

Catheters for Vascular Access and the Göttingen Minipig

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Ellegaard Göttingen Minipigs

Introduction

The main reason for using a venous catheter is to facilitate multiple blood sampling or intravenous dosing. It reduces stress to the animal, improves welfare, and reduces the number of personnel required.

This article will only cover catheters that are implanted by the Seldinger technique. There are some risks and challenges to this method; however, properly managed, it can be successfully applied after some training.

The purpose of this paper is to inform about material and methods that have been tested and used by Minipig users and at Ellegaard Göttingen Minipigs. Some users have sent in complete articles; others have contributed valuable data through personal communication with the author. As studies vary a lot in purpose and design we can by no means cover all possibilities for the use of catheters nor all types of material. Preferences are subjective and what works in one setting might not be appropriate in another. The idea is to give you an overview and inspiration, so you can build upon the experience of others.

Summary

There are several types of catheters that could potentially be used with a Göttingen Minipig. A central venous catheter (CVC) is, by definition, a catheter whose tip resides in the central circulatory system. It is often inserted in close proximity to the heart. A PICC is a peripherally inserted central catheter and a Midline catheter is peripherally inserted without ending up in the central circulatory system.

There are various manufacturers of catheters that can be implanted using the Seldinger technique and each offers a multitude of models in different lengths, calibre, coatings, etc. They are monoluminal, biluminal or multiluminal and are almost all made of PU. Common to all is that they are designed for humans and not for pigs, so it can be a bit tricky to find the model that suits a particular study best.

These types of catheters are intended for short-term use; patency of the catheter can be anything between 3 and 28 days, depending on a multitude of factors.

In a biluminal catheter, one lumen can be used for dosing and the other for sampling or it can give an extra line when the other is occluded.

Loss of patency and infections are the main delayed complications whereas arterial puncture and impossibility to advance the guide wire could be complications during insertion.

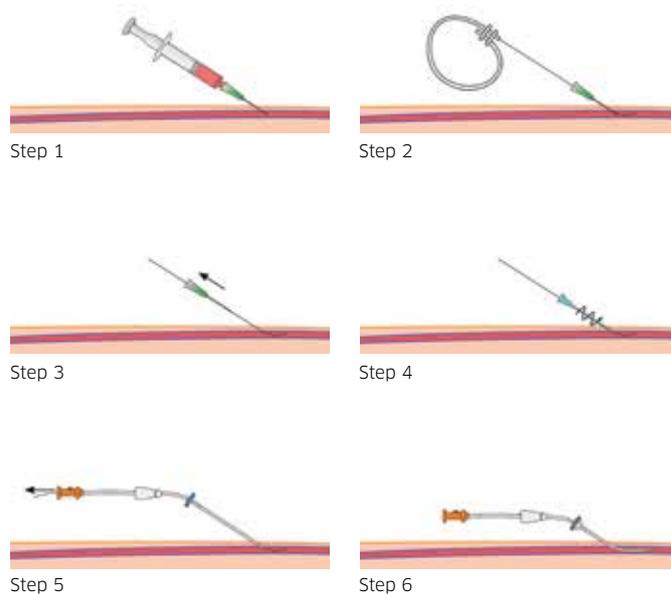
Catheterisation should be executed using aseptic procedures. It is done under general anaesthesia, using the Seldinger or modified Seldinger technique, the day before sampling.

Seldinger Technique

The Seldinger technique is a medical procedure to obtain safe

access to blood vessels and other hollow organs. It is named after Dr Sven-Ivar Seldinger (1921–1998), a Swedish radiologist who introduced the procedure in 1953.

The desired vessel is punctured with a sharp hollow needle. A round-tipped guide wire is then advanced through the lumen of the needle into the vessel and the needle is subsequently withdrawn. A blunt cannula or dilator can now be passed over the guide wire to prepare the way for the catheter. After the dilator has been withdrawn, the catheter can now be passed over the guide wire and inserted into the vessel to the required length. After that the guide wire is withdrawn.



There are some modifications to the above method, like placing an over-the-needle catheter first and then feed the guide wire through it.

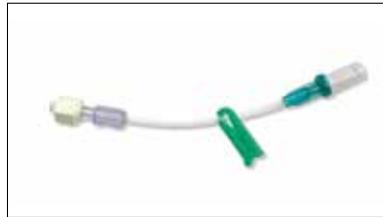
Material

Traditionally larger Göttingen Minipigs have been catheterised because lifting and handling becomes more challenging with the increase of age and weight. Therefore large-calibre catheters were used, but as the procedures were applied in a broader spectrum of animal sizes and intentions, many different products came into use.

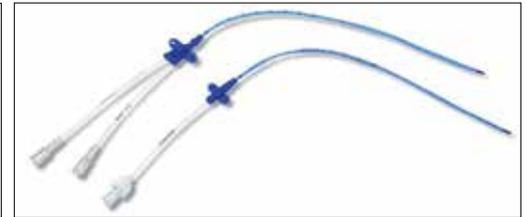
The following list gives an overview of catheters that have successfully been used in Göttingen Minipigs. It is based on user feedback, but is by no means complete. Most of them are monoluminal; some have an integrated extension, others do not. You will probably have to try out a few to find the one that fits your taste and purpose. The use of a needleless valve at the port has been proven to be very handy.



Catheter without extension



Extension with valve



Catheter with integrated extension

Manufacturer	Calibre Ga/Fr	Length, cm	Veins used	Reference
Cook Medical	20/3	8	Jugularis/Saphena	C-PUM-301J
Edwards Lifesciences	20/3	13	Jugularis/Saphena	M1 20130 HS
Arrow	14/7	16	Jugularis	ES 04706
	18/4	20	Saphena	ES 04218
Braun	20/3	12	Jugularis/Saphena	AK 04150 E-S
	14/7	15	Jugularis	Certofix mono S415
	18/4	15	Jugularis	Certofix mono S215
	18/4	20	Saphena	Certofix mono S220
	16/5	30	Jugularis	Certofix mono V330
	16/5	32	Jugularis (peel away intro.)	Cavafix certo 335
	13/7 (biluminal 16/16g)	30	Jugularis	Certofix duo V730
BD	20/3	15/20	Saphena/Auricularis	Careflow 681639
Mila	Mila International has a range of interesting catheters and accessories			milainternational.com

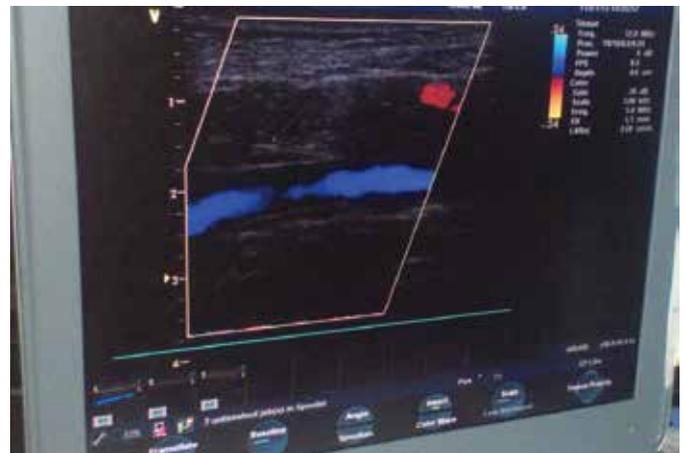
Sites

Neck - CVC

The most common site is the neck where the external jugular vein or the junction of external/internal jugular vein is catheterised. The challenging aspect of this site is that it is a blind procedure to penetrate the vessels as they are deep in the tissue and are not visible. Ultrasound guidance could be used to facilitate this step. It requires a bit of training with this relatively expensive equipment to successfully take advantage of this method but has the advantage that the correct vessel is punctured with the least damage to other tissue.



Transponder and needle at step1



Monitor showing vessel and needle(arrow)

Bandaging the neck can be a bit of a challenge as well due to the anatomy of the pig, but the port of the catheter can be embedded in it so it can be easily taken out at the time of sampling. Depending on the temperament of the respective animal, sampling can take place with the animal unrestrained or placed in a sling. Re-implantation of catheters at the same site has been possible in some cases, but other people reported that they were not successful the second time.

Hind leg – Midline catheter

The saphenous vein is usually prominent and visible in the Göttingen Minipig. The leg can easily be bandaged and, as pigs

are not very athletic, it is impossible for them to interfere with their own bandage. A midline catheter can easily be placed at that site. The preferred technique is to gain venous access by placing an over-the-needle catheter first and then feeding the guide wire through this temporary catheter. In an initial study, 18g 20 cm catheters have successfully been used; the position of the tip was found to be in the area of the hip joint in a 12 kg Minipig. Re-implantation at the same site however proved to be impossible due to changes in the tissue around the place of insertion. Further studies are needed with small-calibre catheters to see if it has the same effect on the vein and surrounding tissue. The use of longer catheters, so that the tip rests in the caudal vena cava, could also be considered.

the other sites, as some narrow corners have to be navigated during insertion. In a 15-kg minipig, the tip of a 15 cm catheter rests in the middle of the external jugular vein and with a 20 cm catheter it is just before the right atrium.



Catheter placed in saphenous vein



Conclusion

The placement of catheters in the Minipig is a valid option in the sense of the three Rs; however, each case has to be considered carefully in regards to benefits achieved. The minimal invasive techniques described here can easily be trained but some challenges remain. The main limitation is the duration of patency and re-implantation issues. The preferred site for implantation is the neck and it has been proven to be effective in practice. The hind leg has some potential but more work is needed to establish a method that is practically viable. There is also room for refinement in regards to the type of catheter suitable for Minipigs; more work is needed also in this area.

Comments

If you have some experience with catheters you would like to share with others, you are welcome to write an article for our next newsletter or contact the author so it can be included in the next update or in our Guide for implantation of catheters using the Seldinger technique in the Göttingen Minipig. This guide is available from Ellegaard if you are interested in learning more about the subject. You are also welcome to join one of our catheter workshops where you can train the procedures in practice.

Acknowledgements

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Minipig with bandaged catheter in pen

Ear - Midline catheter

Some attempts have been made to place a catheter in the auricular vein. It can be successful if the Minipigs are large and the vein well developed. A 20-kg or lighter minipig is the only option here and even then the lumen of the vein is completely occupied by the catheter severely reducing the circulation through that vessel. That will result in changes of the tissue and re-implantation is definitely out of the question. The small size of the vein makes it a difficult technique as well, compared to