Guidewires in ERCP

When Sven-Ivar Seldinger first described his novel technique for arterial puncture in 1953, his simple yet ingenious idea to use a guidewire was slow to gain acceptance. Years later, the "Seldinger technique" has been adapted for a variety of interventional procedures with far-reaching applications throughout medicine. In gastrointestinal endoscopy, guidewires have become an indispensable tool for use in luminal dilation, enteral stent placement, and pancreaticobiliary access in ERCP. In this month's Fellows' Corner, Dr. Gaurav Singhvi and Dr. Stanley Dea from the Olive View-UCLA Medical Center provide a review on the basics of guidewires in ERCP.

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The role of guidewires in ERCP cannot be overstated. Guidewires facilitate access to both the bile and the pancreatic ducts, maintain cannulation, and allow for the passage and exchange of instruments used in ERCP. This article will focus on the physical characteristics of these wires, discuss the differences between long- and short-wire techniques, and review safety and cost considerations.

WIRE SPECIFICATIONS

The basic structure of the guidewire consists of a monofilament core with an outer coating. The core material for the monofilament is typically composed of nitinol, which has largely replaced stainless steel. The monofilament is covered with an outer sheath made of polytetrafluoroethylene (PTFE, or Teflon) or polyurethane, synthetic hydrophobic materials, enabling the smooth exchange of devices over the wire. The distal tip, or business end, of the guidewire is coated with an additional hydrophilic material to facilitate cannulation of the papilla. Also, the tips can be straight or angled, which may be useful when one attempts selective cannulation of either the right or the left system. Spiraled color markings along the entire length of the guidewire allow for detection of wire movement.[1]

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In the earlier days of ERCP, completely hydrophilic guidewires were thought to provide an advantage in achieving successful cannulation, especially when dealing with a difficult papillae or a tight stricture.[2] But this benefit was tempered by the continual need to keep the guidewire lubricated, the increased risk of inadvertent displacement from the duct, and inefficient use of a second nonhydrophilic wire to pass accessories. This led to the development of newer wires with hydrophilic tips in the distal 5 to 10 centimeters while leaving the remainder of the wire nonhydrophilic. This combination took advantage of the strengths of both types of wires, allowing cannulation and exchange in a single device. Although most ERCP guidewires use this design, some endoscopists still prefer the entirely hydrophilic wires for the tactile feel they provide when they work with difficult cannulations and strictures.

The most commonly used guidewires in ERCP come in three different diameters: 0.018, 0.025, and 0.035 inches. Other proprietary wires sized at 0.020, 0.021, and 0.038 inches are also available. The 0.035-inch diameter is the standard size used in biliary endoscopy, but some experts believe that the 0.025-inch wire is more effective in biliary work because the smaller diameter allows for cannulation in small or narrowed papillae. The smallest-diameter wire, 0.018 inches, is advocated to be most effective for work in the small-caliber pancreatic duct and its branches. As the wire becomes smaller in diameter, it becomes more floppy and subsequently harder to control. There are no robust data regarding the effectiveness of the different-size wires in these clinical scenarios; it is the expert's preference which one to use. The available guidewire lengths range from 420 to 480 centimeters; these wires are used in the "long-wire" system. The newer "short-wire" system uses wires that are about half the length, from 185 to 270 centimeters.

LONG- AND SHORT-WIRE TECHNIQUES

Long-wire system

The need for the long wire at the inception of ERCP was dictated by the fact that this length was needed to exchange the various devices needed for the procedure.[3] The endoscopic assistant requires training and experience to be adept at manipulating the guidewire. In addition, excellent communication is needed between the physician and the assistant. This may make using the long-wire system a challenge at facilities that do not have experi-

enced staff available. Difficulties between physician and assistant can lead to loss of access, more difficult cannulation, an inability to advance the wire to the desired location, and problems with device exchange.[4]

Some inherent advantages are associated with the long-wire system. Primarily, universal exchange capabilities are present across all devices and all companies.[1] The long-wire approach may also be better suited in 2 specific circumstances: complex rendezvous EUS-assisted cholangiopancreatography and single-operator cholangioscopy.

Short-wire system

The development of the short-wire system for ERCP is relatively recent and was aided by advances in catheter technology.[1] There are three proprietary short-wire systems: the RX system (Boston Scientific; Natick, MA), the Fusion system (Cook Endoscopy; Winston Salem, NC), and the V-system (Olympus; Tokyo, Japan). The key component of all short-wire systems is the ability to lock the wire in place. The exchange of various devices can then be performed without concern over wire displacement. Guidewires can be locked internally at the elevator or externally at the biopsy port.[1] Both of these locking sites allow easy access to the wire for the physician, and this is thought to be the greatest advantage of the short-wire system because it leads to direct control of the wire by the physician.

The physician's control of the wire puts the endoscopist on a par with members of other procedural subspecialties, such as urologists, cardiologists, and interventional radiologists. This may be particularly beneficial when the patient's anatomy is difficult, because the physician can work with increased tactile feel and response. Perhaps a more tangible benefit of physician-controlled wire guidance is less dependence on a skilled endoscopy assistant to perform ERCP, thus permitting use of the procedure in centers without dedicated staff for interventional endoscopic procedures. The locking mechanism is particularly useful in allowing for easy exchange of devices; otherwise, careful coordination between the physician and assistant would be required when the traditional long-wire approach is used. On the other hand, there are drawbacks associated with the short-wire system. They include poor guidewire visibility, air and bile leakage, risk of eye injury caused by free suspension of the wire after it has been locked in place, and difficulty in placing pancreatic stents.[3]

One prospective randomized study compared the newer short-wire system with the long-wire system.[5] The mean device exchange time and stent insertion time were significantly faster with the short-wire system. In addition, there was a trend toward total shorter procedure time, fluoroscopy time, and time to cannulation, but these differences did not reach statistical significance. These outcomes are clinically significant, inasmuch as shorter fluoroscopy times would minimize radiation exposure to patients and physicians, and shorter procedure times would decrease the duration of procedural sedation, which could in turn prevent anesthesia-related complications. More studies are needed to confirm these benefits.

SAFETY CONSIDERATIONS

The primary complication associated with guidewire use during ERCP is perforation. The main site at risk for guidewire-related perforation is the biliary tree. A large retrospective study of 6620 ERCPs identified 7 guidewire-related perforations.[6] All were recognized during the procedure and were managed medically, with only 1 patient requiring a biliary stent. Concern for electrical injury transmitted from the cutting sphincterotomy wire to the guidewire is more of a historical concern because the newer coated wires effectively prevent this problem. However, this can be a potential concern if the guidewire is damaged or fractured.

Earlier studies indicated that wire-guided cannulation was a risk factor for post-ERCP pancreatitis.[7] However, more recent reports have demonstrated that wire-guided cannulation, as opposed to catheter-guided contrast medium injection, can decrease the incidence of pancreatitis. One of the initial studies to confirm this finding was a randomized controlled trial that assessed 400 patients; half of the patients underwent cannulation by the wire-guided technique, and the other half received cannulation by the traditional catheter-based method. There were no cases of pancreatitis with the wire-guided approach, whereas there were 8 cases when the catheter was used without a guidewire. Moreover, a much higher proportion of patients in the catheter-based cohort had an asymptomatic rise in amylase.[8] A subsequent study evaluated a low-risk population and also found a lower rate of post-ERCP pancreatitis in patients undergoing wire-guided cannulation compared with conventional cannulation with contrast medium injection.[9]

COSTS

All of the guidewires used in ERCP are disposable, single-use items. In many cases, there is no significant difference in price between the various lengths and diameters of the guidewires. However, the short-wire method is generally more expensive than the long-wire technique because of the relatively higher costs of the short-wire accessories, including balloons, baskets, stent deployment systems, and brushes, in comparison with their analogous counterparts in the traditional long-wire system. Also, an additional expense is associated with the external locking device that is essential for the short-wire method.

CONCLUSION

Guidewires play a critical role in ERCP in cannulating the papillae, facilitating selective access to the desired duct, and enabling exchange of devices. They may also serve to reduce post-ERCP pancreatitis—one of the feared complications of the procedure. Although specific benefits are associated with both the short-wire and the long-wire systems, the key difference between them is the degree of physician control over the guidewire. Ultimately, the physician's experience and preferences with ERCP should dictate the size, length, and type of guidewire to be used, to best care for the patient while minimizing the risk of complication.

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