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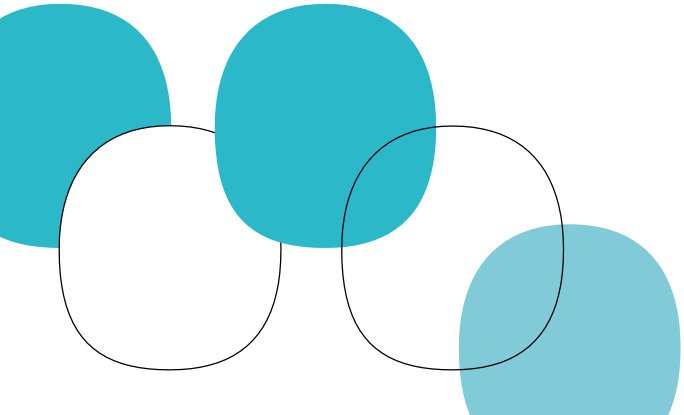
GÖTTINGEN MINIPIGS

Göttingen Minipigs

Vascular Access

and

Implantation of Catheters



Adrian Zeltner

Göttingen Minipig

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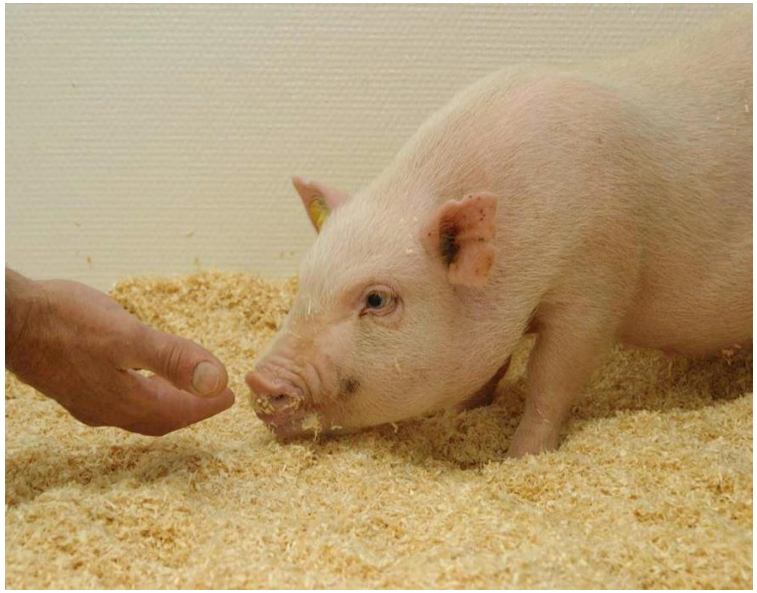
- Shy
- Jumpy
- Curious
- Social
- Clever
- Greedy



Acclimation/Handling

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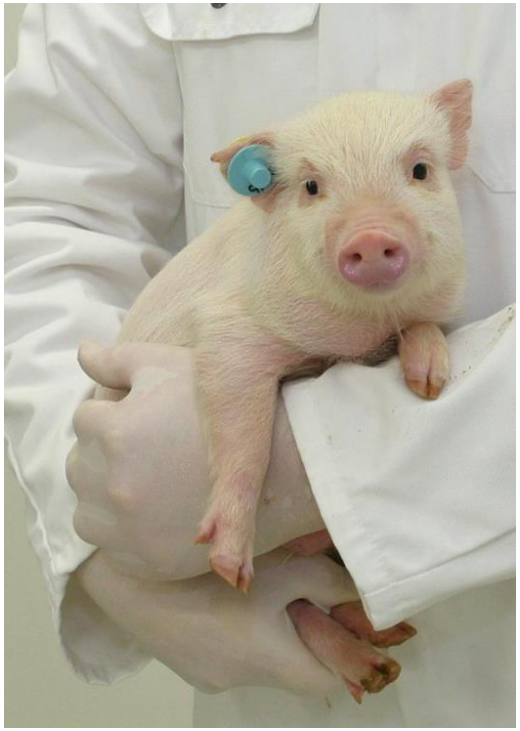
Socializing

As soon as possible

As often as possible

Best possible Quality



Handling

Speak quietly

Move slowly

Handle often

Introduction

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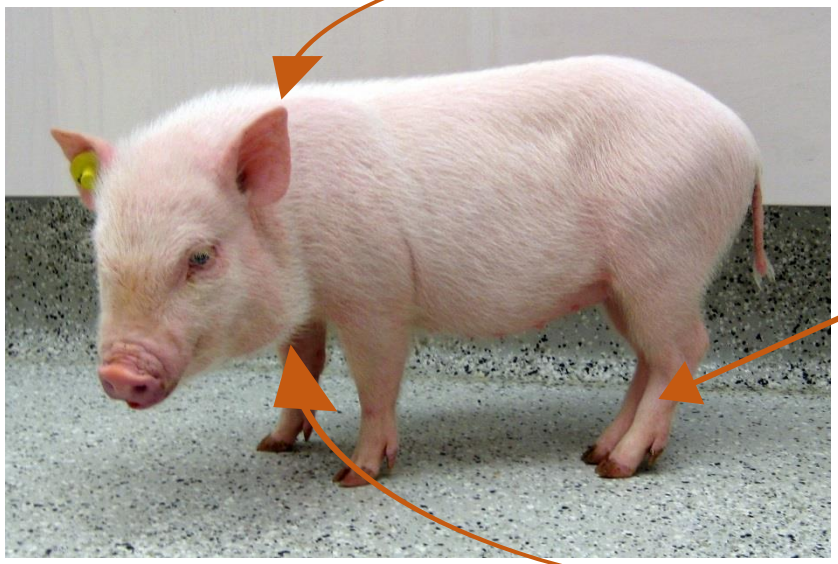
Vascular access is a challenge in Minipigs

- Not many superficial veins
- Difficult to cannulate
- Catheters can often be required

Most common sites



V. Auricularis

V. Saphena

V. Jugularis

Alternative Routes

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Radial Vein Blood Collection in the Miniature Pig

Mozzachio, K.
Mozzachio Mobile Veterinary Services, Hillsborough, NC, USA

INTRODUCTION

Blood collection in miniature pigs can be a challenge as peripheral veins are not readily accessible and some, such as the auricular or ear vein, are inadequate for obtaining sufficient volumes, let alone adequate for repeated sampling. Additionally, collection from the more commonly used jugular vein can be associated with complications such as hematoma formation, thyroid gland damage, or even occasional death. The stress induced by the restraint required for access to certain veins can also be problematic.

The radial vein located along the medial aspect of the forelimb is an access site successfully employed in pet minipigs with no complications and minimal stress. Use of a sling may facilitate blood collection if the pig is acclimated to the device, as the animal cannot see the technician, can be distracted with food treats, and often has no reaction to needle insertion or manipulation of the limb. The vein is also easily accessed when the animal is in dorsal recumbency (as in a V-trough). The vein is large enough to facilitate collection of a significant volume of blood (i.e. 3-6cc) and there are two access sites if both forelimbs are used. It is unknown whether the vein lends itself to the repeated collections required by some research protocols, but the vessel extends the length of the limb and if the initial sample is taken distally, subsequent samples can theoretically be taken at progressively more proximal points. Although potential application in a research environment has not been explored, the radial vein offers an easily accessible site that has not typically been employed in a laboratory animal setting.

OBJECTIVE

To describe blood collection from the radial vein in the miniature pig.

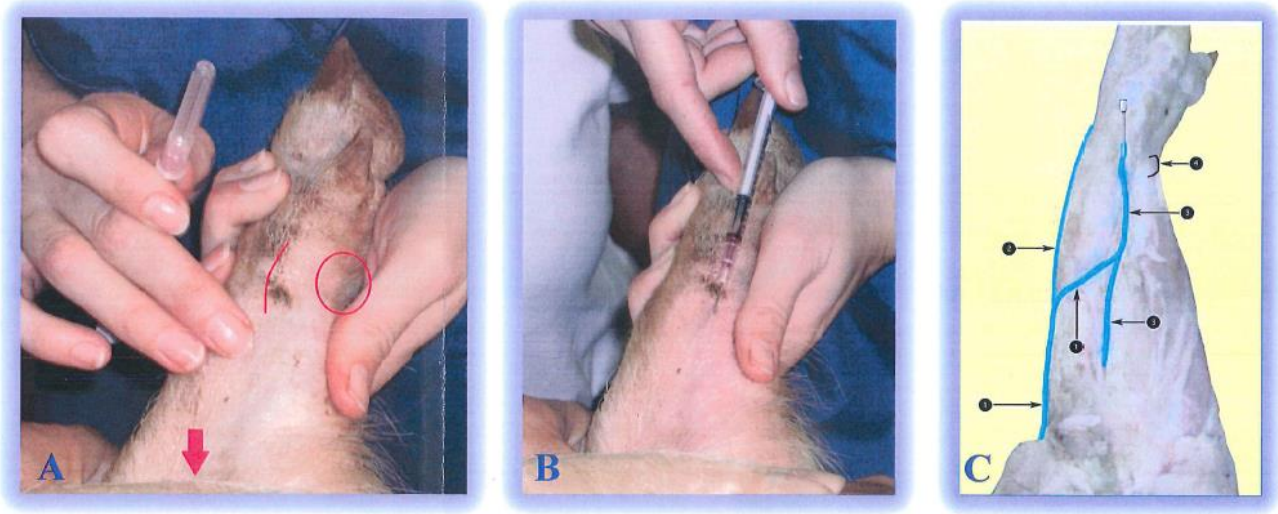

Figure 1

A: Medial aspect of the forelimb of a miniature pig. The curved red line delineates the carpal glands, often bearing visible brown discharge. The red circle identifies the accessory carpal bone – one of the palpable landmarks used to locate the radial vein. The site of venous occlusion close to where the limb joins the body is just out of the frame of the picture (red arrow). The technician is using the fingers to palpate the groove within which the vein lies. B: Blood is collected from the radial vein following identification of landmarks. C: Dissection of the porcine forelimb showing superficial veins and landmarks: (1) cephalic vein; (2) accessory cephalic vein; (3) radial vein; (4) location of accessory carpal bone (palpable). The needle indicates the site for venipuncture as the radial vein crosses the flexor retinaculum of the carpus. Diagram courtesy of Dr. James E. Smallwood.

METHOD

Restrain the animal and apply pressure to the medial aspect of the proximal forelimb, near the axillary region, to occlude the vein (Figure 1A, red arrow). While holding the limb straight, palpate the caudal edge of the long bone (radius/ulna) and the small rounded accessory carpal bone along the caudal aspect of the limb just above the dew claws; the radial vein lies in a groove between these two landmarks (Figure 1A). In young or light-colored animals, the vein may sometimes be visualized but often the vein is neither visible nor palpable. The skin is relatively thin in this area, the vein typically superficial in location, and the needle should be inserted parallel to the long bone (Figure 1B). A 22G, 1-inch needle may be used; rapid clotting may create difficulty with needles of a smaller gauge. Light suction should be applied particularly if larger syringes (i.e. 6cc) are used to prevent collapse of the vein, but steady, gentle suction should yield the desired volume. "Pumping" at the site of occlusion, in which pressure is slowly applied and released repeatedly, may aid sampling.

CONCLUSIONS

The radial vein located along the medial aspect of the forelimb is readily available for blood sampling in the miniature pig and provides easy and safe peripheral venous access.

REFERENCES

Rinke, M [1997]. How clean is a mini-pig? – Impressions and suggestions of a pathologist working in the field of toxicology. *Pharmacology & Toxicology* 80, Suppl 2:16-22.

Smallwood, J. [2010]. The Forelimb. In *A Guided Tour of Veterinary Anatomy*; Millenium Print Group, Raleigh, NC; pp. 319-320.

Mozzachio
Mobile Veterinary Service

Alternative Routes

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Blood Collection from Göttingen Minipigs: A Peripheral Approach

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Battelle
The Business of Innovation

ABSTRACT

Many techniques have been described to collect blood from swine. Due to their anatomy, such techniques typically involve a 'blind stick' of a deep vessel such as the jugular vein or cranial vena cava. Due to the nature of the studies being carried out at our institution, the ability to adequately hold off the vessel after venipuncture, assure hemostasis and visualize the vessel for complications was critical. In larger breed pigs, collection from the ear vein is often possible. However, our studies utilize the Göttingen Minipig, and their small ear veins are not well suited for serial blood collection. After exploring other peripheral vessels for blood sampling, the cephalic veins and cranial epigastric veins were utilized. Greatest success was obtained with the cephalic vein as it crossed the chest toward the thoracic inlet. The minipigs were bled daily under midazolam sedation (0.1-0.5 mg/kg SC) for greater than 30 days obtaining volumes of 0.5-2.0 ml per day (larger volumes were not attempted). Some pigs did develop bruising or hematomas at the venipuncture site. The cranial epigastric veins were a viable option for sampling if there was bruising over the cephalic vein, but had more of a tendency to collapse during collection. While not typical collection sites for blood collection in pigs, peripheral vessels can be used for daily collections of small volumes with excellent results.

INTRODUCTION

•Due to the challenges encountered with obtaining blood samples from these animals, our lab set out to determine the best techniques and methods for repeat blood sampling in minipigs.

•When practical, a vascular access port may be implanted to facilitate blood sampling. However, if the port fails, other techniques must be utilized to obtain required samples.

•We also investigated the effect of sampling site on blood parameters to determine if the cephalic and cranial epigastric sites would yield comparable results.

TECHNICAL APPROACH/METHODS

•Male Göttingen minipigs (3-7 months of age) from Marshall BioResources were utilized. All animals were part of an IACUC approved protocol requiring daily blood collection for up to 30 days. Approximately ten minutes prior to blood collection, animals were given a dose of midazolam (0.1–0.5 mg/kg, SC or IM). Aseptic technique was used throughout all procedures.

•Several collection methods were evaluated including vacutainer systems, standard needle/syringe and butterfly/syringe. When a butterfly was used, the needle was positioned in the vessel. Once blood was flowing into the tubing, the person collecting the sample attached a syringe and withdrew the required amount.

•The technique described requires from 1-4 people to complete, depending upon the cooperation/sedation level of the patient.

•For the sample site comparison study, ten pigs were randomly selected from various treatment groups. On a scheduled blood draw, the animal was sedated as indicated and two samples were drawn. The cephalic sample was drawn first, then the epigastric sample.

Vascular Anatomy

A. Epigastric vessels on ventral abdomen.
B. Close up of epigastric vessels.
C. Cephalic vessels as they cross from the front leg to the thoracic inlet.
D. Sketch/overlay of cephalic vessels.

Positioning/Holding

E. Pig lying down, epigastric vessels occluded.
F. Pig lying down, cephalic vein occluded.
G. Pig upright, cephalic vein occluded.
H. Pig lying down, holder occluding vessel, will also perform venipuncture.

Blood Collection

I. Obtaining blood from an epigastric vessel.
J. Three person technique: one holding/occluding vessel, one performing venipuncture, one collecting sample.
K. Two person technique: one holding/occluding vessel and performing venipuncture, one collecting sample.

RESULTS/DISCUSSION

Sample site comparison table: Select hematological and clinical chemistry parameters from cephalic and epigastric sampling sites (mean ±SD). No statistical differences were noted. The large SD noted with some parameters, reflects the differences in treatment groups among minipigs.

	Cephalic	Epigastric
White Blood Cells, (x10³/µl)	8.53 ± 2.55	8.37 ± 2.75
Red Blood Cells, (x10⁶/µl)	8.32 ± 0.72	8.26 ± 0.62
Hemoglobin, (g/dl)	13.26 ± 1.49	13.30 ± 1.26
Hematocrit, (%)	41.40 ± 4.37	41.39 ± 4.11
Platelets, (x10³/µl)	663.30 ± 124.42	681.70 ± 123.78
Reticulocytes, (%)	1.98 ± 1.31	2.05 ± 1.33
Neutrophils, (%)	50.40 ± 8.50	51.65 ± 8.90
BUN, (mg/dl)	7.70 ± 2.11	7.80 ± 2.10
Glucose, (mg/dl)	99.40 ± 17.40	94.40 ± 15.59
Total Protein, (g/dl)	5.97 ± 0.28	6.04 ± 0.28
Sodium, (mmol/L)	142.30 ± 1.57	142.00 ± 1.49
AST, (U/L)	21.00 ± 3.13	21.80 ± 2.66
Creatine Kinase, (U/L)	623.80 ± 275.38	686.40 ± 281.89

•The cephalic and cranial epigastric sampling sites provide equivalent data and can be used interchangeably.

•Of the methods evaluated, a 23 gauge butterfly and syringe consistently yielded better samples, both in quality and quantity. The butterfly allowed the phlebotomist more leeway to maintain correct positioning should the minipig move at any time during collection.

•Three people per pig worked well: one to hold the pig and occlude the vessel, one to perform the venipuncture and one to collect the sample. While this method may involve more people than other collection methods, the ability to reliably and quickly obtain samples far outweighs the increased labor hours.

•Complications observed were limited, and included bruising, hematomas and mild perivascular scar tissue formation. Sites can be rotated if problems do develop. Additionally, certain vessels can be 'rested' until they appear to be in better condition.

•The described techniques have been used to collect hundreds of blood samples from Göttingen minipigs with great success and very few complications.

Traditional Blood sampling

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Blood volume:

68 ml/kg

Blood sampling Neck

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General Considerations

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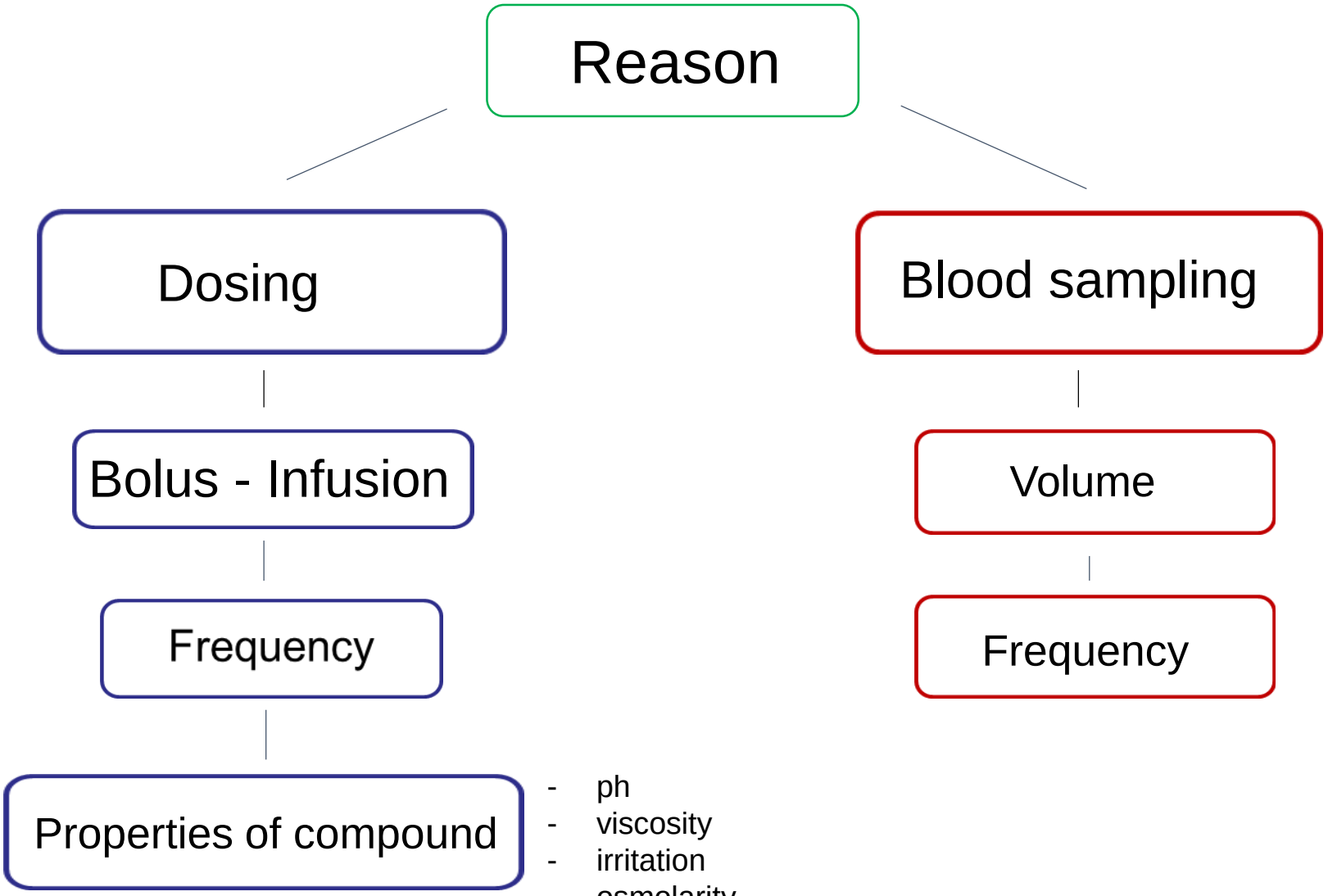

Study design

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How many?

How much?
Infusion rate?

How often?

For how long?

Options I

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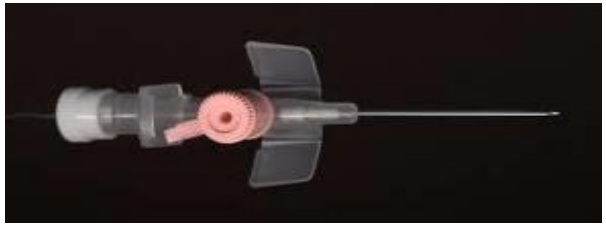
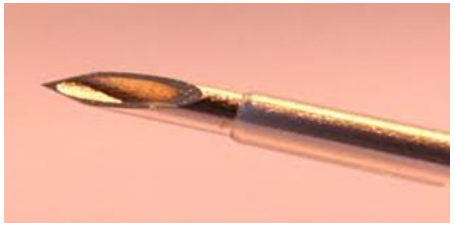
Micro sampling

Serum, EDTA, Heparin

Sampling devices

Over the needle cannulas





Options II Catheters

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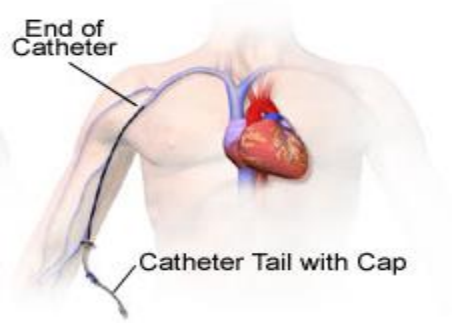
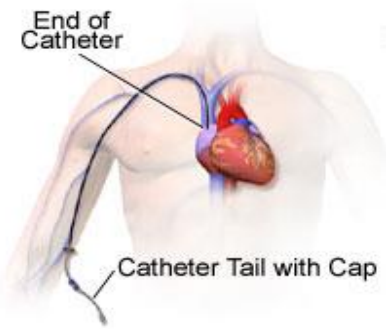
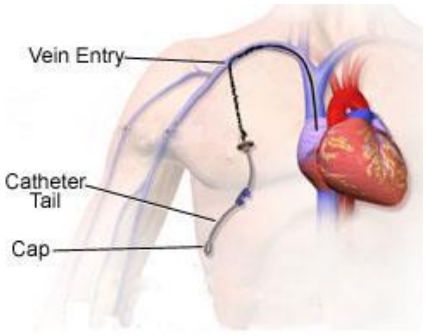


Midline Catheter

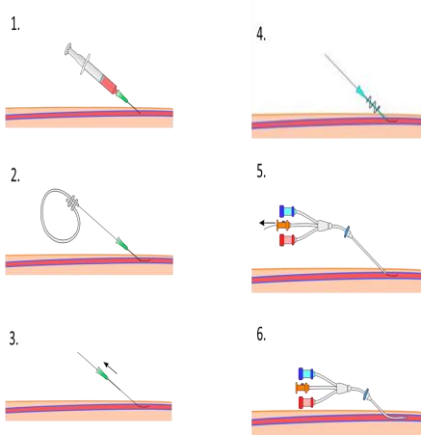


PICC Catheter



Central Venous Catheter

Seldinger Catheter

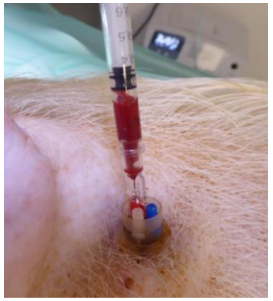


Surgically implanted Catheter (cut down)

Percutaneous

VAP

VAB



Vascular Access

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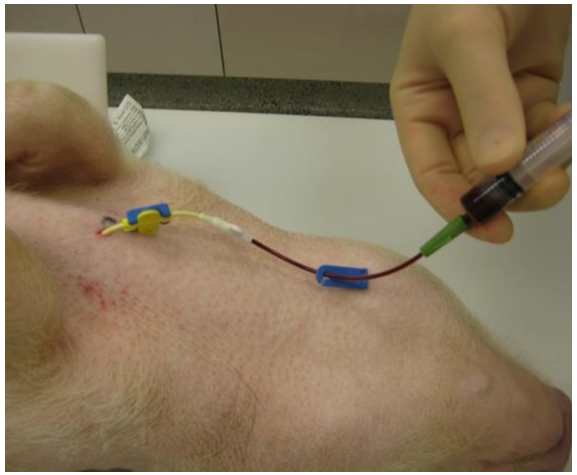
V. Jugularis



Up to 8 samples/24h
Up to max volume
Dosing not recommended

High sample frequency
Up to max volume
Dosing/infusion possible
Consider dual lumen Catheters

Anatomy of the Neck

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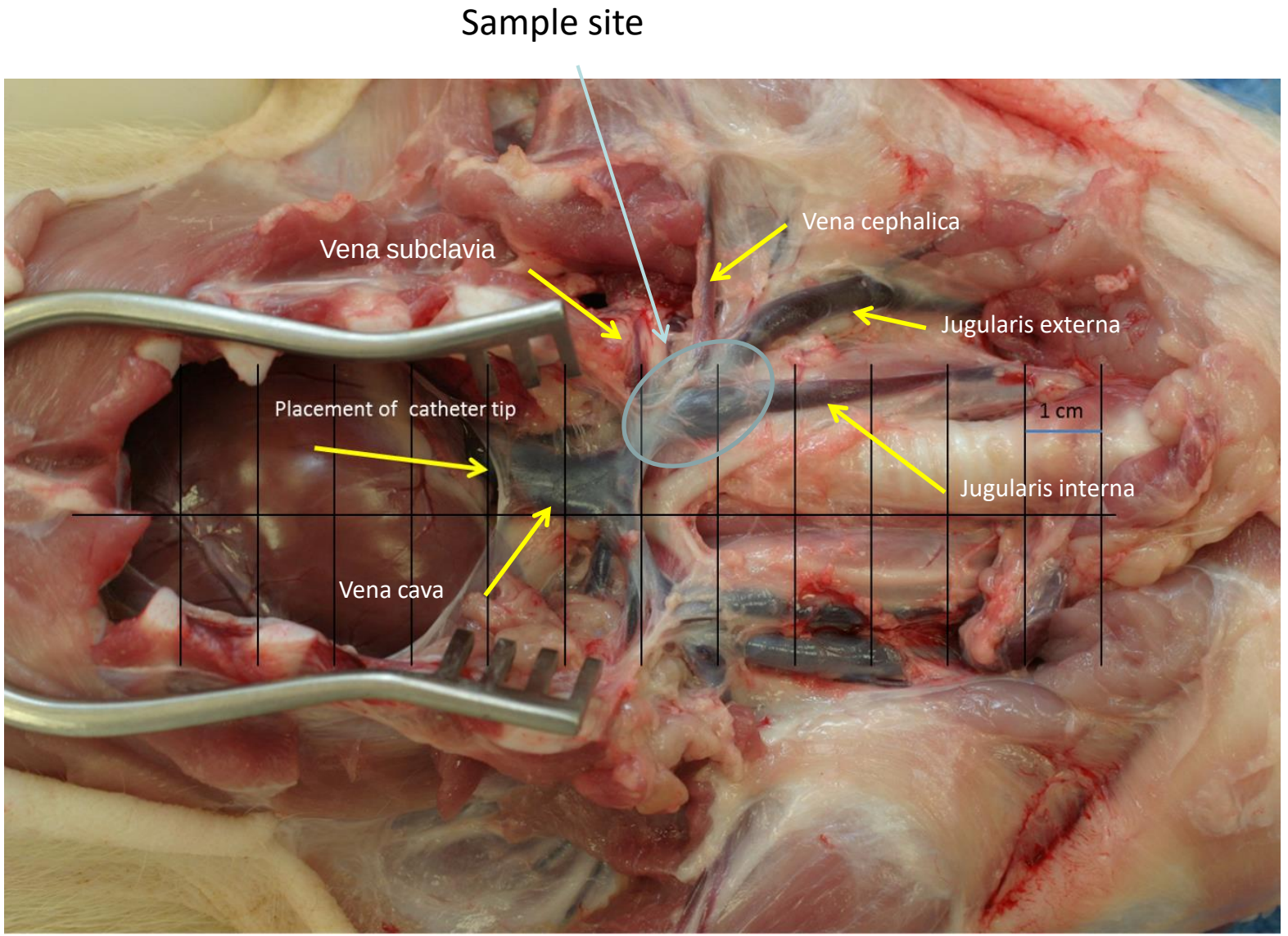

CVC Seldinger

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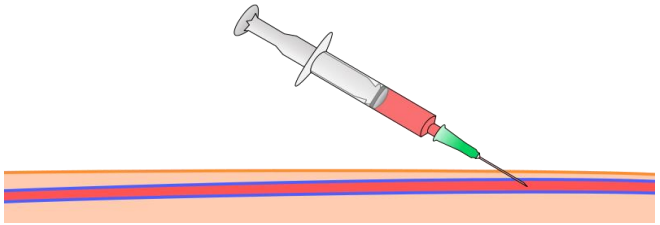

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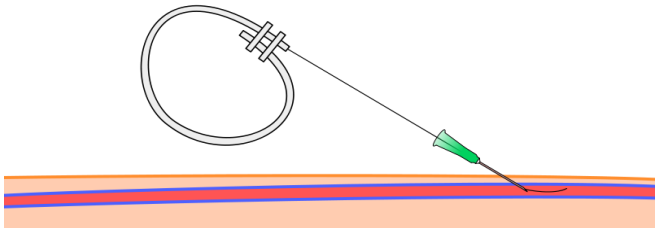

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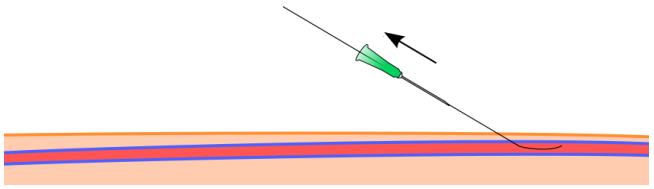

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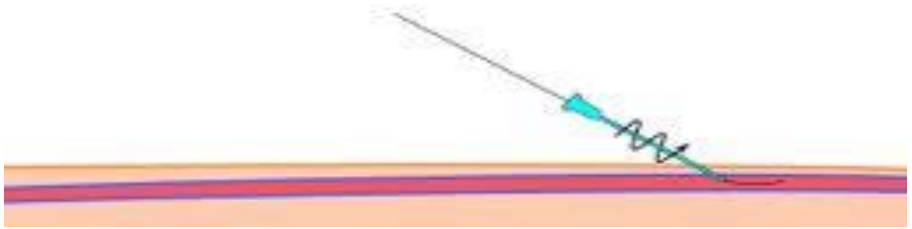

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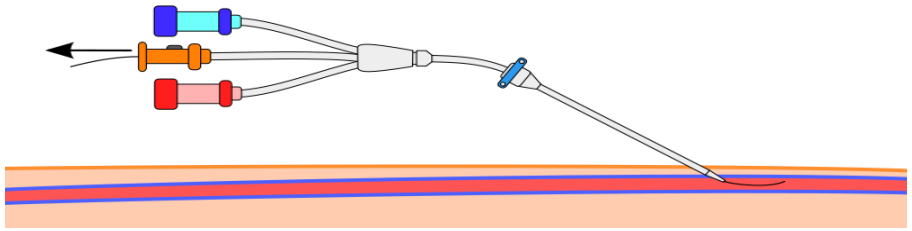

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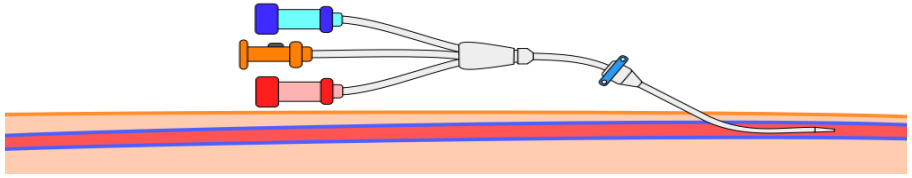

CVC Seldinger tunneled

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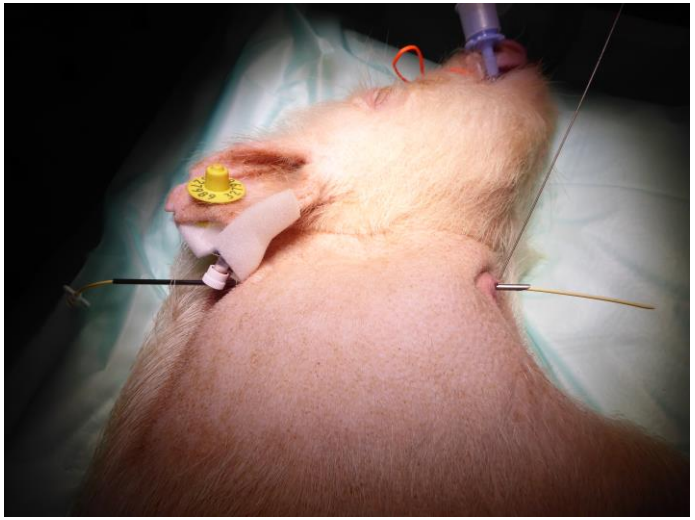

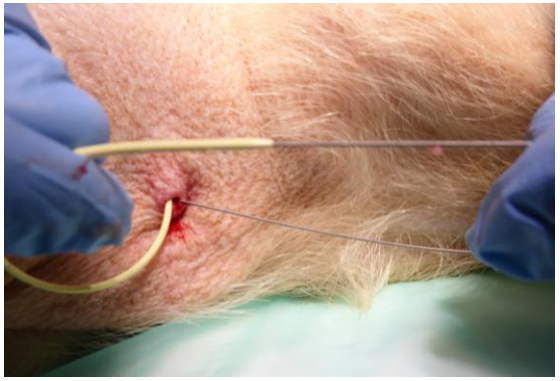

Cut down – VAP - tunneled

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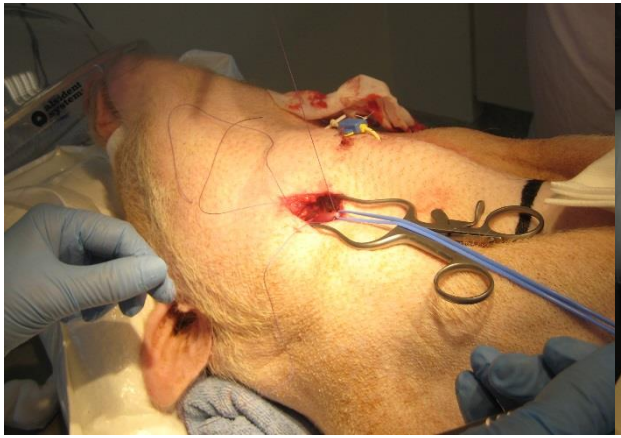

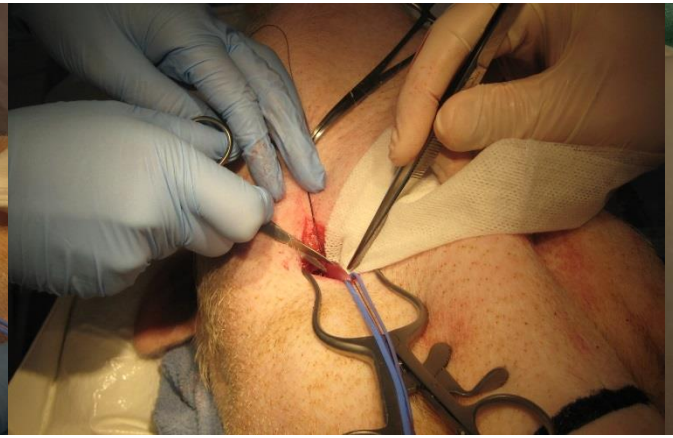

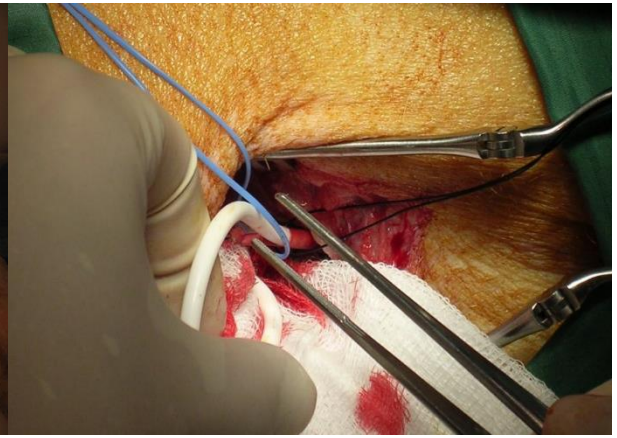

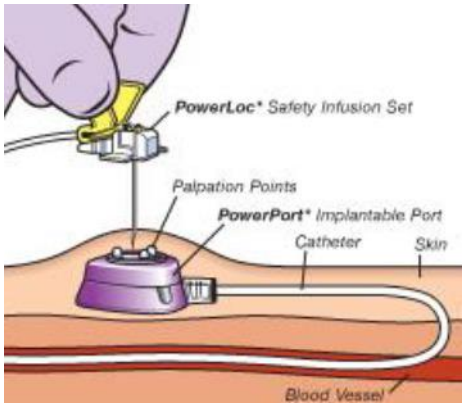

Vascular Access Button VAB

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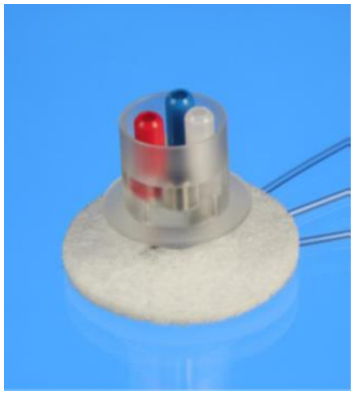

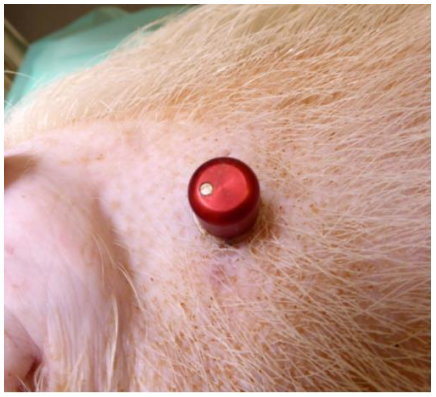

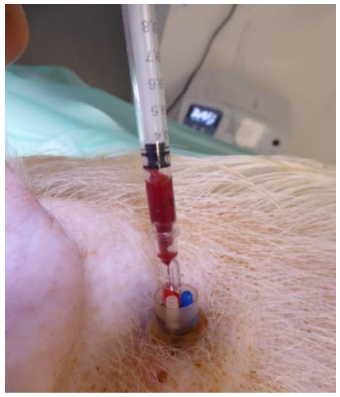

The Vascular access button is designed for rats and is available for 1-3 catheters, 3 fr size only

CVC Summary

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	Seldinger	Cut down		
		Percutaneous	VAP	VAB
Easy to remove	√	surgery	surgery	
Re-implanting	√			
Minimal invasive	√	Minor surgery	Minor surgery	Minor surgery
Risk of displacement	√			
Patency of vessel maintained	√			
Secured by external fixation	√			
Risk of infection	√	√		√
Painless access	√	√		√
Group housing			√	√
Expected patency	5-21d	3m+	1year+	3m+

Vascular Access

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V. Saphena

(VAP)

Occasional Sampling
Up to 5 ml
Dosing possible
Very sensitive site

High sample frequency
Up to max volume
Dosing/infusion possible

Anatomy of the Leg

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Venous Access Leg

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Local anesthetic cream – EMLA - Ice

Decisive penetration with needle

Training

Midline Catheter

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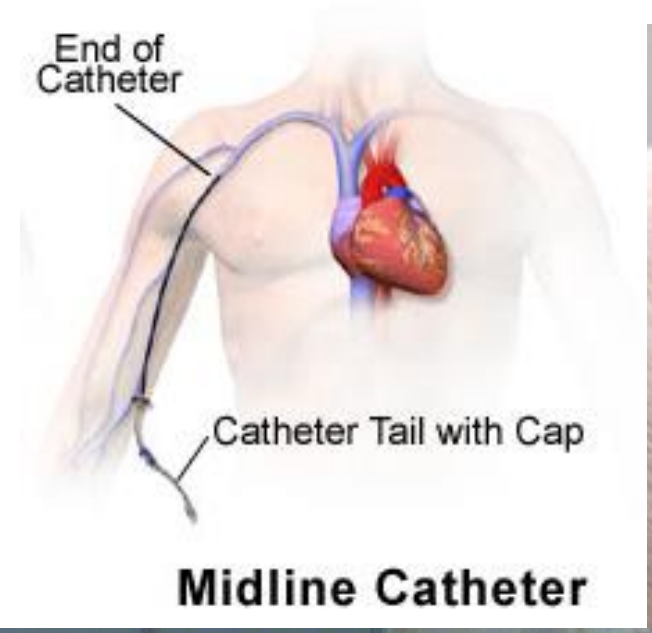

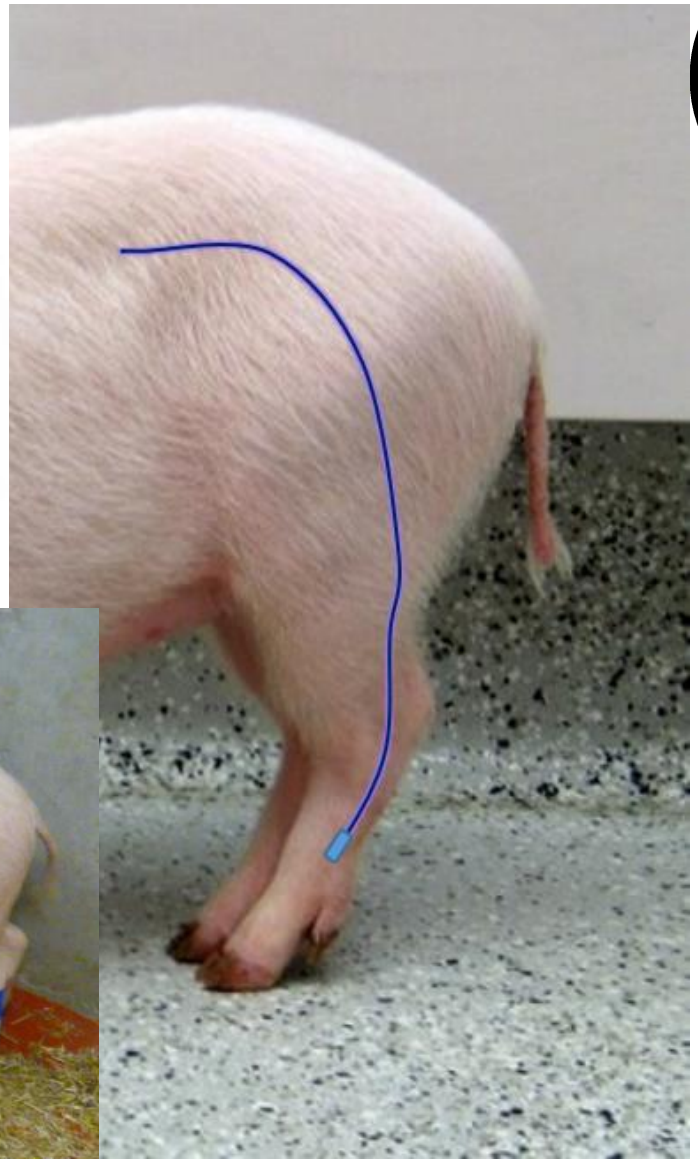

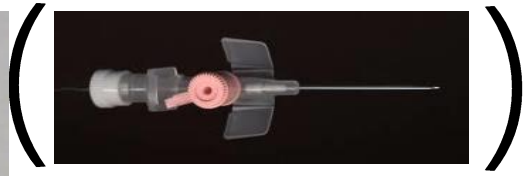

Vascular Access

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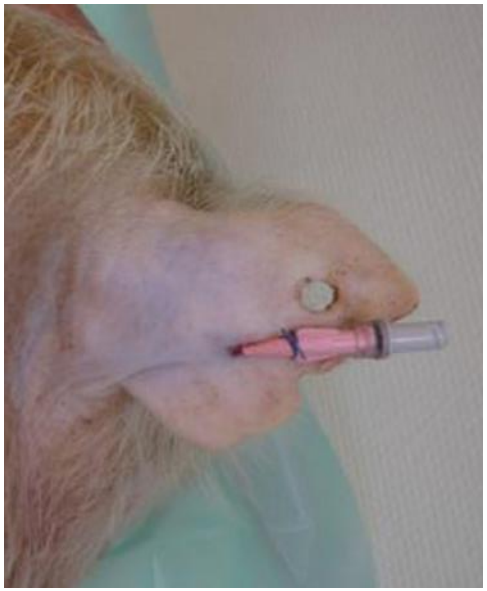
V. Auricularis

Up to 8 samples /24h
Up to 200 µl

Only dosing
Withdraw
not possible



High sample frequency
Up to max volume
Dosing/infusion possible
Max. 3fr catheters

Anatomy of the Ear

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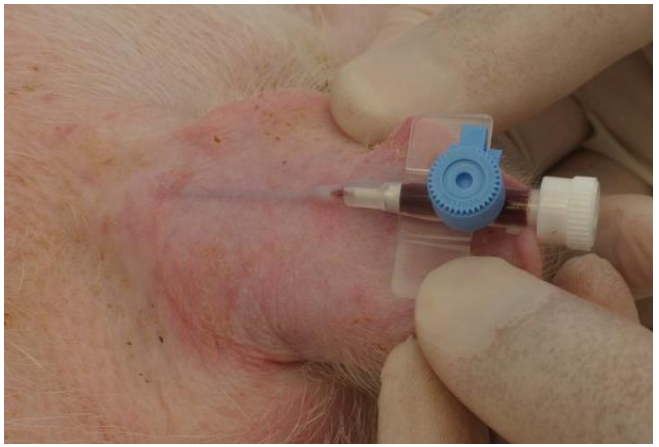

Micro sampling

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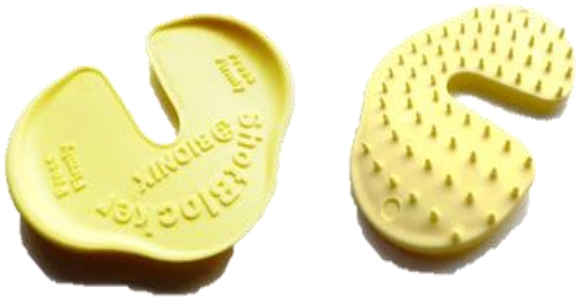
DBS

Dried Blood Spot

EMLA



Ear-vein - Midline Catheter

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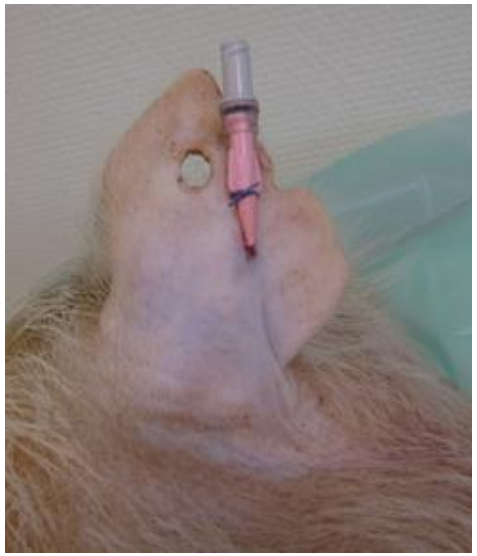
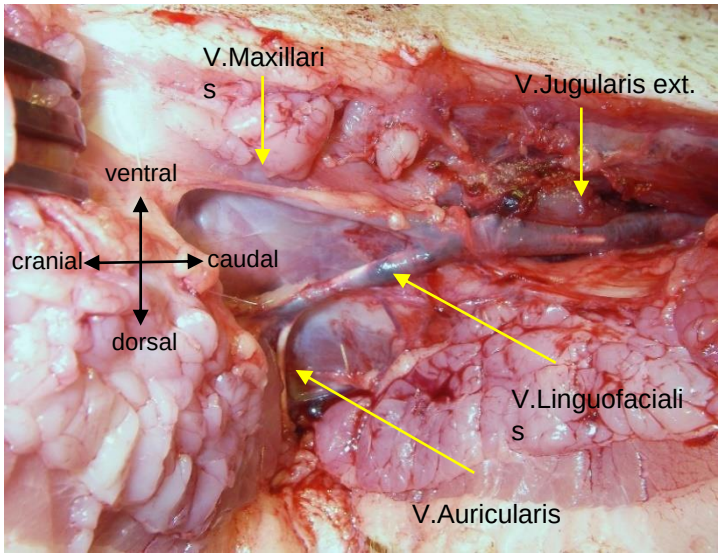
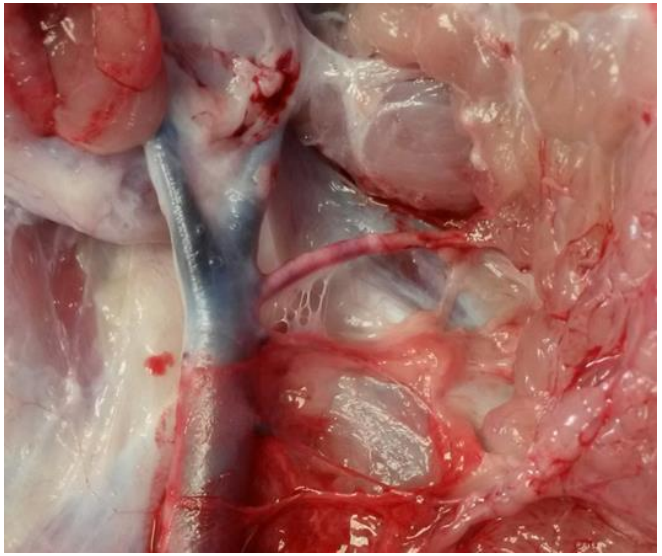
Requires straight veins and Minipigs of a certain size: >12kg

The diameter of the vein is small; select catheters accordingly: 2.5 – 3 Fr

The length of the catheters is 15-20 cm. Select a length that allows the tip to be ca. 2-5 cm before the right Atrium in the Jugularis externa or Vena cava.







Midline Summary

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Choose the right size catheter in regard to diameter and length.

- A thin catheter with the distal end placed in a large vessel.
- Small ø at entry point = small ø of catheter

Percutaniously implanted Seldinger Method
Easy to remove
Minimal invasive
Risk of displacement
Patency of vessel (partially) maintained
Secured by external fixation
Risk of infection
Pain free access
Single housing
Re-implanting not always possible

Catheter suppliers

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Seldinger:

Arrow/Teleflex
Bbraun
BD
Argon
Cook
Vygon

VAP:

Bard
Access Technologies
UNO

VAB:

Instech
SAI

Catheter Sampling

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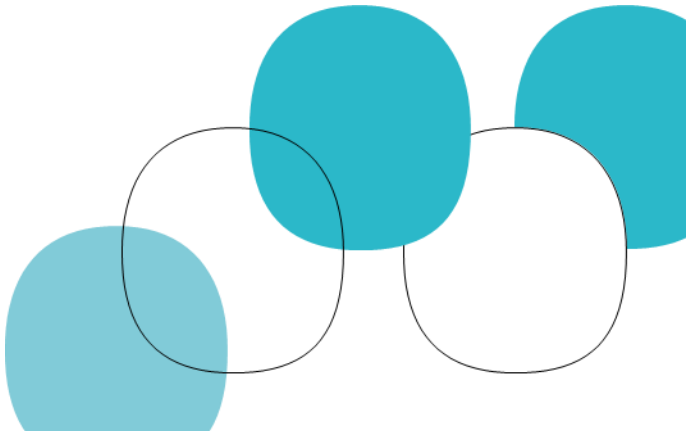
1. Disinfect hub/skin
2. Insert syringe/needle
3. Withdraw lock solution and some blood
4. Discharge
5. Use new syringe for sampling
6. Flush with saline immediately after
7. Lock with lock solution
   - Observe dead volume
   - Positive pressure technique
8. Disinfect hub/skin

Sampling



Catheter maintenance.

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All catheters are thrombogenic and are susceptible to fibrin and bio-film build up.

Observe the following points for extended patency:

- Strict aseptic procedures when implanting and accessing
  - Infections are the most common complications
- Keep contact time of blood and catheter as short as possible
  - To reduce the chance for build-up's
- Flush and lock with positive pressure technique
  - To keep blood out of the tip
- Find a good balance of flushing frequency in idle time
  - Frequent flushing does not increase patency time

Routes for IV access

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Auricularis

Saphena

Jugularis

Microsampling

Blood sampling in comparison

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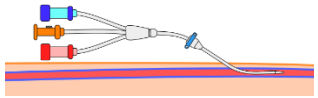
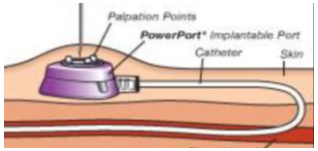
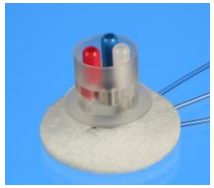
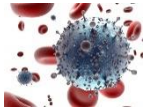






Frequency limit



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Further Info

Courses at Ellegaard

Catheter workshop

Catheter implantation

hands on

all types mentioned

tailored

Pre-implanted Minipigs

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VAP

VAB

Telemetric devices

Please inquire about other possibilities

Thank you for your Attention

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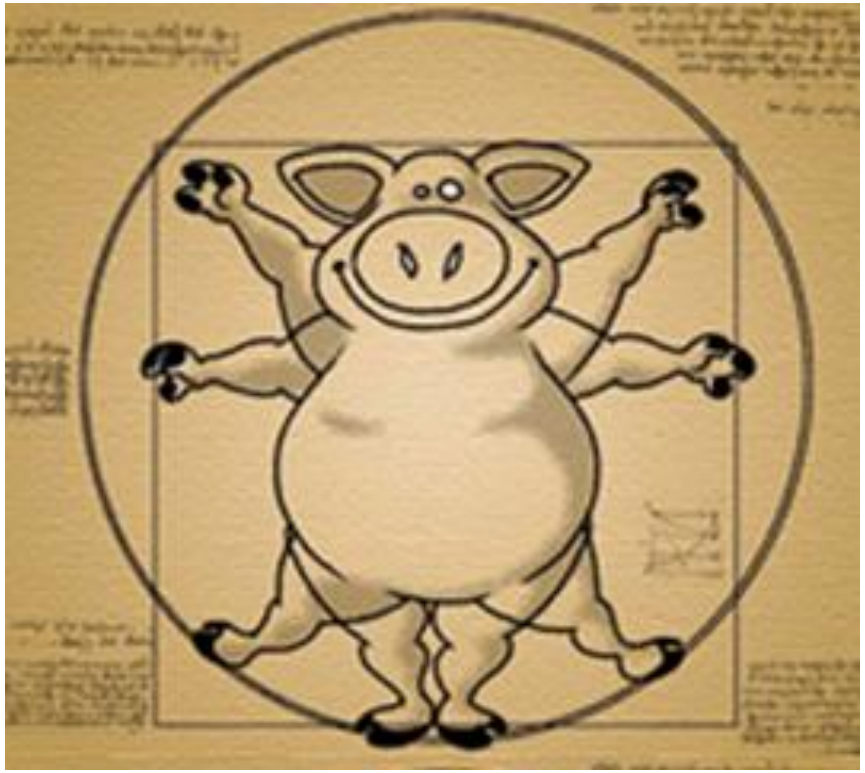

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