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#20	Vascular Access in the Nanopig: Practical Experience with Implantable Vascular Access Ports and Vascular Access Buttons	Jon Ehrmann	Bristol Myers Squibb	Abstract

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Vascular Access in the Nanopig: Practical Experience with Implantable Vascular Access Ports and Vascular Access Buttons

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Background and Objectives:

The nanopig is an emerging swine model in preclinical research, offering distinct advantages in size and manageability; however, reliable long-term vascular access remains a meaningful technical challenge. This presentation discusses the practical development and operational experience with two vascular access devices — the implantable Vascular Access Port (VAP), a fully subcutaneous device requiring percutaneous needle access, and the Vascular Access Button (VAB), an externalized device providing needle-free access. Rather than directly comparing these systems, this presentation explores each device independently with respect to surgical technique, perioperative outcomes, catheter patency, and utility in pharmacokinetic (PK) and pharmacodynamic (PD) study applications. Additional discussion will address postoperative social housing considerations and innovative techniques — including the use of extension sets for both VAP and VAB systems — to facilitate continuous, low-stress access during PK study days, including methods for accessing devices while animals remain in their home cages.

Methods:

A total of fourteen nanopigs underwent surgical implantation of either a VAP (n=6) or a VAB (n=6 successfully completed; n=2 initial feasibility animals). All procedures were performed under general anesthesia with fluoroscopic guidance. For both devices, venous access was achieved via the external jugular vein using a polyurethane catheter advanced to the superior vena cava (SVC), confirmed fluoroscopically. Standard tunneling, closure, and perioperative management techniques were applied. For the VAB, multiple configurations were evaluated across iterative development phases. Initial feasibility work utilized a commonly used rodent VAB incorporating a 3 French non-radiopaque polyurethane catheter and a 22-gauge connector pin. Two catheter configurations were piloted under this design: (1) a single-catheter configuration for standard vascular access, and (2) a dual-catheter configuration within the same vessel, enabling simultaneous infusion and blood collection from a single access site with minimal dead space (~0.1 mL). Building on these findings, the team engaged in direct collaboration with the device vendor to engineer a novel large-animal prototype — the first reported adaptation of a VAB system for large-animal central venous access. Key modifications included increasing the catheter diameter to 5 French, enlarging the connector pin to 17-gauge, and transitioning to a radiopaque polyurethane catheter

to enable precise fluoroscopic placement in the SVC. To further optimize operational performance, particularly given the frequent movement characteristic of nanopigs during study procedures, a custom extension set was developed and integrated into the VAB system. This extension set

connects directly to the VAB and allows for significantly smoother, less disruptive blood collection, reducing the risk of sample loss or catheter complications in animals that are active or resistant to restraint.

Results:

VAP (n=6): Surgical implantation was successful in all animals with reliable catheter patency and consistent performance throughout PK/PD studies. VAB (n=8 total; n=2 rodent-based configuration, n=6 large-animal prototype): Early feasibility work with the rodent-based VAB yielded important insights into catheter design. The dual-catheter configuration demonstrated that simultaneous infusion and blood collection were achievable with appropriate catheter positioning and low dead space. Early recovery and short-term patency were acceptable; however, long-term performance in these initial animals was limited by complications including exudate and catheter erosion, attributable to superficial tunneling, device proximity to the incision site, and infection (MRSA). A single-catheter rodent-based case demonstrated excellent sustained patency with repeated successful access through study completion. The redesigned large-animal prototype VAB (5 Fr radiopaque catheter, 17 Ga pin) was subsequently implanted in six animals. Four achieved full patency with excellent blood return and ease of access. One required conversion to a VAP following mechanical failure, and one required removal due to trauma-related infection. Iterative refinements — including improved tunneling depth, implant positioning, and cap design — significantly improved performance over the course of the pilot series. The integration of the custom extension set further streamlined blood collection procedures, particularly in animals prone to movement during sampling.

Conclusions:

Both VAP and VAB systems provide viable options for long-term central venous access in the nanopig. The VAP offers reliability and procedural consistency. The VAB, through a series of iterative design refinements and close vendor collaboration, evolved from a rodent-adapted device into a purpose-built large-animal prototype — representing a meaningful advancement in the field. The development of a custom extension set for the VAB further enhances its practical utility by enabling smoother, more reliable blood collection in freely moving animals. Taken together, the experience gained across multiple VAB iterations, combined with refined surgical and operational techniques, establishes a strong foundation for the continued use and optimization of these systems in nanopig PK/PD research.