Guidewires: Making Railroads Safer in the 21st Century

Contemporary choice of safe and effective guidewires in high-risk patients.

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Interventional endovascular medicine has brought untold benefits to millions of people around the world. Each year, new frontiers are opened and relief is offered to patients, resulting in lower morbidity rates than previously possible. Despite many advances, several fundamental aspects remain common to essentially all endovascular procedures. These aspects are that access to the vasculature must be obtained, the appropriate destination vessel either for angiography or intervention must be catheterized, and for interventions the lesion must be crossed safely. It is essential for both patient safety and to attain quality measures that these aspects of a procedure be accomplished without damage to the vessel.

Challenges abound as the population ages, and we see more and more tortuous vasculature, which portends to an increased risk of vessel injury, specifically dissection. Catheterization and intervention in the distal carotid artery, cerebral venous system, and antegrade femoral access all require effective and safe approaches. Another expanding clinical area is deep venous interventions, which in the setting of concurrent thrombolytic therapy require us to revisit the safety side of the balance of lesion crossing in our choice of guidewire.

Guidewire selection is usually taught during formal training programs in the more traditional apprentice model of one-on-one case-based instruction. One or two lectures may be given on the topic, but there is a relative scarcity of classic trial data. Just as in the selection of brand of sports equipment, there is significant operator variability. Nonetheless, it is important to review this topic so as not to be discovered midway through one's career using a driver for short putts.

CASE STUDY

A 32-year-old man with known end-stage renal disease was admitted to the ICU with respiratory failure and was started on hemodialysis through a left femoral venous temporary catheter. Despite improvement in his pulmonary edema, he could not be weaned from a ventilator, and on exam had evident severe head, neck, and arm swelling and venous congestion. The patient had known occlusion of both his

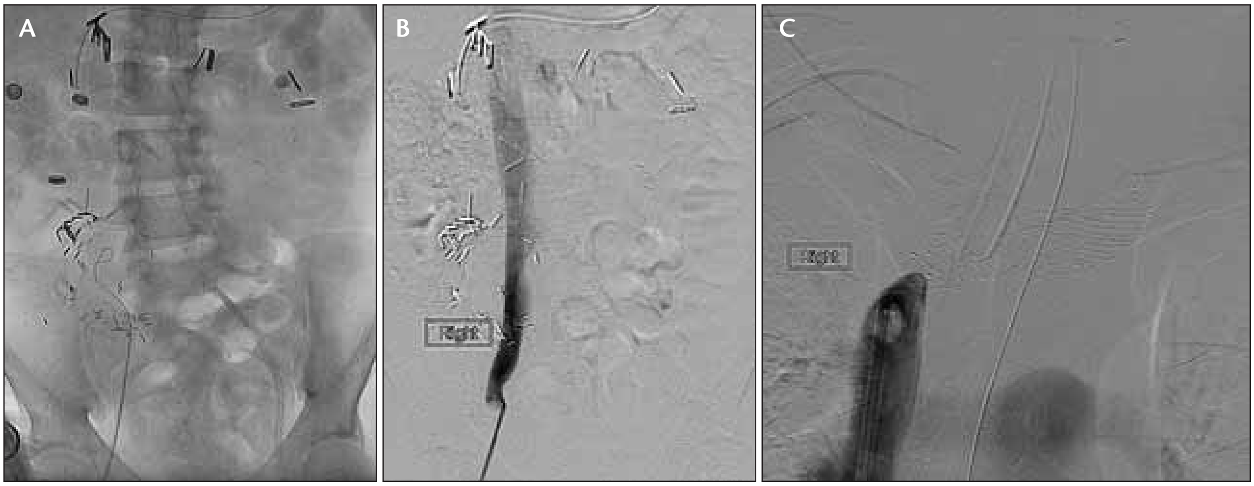

Figure 1. J wire in the right common iliac vein (A). Venogram of the right common iliac vein (B). Occluded SVC (C).

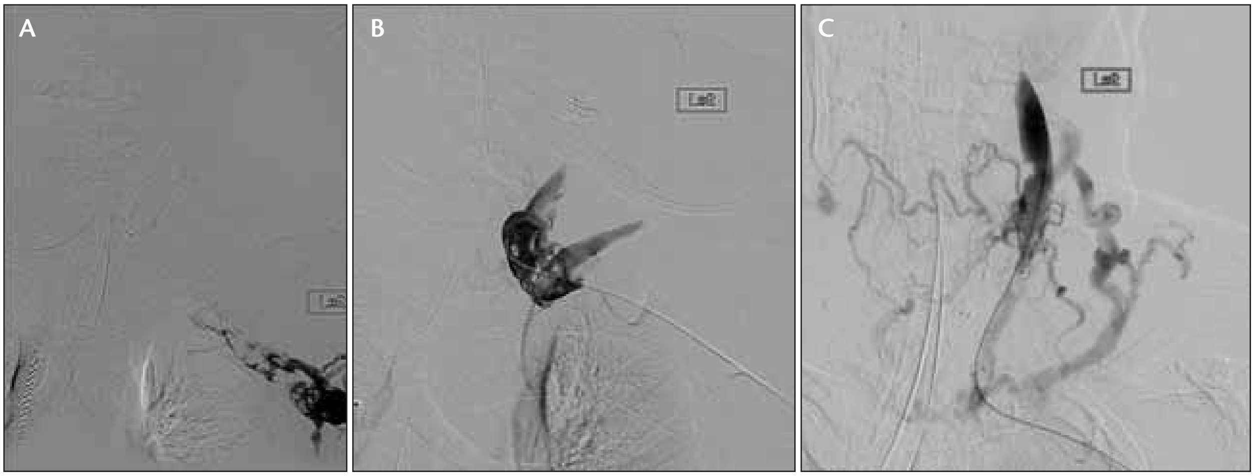

Figure 2. Thrombosis of the left axillary and subclavian veins (A). A Bernstein catheter at the confluence of the left subclavian and left jugular veins (B). The left internal jugular vein was successfully accessed (C).

superior vena cava (SVC) and a previously placed stent in the left brachiocephalic vein. His left subclavian and jugular veins were previously patent with adequate outflow through the left hemiazygos system and other mature venous collaterals.

Computed tomography and duplex imaging demonstrated complete thrombosis of the left internal jugular and subclavian veins. In an effort to relieve the head and neck swelling, the patient was referred to the endovascular suite. A short 6-F sheath was inserted in the right femoral vein. However, the standard J wire would not traverse the right common iliac vein despite more manipulation than is perhaps ideal based on retroflexion of the J wire (Figure 1A). A venogram showed a spiral-type stenosis likely related to previous dialysis catheters or recanalized deep venous thrombosis that was later shown to have a 10 mm Hg gradient, which is highly significant for a vein (Figure 1B). This area was then crossed without difficulty with a simple 145-cm floppy tip Wholey (Covidien, Mansfield, MA), and the same wire was used to traverse the right atrium and cannulate the stump of the SVC (Figure 1C). The gentle floppy shapeable tip of a standard Wholey wire combined with its near 1:1 torqueability make these lesions simple to traverse safely without the repeated cannulation of tiny side branches that tends to occur with hydrophilic wires.

Fluoroscopy time can be diminished and dissections and microperforations avoided. Interventionists who perform coronary, distal renal, or intracranial interventions are too well aware of the risks of unchecked hydrophilic wires and potentially fatal hemorrhagic consequences, such as pericardial effusion, intraparenchymal hemorrhage, and subcapsular hematoma in the kidney.

In this case, it was evident that the SVC was an impenetrable lesion; an 8-F 30-cm sheath was therefore inserted in the left cephalic vein. Venography con-

Figure 3. The Trellis device in the left internal jugular and subclavian veins (A). The Wholey wire in the cavernous sinus to allow stent delivery (B). Excellent flow after intervention in the left internal jugular vein (C). Postintervention venogram of the left subclavian and axillary veins (D).

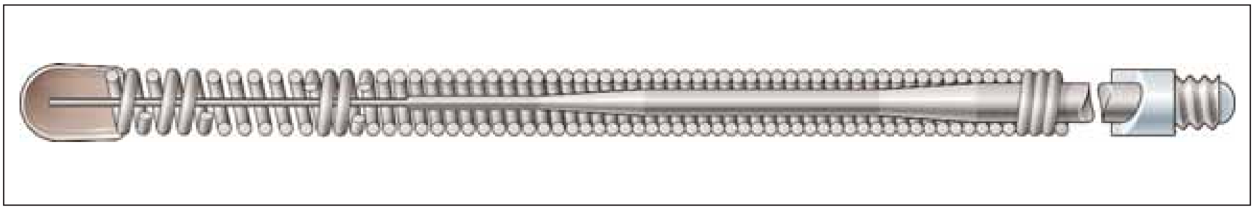
(Courtesy of Covidien.)

Figure 4. Construction features of a 145-cm floppy LOC compatible with the Wholey wire.

firmed thrombosis of the left axillary, subclavian, and left internal jugular veins (Figure 2A). Initial attempts to cross the thrombotic occlusion included use of an angled hydrophilic Glidewire (Terumo Interventional Systems, Somerset, NJ) and a 5-F Bernstein catheter (Angiodynamics, Queensbury, NY) (Figure 2B). However, at the confluence of the left internal jugular and subclavian veins, the hydrophilic wire continued to track through collaterals and small branches. The Glidewire was replaced with a 300-cm 0.035-inch Wholey wire with rapid success, and the jugular bulb and ultimately sagittal sinus were easily accessed (Figure 2C).

Isolated pharmacomechanical thrombolysis with an 8-F Trellis (Covidien) (Figure 3A), venoplasty, and stenting were performed (Figure 3B). Excellent angiographic results were achieved with normal flow in the left internal jugular (Figure 3C) and in the left subclavian and axillary veins (Figure 3D). Good clinical results were also achieved, and the patient's venous congestion and airway compromise improved dramatically over the next 48 hours.

DISCUSSION

The American West was built on railroads, and good endovascular interventional results are similarly dependent on guidewire efficacy. Too often guidewire performance is judged simply on the ability to cross a lesion. Often too little emphasis is placed on choosing a wire based on what it does not do—such as not perforate. This is a particular concern when brain and kidney parenchyma are close to the wire tip and some polymeric wires tend to find the lumen of every microscopic side branch rather than traverse the main lumen.

In our lab, the 0.035-inch Wholey wires have become the first choice in many cases, including carotid cannulation, antegrade sheath insertion in the common femoral artery, any time a J wire does not pass easily in standard femoral or radial arterial access, interventional deep vein thrombosis cases, and any time an 0.035-inch wire may enter the tibioperoneal arterial system. The availability of a 300-cm 0.035-inch Wholey wire with extra support is especially useful when contralateral interventions are performed on the superficial femoral artery because some new self-expanding stents such as the LifeStent (Bard Peripheral Vascular, Inc., Tempe, AZ) have long delivery systems, and 260-cm wires are frequently not long enough in large patients. Crossing inferior vena cava filters or getting catheters past intracardiac pacer/defibrillator leads are another situation in which the non-J soft Wholey tip is a particularity safe and attractive wire choice because retracting the wire will not move the filter or lead. The atraumatic shapeable tips and 1:1 torqueablity of the Wholey wire allow complex anatomy to be crossed safely and quickly, limiting dissections, wire perforations, and fluoroscopic time.

The Wholey family includes standard-length 145- and 175-cm wires, which can be extended with the LOC screw-on exchange system, as well as 260- and 300-cm wires in both standard and extra support. Critical stenoses can be easily crossed with the TAD wires (Covidien), which have a crossing 0.018-inch tip and an 0.035-inch body. The solid, full-length, tapered core allows excellent direct torque characteristics (Figure 4). The gold tip makes tip identification simple even in poor fluoroscopic situations, and the shapeable tip makes wiring of extremely angulated branches possible with minimal effort.

SUMMARY

The Wholey family of wires addresses many of the challenges faced in the endovascular world, and perhaps one of the important attributes of these wires is not just what they do but what complications they can help prevent. ■

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