at an angle of 10 to 20 degrees. The limb should be held firmly during the whole venipuncture procedure, in order to avoid jerky movements that could pull the needle out of the vein.

Foot vein puncture

Puncture of a foot vein is carried out after stasis by an assistant's hand grip. The toes are pulled downwards, and the skin on the back of the foot is pulled taut. The puncture is carried out very tangentially using a blood collection set. As soon as blood begins to flow, a low-volume **VACUETTE**[®] Blood Collection Tube is attached.



Blood Collection With Neonates and Infants

Scalp vein puncture

Using a cloth, the infant's arms are fastened to his/her body, to prevent defensive movements. By combing through the hair on the scalp, the best suitable vein can be located.



An assistant holds the head firmly but gently, fixing the scalp area where the intended vein for puncture is. Using both hands, the hair is parted, and the skin of the scalp below pulled taut. The vein can then be pressed with the fingers.



The phlebotomist spreads his fingers of the left hand across the scalp, keeping the skin taut to avoid rolled veins. After disinfection, the vein is punctured very tangentially using a small dimension blood collection set (angle 5 - 10 degrees).



As soon as the blood flows, a **VACUETTE**[®] Blood Collection Tube is inserted. When the tube is full, it is first removed from the holder and then the blood collection set can be removed. Using a sterile swab, light pressure is placed on the puncture site for at least 2 minutes, until the blood flow has stopped. The infant is then placed in an upright position and is soothed.

Safety Aspects During Blood Collection

Due to the high risk of infection (e.g. HIV, hepatitis), great care should be taken to ensure correct application of materials and equipment, taking particular care to avoid distractions or loss of attention.

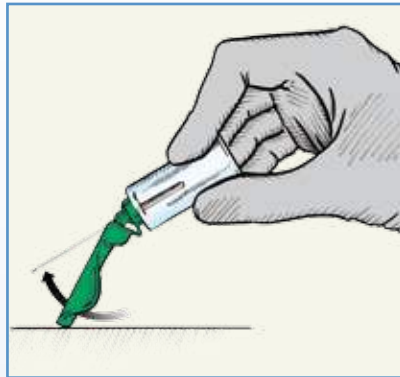
Use of thick-walled plastic tubes

By using thick-walled plastic tubes (PET) instead of glass, the risk of tube breakage and thus injury due to glass splinters is virtually eliminated.

VACUETTE® QUICKSHIELD Safety Tube Holder

The **VACUETTE® QUICKSHIELD** Safety Tube Holder is especially suitable for use on isolation wards and for application in making safe diagnoses of HIV, hepatitis etc.

When using this holder, blood collection is carried out as usual. When the last tube has been filled, withdraw the needle carefully from the vein.



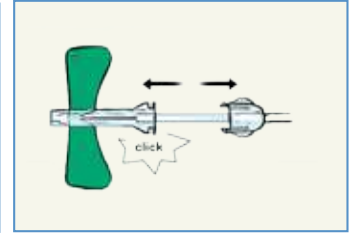
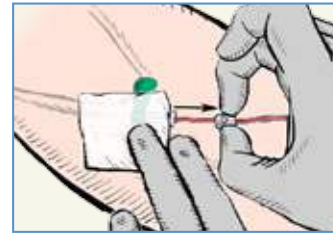
With the aid of a solid support, the needle is enclosed with the protective shield attached to the holder.

An audible “click” signifies to the user, that the safety shield has been properly activated.

VACUETTE® Safety Blood Collection Set

After using the safety blood collection set, the safety mechanism is activated in the patient’s vein.

Whilst removing the tube, a dry, sterile swab and one wing of the set is held by the fingers of one hand.



With the other hand, the trigger mechanism is released and locked in place, by pushing together both sides of the stopper. The slide is then pulled back until a click indicates that the safety mechanism has been correctly activated.

VACUETTE® PREMIUM Safety Needle System

The safety mechanism is activated automatically when pressed against the skin. The safety shield can then move freely, enclosing the needle via the spring mechanism as it is withdrawn from the vein. Features of the system are extreme comfort and maximum safety.

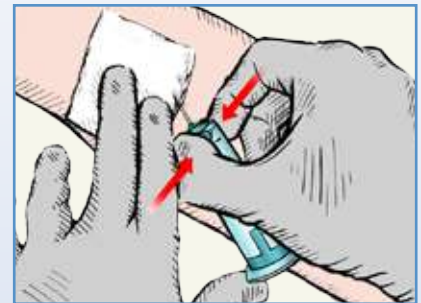


In addition to the „skin-touch“ activated product version, there is the „tube-touch“ activated version. As soon as the tube is inserted into the holder, the safety mechanism is automatically activated.

Available at the end of 2009.

VACUETTE® TIPGUARD Safety Tube Holder with automatic needle withdrawal

After completion of blood collection, the last tube is gently removed. Holding the holder with one hand, the safety retractable mechanism is activated by pressing in both sides of the hub.



The used needle is then enclosed in the holder and can be disposed of with absolutely no risk of danger.

Laboratory Requirements








From the laboratory's point of view, the stasis should always be as short as possible (NB: laboratory values can be falsified, if the stasis is too long).

A long stasis can in particular have an effect on the protein values, the cell count, lipids and on other substances bound to protein.

Furthermore, excessive application of the tourniquet can lead to haemolysis.

To prevent potassium values from increasing, excessive handling of the veins, for example heavily tapping the veins, should not be carried out routinely. This should only be applied in special cases.

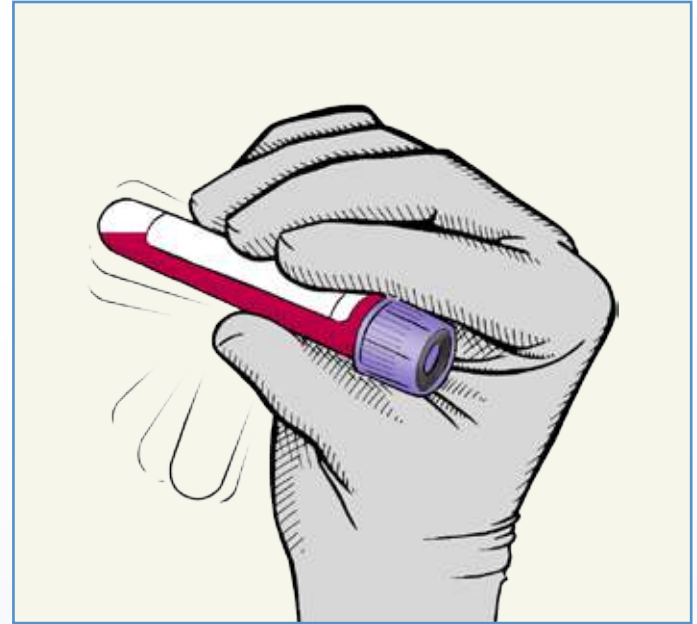
Tubes containing anticoagulants should be drawn last. This prevents impurities from anticoagulants occurring in other samples.

-  Blood culture tubes*
-  Citrate tubes** for coagulation diagnostics
-  Serum tubes with and without gel
-  Heparin tubes with and without gel
-  EDTA tubes
-  Glucose tubes
-  Others

* In cases where blood culture tubes are not required, GBO recommends no-additive tubes.

** When drawn first then only suitable for routine tests (i.e. PT and aPTT).

Coagulation tubes should be fully inverted (180°) 4 times after filling, and all other tubes 8 times. To obtain the full effect of anticoagulants, a thorough mixing is necessary. The air bubble should move from one end to the other, and then back again, for a full inversion.



Incorrect collection from venous catheters can lead to contamination from infusion solutions or dilution.

Complaints about incorrect laboratory values can usually be led back to the blood collection procedure. Clear labelling of samples with patient data is essential. Any labels attached should not block view of blood as it flows into tube. The tubes should be transferred to the laboratory immediately after blood collection.

These guidelines are our recommendations. The protocol of your own facility should be adhered to at all times.

Dr. Martin Dittmann

Graduated in medicine from the "Free University of Berlin". Specialist training as anaesthetist and intensive care specialist at University Clinics in Basel and Cardiff. Deputy manager of Intensive Care Ward at Basel Canton Hospital. Qualification as university lecturer in Basel. Head of department of anaesthesia and intensive care at the Bad Säckingen District Hospital. Currently specialist for eye anaesthesia at the Institute of Ophthalmology (IOA) in Alicante, Spain.

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Responsible for contents/copyright: Dr. Martin Dittmann
Translated by Claire Wiesner
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For further information, please visit our website www.gbo.com/preanalytics or contact us:

Austria

Greiner Bio-One GmbH
Phone (+43) 75 83 67 91-0
Fax (+43) 75 83 63 18
E-Mail office@at.gbo.com

Belgium

Greiner Bio-One BVBA/SPRL
Phone (+32) 24 61 09 10
Fax (+32) 24 61 09 05
E-Mail info@be.gbo.com

Brazil

Greiner Bio-One Brasil
Phone (+55) 19 34 68 96 00
Fax (+55) 19 34 68 96 21
E-Mail office@br.gbo.com

Egypt

Greiner Bio-One Middle East
Phone (+20) 26 21 87 06
Fax (+20) 26 21 87 08
E-Mail hisham.ouda@gbo.com

France

Greiner Bio-One SAS
Phone (+33) 1 69 86 25 50
Fax (+33) 1 69 86 25 36
E-Mail infos@fr.gbo.com

Germany

Greiner Bio-One GmbH
Phone (+49) 2 01 86 18 61-1
Fax (+49) 2 01 86 18 61-2
E-Mail info@de.gbo.com

Hungary

Greiner Bio-One Hungary Kft.
Phone (+36) 96 21 30 88
Fax (+36) 96 21 31 9
E-Mail office@hu.gbo.com

Netherlands

Greiner Bio-One B.V.
Phone (+31) 1 72 42 09 00
Fax (+31) 1 72 44 38 01
E-Mail info@nl.gbo.com

Switzerland

Greiner Bio-One VACUETTE
Schweiz GmbH
Phone (+41) 7 12 28 55 22
Fax (+41) 7 12 28 55 21
E-Mail office@ch.gbo.com

Thailand

Greiner Bio-One Thailand Ltd
Phone (+66) 3 84 65 63-30
Fax (+66) 3 84 65 63-6
E-Mail office@th.gbo.com

UK

Greiner Bio-One Ltd.
Phone (+44) 14 53 82 52 55
Fax (+44) 14 53 82 62 66
E-Mail info@uk.gbo.com

USA

Greiner Bio-One North America Inc.
Phone (+1) 70 42 61 78 00
Fax (+1) 70 42 61 78 99
E-Mail info@us.gbo.com