Dilation of high-grade pancreatic and biliary ductal strictures with small-caliber angioplasty balloons

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Background: Pancreatic and bile duct strictures may be too stenotic to allow passage of conventional endoscopic dilators.

Methods: Four patients with strictures (3 pancreatic, 1 biliary) that could not be traversed with conventional endoscopic dilating devices, or in 1 case by a Soehendra stent extractor, underwent stricture dilation with a 3.3F peripheral angioplasty balloon to a maximum diameter of 6 mm.

Observations: All strictures in the 4 patients were successfully traversed and dilated and stents were placed with resolution of the presenting clinical problem.

Conclusions: Small-caliber angioplasty balloons are useful for dilation with subsequent stent placement of pancreatic and biliary strictures that are refractory to standard endoscopic approaches.

Pancreatic and biliary strictures may be highly stenotic, especially in the setting of advanced chronic pancreatitis or primary sclerosing cholangitis, and thus refractory to dilation with standard endoscopic accessories. The efficacy of graduated dilation is limited by the amount of force that can be applied to pass a dilating device through a stricture, especially in the case of proximal strictures distant from the papilla. The usefulness of endoscopic balloon dilators is limited by the relatively large diameter of the catheter itself (minimum 5.8F [1.9 mm]), which is often too large to be passed through a high-grade stricture. A novel approach to dilating refractory and pancreatic and biliary strictures is the use of the Soehendra stent extractor (Wilson-Cook Medical, Inc., Winston-Salem, N.C.) which has a screw-type design. However, this device may be difficult to advance into a tortuous or small-diameter duct, its use may traumatize the duct, and it dilates to a maximum diameter of only 7 or 10F (2.3 to 3.3 mm).

This is a report of the use of a small-diameter peripheral angioplasty balloon for dilation of pancreatic and biliary strictures that were refractory to other methods of endoscopic dilation.

PATIENTS AND METHODS

Four patients with strictures (3 pancreatic, 1 biliary) that could not be traversed with conventional endoscopic dilating devices, or in 1 case by a Soehendra stent extrac-
tor, underwent stricture dilation with a 3.3F peripheral angioplasty balloon to a maximum diameter of 6 mm. This angioplasty catheter (Jupiter, Cordis, Johnson and Johnson, Miami, Fla.) has a length of 155 cm and a diameter of 3.9F (0.052 in, 130 mm) that tapers to 3.3F (0.043 in, 1.10 mm) along the distal portion on which the balloon is mounted. The balloon is 2.0 cm in length with an inflated diameter of 6.0 mm maximum at 16 atm pressure; the balloon extends to the distal tip of the catheter. The catheter accepts guidewires up to 0.018 inch (0.46 mm) in diameter.

**OBSERVATIONS**

**Case 1**

A 49-year-old man with primary sclerosing cholangitis presented with recurrent jaundice, low-grade fevers, and pruritis. During the previous year he had undergone endoscopic biliary sphincterotomy, dilation, and temporary stent placement for a high-grade dominant mid-common hepatic duct stricture after biopsies, brushings, carbohydrate-associated antigen 19-9 (CA-19-9), carcinoembryonic antigen (CEA), and EUS had excluded cholangiocarcinoma with a reasonable degree of certainty. ERCP demonstrated recurrence of the common hepatic duct stricture (Fig. 1A). After passage of an 0.018-inch (0.46 mm) “Roadrunner” guidewire (Wilson-Cook), an ultra-tapered 5-4-3F “Contour” catheter (Boston Scientific Microvasive Endoscopy, Inc., Natick, Mass.) could not be completely advanced through the stricture. A 3.3F (0.043 in, 1.10 mm) OD angioplasty balloon (“Jupiter,” Cordis) was advanced through the stricture, and expanded to 6 mm at 12 atm of pressure (Fig. 1B), and an 8.5F Amsterdam-type biliary stent placed. The jaundice and pruritis resolved.

**Case 2**

A 42-year-old woman with chronic pancreatitis presented with recurrence of intractable pain 1 year after successful endoscopic dilation with temporary stent placement of a ductal stricture in the head of the pancreas. At ERCP, a high-grade distal pancreatic stricture with a moderately dilated (7 mm) main pancreatic duct was demonstrated. The stricture could be traversed with an 0.018-inch (0.46 mm) “Roadrunner” guidewire (Wilson-Cook) and 5F catheter, but not with a graduated 4-5-7F dilator or a 5.8F (1.9 mm) dilating balloon (Fig. 2A). A 3.3F (0.043 in, 1.10 mm) OD angioplasty balloon (“Jupiter,” Cordis) was passed through the stricture and inflated to 6 mm diameter at 12 atm with partial obliteration of the waist (Fig. 2B). With an additional 1 minute dilating time, the waist disappeared, allowing placement of a 5F stent. The patient’s pain resolved.

**Case 3**

A 45-year-old woman with chronic pancreatitis was referred for further management of intractable pain and recurrent pancreatic fluid collections. One year earlier she had undergone a two-thirds pancreatectomy for recurrent pseudocysts caused by complete disruption of the main pancreatic duct. ERCP showed a highly stenotic stricture in the pancreatic duct approximately 1 cm from the papilla with a leak from the terminal stump 2 cm proximal to the stricture. After pancreatic sphincterotomy, an 0.018-inch “Roadrunner” guidewire (Wilson-Cook) was passed to the end of the remnant duct, but it was not possible to insert a 5-4-3F tapered “Contour” cannula
(Microvasive) through the stricture. A 4F Soehendra dilator (Wilson-Cook) was passed and a 3F pancreatic stent placed. One week later a 4F stent placed. The following week, in an attempt to further dilate the stricture, a 7F Soehendra stent-extractor (Wilson-Cook) was screwed into the pancreatic duct over a guidewire, but did not reach the stricture because of the small diameter of the distal duct. A 5.8F (1.9 mm) balloon dilator could not be passed through the stricture. A 3.3F (0.043 in, 1.10 mm) OD angioplasty balloon (“Jupiter,” Cordis) was used to dilate the stricture to 6 mm, allowing placement of a 5F stent. Eventually, the stent was upsized to a 7F stent. The patient’s pain and the fluid collections resolved, and the duct disruption healed.

**Case 4**

A 49-year-old woman with intractable pain and advanced chronic pancreatitis was referred for endoscopic therapy. A previous ERCP had demonstrated complete occlusion of the main pancreatic duct in the body of the gland. Magnetic resonance cholangiopancreatography (MRCP) showed a small-caliber main pancreatic duct with a mid-ductal stricture and upstream duct dilation. At ERCP, complete obstruction of the main pancreatic duct at the mid-body was found. After pancreatic sphincterotomy, and passage of an 0.018-inch hydrophilic Glidewire (Microvasive) through the stricture, only the tip of a 5-4-3F tapered “Contour” cannula (Microvasive) could be advanced. An 0.018-inch (0.46 mm) “Roadrunner” guidewire (Wilson-Cook) was substituted and passed beyond the stricture. A 5.8F (1.9 mm) OD Olbert dilating balloon (Microvasive) could not be advanced over this wire through the stricture. A 3.3F (0.043 in, 1.10 mm) OD angioplasty balloon (“Jupiter,” Cordis) was inserted through the stricture, and the balloon inflated to 6 mm at 12 atm with obliteration of the waist. A 5F pancreatic stent was placed to the tail of the pancreatic duct. Based on improvement in symptoms, the patient underwent surgical resection of the tail of the pancreas with good response at follow up after 1 year.

The strictures in these 4 patients were successfully traversed and dilated and stents were placed with resolution of the presenting clinical problem.

**DISCUSSION**

These cases illustrate the adaptation of an interventional radiology accessory for endoscopic dilation of strictures of the bile and pancreatic ducts that were too stenotic to be dilated with conventional endoscopic accessories. In general, the adaptation of nonendoscopic accessories to endoscopic purposes is limited by inadequate length (they are usually shorter than the minimum required length of 140 cm), or need for extremely small-caliber guidewires.

Baron et al. reported the novel use of an angioplasty balloon to extract a migrated pancreatic stent. However, that device required use of a 0.014-inch guidewire with a special extension and lacked the necessary rigidity for passage through tight strictures. The device used in the cases described here, designed for peripheral angioplasty, has an OD (3.3F) sufficiently small to permit passage through high-grade strictures together with an inner diameter adequate for passage over a standard 0.018-inch (0.46 mm) endoscopic guidewire. The device is just long enough to traverse the stricture and deploy the stent.
enough to reach a stricture 15 cm above the papilla, thus bringing the entire length of the pancreatic and biliary tree within range. One advantage of this balloon over a screw-type dilator is that it provides large-diameter dilation (6 mm) at the initial procedure, thus avoiding an excessive number of maneuvers or repeated ERCPs. Small-caliber angioplasty devices may prove to be particularly useful for endoscopic purposes, not only for dilation of high-grade pancreatic duct strictures associated in chronic pancreatitis and biliary strictures caused by sclerosing cholangitis, but for excessively stenotic benign and malignant hilar or intrahepatic strictures as well.

**DISCLOSURE**

The principal author has received speaking honoraria from manufacturers of some devices mentioned in the manuscript, including Boston Scientific and Wilson-Cook, and has received research grants from Boston Scientific.

**REFERENCES**