Difficult biliary cannulation: use of physician-controlled wire-guided cannulation over a pancreatic duct stent to reduce the rate of precut sphincterotomy (with video)

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Background: Successful cannulation of the common bile duct (CBD) remains the benchmark for ERCP. Use of a pancreatic duct (PD) stent to facilitate biliary cannulation has been described, although the majority of patients require precut sphincterotomy to achieve CBD cannulation.

Objective: To report the performance characteristics of using a PD stent in conjunction with physician-controlled wire-guided cannulation (WGC) to facilitate bile duct cannulation.

Design: Retrospective cohort.

Setting: Two tertiary care, academic medical centers.

Patients: All undergoing ERCP with native papillae.

Intervention: In cases of difficult biliary access in which the PD is cannulated, a pancreatic stent is placed. After this, physician-controlled WGC is attempted by using the PD stent to direct the sphincterotome into the biliary orifice. If cannulation is unsuccessful after several minutes, a precut sphincterotomy is performed over the PD stent or the procedure is terminated.

Main Outcome Measurements: Frequency of successful bile duct cannulation and precut sphincterotomy.

Results: A total of 2345 ERCPs were identified, 1544 with native papillae. Among these, CBD and PD cannulation failed in 16 (1.0%) patients, whereas 76 (4.9%) patients received a PD stent to facilitate biliary cannulation. Successful cannulation was achieved in 71 (93.4%) of 76 patients, 60 (78.9%) of whom did not require precut sphincterotomy. Complications included mild post-ERCP pancreatitis in 4 (5.3%) and aspiration in 1 (1.3%). Precut sphincterotomy was complicated by hemorrhage, controlled during the procedure in 2 (13.3%) of 15.

Conclusions: Physician-controlled WGC over a PD stent facilitates biliary cannulation while maintaining a low rate of precut sphincterotomy. (Gastrointest Endosc 2010;71:275-9.)

Deep cannulation of the bile duct is an important benchmark of successful ERCP. In a minority of patients, the endoscopist will encounter a challenging papilla in which cannulation of the pancreatic duct (PD) can be achieved but deep access of the common bile duct (CBD) remains elusive. In these cases, some endoscopists will perform a precut needle-knife sphincterotomy to obtain access to the CBD. Precut sphincterotomy significantly increases the risk of procedure-related complications, including pancreatitis, hemorrhage, and perforation.[1-4] In particular, complications of this intervention are highest among less-experienced physicians who perform this intervention less than once per week.[2]

Two groups have reported the use of a PD stent to achieve bile duct cannulation without the use of a precut sphincterotomy.[5,6] Slivka[6] first described the technique when using the PD stent as a guide for an ultratapered cannula (5-4-3 tip Contour cannula; Microvasive, Natick, Mass) in 3 patients. Goldberg et al[5] successfully achieved

Abbreviations: CBD, common bile duct; PD, pancreatic duct; WGC, wire-guided cannulation.

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deep bile duct cannulation in 38 (97.5%) of 39 patients after placement of a 5F polyethylene stent in the PD (Geenen or Zimmon stent, Cook Medical, Bloomington, Ind). However, 23 (59%) patients required precut sphincterotomy to access the CBD. The PD stent likely facilitates biliary cannulation by straightening the common channel and by preventing inadvertent access to the PD. In doing so, the endoscopist uses the stent to direct a guidewire or sphincterotome tip in the direction of the biliary orifice once the papilla is engaged. Another potential advantage of this approach is that PD stent placement reduces the rate of ERCP-associated pancreatitis among higher-risk patients.[7-10]

With the advent of short wire (260 cm) ERCP platforms,[11] physician control of the wire has become easier. Physician-controlled wire-guided cannulation (WGC) has been compared with standard cannulation techniques in several clinical trials, and some studies suggest a lower rate of ERCP-associated pancreatitis.[12-15] We report a modified technique combining the use of a PD stent with physician-controlled WGC to facilitate biliary cannulation.

Capsule Summary

What is already known on this topic

- When papillae interfere with deep access of the common bile duct, a precut needle-knife sphincterotomy may be performed, but it increases the risk of pancreatitis, hemorrhage, or perforation.

What this study adds to our knowledge

- In a retrospective study, the use of a pancreatic duct stent to facilitate biliary cannulation resulted in a 93% success rate and a 19% rate of precut sphincterotomy through the use of wire-guided cannulation.

METHODS

We performed a retrospective, cohort study of all ERCPs performed between January 2006 and April 2008 by 2 experienced endoscopists (R.A., D.P.) who each perform more than 350 ERCPs per year at 2 independent tertiary care medical centers. Both endoscopists routinely attempt freehand cannulation or a WGC technique when attempting to cannulate a native papilla. A sphincterotome with a 4.4F tip and a short, straight 0.035-inch guidewire are usually used. When biliary cannulation is unsuccessful, both endoscopists routinely use a PD stent to facilitate biliary cannulation before resorting to precut sphincterotomy. All patients with a native papilla that could be reached by using a duodenoscope were included in this study. We identified all patients who required a PD stent to facilitate biliary cannulation within our electronic endoscopy databases (Provation MD; Provation Medical, Minneapolis, Minn, and gGastro; gMed, Weston, Fla). Standard biliary cannulation and failure to cannulate the CBD and PD were excluded.

The primary outcome was the rate of successful biliary cannulation without performing a precut sphincterotomy. We also reported rates of precut sphincterotomy and procedure-related complications. The research protocol was approved by the Human Research Protection Offices at the participating institutions.

Technique

If biliary cannulation is unsuccessful, the PD is cannulated and a 0.025- or 0.035-inch guidewire is advanced to the level of the mid pancreatic body to allow placement of a soft polyethylene stent. The type of stent is left to the discretion of the endoscopist, either a 4F (if using a 0.025-inch wire) or 5F stent with an external pigtail and single internal flange (Freeman pancreatic stent; Hobbs Medical Inc, Stafford Springs, Conn) or a 5F stent with a double external and single internal flange (Geenen pancreatic stent; Cook Medical, Bloomington, Ind). The internal flange is occasionally removed to promote spontaneous passage of the stent after the procedure. A pancreatic sphincterotomy was not performed before deploying the PD stent. The stent may be deployed by using the sphincterotome as a pusher. Once the stent is advanced to its desired position, the wire is pulled back into the sphincterotome and attempts at biliary cannulation resume. Physician-controlled WGC of the bile duct is then attempted over the PD stent.[12-14] This technique is summarized in Figure 1A and B. If cannulation is unsuccessful after several minutes, a precut sphincterotomy is performed over the PD stent (Fig. 1C) or the procedure is terminated and the patient rescheduled for another attempt. Several examples of using a PD stent to facilitate biliary cannulation are demonstrated in the attached video clip (Video 1, available online at www.giejournal.org). Postprocedure PD stent management was left to the discretion of the endoscopist.

Statistical analysis

We used descriptive statistics to report the performance characteristics of physician-controlled WGC in conjunction with a PD stent. Comparative statistics (χ^2 test) were used to evaluate the technique between the 2 endoscopists. Statistical analysis was performed by using Stata version 10.0 (StataCorp LP, College Station, Tex).

RESULTS

A total of 2345 ERCPs were performed during the study period, 1544 with native papillae that could be reached by using a therapeutic duodenoscope (TJF-160VF; Olympus America, Center Valley, Pa). Of these, biliary duct and PD

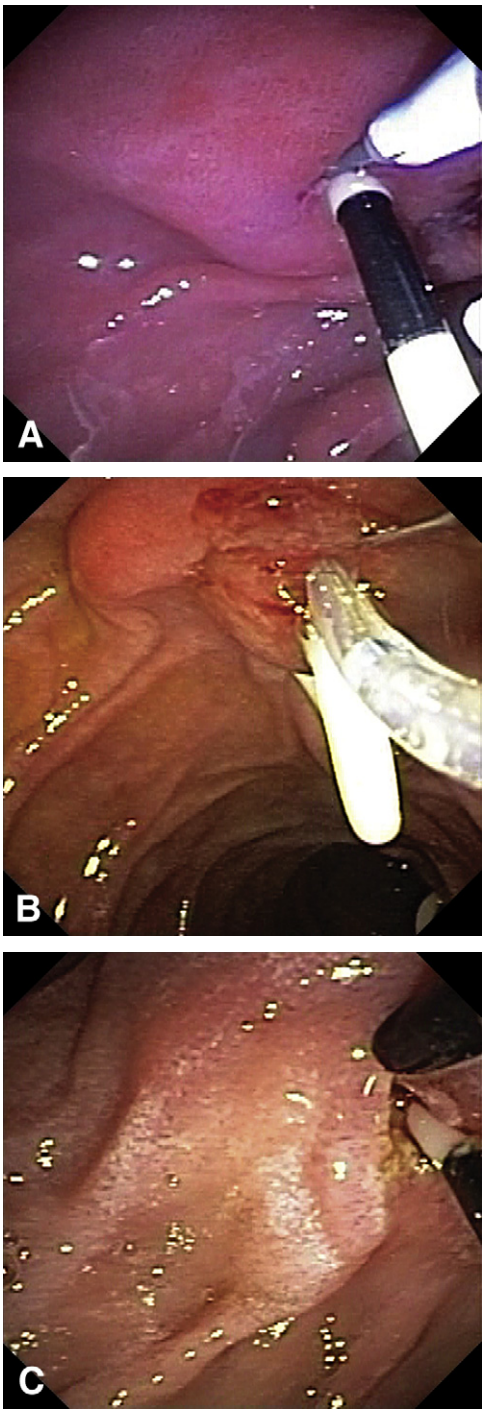

Figure 1. Examples of using a PD stent to facilitate bile duct cannulation. **A,** Small papillary orifice. Using the physician-controlled WGC technique, we first introduced the tip of a 0.035-inch hydrophilic guidewire into the papillary orifice to guide the papillotome on top of the 5F PD stent. **B,** Edematous papilla. The sphincterotome is used to directly cannulate the biliary orifice by bowing the sphincterotome 30 degrees superior to the long axis of the PD stent. **C,** Precut papillotomy over a PD stent. A patient was referred after standard approaches and a freehand needle-knife sphincterotomy (*dashed arrow*) were unsuccessful. After deploying a PD stent, the needle-knife is directed to the 11 o'clock position relative to the PD stent (*solid arrow*) to perform a precut sphincterotomy.

cannulation failed in 16 (1.0%) patients, whereas 76 (4.9%) patients required a PD stent to facilitate biliary cannulation. The mean age of patients ± standard deviation was 63.1 ± 16.9 years, and 49 (65%) of 76 were women. ERCP was performed for a variety of indications, including abnormal liver function test results of suspected biliary origin (n = 24), suspected CBD stone (n = 17), biliary stricture (n = 16), and dilated CBD on cross-sectional imaging (n = 9), among others (n = 10). Seventy-one of 76 cases involved using a 5F Freeman (Hobbs Medical) (n = 40) or a 5F Geenen (Cook Medical) (n = 31).

Cannulation data for the entire cohort are summarized in Figure 2. Among PD stent cases, 71 (93.4%) of 76 achieved successful cannulation after deploying a PD stent. Of 76 (78.9%) patients, 60 did not require a precut biliary sphincterotomy to facilitate cannulation. Precut sphincterotomy was performed in 15 (19.7%) and was successful in facilitating cannulation in 11 (73.3%) of these cases. Among 5 cases of failed cannulation, precut sphincterotomy was performed in all but 1 case. The frequency of successful biliary cannulation using the PD stent technique (91% and 95%) and precut sphincterotomy (24% and 9%) were not significantly different between endoscopists (P = .47 and .10, respectively).

Seventy-four (97.4%) of 76 patients received a 5F PD stent. Twenty-six (34.2%) of 76 PD stents were removed at the completion of the initial ERCP. Among 50 stents that were left in place, 20 (40.0%) passed spontaneously based on abdominal films obtained 14 days after the procedure. Of these, 16 (80%) were Hobbs stents, 8 of which had the internal flange removed before insertion. The remaining cases (n = 30) required an upper endoscopy for stent extraction. There were 4 (5.3%) cases of mild post-ERCP pancreatitis, 2 of which occurred in patients who had their PD stent removed at the completion of the procedure. This corresponds to a post-ERCP pancreatitis rate of 7.7% among patients who had their stent removed compared with 4.0% in all others (P = .49). There was no correlation with the type of PD stent (external pigtail vs flange design) and frequency of ERCP-associated pancreatitis.

In addition to 4 cases of pancreatitis, 2 cases were complicated by bleeding during the procedure, both related to precut sphincterotomy. Bleeding was successfully controlled with submucosal injection of epinephrine (0.1 mg/mL) and did not require a blood transfusion. No other procedure-related complications were identified.

DISCUSSION

This is the largest reported series describing the use of a PD stent to facilitate biliary cannulation. Although our high success rate (93.4%) is comparable to that of previous reports,[5,6] our rate of precut sphincterotomy (19.7%) is markedly lower than that reported by Goldberg

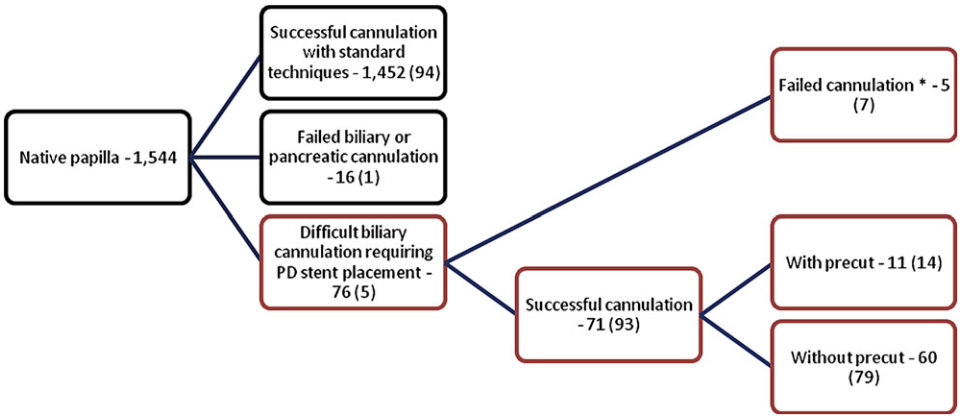

Figure 2. Results of PD stent placement for biliary cannulation (n = 1544), number (%). *Precut sphincterotomy was performed in 4 of 5 cases of failed cannulation.

et al[5] (59%). There are 2 explanations that may contribute to this difference. First, Goldberg et al might have had a lower threshold to perform a needle-knife or transpancreatic precut sphincterotomy. In fact, they reported performing a small pancreatic sphincterotomy in some cases (the exact number was not reported in their article) to facilitate placement of a PD stent.[5] Another reason for our lower rate of precut sphincterotomy may be the use of WGC to access the CBD over the PD stent. Although a PD stent may straighten the common channel, decrease the likelihood of repeated PD cannulation, and clarify the orientation of the biliary orifice, occasionally it can be challenging to place the sphincterotome adjacent to the stent, within the common channel, particularly in the setting of a small ampullary orifice. Physician-controlled WGC allows the endoscopist to feel the variable amount of resistance to advancing the guidewire. By controlling the guidewire and the sphincterotome, the endoscopist can introduce the wire tip over the stent 1 to 2 mm and then immediately manipulate the sphincterotome into the papillary orifice over the guidewire. There are no prospective trials comparing physician-controlled WGC with WGC when the guidewire is controlled by an experienced assistant.

Anecdotally, most of our cannulation failures in this series occurred in the setting of a small papillary orifice. In this scenario, it is challenging to engage the guidewire tip and sphincterotome alongside a PD stent. As a result, some authors have advocated the use of a pancreatic wire to facilitate bile duct cannulation.[16-18] This approach involves leaving a guidewire in the PD while attempting to cannulate the biliary orifice by using standard methods or a wire-guided approach. A pancreatic wire may confer some advantage over a PD stent in the setting of a small papillary orifice by allowing more space for the sphincterotome to access the biliary tree. However, the wire is more tenuous compared with the stent because it is easily displaced when the position of the duodenoscope is altered. Further, the stent may be more likely to block access to the PD, thereby directing the guidewire and catheter into the biliary orifice after the papilla is engaged. Of note, many difficult cannulation cases are likely to require a prophylactic PD stent anyway. From a cost perspective, the added cost of a second guidewire may be balanced by the need to follow patients whose PD stent remains intact at the completion of the procedure. The optimal strategy may be to use a PD stent except in cases of a small papillary orifice, in which a pancreatic wire can be tried first. If the wire technique is unsuccessful, a PD stent can always be deployed over the wire before resuming cannulation efforts.

In addition to facilitating bile duct cannulation, a PD stent offers 2 distinct advantages. First, the rate of ERCP-associated pancreatitis is lower among high-risk patients who receive a prophylactic PD stent.[7-10] Cases of difficult biliary cannulation may be at higher risk, particularly in the setting of repeated PD injection.[19,20] Similarly, if the endoscopist chooses to perform a needle-knife sphincterotomy, a PD stent can protect the pancreatic orifice and serve as an anchor to guide the precut sphincterotomy. There are conflicting data comparing the safety of needle-knife sphincterotomy over a PD stent with transpancreatic sphincterotomy, although both of these approaches are probably best used by experienced endoscopists.[21,22]

Because we routinely use a 0.035-inch guidewire, more than 90% of patients received a 5F PD stent. We either used stents with a double external flange (Geenen) or a three-quarter pigtail design (Freeman). Pigtail stents are less likely to internally migrate while cannulation of the biliary orifice is attempted. Occasionally, the pigtail needs to be redirected away from the papillary orifice when it faces up after deployment. We observed a higher rate of spontaneous passage with pigtail stents, although 50% of these had the internal flange removed before insertion. We are unable to make any significant conclusions with regard to the ideal PD stent based on our retrospective observations. However, this is an important outcome

for prospective trials because the need to repeat an upper endoscopy for stent extraction adds significant cost and inconvenience. We prefer to remove the pancreatic stent at the completion of the initial ERCP if the cannulation effort is relatively atraumatic to the pancreatic orifice and the patient is otherwise considered at low risk of ERCP-associated pancreatitis. Our study was not adequately powered to detect a significant difference in the rate of post-ERCP pancreatitis.

A potential limitation of this study is our lack of specified criteria for difficult biliary cannulation. Because we collected data retrospectively, we did not define this a priori. However, the low frequency of using a PD stent to facilitate bile duct cannulation of 5% and failure to cannulate either duct of 1% is reflective of endoscopists at high-volume centers for biliary endoscopy.

Bile duct cannulation remains an important benchmark of successful ERCP. In cases in which access is limited to the PD, placement of a soft polyethylene stent protects the pancreatic orifice and facilitates cannulation of the bile duct. The combination of a PD stent with physician-controlled WGC facilitates bile duct cannulation while maintaining a low rate of precut sphincterotomy. Particularly among less-experienced biliary endoscopists, a PD stent confers less risk than a precut sphincterotomy. If biliary cannulation remains unsuccessful, the stent can be left in anticipation of transfer to a tertiary medical center. To further define the efficacy and generalizability of this approach, prospective, randomized trials comparing the use of a PD stent with alternative methods will be necessary.

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