

## CASE REPORT

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# Proximal Migration of a 3 French Pancreatic Stent in a Patient with Pancreas Divisum: Suggested Technique for Successful Retrieval

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### ABSTRACT

**Context** Pancreatic stents may be placed during therapeutic ERCP for a variety of indications. One such indication is to prophylax against the development of pancreatitis following sphincterotomy of the minor papilla in patients with recurrent acute pancreatitis and pancreas divisum. Increasingly, endoscopists that perform pancreatic ERCP are placing small caliber (3 Fr), unflanged, single pigtail stents into the long axis of the pancreatic duct with the expectation that these stents will only stay in place for a few days and the majority will pass spontaneously on their own without the need for follow-up endoscopic retrieval. As such, these stents are generally regarded as safer and associated with a lower rare of complication than larger (5 and 7 Fr), double flanged pancreatic stents.

**Case report** We present the case of a 3 Fr stent that migrated proximally into the dorsal duct in a patient with recurrent pancreatitis and pancreas divisum. Due to the small size of the patient's dorsal duct, it was difficult to pass appliances alongside the stent to facilitate retrieval and a variety of appliances were used before success was achieved.

**Discussion** The medical literature contains series of proximally migrated larger caliber flanged, pancreatic stents but proximal

migration of small caliber, unflanged, pigtail stents has not yet been reported. As the use of these small stents increases, we feel that it is important to highlight the potential for this complication and discuss how we successfully treated our patient.

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### INTRODUCTION

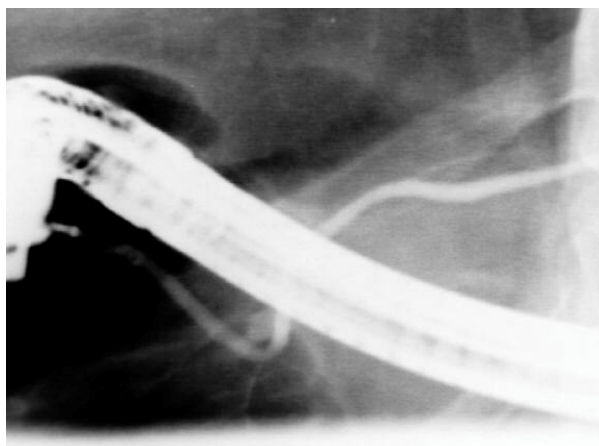
Pancreatic stents are used for a wide variety of conditions in pancreatic endoscopy. Therapeutic uses include transpapillary drainage for pancreatic pseudocyst, pancreatic fistula or pancreatic duct disruption [1, 2, 3, 4, 5, 6,7] and treatment of pancreatic duct obstruction from stricture or malignancy [8]. Prophylactic uses include anastomotic stenting with pancreaticoduodenectomy [9], after ampullectomy [10], following pancreatic sphincterotomy or pre-cut biliary sphincterotomy and following repeated pancreatic cannulations (to avoid post-procedure pancreatitis) [11, 12]. The use of small caliber 3 or 5 French (Fr) unflanged pancreatic stents for the prevention of post-ERCP pancreatitis in high risk patients has gained acceptance as one of the only modalities statistically proven to reduce the risk of this unfortunate complication [13]. Small caliber stents are preferred due to the small size of the typical pancreatic duct. Long (8 or 10 cm) stents allow alignment along the long axis of the duct in the pancreatic body

and reduce the chance of stent-induced injury resulting from the tip of the stent traumatizing the wall of the duct. The absence of internal flanges facilitates spontaneous distal migration and avoids the need for a second endoscopy to remove the stent.

Reports of proximal pancreatic stent migration and techniques for retrieval exist from the era when pancreatic stents were straight stents with internal and external flanges and ranged in size from 5 to 10 Fr [14, 15, 16, 17, 18, 19]. Despite the growing use of smaller caliber (3 Fr) pancreatic stents, proximal migration of these stents has not been reported. We present the case of a patient with recurrent acute pancreatitis and pancreas divisum treated with minor papillotomy and pancreatic stent placement into the dorsal duct that experienced proximal migration of a 3 Fr, 8 cm unflanged, single-pigtail pancreatic stent and discuss our technique for successful retrieval of the migrated stent.

## CASE REPORT

The patient is a 42-year-old white male with recurrent episodes of acute pancreatitis in May 1999 and March 2004. Details from the first evaluation were not available. The March 2004 episode was preceded by the consumption of 4 beers and characterized by typical abdominal pain, elevated pancreatic enzymes (amylase 3,859 U/L, reference range: 30-110 U/L; lipase 6,511 U/L,



**Figure 1.** Cannulation of minor papilla with pancreatogram of dorsal duct.

reference range: 23-208 U/L) and abdominal CT consistent with non-necrotizing pancreatitis affecting the head of the pancreas. Right upper quadrant US was negative for cholelithiasis, choledocholithiasis or biliary ductal dilatation. ERCP at an outside hospital was not successful. The patient recovered completely with conservative therapy.

Following discharge the patient was referred to the Duke Biliary/Pancreatic Clinic for further evaluation of recurrent acute pancreatitis. His medical history was significant for a fractured leg secondary to playing football while in college though no known abdominal trauma was reported. He admitted to consuming 2-4 beers per week and smoked an occasional cigar but denied habitual or excessive consumption of alcohol or tobacco products. Family history was negative for cystic fibrosis, pancreatitis or pancreatic cancer. The patient had been using finasteride daily for the prior 3 years but no other medications, over-the-counter products, herbs or supplements. Serum calcium and triglyceride levels were normal. EUS of the pancreas showed sonographic focal changes consistent with moderate-severe chronic pancreatitis in the pancreatic head extending up to the neck. There was no sign of significant endosonographic abnormality in the common bile duct or gallbladder. Pancreas divisum could not be assessed with this study; therefore, ERCP was performed at a subsequent date.

At ERCP, a complete pancreas divisum was identified (Figure 1). The dorsal duct appeared normal with no dilatation or features of chronic pancreatitis. After dorsal pancreatic sphincterotomy, a 3 Fr, 8 cm pancreatic stent with a 3/4 external pigtail and no internal flanges was placed into the dorsal pancreatic duct. The patient was instructed to have a supine abdominal radiograph in one week to confirm spontaneous passage of the stent. Instead, the local referring physician performed esophagogastroduodenoscopy for stent retrieval and found no evidence of the stent within the duodenal lumen. At this point, abdominal radiography was performed demonstrating persistence of the pancreatic



**Figure 2.** Radiograph demonstrating proximal migration of pancreatic stent.

stent in the area correlating with the pancreas and possible proximal stent migration was entertained.

The patient returned to our institution for ERCP and stent retrieval. Again, the scout abdominal radiograph confirmed the persistence of a pancreatic stent in the dorsal duct (Figure 2). Although the pigtail of the stent was in the proper configuration, endoscopic views confirmed that the stent had migrated into the duct. Despite previous sphincterotomy, the minor papilla appeared stenotic. The dorsal duct was cannulated with the Glotip 5-4-3 catheter (Wilson-Cook Medical, Winston-Salem, NC, USA) and a 0.018-inch guidewire (Roadrunner, Wilson-Cook Medical, Winston-Salem, NC, USA) followed by exchange for a short-tip traction sphincterotome (Apollo 3AC, C.R. Bard Inc, Billerica, MA, USA). The minor papillotomy was extended and the duct deeply cannulated. The 0.018-inch guidewire did not provide a stable platform for our purposes and was exchanged for a 0.035-inch guidewire (Jagwire, Boston Scientific Corporation, Miami, FL, USA). To retrieve the stent, a 8.5 mm retrieval balloon (Duraglide 3, C.R. Bard, Billerica, MA, USA) was passed into the duct alongside the stent to facilitate traction removal of the stent. Due to the small pancreatic duct size (approximately 2.4 mm), advancement of the 7-5 Fr balloon catheter (2.3-1.7 mm) resulted in friction alongside the stent with subsequent deeper migration into

the duct. Next, the 4 mm dilation balloon (Hurricane RA, Boston Scientific Corporation, Natick, MA, USA) was used as its delivery system (5.8 Fr catheter) was the smallest available that was compatible with the 0.035-inch guidewire (Figure 3). The balloon was passed alongside the stent until it was positioned at the proximal third of the stent and then carefully inflated under fluoroscopic guidance until it was seen to approximate the size of the pancreatic duct. Given the size of the pancreatic duct, we did not attempt to fully inflate the balloon to its 4 mm maximum size. No further proximal migration of the stent occurred. The balloon was slowly withdrawn with careful attention to watch the portion that was previously pigtailed, ensuring the tip of the stent did not inadvertently try to enter a side branch. Further withdrawal led to visualization of the tip exiting the minor papilla and the entire stent was successfully removed via traction. The patient was observed for approximately 2 hours following the procedure in our recovery unit. He reported mild abdominal discomfort but no nausea, vomiting or pain that warranted admission for observation. No further analgesia or antiemetic was required



Inflated balloon provides traction against stent within pancreatic duct to facilitate removal.

**Figure 3.** Photograph of 0.035 inch guidewire through 4 mm dilation balloon and 3 Fr, 8 cm stent. Cartoon demonstrates intraductal application of balloon for traction removal of migrated stent.

during the recovery period. We do not routinely draw laboratory studies following uncomplicated outpatient ERCP procedures in our unit and therefore none were drawn from this patient. The patient was subsequently discharged home following the procedure with no late complications reported from the referring physician.

## DISCUSSION

The Duke University Medical Center Pancreaticobiliary Service is a tertiary referral service providing therapeutic ERCP and performs over 1,000 ERCPs annually. Despite our increasing use of long (8-10 cm), small caliber unflanged, single pigtail 3 Fr pancreatic stents, this case represents the first case of proximal stent migration of a 3 Fr stent into the dorsal duct that we have experienced. A subsequent literature search revealed no documented reports of proximal migration of a 3 Fr pancreatic stent into the dorsal duct, therefore, we felt it important to share our experience and highlight the potential risks associated with the use of these devices.

Johanson *et al.* [15] reviewed the incidence and risk factors for migration of biliary and pancreatic stents in 1992. At this time, the smallest pancreatic stent in use was 5 Fr in caliber and was flanged on both ends. Their data represented a 4.5-year experience at a busy therapeutic ERCP center and was comprised of 300 pancreatic stent placements and a 5.2% incidence (14 of 267 with available follow-up) of proximal pancreatic stent migration [15]. They assessed stent migration by diagnosis indicating stent placement (acute recurrent pancreatitis, chronic pancreatitis, sphincter of Oddi dysfunction, benign stricture and other), location (major versus minor papilla), size of stent (5 or 7 Fr) and length (less than or equal to 7 cm versus greater than 7 cm). The only factors statistically associated with an increased risk for proximal migration was diagnosis of sphincter of Oddi dysfunction (odds ratio 4.2, 95% CI 1.0-16.4) and stent length greater than 7 cm (odds ratio 3.2, 95%

CI 1.01-10.0). Smaller stent caliber (5 Fr) approached, but fell short of, significance (odds ratio 2.0, 95% CI 0.5-7.6). This study raised the speculation that longer pancreatic stents may have a greater tendency to migrate by virtue of extending beyond the genu. Shorter stents were postulated to be less prone to proximal migration because their proximal end is distal to the genu and therefore less apt to advance beyond the angulation. Realizing that a stent may have a greater chance to migrate the longer it is present within the duct, we were disappointed that this information was not reported in this study.

While the authors did not state whether the pancreatic stents placed had internal and external flanges, pancreatic stents in use during the time of the study (1986-1990) uniformly had flanges at both ends. A later report by the same authors [20] proposed that proximal stent migration could occur by a ratchet phenomenon caused by the stent's proximal barbs. To test this theory, they removed the proximal barbs from all pancreatic stents placed during a six-month period and assessed the impact on rate of proximal migration. Again, 5 and 7 Fr stents were used and varied in length from 3 to 10 cm. Although the duration of stent placement was not mentioned in the first publication, a 4-month dwell time before routine removal was reported for the latter study. Of the 51 modified pancreatic stents placed, none migrated proximally, while 5.3% of the standard flanged pancreatic stents migrated proximally (P=0.05) [20]. Though the number of stents placed in this second study was smaller, the 5.3% rate of proximal migration was nearly identical to the 5.2% rate reported in the larger prior study.

Further modifications to the design of pancreatic stents to decrease the rate of proximal migration were made by Cohen *et al.* [21], who reported one proximal migration of 43 pancreatic stents fashioned with a single proximal barb and a distal C-loop. The dwell time, indication for placement, length and caliber of these stents was not reported.

Modifications to pancreatic stents have been done over time both to prevent proximal

migration, but also to decrease the incidence of stent-induced ductal changes. It has been recognized that pancreatic stents can occlude side branches or traumatize the duct wall and lead to changes analogous to those seen with chronic pancreatitis [22, 23]. As a result, when pancreatic stents are placed prophylactically following therapy for pancreas divisum or in instances of difficult cannulation such as needle knife access papillotomy, a small caliber stent with no internal flanges is placed into the long axis of the duct with the goal of maintaining patency across the sphincter long enough for procedure-related spasm, edema or inflammation to subside. This typically occurs over a few days and so spontaneous distal migration of the pancreatic stent is anticipated in order to avoid a second procedure for stent removal. We routinely assess for continued stent presence in one week following stent placement. If the stent is still present, we perform upper endoscopy to remove the stent within the next week in order to prevent complications from long-term stent placement.

Case reports describing successful retrieval of proximally migrated pancreatic stents have included such techniques as indirect traction using a stone extraction balloon catheter positioned above or alongside the stent, direct traction using various accessories (baskets, snares, forceps) and retrieval after cannulating through the stent lumen (Soehendra extractor, balloon, basket) [14, 16, 18]. Some cases have required surgical removal [24] or innovations using accessories borrowed from the interventional cardiology field [19]. As with the large series reporting experience with retrieval of migrated stents [15, 18], the stents described in these case reports were all straight, flanged, 5, 7 or 10 Fr pancreatic stents typical of those used in the 1980's and 1990's. The observations that led to the development and increasing use of small caliber, unflanged, single pigtail pancreatic stents appeared to greatly decrease the opportunity for proximal stent migration and explains why we have not experienced this phenomenon thus far.

In the case presented, despite a short dwell time of one week, the presence of a relatively straight dorsal duct and confirmation of the pigtail curled within the duodenal lumen during endoscopy, the patient's stent migrated proximally. We postulate that the prior sphincterotomy may have increased the risk of proximal migration, though prior case series in the literature have not conclusively established sphincterotomy as a risk factor for proximal pancreatic (or biliary) stent migration [15]. Upon review of the fluoroscopic images, perhaps the use of a full rather than 3/4-pigtail may have prevented migration from occurring. We were fortunate to have been able to remove the stent without complication using traction alongside the stent with a 4 mm dilation balloon and recommend this technique for patients with non-dilated pancreatic ducts where a stiffer guidewire (0.035-inch) and more narrow catheter (5.8 Fr outer diameter) will provide a greater likelihood of successful retrieval. We caution those who attempt retrieval of proximally migrated pigtail stents to exercise caution when performing the traction method. Care must be taken to inflate the balloon only to the point that traction against the stent is felt, as overinflation can be counterproductive. While our patient did not experience clinical pancreatitis or other untoward events, one can understand that overinflation of a balloon within the pancreatic duct may lead to this complication. In addition, we caution that one not rush to remove the stent too quickly. A pigtail that has straightened within the duct may try to coil back into its native pigtail configuration, increasing the chance that the leading edge might inadvertently try to enter a side branch. We recommend the use of fluoroscopy throughout the withdrawal process and advise repositioning of the balloon alongside the pigtailed portion if it appears that the tip is not oriented properly within the duct.

In summary, biliary endoscopists are cautioned to be mindful of the potential for proximal migration of 3 Fr pancreatic stents - even when placed into the dorsal duct. A follow-up radiograph should be standard of

care to ensure spontaneous passage of the stent, as the stent was not visible at endoscopy in our case and could have been mistaken for having passed if a radiograph had not been obtained. Finally, our case stresses the importance of ensuring that the pigtail has fully deployed prior to scope withdrawal to ensure maximum protection against proximal migration.

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Received December 11<sup>st</sup>, 2004 - Accepted January 13<sup>th</sup>, 2005

**Keywords** Cholangiopancreatography, Endoscopic Retrograde; Pancreatic Ducts; Postoperative Complications

**Declaration** The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army, the Department of Defense, or the United States Government

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