The novel use of a biodegradable stent placed by percutaneous transhepatic cholangiography for the treatment of a hepaticojejunostomy biliary leak following an extended left hepatectomy and pancreaticoduodenectomy

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ABSTRACT

A 61-year-old man presented with jaundice, and subsequently underwent an extended left hepatectomy and pancreaticoduodenectomy for a cholangiocarcinoma invading the head of the pancreas. The patient developed sepsis due to a biliary leak at the hepaticojejunostomy. We describe the original use of a biodegradable stent, deployed via percutaneous transhepatic cholangiography into the Roux limb, resulting in good drainage and resolution of sepsis. The chief benefit of this procedure is the lack of need for subsequent removal as well as purported reduced biofilm accumulation. We believe this to be the first reported case of this type and the literature surrounding the subject is also discussed.

KEYWORDS

Biodegradable stent – Pancreaticoduodenectomy – Pancreatic leak

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Mortality rates following pancreaticoduodenectomy have improved significantly over the last few decades with the figure now quoted as less than 5% but with many high volume centres reporting rates closer to 1%.¹ A significant cause of morbidity is anastomotic leaks, mainly pancreatic but, to a lesser extent, biliary.² Biliary leaks are usually managed with non-operative techniques such as percutaneous transhepatic cholangiography (PTC), endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous radiologically guided drains. Biliary drainage using a PTC technique utilises a plastic stent or a self-expandable metal stent (covered or uncovered). Plastic stents have attendant problems with blockage and infection, and they are only a short-term solution. Metal stents are less prone to blockage but present a potential infection risk as a permanent foreign body, and their removal is difficult and often hazardous.

Recently biodegradable self-expandable stents deployed via ERCP have been used successfully in the treatment of anastomotic leaks as well as benign and malignant strictures. The benefits include the negation of the need for subsequent removal, decreased biofilm accumulation and proliferative changes.³ The use of a biodegradable stent placed via PTC for the treatment of a biliary leak

following a hepaticojejunostomy has not been described previously.

Case History

A 61-year-old man presented with abnormal liver function tests and abdominal pain. Computed tomography (CT) and magnetic resonance imaging showed a mid-common bile duct stricture with no distant disease. ERCP and plastic biliary stenting was initially performed to relieve the obstruction. A mid-duct cholangiocarcinoma was suspected and the patient proceeded to surgery. Intraoperative frozen section from the upper and lower aspect of the biliary tree demonstrated malignancy. As a result, a left hepatectomy, caudate lobectomy and pancreaticoduodenectomy were performed. Histology revealed a moderately/poorly differentiated distal cholangiocarcinoma (pT2 N0 M0) with negative margins.

On postoperative day 5, the patient was treated for systemic sepsis. CT suggested a biliary leak from the hepaticojejunostomy. A PTC was therefore performed, which demonstrated that the Roux limb was disconnected from the liver. A PTC drain was left in place but negotiation into the Roux limb was not possible. A period of time elapsed with treatment of sepsis and nutritional support. A further

Figure 1 Percutaneous transhepatic cholangiography prior to stenting showing contrast filling an irregular collection from the intrahepatic duct, with some drainage into the duodenum

Figure 2 Percutaneous transhepatic cholangiography following stenting revealing drainage into the duodenum with no extravasation

PTC attempting negotiation into the Roux limb was performed. A biodegradable stent (SX-ELLA DV biliary, 8mm $\times$ 60mm; ELLA-CS, Hradec Kralove, Czech Republic) was placed from the liver into the Roux limb without complication (Figs 1 and 2). The external access was removed four days later following a contrast study that showed excellent drainage. The patient was discharged home 113 days following surgery. He was well at the ten-month clinic review.

Discussion

The pancreatic leak rate following pancreaticoduodenectomy is between 5% and 10%, and biliary leak rates have been identified at 1–6%.² Leak rates following combined hepatic and pancreatic resection are not well documented in the published literature. However, one study of combined major hepatectomy and pancreaticoduodenectomy published rates of 25% for pancreatic and 14% for biliary leaks, higher than for pancreaticoduodenectomy alone.⁴

The treatment options for this patient following the detection of disconnection of the Roux limb from the liver were surgery or management via PTC. In order to avoid surgical risks, a percutaneous approach was adopted. A plastic stent was not used because of the risk of blockage. A metal stent was considered but not used owing to the infection risk posed by the persistent foreign material (irretrievable without surgery). Consequently, a biodegradable expandable stent was used.

A common complication of plastic biliary stents is occlusion from bacterial contamination with subsequent biofilm and biliary sludge formation.⁵ However, biodegradable stents have good biocompatibility and, more importantly, a self-clearing effect to clear the sludge away, thereby potentially reducing the incidence of stent blockage.⁶

Biodegradable stents were developed in the 1980s and initially used in the interventional cardiology clinical setting. They are now commonly used in urology (for the treatment of urethral strictures and benign prostatic hypertrophy), cardiothoracic surgery (for the management of tracheobronchial obstruction) and general surgery (deployed by ERCP for the treatment of biliary and gastrointestinal strictures as well as bile leaks).⁵ An animal study has also suggested a potential use in the prevention of anastomotic leaks (both pancreatic and biliary).⁷

There are a few case series demonstrating the successful use of biodegradable stents in the clinical setting. Their use in the treatment of oesophageal perforation has been examined, with the results of a small study revealing a 100% technical success rate and leak sealing achieved in four out of five of the patients. During their two-year follow-up period, no further leaks were detected. The stents then degraded at 3–4 months with no complications and the patients experienced no early complications (including pain and bleeding). Potential pitfalls to biodegradable stents revealed by this study included the fact that stent migration occurred in three of the patients (although two migrated after leak sealing had been achieved) and one stent had to be removed owing to deformity.⁸

The SX-ELLA stent used in this study consists of polydioxanone, which is a semicrystalline, biodegradable polymer. The stent is placed into a 28Fr applicator with an atraumatic dilator tip. Following deployment, the stent expands gradually, achieving its preformed diameter after 24–48 hours.

The stent will usually start to degrade after four weeks by random hydrolysis of its molecule ester bonds. It can be visualised radiographically for up to six months following deployment.

Conclusions

This case demonstrates that biodegradable stents are a viable option for the treatment of a hepaticocentric leak following a hepaticojejunostomy. Although long-term outcomes of expandable biodegradable stents are not available, we believe the use of this device has avoided a further operation and risks of alternative types of stents.

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