ORIGINAL ARTICLE

PANCREAS PRESERVING SURGERY IN TRAUMATIC COMPLETE PANCREAS TRANSECTION: A CASE SERIES

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Abstract

Background: Pancreatic trauma constitutes a great challenge both in diagnosis and in management especially complex injuries involving the main pancreatic duct. We aimed at evaluation of outcome of pancreaticogastrostomy (PG) as an alternative to distal pancreatectomy or pancreaticojejunostomy (PJ) for management of complete pancreas transection in children.

Patients and Methods: This is a retrospective analysis performed from January 2001 to October 2012 including children presented to the Trauma department of Sohag University Hospital with complete pancreas transection at the neck or central body after blunt trauma managed with distal stump PG.

Results: Seven cases of complete pancreas transection injuries were managed with pancreas salvage operation with two major complications; pancreatic fistula (PF) occurred in one patient which was transient and one case with intraabdominal abscess treated with percutaneous drainage. Short term follow-up showed no pancreatic insufficiency. In-hospital mortality occurred in 1 patient. Long-term outcome could not be assessed.

Conclusion: PG is a good alternative to distal pancreatectomy when dealing with major pancreatic injury especially in children if the patient is hemodynamically stable and the surgeon has the experience in pancreatic surgery.

Keywords: Blunt pancreatic injury, Pancreatic fistula, Abdominal injuries, Organ preservation, Pancreatic anastomosis.

INTRODUCTION

Pancreatic injury is the fourth most common solid organ injury.(1) It occurs in approximately 10% of cases of blunt abdominal pediatric trauma,(2) resulting in most of these injuries.(3)

Pancreatic injury associated morbidities are significant, such as massive bleeding, abscess, pancreatic pseudocyst or fistula formation.(4) The challenge in blunt pancreatic injury is the difficulty in early diagnosis which results in increasing morbidity.(5) Death from pancreatic injury is mostly due to adjacent major vessel and associated abdominal organ injuries that result in uncontrolled bleeding or severe septic shock.(6) The management of pancreatic trauma largely depends on the presence of duct disruption which occurs in one quarter of cases(7) and other associated injures.(8)

The American Association for the Surgery of Trauma has devised a 5-scale grading system for pancreatic trauma. A grade of III or greater in this classification equates to major injury, often involving the major pancreatic duct and requiring operative intervention.[9] In most cases, an aggressive management is recommended to reduce morbidity which is significantly increased by delayed treatment.[7]

The traditional management approach for major pancreatic trauma at the level of the pancreatic neck, body, or tail is open exploration and distal pancreatectomy with splenectomy.[10] Spleen preserving distal pancreatectomy, primary repair of the pancreas and main pancreatic duct[11], and pancreas parenchyma preserving surgical approach[12] are other proposed alternatives.

Distal pancreatectomy to the left of superior mesenteric vessels is associated with loss of significant amount of normal pancreatic parenchyma resulting in increased risk of pancreatic insufficiency.[13] Splenectomy is associated with a risk of infectious and hematologic morbidity.[14] Endocrine, exocrine pancreatic insufficiency, infectious hematological complications following distal pancreatectomy and splenectomy have encouraged the pancreas and spleen preserving strategies for management.[14]

Aim of the work: This study aimed at evaluation of the feasibility, safety, mortality and morbidity of PG as a more physiologic solution instead of distal pancreatectomy or PJ in complete pancreas transection at the level of the neck or central body of the pancreas without duodenal laceration in children.

PATIENTS AND METHODS

This study was a retrospective study performed from January 2001 to October 2012 on children admitted to the Trauma department of Sohag University Hospital with blunt abdominal trauma resulting in complete pancreas transection at the neck or central body conditioned that the head of the pancreas was intact and no duodenal laceration was present (grade III injury),[9] they presented acutely and were managed surgically within 24 hours of accident with PG as an alternative to distal pancreatectomy or PJ (Fig. 1).

Data collected were age, mechanism of injury, pancreatic injuries, associated injuries, serum amylase level on admission, investigations, surgical management, and postoperative outcome mainly morbidity and mortality.

Diagnosis was based on a combination of history, physical examination, abnormal pancreatic enzyme levels, computed tomography (CT), ultrasound findings, and lastly operative exploration.

Operative technique: Diagnostic laparotomy was made through a midline incision, exploration seeking for vascular, solid organ, or visceral injuries after mopping and suction of any collection was done.

Opening of the greater omentum to have access to the lesser sac and assess the pancreas injury. The proximal injured pancreatic segment was oversewn with hand utilizing 3-0 Polydioxanone suture (PDSII® Ethicon) after ligation of the transected pancreatic duct and the distal injured segment was mobilized for 4 cm off the splenic vein starting a PG, a seromuscular layer of sutures was taken from the posteroinferior gastric wall, at least 5 cm from the proposed cut edge of the stomach, to the posterior wall of the body of the pancreas with 3-0 Polydioxanone suture (PDSII® Ethicon) in an interrupted pattern, after all sutures were placed, they were tied. About 5 sutures were taken for the inner posterior layer. After all sutures in the inner posterior layer were placed, they were tied one by one and then a gastrotomy was made (Fig. 2). Hence sutures were placed from the posteroinferior gastric wall to the anterior surface of the body of the pancreas in an inner and outer layers similar to the posterior row (Fig. 3).

Sutures entered the pancreas at least 2 cm from the cut edge and exited 1 cm from the cut edge sparing the main pancreatic duct, and when the sutures were tied, invaginating the pancreas into the stomach without a stent. Great care was taken to prevent tearing of the pancreatic parenchyma and to adequately fix the pancreas and stomach.

Two suction drains were placed, a left one in the lesser sac behind the stomach near the PG and a right one in the Morrison's pouch.

Postoperative course: Postoperative patients were transferred to Intensive Care Unit to complete their postoperative course. The nasogastric tube which was inserted intraoperative was removed on day 5 postoperative, provided that the outcoming fluid was less than 200 ml daily. Total parenteral nutrition (TPN) started postoperative till the tenth postoperative day. H_2-antagonist, octreotide was given for 7 days and a course of antibiotics. Patients were given a liquid diet on day 6 and, if tolerated, advanced to a semisolid diet on day 7. A low fat diet was resumed on day 9. Drainage from the left drain was measured for amylase content from day 3 to day 7 postoperative in conjunction with the serum amylase level. The drains were removed on the tenth postoperative day conditioned that the collected fluid through the drains was less than 20 ml/day for each drain separately. Determination of serum glucose level was done serially from the first day postoperative and all through the whole postoperative course. The follow-up period extended for 2 months postoperative, long term follow-up could not be assessed.

Fig 1. Intraoperative photo showing region of pancreatic transaction indicated by white arrow

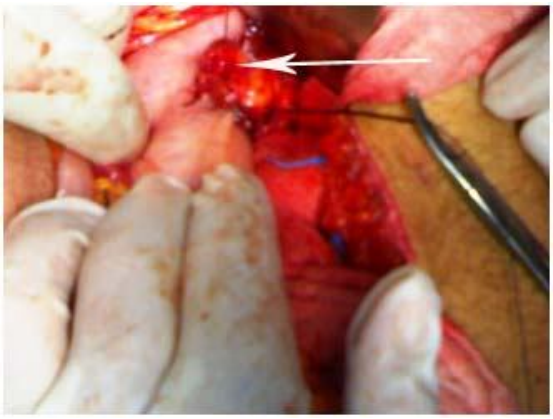

Fig 2. Anastomosis of the posterior wall of the distal pancreas with the posteroinferior gastric wall with the arrow pointing to the main pancreatic duct

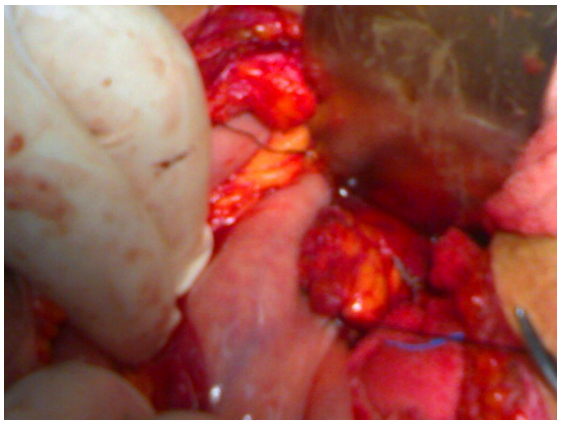

Fig 3. Telescoping of the distal pancreatic segment in the interior of the stomach after finishing of the inner layer anastomosing the anterior wall of the pancreas with the posteroinferior surface of the stomach

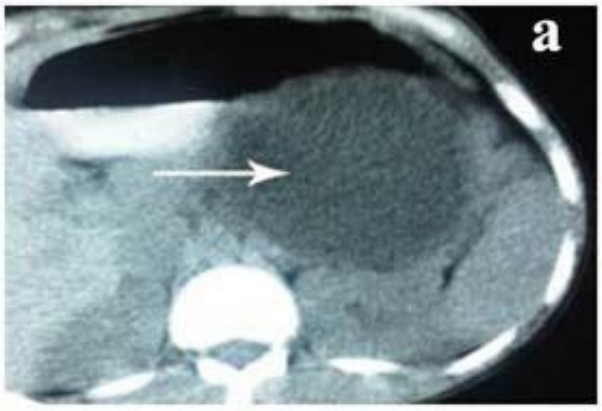

Fig 4a. Axial CT scan at the level of pancreas showed fluid collection at the region of pancreatic body and tail (white arrow inside)

Fig 4b. Ultrasound–guided insertion of 10 FG Pig tail catheter was carried out and left in-place till resolution of the pancreatic abscess

RESULTS

This study included 7 patients, 5 cases of them (71.4%) were boys and 2 cases (28.6%) were girls with a male-to-female ratio of 2.5:1 and the mean age was 7.5± 1.6 years (range 5-12 years).

The cause of injury was motor car accident in 3 cases (42.8%), fall from height in 2 cases (28.6%), bicycle handlebar accident in 1 case (14.3%), and animal kick in 1 case (14.3%) (Table 1).

Table 1. Mechanism of injury.

Cause	Number of Patients (%)
Motor car accident	3 (42.8)
Fall from height	2 (28.6)
Bicycle handlebar	1 (14.3)
Animal kick	1 (14.3)

The presentation of these cases was in the acute stage with complete pancreas transections; 6 cases (85.7%) were in the central body of the pancreas and 1 case (14.3%) was in the neck. The associated extra-abdominal injuries were head injury with disturbed level of consciousness in one child due to fall from height, 2 cases with thoracic injuries and one case with fracture femur. There were other intra-abdominal injuries in addition to the pancreas injury in 3 patients (42.8%); 2 patients had associated splenic injuries and 1 patient had associated liver injury.

There was a definite diagnosis of pancreas transection by preoperative CT in 3 patients which clearly demonstrated the site of ductal injury. It showed an abnormality in a further 2 cases but it was not conclusive until exploratory laparotomy settled the diagnosis of pancreas transection. Two cases were diagnosed intraoperative as prompt surgical intervention was done for them due to their urgent conditions; one of them had associated tear of the lesser omentum with hemoperitoneum and shock. Hyperamylasemia was detected in 5 patients.

The median operating time was 3.1 hours (range, 2.5-4 hours). The median postoperative hospital stay was 13 days (range, 10-31 days). A PF occurred in 1 patient (14.3%) and was the commonest morbidity, which was transient and closed after two weeks with maintenance of drains and continued oral intake, and didn't require further operative intervention. An intra-abdominal abscess occurred in one patient who was treated with ultrasound guided percutaneous drain by means of interventional radiology (Figure 4). Chest infection occurred in 3 cases (42.8%) and lastly wound infection occurred in 3 cases (42.8%) (Table 2). In-hospital mortality occurred in 1 patient (14.3%) who died with multiple organ failure on the 15th postoperative day. Long-term outcome could not be assessed.

Table 2. Postoperative complications.

Complication	Patients (%)
Pancreatic leak	1 (14.3)
Intraabdominal abscess	1 (14.3)
Wound infection	3 (42.8)
Pneumonia	3 (42.8)
Multiple organ failure	1 (14.3)
Mortality	1 (14.3)

DISCUSSION

There is a low incidence of pancreatic injury due to its retroperitoneal position and its fixity which makes it only affected by crush injury. Children are more susceptible to trauma because of their smaller size; a given force is applied over a relatively larger area of the abdomen in children than in adults, increasing the likelihood of multiorgan injury.[15] Also, children have less abdominal wall muscle mass and fat than adults and a more compliant and yielding thoracic cage, all these factors result in a less effectively protected abdominal organs, increasing the risk for organ injury compared with adults.[15] Usually pancreatic injury has an incidence of associated injuries ranging from 50% to 98%.[16] Although 2 cases of the studied children had splenectomy in addition and it would be more logic to do distal pancreatectomy for such patients but as they were hemodynamically stable, they deserved the chance to preserve the pancreatic function.

Blunt pancreatic injury is difficult to diagnose with history and clinical examination alone. The mechanism of injury that involves pancreatic compression against the vertebral column or blows to the abdomen[17] and nature of any accompanying injuries should raise the possibility of a pancreatic injury, as the earlier the diagnosis the better the outcome. The timing for intervention remains controversial, but the sooner it is performed (i.e. <72 h post-injury), the less pancreas associated complications occur.[18]

Hyperamylasemia takes more than 3 hours to develop, but must be considered a sign of probable pancreatic injury so should be combined with serum lipase as some cases of brain injury may have hyperamylasemia in the absence of abdominal trauma; suggesting that a central nervous system pathway is involved in regulation of serum amylase levels.[19] The degree of hyperamylasemia has no relation to injury severity.[20]

CT is the investigation of choice which is indicated in hemodynamically stable patients with abdominal complaints after trauma in whom a pancreatic injury is suspected, or for the evaluation of late pancreatic injury complications.[20] It may miss or underestimate pancreatic injury if done early before development of pancreatic edema which separates both fractured pancreatic ends.[21] So unexplained thickening of the anterior renal fascia should arouse suspicion of pancreatic injury,[21] as well as fluid between the splenic vein and the pancreas.[22]

The classic management for major pancreatic injury beyond the neck is distal pancreatectomy.[10] This has an impact in pancreatic insufficiency, so the necessity to apply a more physiologic solution salvaging the distal pancreas is necessary. We used PG invaginating the distal pancreatic stump to the stomach without stenting to restore the pancreatico-enteric continuity, thus saving most of the bulk of the pancreas. It has the advantages of splenic and pancreatic tissue preservation, and is no more challenging than distal pancreatectomy with splenic preservation.[12]

All studies evaluating PJ and PG concluded by reporting the superiority or at least equality of PG over PJ,[23] some authors describe PG as a safer reconstruction method having a lower rate of PF,[24] also other postoperative complications needing interventional drainage, relaparotomy, and less mortality which suggested that PG was superior to PJ.[25]

Many factors are associated with increased incidence of PF.[26] Among them; a soft pancreas with a small and thin pancreatic duct makes completion of the anastomosis technically difficult leading to leakage of activated enzymes which may digest the surrounding major blood vessels leading to life threatening bleeding.[27] Several methods have been suggested to reduce the occurrence of leakage, but the ideal technique is still a subject of debate.[28]

PG is technically easier than PJ as the stomach holds suture better and there is potentially less tension on the anastomosis as the pancreas is fixed and anatomically near to stomach compared to the jejunum.[29] In PG there is a lack of pancreatic enzyme activation which prevents autodigestion of the suture line.[30] In addition, the alkaline pancreatic secretions prevent marginal ulceration. Moreover, the stomach has thicker walls, wider lumen and rich blood supply making its operative handling easier and more favorable for anastomotic healing in comparison to the small lumen and the blood supply of the jejunum which has the chance to get worse .[29]

We did not use a stent with anastomosis as stenting of PG is of no benefit in prevention of pancreatic leakage and ductal occlusion.[31] Stents can cause cystic collection at PG sites, external stents can get accidentally pulled off, or cause persistence of fistula. Migration of trans-anastomotic stents has also been reported. Moreover histologic findings of the PG in human autopsies have shown good continuity of both epithelia even without suturing the pancreatic duct and gastric mucosa.[32] Furthermore a stenosed PG is easily amenable to endoscopic stenting which is not applicable to PJ.[30]

A nasogastric tube was inserted intraoperative to provide bowel rest and less tension over the anastomotic line, a benefit not possible with a PJ.[33] We preferred to use closed suction system for drainage. The rationale behind drainage is to exteriorize the PF if it occurs, minimize the consequences, as well as to ensure early diagnosis and management.[34] We left it in place for 7 to 10 days because PF will become evident by that time should it happens.[35] Also drains should be in place while the patient resumes oral intake, as resumption of an oral diet may increase the drain output.[36]

It is known that TPN has the value of resting of the gastrointesinal tract and hence decreasing the likelihood

of PF. So, it is our routine to administer TPN. We used octreotide in the postoperative period for 10 days as it reduces the incidence of postoperative complications in pancreatic surgery.[37] We used H_2-antagonist after surgery to obviate the ulcerogenic effect of the stress of trauma and surgery.

The long-term effects of PG include stenosis of pancreatic duct in 21.1%,[38] dilatation of pancreatic duct in 5.6-20%,[39] exocrine pancreatic insufficiency in 25-95% patients[38] and endocrine deficiency producing diabetes in 6.5% patients.[39] But these effects happened after pancreaticoduodenectomy for pancreatic carcinoma which is a different issue and wouldn't be the same after pancreatic trauma. Though we do not have any long-term results, in our short experience, there were no clinical features of exocrine or endocrine pancreatic insufficiency.

In conclusion PG is a safe and physiological solution especially in children with complete pancreas transection in an otherwise hemodynamically stable patient. The present data suggest that PG produces excellent early and medium-term results and should be considered in dealing with such trauma.

Limitations: More cases and longer follow-up are needed for better determination of its efficacy; also comparative controlled studies are needed.

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