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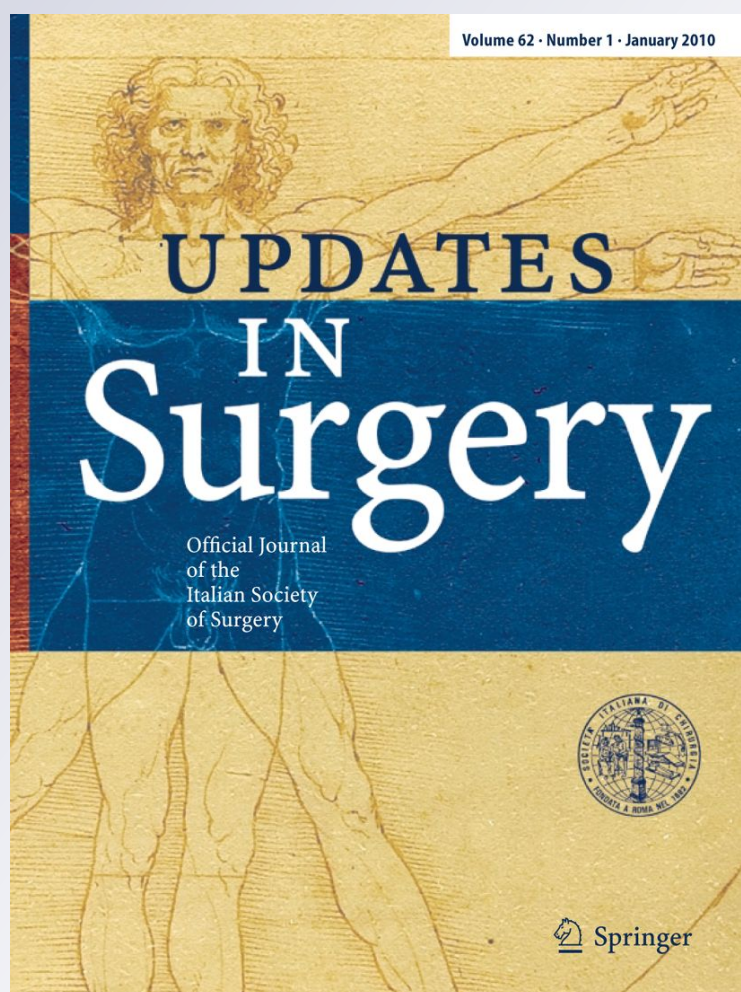
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Biliodigestive anastomosis with circular mechanical device after pancreatoduodenectomy: our experience

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Abstract The authors describe the technique to perform a mechanical biliodigestive anastomosis after pancreatoduodenectomy that could be able to reduce the time of surgical intervention and the major systemic postoperative complication especially in elderly patients. Pancreaticoduodenectomy (PD) is considered to be the most effective procedure for the treatment of tumors of the pancreatic head and periampullary tumors. Postoperative morbidity remains high, reaching 40–50% in some series. Leakage and stricture of hepaticojejunal anastomosis have a special significance and occur in 2.5–5% of cases. The usefulness of mechanical staplers is well established in gastric and colorectal surgery, but their use in creating biliodigestive anastomosis is still a very controversial application. In the last 2 years (Nov 2008–Nov 2010), seven patients who underwent PD and presented at the time of operation, a main bile duct (MBD) greater of 20 mm, received a mechanical biliodigestive anastomosis with surgical stapler. All the patients were postoperatively controlled with an ultrasonography at 3 and 6 months, and a cholangio MRI at 1 year from operation. The follow up of the seven patients ranged from 3 to 18 months. Six patients are still alive and free of oncologic disease. One patient presented a

single episode of cholangitis with a significant reduction of caliber of the biliodigestive anastomosis. The remaining five patients showed a good caliber of hepaticojejunal anastomosis. The authors suggest this procedure as a safe, feasible, more rapid and easier technique than traditional suture for bilioenteric anastomosis, when a suitable caliber of MBD allows to perform it.

Keywords Pancreatic surgery · Pancreatoduodenectomy · Biliodigestive anastomosis · Mechanical device

Introduction

Currently, pancreaticoduodenectomy (PD) is considered to be the most effective procedure for the treatment of tumors of the pancreatic head and periampullary tumors despite high postoperative morbidity and mortality rates. However, perioperative mortality has gradually decreased over the last two decades, thanks to the introduction of new surgical materials and increasingly effective postoperative intensive therapies. Conversely, postoperative morbidity remains high, reaching 40–50% in some series [1–3]. Among local complications, the leakage and stricture of hepaticojejunal anastomosis have a special significance and occur in 2.5–5% of cases [4, 5].

While the usefulness of mechanical staplers is well established in gastric and colorectal surgery, their use in creating biliodigestive anastomosis is still a very controversial application.

In biliary surgery, today, the use of staplers is only established for palliative cholecystojejunostomy in patients with unresectable cancers of pancreas or main biliary duct and, especially in pediatric surgery, or for

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hepaticojejunostomy after excision of a congenital choledochal cyst [6–9]. The use of surgical mechanical devices in biliodigestive anastomosis in adults has been recently proposed as being rapid, easily performed and associated with low mortality [6, 10].

During their initial experience, the authors have been able to confirm the value of these features and to test the effectiveness of the surgical technique.

Materials and methods

In the Department of General and Oncologic Surgery (UOC Chirurgia Generale ed Oncologica) of S. Camillo Hospital of Rome, Italy, a pylorus preserving pancreatoduodenectomy (PPPD) is the most performed operation for cancers of the head of the pancreas and periampullary neoplasms. All the patients are preoperatively evaluated with a total body CT scan and cholangio MRI. In the last 2 years (Nov 2008–Nov 2010) seven patients (6F/1M, median age 70.5, range 48–81) presented, at the time of the operation, a main bile duct (MBD) with a diameter greater of 20 mm. This was considered the main surgical indication to perform a mechanical biliodigestive anastomosis. Before the operation, all the seven patients presented jaundice with serum total bilirubin levels which ranged from 8.1 to 17.3 mg/dl. Alkaline phosphatase (ALP) serum levels ranged from 170 to 535 U/l (normal range 35–105 U/l) and gamma-glutamyltransferase (GGT) serum levels ranged from 133 to 555 U/l (normal range 2–65 U/l). Five of seven patients had an adenocarcinoma of the head of the pancreas and two presented a periampullary adenocarcinoma. In all the seven patients, a PPPD was performed. In these cases, a surgical stapler EEA 21 (Premium CEEA 21, Covidien Autosuture, Mansfield, MA, USA) was utilized for a mechanical end to side hepaticojejunostomy, except in 1 case when an EEA 25 was used because MBD had a caliber of 33 mm. A purse-string suture is placed around the common hepatic duct (Fig. 1). Then, the anvil (21–25 mm of diameter) is introduced into the lumen and the suture is tied (Fig. 2). The instrument is introduced without anvil for 20 cm into the lumen of the jejunum through the open transected end (Fig. 3). The shaft is advanced through an antimesenteric incision and then the instrument is closed and the staples fired (Fig. 4). The operating time needed to perform the biliodigestive anastomosis was approximately 5 min. All these patients were postoperatively controlled with an ultrasonography (US) at 3 and 6 months, and a cholangio MRI at 1 year from operation (Fig. 5; Table 1). In all alive patients serum total bilirubin (BILT), alkaline phosphatase (ALP), gamma-glutamyltransferase (GGT) levels were measured at 3 and 6 months, and at 1 year from intervention.

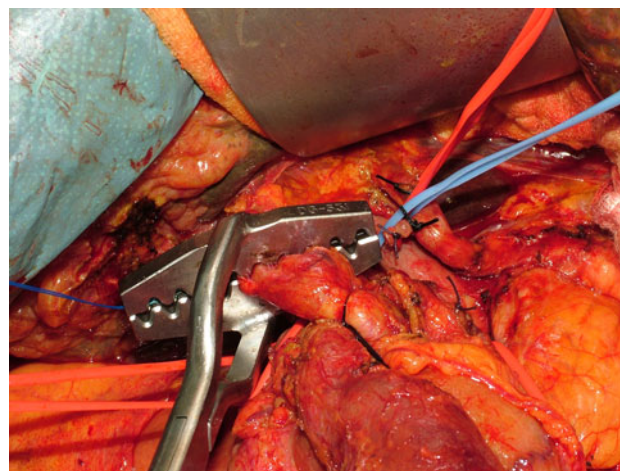


Fig. 1 A purse-string suture is placed around the common hepatic duct

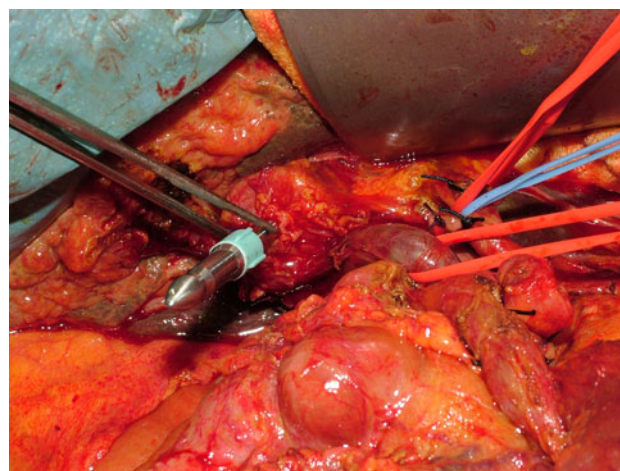


Fig. 2 The anvil is introduced into the lumen and the suture is tied

Results

None of the seven patients presented major or minor complications regarding the PPPD procedure during the hospital stay. All the seven patient removed their abdominal drains, as usual and without complications, 6 days after operation. The hospital stay ranged from 8 to 13 days after intervention. The follow up of the seven patients who underwent a mechanical biliodigestive anastomosis ranged from 3 to 18 months. One of the patients died 6 months after surgical intervention in consequence of a massive acute myocardial infarction. The abdominal US performed 3 and 6 months after the operation showed no dilatation of biliary tract with a good patency of biliodigestive anastomosis. Eight months after the operation one patient presented a single episode of cholangitis with abdominal pain, mild jaundice (4.4 mg/dl total bilirubin, ALP 115 U/l, GGT

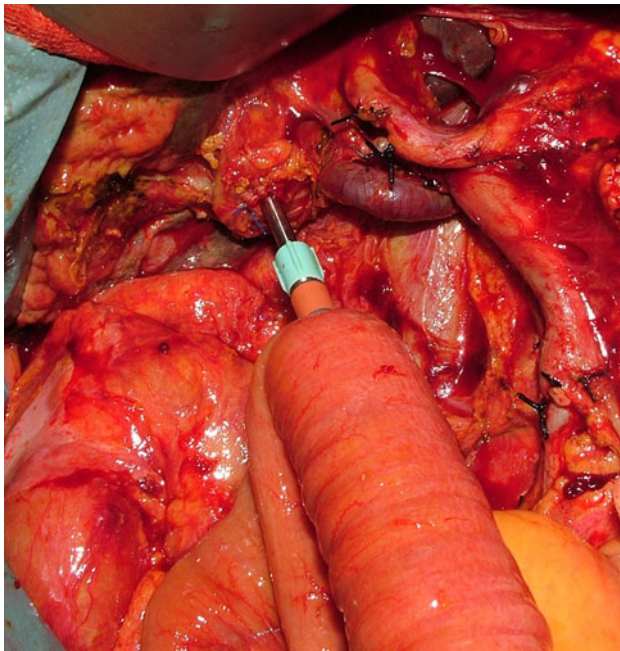


Fig. 3 The instrument is introduced without anvil for 20 cm into the lumen of the jejunum through the open transected end

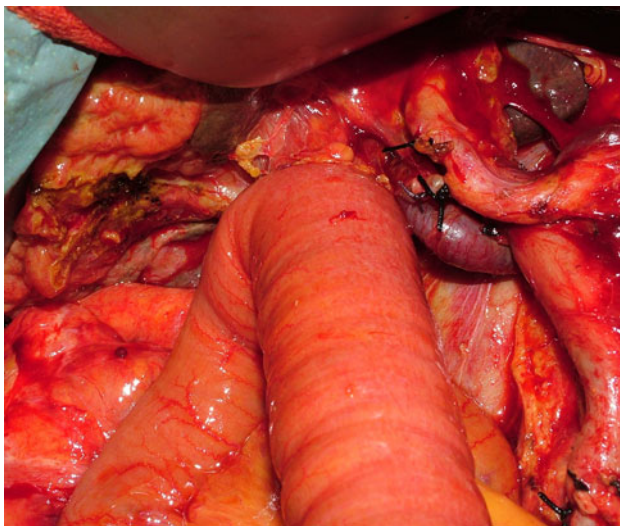


Fig. 4 The shaft is advanced through an antimesenteric incision and then the instrument is closed and the staples fired

125 U/l), and a slight continuous fever for 3 days. The clinical picture completely resolved after a short antibiotic treatment. A cholangio MRI performed during hospitalization showed a biliodigestive anastomosis (performed with an EEA 21) with a caliber of 10 mm. At the same period the patient was completely free from oncologic disease. The remaining five patients controlled with cholangio MRI after 1 year from operation showed a good caliber of hepaticojejunal anastomosis (respectively, 15,

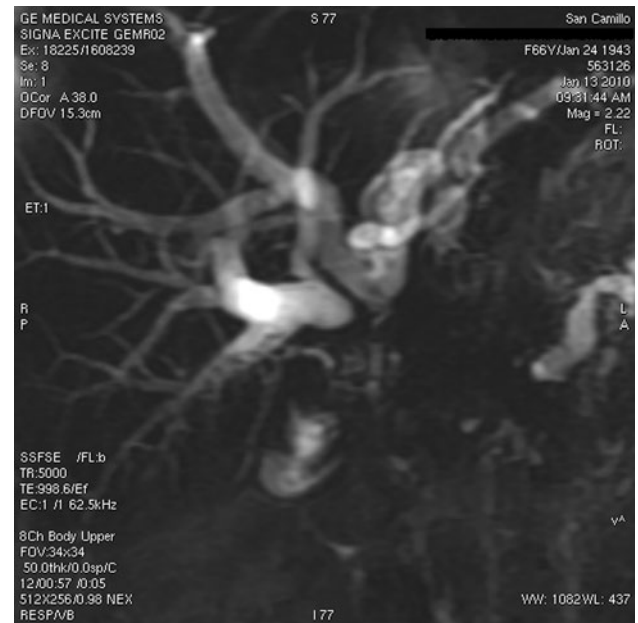


Fig. 5 Cholangio MRI at 1 year from operation. The picture shows a good patency of biliodigestive anastomosis

13, 16, 14 and 15 mm), no symptoms related to episodes of cholangitis and their serum BILT, ALP, and GGT levels were within the normal range.

Discussion

Pancreatoduodenectomy has become an increasingly common and safe operation for patients affected by pancreatic and periampullary neoplasms. Today, many high volume pancreatic surgical centers report an acceptable operative mortality (less of 5%). This is an outstanding improvement over the rate of 20%, often reported during the 1970s. However, the postoperative morbidity remains still high (40–50%) everywhere in the world [1–3]. The majority of the perioperative complications are not life threatening, though they result in increased length of hospital stay and costs, re-admissions for care, and delay in adjuvant therapy. Hemorrhagic complication occurs in 5–16% of patients following PD. Delayed gastric emptying (DGE) represents the other more frequent complication after PD. It was seen in 10–20% of operated patients in various international reports [5, 11, 12]. Pancreatic leakage is the major cause of morbidity and mortality after PD, with incidence varying between 6 and 24% and a relative mortality rate up to 40% [13, 14]. Often associated with the appearance of pancreatic fistula is the leakage of the biliodigestive anastomosis. This complication nearly occurs in 4% of cases [5]. The collection of pancreatic juice and bile with pancreatic enzymes activated by biliary components

Table 1 Mechanical biliodigestive anastomosis after PD

PPPD Pylorus preserving pancreato duodenectomy, *PO* post operative, *A/D* anastomosis diameter at 1 year

^a Expired 6 months PO for acute myocardial infarction

Pts	Age	Localization	Intervention	PO complications	PO A/D Ø (mm)
BAM ^a	81	Head pancreas	PPPD	None	
GMG	65	Head pancreas	PPPD	None	15
FG	73	Periampullary	PPPD	Cholangitis 8 months after surgery	10
SF	79	Periampullary	PPPD	None	13
BMT	69	Head pancreas	PPPD	None	16
PM	48	Head pancreas	PPPD	None	14
DFA	77	Head pancreas	PPPD	None	15

represents, in fact, a very dangerous event for the patient's outcome and a life threatening complication. Biliary strictures and its sequelae of recurrent cholangitis is referred in the international literature as a complication with lower incidence (5–8%) [15], but very important since it can decrease the quality of the patient's life. The aim of our study is to try to lower the incidence of biliary leakage and strictures in pancreatoduodenectomies using a circular stapling device. In the same way, we attempted to reduce the operating time of PD in elderly patients with important comorbidities and, in addition, to reduce the incidence of major general events. Recently, the use of mechanical devices for biliodigestive anastomoses was proposed by clinical and experimental studies [6, 9, 10]. In 1991, Gusaref et al. described an experimental model of a suturing instrument for making linear biliodigestive anastomoses. They collected data on 29 patients who had cicatricial stenosis of the Vater's papilla, carcinoma of the head of the pancreas and of the biliary tract. They did not report any complications associated with the use of the instrument [6]. In 1999, Cirocchi et al. performed a mechanical end to side biliodigestive anastomosis with a circular 21 mm stapler device in one patient who was affected by non neoplastic papillary stenosis. The dilatation of biliary tract was referred to be >30 mm of diameter. The follow-up at 1 year was performed using US and cholangiopancreatography MRI and showed a good patency of biliary tract and biliodigestive anastomosis [10]. These reports were preceded by some papers where the authors described the feasibility of the technique for cholecystojejunostomy. In 1983, Mullin performed an anastomosis of the gallbladder to the small bowel with a circular EEA stapler in seven dogs. After a follow up period of 52 weeks, he documented a secure and patent anastomosis. He decided to carry out the same technique in three human patients with unresectable cancer of the head of the pancreas with an excellent palliation [7]. In 1986, Thompson and Nagorney reported the stapled cholecystojejunostomy combined with gastrojejunostomy as a quick, safe, simple and effective palliation of biliary and duodenal obstruction

in cases of unresectable carcinoma of the head of the pancreas [8]. In 2003, Vallasciani et al. described the treatment of a 12-year-old girl with a type IV choledochal cyst, who was successfully treated with cyst excision and Roux-en-Y end to end hepaticojejunostomy created with a circular 21 mm surgical stapler. Follow-up hepatobiliary scintigraphy at 12 months showed a properly functioning anastomosis without evidence of intrahepatic duct dilatation on US performed at 12 and 24 months [9]. In our series of seven patients, with hepatic duct diameter >20 mm, we carried out the procedure without difficulties and the biliary anastomosis during PD resulted to be very quick and simple enough to make for an experienced surgeon. The safety and the feasibility of the technique was afterwards confirmed by the absence of early complications, such as biliary leakage and by the shortage of late ones, such as a single episode of cholangitis in one patient with a mild stricture of mechanical hepaticojejunostomy. We do not recommend using the EEA 25 disposable loading unit when tissue's thickness is <2.0 mm. In this case, the staples will not be tight enough to ensure hemostasis and could cause poor healing and narrowing of the anastomosis. We also do not recommend using 25 or 21 mm loading units when the biliary duct diameter is <20 mm.

Conclusions

On the basis of our experience we suggest, when the biliary duct has a diameter greater than 20 mm and the wall thickness is greater than 2.0 mm, the biliodigestive anastomosis can be performed with a circular stapling device. This procedure is more rapid and easier than traditional suture for bilioenteric anastomosis and can be very useful in laparoscopic pancreatic and biliary operations, making the bilioenteric anastomosis safe and feasible. In addition, the reduction of operative time may be associated with a lower rate of postoperative complications. In consideration of these good preliminary results, we are encouraged to

recruit a larger number of patients to confirm the validity of the surgical technique.

Conflict of interest None.

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