NEWS YOU CAN USE - ONE SIZE DOESN’T FIT ALL ! ! !

....from the smallest mouse to the largest non-human primate, and for everyone in-between, we offer catheter designs and access ports for all sizes of Species and all Access Targets, including jugular, femoral, carotid, portal, gastric, intrathecal and biliary.

RODENT CATHETERS

Rodent catheters should be more than miniaturized versions of catheters for larger species. They should be designed to suit the size of the rodent and the access target. If you don’t find an “off the shelf” catheter that perfectly suits your need, consider our...

Built to Order option and let us make you a custom catheter.

CATHETERS FOR LARGER SPECIES

... include the Silo-Cath and Chronic-Cath as well as our selection of site specific gastrointestinal catheters - the burp valve, the slit valve and the perfusion catheter. Catheters can be connected to vascular access ports for a closed system or externalized and inserted percutaneously. Peel-away needle introducers are available for catheter sizes 3-7 French and Introducer kits containing an 18ga needle, dilator and guidewire are available for catheter sizes 7-9 French. Information on these can be found on our website and in our catalog.

CATHETER SELECTION

Catheters are foreign bodies and no matter how biocompatible they are, elicit a response. In order to optimize infusion and sampling, catheter choice should therefore be such that it minimizes vessel trauma and phlebitis. Phlebitis is the inflammatory reaction in the vessel due to mechanical trauma, chemical irritation or bacterial colonization. Mechanical trauma is caused by injury to the endothelial layer of the vessel during catheter insertion and advancement. The stiffness of the material, surface texture and shape of the catheter tip play important roles in determining intimal irritation. While stiffer tubing and bevelled tips are easier to insert into smaller vessels, the friction and endothelial irritation that occurs may limit vessel patency. Don’t forget about the importance of the ratio between the vessel ID and catheter OD. In general a catheter that is small enough to allow continuous blood flow around it has a decreased chance of inducing a clot. (Virchow’s triad and the Poiseuille Equation)

Material properties you should consider include.... Design properties you should consider include....

- biocompatibility and thrombogenicity
- stiffness, flexibility and tensile strength
- stiff tubing promote endothelial injury
- ease of insertion and modification
- the ID/OD ratio of the material
- the surface coefficient of friction

Dear Friend, While I do realize that your research might not always require the use of our products, and therefore we might not hear from you from time to time, I always enjoy learning what you are doing, so please keep in touch and remember to keep your Tips coming.

Pam (pwolf@norfolkmedical.com)
NEWS YOU CAN USE - WHICH PORT SHOULD I USE!!!

...similar to catheter choice, vascular access port choice model depends in large part on the species it will be placed in, the study design and implantation site. Answering the question “Which port (VAP) stays patent the longest?” is more complicated. There is no simple answer. It is because the vascular access port is simply a biocompatible device with no moving parts that does not degrade over time that makes the answer dependant on more than just the product itself. Patency of the port depends on the skill and experience of both the surgeon, the maintenance team and.....the internal fluid pathway i.e. the reservoir design. It was in response to data presented by Lawson1 and Fraschini2 in the early 1990’s suggesting a strong correlation between the presence of sludge in the port reservoir and the incidence of occlusions and infections, that led our parent company, Norfolk Medical to focus on the internal fluid pathway and examine the reservoir more closely.

WHY the reservoir or chamber shape is important

FLOW DYNAMICS

it is well documented that the dead space in the port chamber retains thomosed blood and drug residuals known as SLUDGE that builds up over time, like a sand castle, and may occlude the port. The three places where sludge can build-up are: in the corners where the septum joins the base, in the corners of the base and, where the catheter enters the port.

The withdrawal occlusion you see is likely the result of the needle eye being buried in sludge!! (fig 1)

HOW we changed the reservoir to improve patency

FLOW DYNAMICS

first we introduced the ClearPort series with rounded port reservoir and then, we went a step further, introducing the SwirlPort. This port has a spherical chamber, a smaller dead space volume and an enlarged and radiused septum. With a spherical flow pattern, no corners for sludge to accumulate the SwirlPort ensures complete flushing and has the lowest chamber flushing volume of any port on the market.

A Noteworthy Tip . . . when accessing a vascular access port, especially when withdrawing, be sure the needle tip hits the base of the port. You will hear a ‘click’ when the needle hits the base of the port that will confirm the needle eye/heel has cleared the septum. Maintain positive pressure as the natural tendency is to pull back on the needle when it hits the metal base.

If the deflected tip/needle heel does not totally clear the septum, withdrawal will be difficult due to the occlusion caused by the ‘partially occluded needle eye’.

This leads to another question - What is the best/optimal needle length? More about needles in the next issue.

A Noteworthy Tip . . . when choosing a catheter, choose the smallest French size possible. The optimal proportion between the catheter diameter and the vessel diameter is a balancing act. Human studies have shown that larger catheter sizes produce higher rates of vein thrombosis. (Bedford 1977, Downs 1974). If the catheter is too large for the vessel, it may encourage stasis (one of the components of Virchows Triad) and be a set up for .....”trouble down the pipe-line”.

This leads to another question - How large a catheter is too large? More about catheter size in the next issue.

The TipS is a forum for sharing - your comments are important. Please consider sharing them.
**CATHETER BASICS - MATERIALS COMPARISON**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Silicone</th>
<th>PolyUrethane</th>
<th>PolyEthylene</th>
<th>Teflon/PTFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Ratio</td>
<td>Thicker Wall/ID Smaller</td>
<td>Thinner Wall/ID Larger</td>
<td>Thicker Wall</td>
<td>Thicker Wall</td>
</tr>
<tr>
<td>Biocompatibility</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Fair</td>
<td>Fair</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Possible Reactivity</td>
<td>Possible Reactivity</td>
<td>Inert</td>
<td>Possible Reactivity</td>
</tr>
<tr>
<td>Heat Sensitivity</td>
<td>Excellent</td>
<td>Poor</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Stiffness</td>
<td>Soft</td>
<td>Softens in body</td>
<td>Stiffer</td>
<td>Stiff</td>
</tr>
<tr>
<td>Ease of Insertion</td>
<td>More Difficult</td>
<td>Moderately Easy</td>
<td>Easy</td>
<td>Easy</td>
</tr>
<tr>
<td>Ease of Modifying</td>
<td>Easy</td>
<td>Fair</td>
<td>Poor</td>
<td>Difficult</td>
</tr>
<tr>
<td>Memory</td>
<td>Excellent</td>
<td>Poor</td>
<td>Poor</td>
<td>Poor</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>Fair</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Excellent</td>
<td>Moderate</td>
<td>Poor-Rigid</td>
<td>Poor-Rigid</td>
</tr>
<tr>
<td>Coefficient of Friction</td>
<td>Fair</td>
<td>Excellent</td>
<td>Good</td>
<td>Excellent</td>
</tr>
<tr>
<td>Coating Option</td>
<td>n/a</td>
<td>Hydromer</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Sterilization Method</td>
<td>Autoclave or EtO</td>
<td>EtO</td>
<td>Autoclave or EtO</td>
<td>Autoclave or EtO</td>
</tr>
</tbody>
</table>

**Catheter Size / Measurement System(s)**... there are 2 systems by which catheters are measured; French and Gauge.

**Which should you use?** It is more common to use the French scale for catheters and the Gauge scale for needles. It is important to exercise caution when considering catheter/needle and guidewire combinations to not mix up the measuring systems.

In the French measurement scale, each unit is equivalent to 0.33mm in outer diameter. For example, a 5Fr catheter will have an OD of 1.65mm (5x0.33). French size and OD are directly related, the smaller the French size, the smaller the OD.

Gauges are old measures of thickness. They originated in the British iron wire industry at a time when there was no universal unit of thickness. It was later adopted for hollow needles and catheters. It measures how many wires can be placed side by side in a given space and varies inversely with outside diameter, the higher the gauge size, the smaller the outside diameter. A 20 Ga needle for example is larger than a 25 Ga needle. Yes, a lower gauge indicates a bigger/thicker needle.

**Table showing the French-Gauge Conversion of Tubing**

<table>
<thead>
<tr>
<th>French</th>
<th>Gauge</th>
<th>Inner Diameter</th>
<th>Outer Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27</td>
<td>0.007”/0.2mm</td>
<td>0.16”/0.4mm</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>0.012”/0.3mm</td>
<td>0.25”/0.6mm</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>0.020”/0.5mm</td>
<td>0.37”/0.9mm</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>0.025”/0.6mm</td>
<td>0.47”/1.2mm</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>0.030”/0.7mm</td>
<td>0.65”/1.7mm</td>
</tr>
<tr>
<td>7</td>
<td>13</td>
<td>0.050”/1.3mm</td>
<td>0.95”/2.4mm</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>0.062”/1.6mm</td>
<td>0.125”/3.2mm</td>
</tr>
</tbody>
</table>

**Catheter Size . . . what's best?**

...it depends on the vessel size as to how it fits into the vessel?

In smaller diameter vessel, the catheter takes up a larger percentage of the area compared with the space occupied by the catheter in the larger vessel. The catheter in the larger vessel is less likely to result in stasis of flow and is the same catheter in the smaller vessel. Remember, **Stasis of Flow** is one of the three broad categories of factors in Virchow’s Triad that are thought to contribute to thrombosis.

In addition, catheters are much more likely to have direct contact with the intima in a smaller caliber vessel than in a larger vessel causing damage to the tunica intima. Remember, a **healthy endothelium** is your best defense against thrombosis.

![Catheter Size...Bigger is Not always Better!!!](image)

The same size catheter in different sized vessels
CATHETER DESIGN A CUSTOM CATHETER

Material for Catheter Construction
- should have high tensile strength
- should be soft and pliable
- should be chemically resistant
- should be biocompatible

Stiffer tubing is easier to insert but may promote endothelial injury during insertion and advancement promoting tissue proliferation and microthrombi formation.

Distal Tip Configuration
- preferably an atraumatic rounded tip

While bevel and blunt tips may be easier to insert they can cause friction and endothelial irritation during insertion and advancement that results in mechanical damage to the tunica intima, the endothelial lining. Potential results of this roughing of the surface within the vessel wall, allowing platelet aggregation, include phlebitis and thrombus formation.

French Size
- to meet flow requirements
- to suit the vessel diameter
- to maintain minimally invasive profile

In general a catheter diameter that permits continuous blood flow around it has a decreased chance of inducing a clot. Catheter diameter relative to vessel diameter is a balancing act; too large a catheter takes up too much space in the vessel and too small a catheter increases the resistance to infusion and withdrawal.

Modifications
- to suit the access location
  - vascular, tissue, organ or skin

Exit Site Options
- access port, luer adaptor, pigtail, cuff or plug
- to allow repeated access to the catheter