



## Preparing for a successful infusion study

Steve Denault & Candace Rohde-Johnson

An infusion system can be as simple as a needle and syringe or it can include everything from catheter to extension lines to pump, and all the parts between. Whether simple or complex, there are some processes, tips and products that can help you achieve success in any catheterized animal study.

### Pumps

Options exist for both tethered and ambulatory systems. Tethered infusion systems allow constant access to the pump and can be beneficial if you need to change the reservoir frequently, administer high volumes of solution or if you need to perform frequent manipulations to the flow rate. Since the animals will be tethered, you must make sure that your housing is able to accommodate both the internal line and the external swivel.

Ambulatory systems permit greater freedom of movement within the enclosure. This results in improved expression of natural behaviors and, in some cases, permits group housing. Ambulatory systems are ideal for minimizing human interaction or for species that require group interaction. Keep in mind that each pump has different volume limits and that in ambulatory studies, changing the dosing solution requires capture and temporary restraint. When choosing an ambulatory pump, you must consider the size of the animal as well as the weight and placement of the pump, including the weight of the test solution. The size of the pump can be especially challenging with smaller species, but there is an easy-to-use and ultra-lightweight option available in the 3D Mini Ambulatory Infusion Pump (Fig. 1).

Pumps are typically the most expensive part of the infusion set up. For short term needs, take advantage of rental pumps. Whether you have a larger than usual study, or you're just not sure that you'll need them 365 days a year, rental from SAI is an excellent option to keep your capital costs down. Whether renting or buying, it is essential to take good care of your pumps; to keep them in good condition:

- Clean everything immediately after use and store them in a safe, climate controlled location.
- To avoid last-minute emergencies, schedule appropriate testing/calibration ahead of the study.
- Place pumps on a maintenance schedule so that they receive preventative service at least once per year. SAI offers testing and repair services to make this affordable and easy.



**FIGURE 1** | The SAI 3D MiniBT™ Ambulatory Infusion Pump is extremely lightweight at 141g, making it an excellent option for ambulatory infusion studies.

### Catheters

Catheter materials are important for a variety of reasons. From the surgeon's point of view, it can be helpful to use materials that are easy to work with, but the impact on the subject is even more important. For example, polyethylene is a favorite material for surgeons due to relative stiffness, but this same stiffness can cause



**FIGURE 2** | Percutaneous catheters are excellent for medium term studies and don't require cut-down surgery. Designs similar to the one here are available for dogs, pigs and rabbits.

© 2017 Nature America, Inc., part of Springer Nature. All rights reserved.

SAI Infusion Technologies. Correspondence should be addressed to [info@sai-infusion.com](mailto:info@sai-infusion.com)

**SAI  
Rounded  
Tip**      **Competitor's  
Rounded  
Tip**



**FIGURE 3** | Rounded tips on different catheters. The tip on a SAI catheter (left) is rounded more gradually than those commonly found on competitor products (right).

damage when inserted into delicate vessels. You must also pay careful attention to the dosing solution; certain materials are more porous or reactive than others. Ultimately, there is no single material appropriate for all applications, making it worthwhile to assess each option and perform in-vitro testing prior to any study.

Choosing the implant site is also important. Selecting the vessel to cannulate can just be a matter of preference, but more often it involves a consideration of the anatomy of the species, the solution being administered, the duration of the study and the volume of the system. Even within the same vessel, you have options; for a longer term study in large species, a jugular catheter should be placed using cut-down technique and it may be advisable to use a vascular access port (VAP). Alternatively, for a short study, minimize surgical intervention by using a percutaneous jugular catheter (Fig. 2) instead.

The design of the catheter should be driven by the species and the placement, but some design features are universally beneficial. Securing beads or mesh will help keep the catheter from moving after surgery; resulting in less rubbing and a lower likelihood of inflammation. A rounded tip on the catheter can reduce trauma and lead to better catheter patency. Not all rounded tips are created equally, though. The rounded tip from SAI (Fig. 3) has a smooth surface with a more gradual slope for reduced damage during insertion and throughout the life of the catheter.

**Study design**

Think about each step of your process and how to make it easy to access animals and change lines without introducing pathogens. Simply including a luer valve with a swabbable top can make connections a breeze. Pay careful attention to the syringes that you use



**FIGURE 4** | Prefilled syringes can save time and reduce mistakes when accessing catheters and ports.

to flush catheters and infusion lines; these components should be filled using aseptic technique. To reduce the time spent on these tasks and to ensure that you are using clean, safe tools, add prefilled syringes (Fig. 4) to your routine.

There is no right answer regarding the frequency for changing infusion lines. For some, the lines are changed when a new formulation is used, but for others, lines are changed during a regularly scheduled health check. If there isn't a specific regimen that fits with your study, then follow the NIH guidelines for human catheters and change the lines once per week.

Careful preparation is the best way to manage the success of your study. Here are a few ideas that might help you with planning:

- Depending on the length and difficulty of your study, additional animals should be included in the design.
- Just as you plan for additional animals in your study, you should also plan for some extra supplies. Whether it's a dropped syringe, additional sampling time points, or an uncooperative animal, you'll be happy that you have a few extra items on hand.
- Introduce some time-saving products into your routine.
  - Pre-mixed Catheter Locking Solution can save time and maximize patency
  - Correctly sized blood tubes ensure the proper additive ratio and will maximize plasma/serum yield
  - Surgical kits and drape packs for surgery can reduce your inventory, packing and autoclaving time.

Whether your infusion system is simple or complex, the experts at SAI are ready to put their experience to work for you. Contact us for more information.

**This article was submitted to *Lab Animal* by a commercial organization and has not been peer-reviewed. *Lab Animal* takes no responsibility for the accuracy or relevancy of the information provided therein.**