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ORIGINAL ARTICLE

Trauma Pancreaticoduodenectomy for Complex Pancreaticoduodenal Injury. Delayed Reconstruction

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ABSTRACT

Objective To assess the feasibility and safety of the delayed reconstruction approach in patients with complex pancreaticoduodenal injuries.

Setting Tertiary care center in Northern India.

Subjects Five patients with complex pancreaticoduodenal injuries, three following blunt and two following penetrating injury.

Results All patients underwent a pancreaticoduodenectomy. T-tube drainage of the common bile duct and external tube drainage of the pancreatic duct were established. A wide bore tube drain was left in the right upper abdomen. The postoperative course was uneventful in four patients. One patient died from coagulopathy on the 4th postoperative day. Delayed reconstruction was carried out in four patients. In one patient, a pancreaticojejunal anastomosis could not be performed. The postoperative period was uneventful and no patient had a biliary or a pancreatic leak. All four patients are well on follow-up.

Conclusion Delayed reconstruction in complex pancreaticoduodenal injuries is a feasible and viable option as was demonstrated by this study. Controlled external tube drainage of the bile and pancreatic ducts facilitates postoperative care and prevents on-going contamination of the peritoneal cavity with bile and pancreatic juice. Leaving behind the uncinate process shortens the operating time with less blood loss. Planned reconstruction is carried out once the inflammatory process has settled.

INTRODUCTION

Pancreaticoduodenal injuries are often associated with complicated treatment strategies [1, 2]. Severe pancreaticoduodenal injuries involve a significant mortality rate ranging from 10 to 36% [3, 4, 5]. The extent of the pancreatic injury is not often evident on an initial computed tomography scan [6]. A variety of approaches to pancreatic trauma have been reported [1, 6, 7]. Pancreatico-duodenectomy for combined pancreatico-duodenal injuries is rarely resorted to in the trauma setting owing to severe concomitant injuries [3, 4, 8, 9]. Moreover, the release of pancreatic enzymes and bile may jeopardize anastomosis [7, 10]. In a series of 48 patients with pancreatic trauma, a pancreatico-duodenectomy was performed in only two patients [7]. Asensio *et al*. [5] reported a 5% incidence of pancreaticoduodenectomy for patients with pancreatic and duodenal injuries. Pancreaticoduodenectomy should be reserved for patients who have a devascularized pancreatic head or when the ampulla is damaged [4, 9, 11, 12]. The philosophy of the management of complex pancreaticoduodenal injuries is to avoid complex reconstructive procedures in an

unstable patient [13]. The use of an abbreviated laparotomy may be helpful in salvaging moribund patients having combined pancreaticoduodenal injuries [4, 10]. Drainage with the formation of a controlled pancreatic fistula carries a low mortality rate, has acceptable morbidity and should be preferred over a pancreaticoenteric anastomosis [14]. Reconstruction can be carried out subsequently [4, 15]. The principle of a staged laparotomy applied to pancreaticoduodenal injuries could lead to improved survival in these patients [4, 10, 13].

The objective of this study was to review our experience with a staged approach (delayed reconstruction) for complex pancreatico-duodenal injuries.

PATIENTS AND METHODS

The records of five patients with complex pancreaticoduodenal injuries were reviewed over a period of five years, from March 2003 to March 2008. The mode of injury was blunt trauma in three, and penetrating in two (one stab wound and one gunshot wound). All patients were male, and their ages ranged from 17 to 34 years. All patients had peritonitis at presentation and underwent an urgent operative exploration. Two patients were operated on at another hospital and had a bile drainage tube in place before being transferred to our hospital for specialized care. No imaging studies were undertaken as all the patients were acutely ill at presentation. Two patients had associated injuries: a fracture shaft femur in one and hemopneumothorax requiring chest tube insertion in the other (Table 1).

Operative Findings

Two patients had pancreaticoduodenal disconnection with ampullary disruption, two had extensive laceration of the medial wall of the duodenum with laceration of the pancreatic head, and one had

Table 1. Clinical profile at initial injury.

Parameter	Case 1	Case 2	Case 3	Case 4	Case 5
Mode of injury	Blunt	Penetrating	Gunshot	Blunt	Blunt
Initial management prior to referral	Conservative	Operative	Conservative	Conservative	Operative
Interval between injury and presentation	36 h	36 h	12 h	24 h	36 h
Associated injury	Nil	Nil	Chest injury	Fracture shaft of femur, right colonic injury	Nil
Presentation	Peritonitis	Peritonitis	Peritonitis	Peritonitis	Peritonitis
Surgical procedure	PPPD	PPPD	Classical PD	PPPD	PPPD
Pancreatic remnant	ED	ED	ED	ED	ED
Bile duct	ED	ED	ED	ED	ED
Complications	Residual abscess	Abdominal dehiscence, dislodgement of catheters	Hemothorax, coagulopathy	Nil	Delayed gastric emptying
Outcome	Recovered	Recovered	Died	Recovered	Recovered

ED: external drainage
PD: pancreaticoduodenectomy
PPPD: pylorus preserving pancreaticoduodenectomy

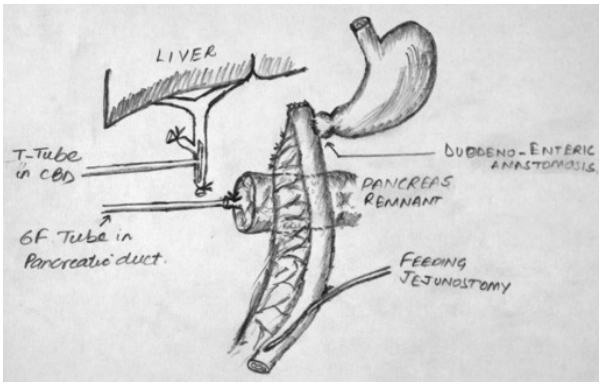

Figure 1. Line diagram to demonstrate the method of biliary and pancreatic exteriorization. A T-tube has been placed in the bile duct. Note the division of the bile duct below the level of the cystic duct. The pancreatic remnant has been exteriorized with a tube in the pancreatic duct. The enteric continuity has been restored. A feeding tube has been placed.

devascularization of the duodenum and a devitalized head of the pancreas. Pancreaticoduodenectomy was performed in these patients: four patients underwent a pylorus-preserving pancreaticoduodenal resection and a classical Whipple procedure was carried out in one owing to the extensive damage to the antrum.

The common bile duct was transected as low as possible to preserve its length. The lower end was closed with absorbable sutures and a T-tube was placed through a choledochotomy. The pancreas was soft with evidence of localized pancreatitis. No attempt was made to completely remove the uncinate process. The pancreatic duct was identified and drained externally with a 6 F infant feeding tube/umbilical vein cannula. Gastrointestinal continuity was restored. A feeding jejunostomy tube was placed in all cases, 20 cm distal to the gastroenteric anastomosis to provide postoperative nutritional support (Figure 1). A large bore (32 F) tube drain was placed close to the pancreatic bed in the right upper abdomen to allow the egress of any residual infection.

Postoperaive Course

One patient died in the immediate postoperative period due to coagulopathy. Post-operative complications were intra-abdominal abscess in one requiring image-guided drainage, delayed gastric emptying in one, and abdominal wound dehiscence and dislodgement of drainage tubes in one (Table 1). None of these patients needed surgical intervention. Their hospital stay ranged from 14 to 42 days.

Delayed Reconstruction

Reconstruction was undertaken from 6 to 28 weeks later in four patients. CECT performed prior to the reconstruction showed a normal pancreas and decompressed biliary system (Figure 2). In an isolated Roux loop of the jejunum, a pancreaticojejunostomy and a hepaticojejunostomy were performed in three patients. In one patient, only a hepatico-jejunostomy could be performed as there were dense adhesions in the region of the pancreas. The postoperative course was uneventful.

Follow-up

The follow-up period ranged from 6 to 24 months. All the patients are well on follow-up.

DISCUSSION

The surgical management of combined pancreaticoduodenal injuries is complex and the options vary from repair and external drainage to pancreaticoduodenectomy [1, 12, 16]. Pancreaticoduodenectomy is reserved for patients with uncontrollable bleeding from the pancreatic head, proximal pancreatic duct or

Figure 2. CECT performed prior to reconstruction shows a normal pancreas. The pancreatic catheter (arrow) can be seen in situ. Note the biliary system is decompressed.

ampullary injuries which preclude reconstruction, and extensive devitalization of the duodenum and pancreatic head.

We had to resort to a Whipple procedure in all our patients because of devastating injury and uncontrolled bleeding. Leaving behind devitalized tissue would have resulted in postoperative bleeding and infective complications. Pancreaticoduodenectomy in our patients was essentially a debridement procedure to salvage these critically ill patients. Controlled external drainage of the bile and pancreatic ducts facilitates postoperative care and prevents on-going contamination of the peritoneal cavity. The technique of external drainage as an alternative to pancreatic enteric anastomosis is safe and simple to perform, and no complications of the external drainage of the pancreatic duct have been reported [17].

In a relatively stable patient, pancreaticoduodenectomy with or without reconstruction may be a valid option [12, 18]. The mortality rate of a pancreaticoduodenectomy in an emergency situation is high [3, 19]. In one series, the mortality rate of acute pancreaticoduodenectomy exceeded 30% [9]. The main factor responsible for these high morbidity and mortality rates in pancreatic injury is an elevated pancreas-associated complication rate [7, 9, 20]. The factors responsible for an anastomotic leak are associated pancreatitis, a soft and friable pancreas and an undilated normal sized pancreatic duct. A variety of procedures have been advocated to minimize the anastomotic leak rate but no one of these has shown a clear advantage over the other [21]. Moreover, their application in an emergency situation is not well established. Chances of a pancreatic leak are high while working in the presence of a normal, soft pancreas. A controlled external fistula is safe. The vast majority of pancreatic leaks resolve spontaneously with control of sepsis and adequate drainage [22, 23]. Spontaneous healing of a pancreatic leak has been described [24]. Spontaneous healing of a fistula occurred in one patient and the patient is well on follow-up.

In view of this high mortality rate, it is debatable whether a pancreaticoduodenectomy should be carried out on an emergency basis; there is a need to adopt a bailout procedure in these complex injuries [10, 25]. A damage control procedure in unstable patients in the form of externally draining the pancreas and biliary tree could be a life-saving approach [25, 26, 27].

A staged procedure has been advocated in this difficult situation [5, 15, 27, 28]. This entails pancreaticoduodenal resection and bilio-pancreatic exteriorization as a damage control measure [14]. The stomach, jejunum and pancreatic stump are stapled off. The common bile duct is ligated or drained, the gallbladder is not removed and may be used for biliaryenteric reconstruction. It is not necessary to remove the uncinate process. This simplifies the procedure as the surgeon can operate away from the superior mesenteric vein [29]. One of the most time consuming and demanding steps during pancreaticoduodenectomy is the dissection of the uncinate process which can result in severe intra-operative bleeding and is a difficult and frustrating experience. Leaving behind the uncinate process shortens the operating time with less blood loss. The application of endovascular clips has also been advocated to deal with the uncinate process [30] but may not be applicable in the setting of trauma, especially in an unstable patient. Pancreatic duct ligation has been advocated as an option in unstable patients and when faced with a soft normal pancreas [31]. A low output pancreatic leak resolves spontaneously [23, 24].

Reconstruction is delayed to allow intra-abdominal sepsis to be resolved. Following reconstruction, none of the patients in our series developed a pancreatic anastomotic leak. This was due to the firm texture of the pancreas which holds sutures well.

There is a paucity of published studies attesting to the usefulness of delayed reconstruction in complex pancreaticoduodenal injuries [5, 15, 16, 27, 32]. Our results have shown the usefulness of a staged pancreaticoduodenectomy as a damage

control measure and a delayed reconstruction in these critically ill patients. Four of the five patients survived. The management of severe pancreaticoduodenal injuries is one of the most difficult challenges. Initial damage control and the application of delayed reconstruction may be an optimal choice in that they can obviate complications such as anastomotic breakdown.

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