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Thoracic Endovascular Aortic Repair (TEVAR) Sheaths ^[1]

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Introduction

Introducer sheaths currently provide the safest method of maintaining access to the vascular system during an endoluminal procedure. The use of sheaths is now recommended for nearly every endoluminal procedure, whether diagnostic or interventional. Sheaths are essential if exchanging of guidewires or catheters is planned, if any large or irregular devices are to be introduced, and in all interventional procedures.

Sheaths are introduced during initial vascular access by insertion over the primary access guidewire after cannulation of the artery using the Seldinger technique. Appropriately sized dilators aid the insertion of the larger sheath into the small puncture made by the initial needle. Subsequent to insertion, all exchange or introduction of guidewires, catheters, and devices will take place through the lumen of the sheath. The benefit of the sheath lies in the exclusion of the vessel puncture site from this activity. Each guidewire or catheter introduced directly into the vessel carries a risk of localized hematoma formation or vessel trauma (enlarging the puncture site, dissection of an intimal flap, tearing of vessel walls, etc.), but the sheath serves to minimize vessel trauma and extravasation of blood while maintaining vascular access.

Construction & Materials

Sheaths and dilators are usually constructed of Teflon (tetrafluoroethylene). This rather inflexible material has an extremely low coefficient of friction and is very torquable (turning the ex-vivo portion results in rotation of the in-vivo portion), making it ideal for establishing a conduit through which exchange of devices can occur. A radiopaque material is often incorporated into the distal end of the sheath, enabling clear visualization under fluoroscopy. Nearly all sheaths feature a hemostatic valve and side infusion port. The valve is of principal importance to the function of sheaths: it allows insertion of devices into the vessel while maintaining hemostasis. Hemostatic valves can either be the traditional slotted membrane or the rotating valve, which

can be manually opened and closed. While both types are effective in preventing blood loss, the rotating hemostatic valve allows back-bleeding in the open position, which is thought to reduce the risk of air embolization. The sheath side port can be used for blood sampling, pressure monitoring, and contrast injection.

Sheath Dimensions

While catheters and dilators are sized by their outer diameter, sheaths are sized according to their inner diameter (the largest size device that can be inserted through them). There is a universal color coding system for standard sheath sizes:

4 French	=	red
5 French	=	grey
6 French	=	green
7 French	=	orange
8 French	=	blue
9 French	=	black
10 French	=	violet
11 French	=	yellow

In addition, large diameter sheaths (20-24F) are available for delivery of endografts in the treatment of aortic pathologies. These sheaths are often included into the endograft delivery systems. Sheath lengths range from 10 cm to 65 cm, but the 10 cm to 15 cm length is standard for most peripheral vascular interventions. Longer length sheaths are usually only needed for endograft placement or access to the contralateral side of the body. The majority of sheaths used in our endograft cases are 10 cm in length.

Device	Dimensions	Company	Characteristics
Pinnacle Introducer	7-11F by 10-25(4F with brachial access)	Terumo	Straight sheath with cross-cut hemostatic valve
Large (12-24Fr) Sheaths are incorporated in endograft delivery system			
Keller-Timmerman	18-24F by 25-65 cm	Cook	Large, valved sheath

Large & Extra Large Check Flo	10-24F by 25-60 cm	Cook	Tapered sheath with hemostatic valve
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Conclusion

The scrupulous preoperative planning that is required for all endoluminal procedures also extends to sheath selection. An example of this is seen in our initial sheath placement during (T)EVAR. While a 6F or 7F will often suffice for the initial lesion crossing and angiography of the procedure, we rarely use these sheath sizes for primary access. All of our endograft procedures are done using IVUS imaging, and so a 9F sheath, at the smallest, will be introduced to accommodate the 8.2F IVUS Catheter (Visions PV 8.2F; Volcano Corp.). In cases where acute rupture is an impending concern, we use a 12F or 14F sheath for primary access, to potentially accommodate a large diameter occlusion balloon (e.g. 12F Reliant Stent Graft Balloon; Medtronic Inc.). A large and varied array of sheaths should be available for every endoluminal procedure to account for operative variations and unforeseen circumstances.

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