Patency of Vascular Access Ports in Minipigs
A Success Story

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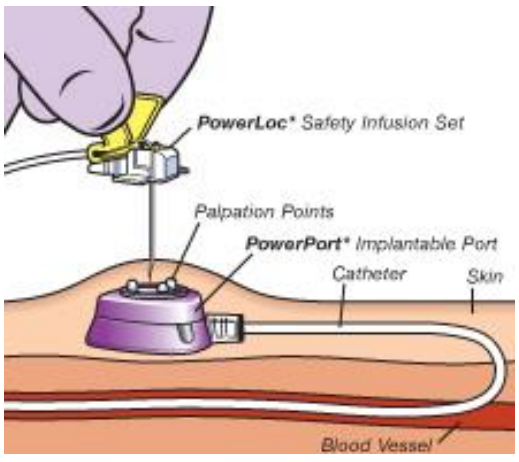
Introduction

Vascular access ports (VAPs) for studies requiring intermittent or continuous infusion and frequent blood sampling are well established and routinely used not only in humans but also in large animal species such as minipigs.

However, the use of such medical devices also bears the risks of serious complications, like infections, port inversion or dislocation, port rejection reaction and port pocket bleeding, mechanical failure by thrombotic or mechanical obstruction or animal-associated complications such as necrosis of the overlying skin. This may then lead to euthanasia of the affected animal and consecutive diminishing of the group size in the study.

Example of a VAP consisting of a port hub and catheter



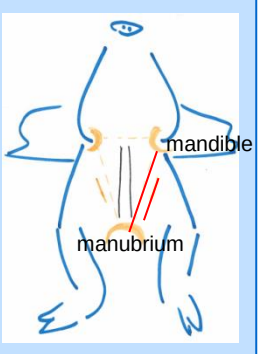
Localization of the VAP and insertion of the Huber needle into the port septum

Background

For a subchronic preclinical safety study, purpose-bred Göttingen female minipigs obtained from Ellegaard Göttigen Minipigs Denmark were pair-housed in pens spaced of approximately 9 m^2 in an AAALAC accredited facility. Animals were offered sufficient food and water, environmental enrichment and were kept at 20 $\pm$ 2°C at a relative humidity of 40-80% and a 12 hours light/dark cycle. All animals were regularly and carefully monitored. All procedures were in accordance with the respective Swiss regulations and according to the animal permissions granted by the Cantonal Ethical Committee for Anima Research. Minipigs were to be administered a test item intravenously for 5 minutes every other day for two weeks. These slow intravenous injections were performed with an electronic infusion pump, VAPs were implanted into the external jugular vein at about 4 weeks prior to study initiation in a total of 18 female minipigs, at 5 months of age.

M & M of VAP catheterization – refinement of the procedure

- **Optimal site of incision**: 1-2 cm lateral to the theoretical line between mandible and manubrium (see image)
- Blunt dissection to expose the external jugular vein
- Placement of a ligature cranial to the proposed insertion site the vein; incision and insertion of the catheter tip and advancement; securing the catheter with sutures using sutures.
- **Incision for the subcutaneous pocket in a half-circular shape from dorsal to ventral** (see image)
- Subcutaneous pocket sufficiently deep but being still palpable from externally; assure preservation of superficial tissue
- Flushing the port and catheter with heparinized saline
- **Securing the hub with sutures to avoid migration**
- SQ tunneling of the catheter dorsally and attachment to the hub
- Limiting dead-space
- Limited antibiotic treatment possible and **strict adherence to aseptic techniques**

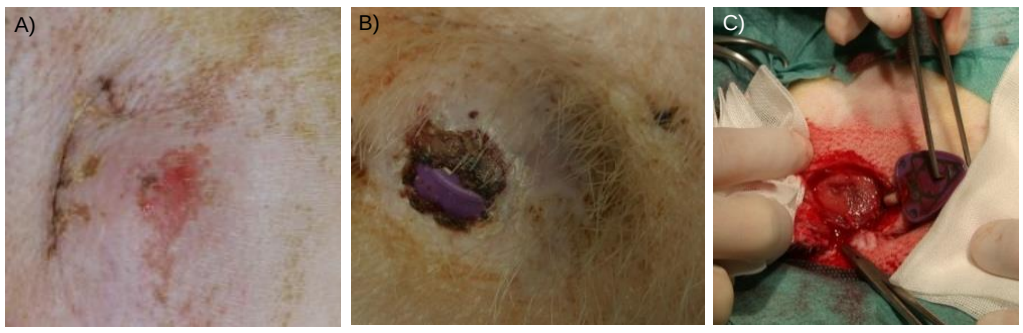


Case report - challenges and solutions

Exposure of the VAP caused by skin necrosis is one of the common serious events amongst VAP associated complications. Bacterial contamination and infection are subsequent consequences of VAP exposure. There is only very scarce information publically available for salvage of such VAP complications in veterinary medicine.

Here we report a case with skin necrosis at the site of VAP hub in the minipig that occurred 2 weeks after implantation of the device. Previous attempts using skin grafts were unsuccessful, hence we applied a new approach, which resulted in a patent VAP with immediate recovery of this animal.

In contrast to previous methods we exchanged the hub of the VAP and relocated it into a new SQ pocket. Extra effort was undertaken to manage the biofilm known to play a key role in rejection reactions.



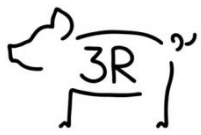
Case example for a skin reaction after VAP implantation in the minipig. A) Beginning of skin necrosis overlying the VAP hub. B) Exposure of the hub with severe skin necrosis. C) Preparation of the hub and subsequent wound revision

Successful new approach for management of VAP rejection reaction

- Immediate surgical approach (preferably within 24hrs after detection of rejection)
- Removal of necrotic skin surrounding the hub
- Cultures swabs for bacteriology and antibiogram
- Removal of the infected hub
- Aggressive debridement and complete capsulectomy
- Thorough mechanical washing of the pocket with large amounts of saline
- Subsequent exchange of all surgical equipment with sterile material
- Creation of a new SQ pocket ventrally to the previous one, in line with the catheter (see picture)
- Shortening of the catheter accordingly
- Attachment of a new hub and fixation within the pocket with sutures
- Injection of an antimicrobial block in the port hub filling the catheter containing gentamicin and EDTA
- Flushing of the VAP daily for at least 3 consecutive days
- Local treatment with sulfadiazine /silver ointment
- Adaption of the systemic antibiotic therapy according to the sensitivity results if necessary

Conclusions

- Close, continuous and diligent monitoring of minipigs and capabilities of immediate intervention after diagnosis of a port rejection reaction is essential to assure animal welfare as well as high-quality and sound scientific conduct of a study.
- **Refinement** of the surgical setup as well as the post-operative care together with successful management of complications will ultimately both benefit the well-being of the animals as well as **reduce** the total number of animals required.



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