

Spectrum and Outcome of Pancreatic Trauma

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ABSTRACT

Background and Aims: Pancreatic trauma is associated with high morbidity and mortality. Diagnosis is often difficult and surgery poses a formidable challenge.

Method: Data from 17 patients of pancreatic trauma gathered from a prospectively maintained database were analysed and the following parameters were considered: mode of injury, diagnostic modalities, associated injury, grade of pancreatic trauma and management. Pancreatic trauma was graded from I through IV, as per Modified Lucas Classification.

Results: The median age was 39 years (range 19–61). The aetiology of pancreatic trauma was blunt abdominal trauma in 14 patients and penetrating injury in 3. Associated bowel injury was present in 4 cases (3 penetrating injury and 1 blunt trauma) and 1 case had associated vascular injury. 5 patients had grade I, 3 had grade II, 7 had grade III and 2 had grade IV pancreatic trauma. Contrast enhanced computed tomography scan was used to diagnose pancreatic trauma in all patients with blunt abdominal injury. Immediate diagnosis could be reached in only 4 (28.5%) patients. 7 patients responded to conservative treatment. Of the 10 patients who underwent surgery, 6 required it for the pancreas and the duodenum. (distal pancreatectomy with splenectomy-3, pylorus preserving pancreatoduodenectomy-1, debridement with external drainage-1, associated injuries-duodenum-1). Pancreatic fistula, recurrent pancreatitis and pseudocyst formation were seen in 3 (17.05%), 2 (11.7%) and 1 (5.4%) patient respectively. Death occurred in 4 cases (23.5%), 2 each in grades III and IV pancreatic trauma.

Conclusions: Contrast enhanced computed tomography scan is a useful modality for diagnosing, grading and following up patients with pancreatic trauma. Although a majority of cases with pancreatic trauma respond to conservative treatment, patients with penetrating trauma, and associated bowel injury and higher grade pancreatic trauma require surgical intervention and are also associated with higher morbidity and mortality.

Key words: Pancreatic trauma, diagnosis, management

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INTRODUCTION

Since the first reported case of pancreatic trauma by Travers in 1827 till date, pancreatic trauma poses a formidable challenge to the surgeon.¹ The reason for this is the difficulty in diagnosis, due to the absence of characteristic physical findings and non-specific laboratory findings. Also the incidence rate of pancreatic injury is low (only 1 in 250,000 hospital admissions), and there is thus no consensus regarding its optimal treatment.

² This study is a single institute's experience of pancreatic trauma, addressing the issues of mechanism of injury, diagnosis, and management.

PATIENTS AND METHODS

Records of 17 patients of pancreatic trauma, admitted over the last five years between the years 2000 and 2005, were reviewed from our database. The records were examined for mode of injury, diagnostic modalities, associated injury, grade of pancreatic trauma and management. All patients of blunt abdominal trauma were subjected to contrast enhanced computed tomography (CECT) scan after initial stabilisation. Pancreatic trauma was graded as per the Modified Lucas Classification described in Table I.³ Besides routine haematological and biochemical investigations, serum amylase levels were also determined on admission and at 72 hours. Depending on the grade and severity of injury, and associated injuries, patients were either subjected to surgery or treated conservatively with close intensive monitoring. All patients with penetrating trauma were subjected to emergency surgery after initial resuscitation. Patients with blunt abdominal trauma were given a trial of conservative treatment for 48 to 72 hours, with intensive monitoring of vital parameters and periodic abdominal, haematological and biochemical examinations. Non-responsiveness to conservative treatment or clinical deterioration, while on expectant treatment was indication for surgery in patients with blunt trauma. Data are expressed as median value (range).

Table I: Modified Lucas classification

Class I	Contusion or peripheral laceration with minimal parenchymal damage. Main pancreatic duct intact.
Class II	Major laceration, perforation or transection of body or tail with or without duct injury.
Class III	Severe crush, perforation or transection of the pancreatic head with or without duct injury.
Class IV	Combined pancreaticoduodenal injury: a) Minor pancreatic injury b) Severe pancreatic injury with duct disruption

RESULTS

Of 442 abdominal trauma cases (both blunt and penetrating) admitted from the year 2000 through 2005, 17 patients (3.7%) were identified with pancreatic trauma [15 (88.2%) male and 2 (11.7%) female]. The median age of these 17 patients was 39 years (range 19–61). The aetiology of pancreatic trauma was blunt abdominal trauma in 14 (82.3%) patients and penetrating injury in 3 (17.7%). There was associated bowel injury in 4 patients (23.5%); of these 3 had suffered stab injury and 1 had

blunt abdominal trauma. One patient (5.8%) also had associated vascular injury.

CECT scan was used to diagnose pancreatic trauma in all patients with blunt trauma. Immediate diagnosis after performing CT scan on admission could be reached only in 4 patients (28.5%). In 9 patients diagnosis was established on exploratory laparotomy for the associated injury, whereas a delayed diagnosis was made in 4 patients after 72 hours on repeat CT scan. These 4 patients had persistent hyperamylasaemia even at 72 hours, which prompted a repeat CT scan.

As for treatment, all 3 patients of penetrating trauma were subjected to emergency surgery following stabilisation. Of the 14 patients of blunt abdominal trauma, 7 were treated conservatively (5-grade I and 2-grade II trauma patients), whereas the other 7 patients were subjected to surgery (1-grade II, 5-grade III and 1-grade IV trauma patient). One patient of grade II trauma underwent debridement with external drainage. 3 patients of grade III trauma underwent distal pancreatectomy with splenectomy, 1 patient of grade IV trauma underwent pylorus preserving pancreato-duodenectomy, and 1 patient of grade IV trauma was subjected to pyloric exclusion with gastro-jejunostomy.

Complications in the form of pancreatic fistula in 3 (17.05%), pancreatitis in 2 (11.7%), and pseudocyst formation in 1 (5.8%) patient, were seen. While the first two complications were managed by conservative treatment, the pseudocyst was treated by endoscopic gastrostomy performed at the end of eight weeks. Death occurred in 4 (23.52%) patients, 2 with grade IV, and 2 with grade III trauma, both of whom had undergone distal pancreatectomy with splenectomy. Correlation between grade of trauma, aetiology, associated bowel injury, vascular diagnosis and treatment offered is shown in Table II.

DISCUSSION

Pancreatic trauma is rare, with a reported incidence of 0.4 per 100,000 population, occurring in 10% of abdominal injuries.^{2,4} Though uncommon, the associated high morbidity and mortality, make it imperative for all surgeons to understand the mechanism of injury and management.

Patients of pancreatic trauma are relatively young, with marked male predominance. In our series 88.2% were male and the median age was 39 years, comparable with the study of Levison et al.⁵ Pancreatic trauma is caused by either blunt or

penetrating trauma; the former is more common, following road accidents.⁶ The mechanism of blunt trauma involves the anatomical relation of the pancreas with the vertebral column. Penetrating trauma is usually a result of knife wounds and is commonly associated with injury to bowel and blood vessels. In our series, 14 patients (82.3%) had blunt abdominal trauma, and 3 (17.7%) had penetrating trauma, following stab injury.

Isolated injury to the pancreas is uncommon. There is a very high incidence of associated injury with figures of 50–98% reported in the literature.^{7–9} Not uncommonly three or more organs are involved. The liver, spleen, stomach, duodenum and colon are the organs most commonly injured.^{7,8,10} Frey and Wardell noted associated injury to the liver (26%), colon or small bowel (25%), major vessels (25%), duodenum (24%), stomach (19%), spleen (12%) and kidney (10%).¹¹ In our series, there was associated bowel injury in 4 patients (23.5%), 3 patients had stab injury and 1 patient had blunt abdominal trauma. 2 patients (11.7%) had duodenal injury whereas 1 patient (5.8%) had small bowel injury. 1 patient (5.8%) also had associated vascular injury involving the superior mesenteric vessels. This is comparable to the other series reported in the literature.^{7–11}

The retroperitoneal location of the pancreas makes the investigation of pancreatic trauma a diagnostic challenge. This is true, if there are associated vascular and other intra-abdominal organ injuries, when the diagnosis is not reached until laparotomy. CT scan remains the gold standard for investigating patients of blunt abdominal trauma, having proved its utility in detecting liver and spleen injury. However it has low sensitivity for detecting pancreatic injury as an initial study, either missing it or under-grading it.¹² This is because of the evolving nature of the pancreatic injury. Hence a repeat scan in light of continuing symptoms is recommended, to improve its diagnostic ability.¹³ Studies with single-detector CT with 10 mm collimation have shown limited sensitivity and specificity for detection of pancreatic injury, not exceeding 80%.^{7,14}

Though none of our patients was subjected to magnetic resonance pancreatography (MRP), this technique has emerged as an attractive alternative for direct imaging of the pancreatic duct.¹⁵ MRP has the advantage of being noninvasive, faster, and more readily available than endoscopic retrograde cholangiopancreatography (ERCP). In addition, MR pancreatography may demonstrate abnormalities not visible at

Table II: Co-relation of the grade of injury, aetiology, associated injury diagnosis and treatment

Grade of injury	No of patients	Etiolog injury	Bowel injury	Vascular	Diagnosis	Treatment
I	5	Blunt	No	No	Delayed (4)	Conservative
				Immediate (1)		
II	3	Blunt	No	No	Immediate	Debridement & External
III	7	2-Stab	Yes	No	At time of surgery	Distal pancreatectomy with
		5-blunt (1pt)	Yes	No		splenectomy (3pt) conservative (4pt)
IV	2	1-stab	Yes	Yes	At time of surgery	PPPD (1pt), pyloric exclusion with
		1-blunt	Yes	No		GJ (1pt)

PPD: Pylorus preserving pancreato - duodenectomy

GJ: Gastrojejunostomy

pt: Patient

ERCP, such as fluid collections upstream of the site of duct transection, and is helpful in assessing parenchymal injury.¹⁶ Besides, MR pancreatography can be helpful in directing ERCP-guided therapy when ductal anomalies are present, such as pancreas divisum.

ERCP is indicated when pancreatic injuries are detected at CT or MR imaging or if there is high clinical suspicion of ductal injury. ERCP can direct appropriate surgical repair or can be used for primary therapy by means of stent placement. When ERCP-guided stent placement is being considered, delay in therapy longer than 72 hours after the initial trauma may lead to increased complications and prolonged hospital stay.¹⁷ As with MR pancreatography, patients in whom ERCP shows no pancreatic duct injury, may be treated conservatively with clinical and laboratory follow-up. In our series none of the patients was subjected to ERCP.

Although the highest concentration of amylase in the human body occurs in the pancreas, isolated hyperamylasaemia is not a reliable indicator of pancreatic trauma. The sensitivity of serum amylase in detecting blunt pancreatic trauma varies from 48% to 85%, and the specificity from 0% to 81%.¹⁸ The negative predictive value of serum amylase after blunt trauma is about 95%,¹⁹⁻²¹. It implies that 95% of patients with blunt trauma whose amylase findings are negative will indeed not have pancreatic injury. Although elevation in serum amylase or peritoneal lavage effluent amylase does not confirm the presence of a pancreatic injury, it does mandate further evaluation. In our study, pancreatic injury on repeat CT scan was detected in 4 patients with persistent hyperamylasaemia even at 72 hours.

Although there is no consensus as regards the optimal management, due to reported low incidence of pancreatic injury, and paucity of studies; all studies to date agree that factors dictating the management are of pancreatic trauma are: 1) grade and severity of pancreatic injury, 2) associated injury and 3) haemo-dynamic stability of the patient on presentation. Modified Lucas Grading for the severity of pancreatic trauma is universally accepted. The management plan as per the grade of trauma is as follows:

In patients with grade I and II trauma, a conservative approach is recommended. If the pancreatic duct is intact a simple external drainage is adequate. External drainage provides an excellent means of removal of pancreatic secretions, which contain activated proteolytic enzymes. Besides, adequate drainage prevents the complications of abscess formation and fistula formation. However simple passive drains many a time become ineffective because of plugging by collapse of adjacent tissues. Hence sump drainage is recommended as it provides almost complete evacuation of secretions and avoids autodigestion, thus reducing the complications.²² However; the drawback of sump drainage is that, there is a high chance of abscess formation following colonisation by hospital pathogens and erosion of the adjacent viscera or vessels, the drain being rigid. Wynn et al,²³ Sorenson et al²⁴ and Cogbill et al²⁵ have shown excellent results without much complication, with external drainage using a sump drain in patients with grades I and II trauma.

In patients with grade II trauma with injury to the duct, the best option is to perform a distal pancreatectomy with splenectomy.^{23,26,27} Though many advocate preservation of the spleen, this seems inappropriate in an acute emergency situation as it involves tedious dissection and added operative time. Besides, there is also the possibility of splenic vein thrombosis, developing at a later stage.

In our series all 5 patients (29.4%) of grade I trauma and 2 patients (11.7%) of grade II trauma were treated conservatively, with close monitoring as they were haemodynamically stable. 1 patient (5.8%) of grade II trauma who had parenchymal laceration with collection was treated with passive external drainage, as the duct was intact. This patient developed a pancreatic fistula, which was successfully treated conservatively.

Grade III and IV trauma include major injuries to the pancreatic head. Injuries to the pancreatic head without ductal damage are best treated conservatively by sump drainage. In case of exclusive ductal damage, the Rouxen-Y loop is probably the best option.^{27,28,29} In a six year review comprising 41 patients published by Sorenson et al,²⁴ 20 patients were treated with drainage alone, with an 11% mortality rate and 2 pancreatic and 6 non-pancreatic complications. 21 patients underwent resection with a resultant 19% mortality rate and 18 pancreatic and 19 non-pancreatic complications. The difference in morbidity and mortality rates could not be accounted for by the severity of injury. They recommended drainage for the majority of penetrating pancreatic injuries and suggested reserved resection for injuries requiring debridement and for homeostasis.

Pancreato-duodenectomy for grade IV trauma has a high morbidity rate especially in an emergency setting, with reported overall mortality of 30–40%.²³ It is thus said that a Whipple's procedure should be generally performed only in severe injuries because here tissue fragmentation has already taken place and what remains to be done is essentially debridement of devitalised tissue. The other surgical alternatives recommended are the Roux loop to cover the damaged areas to the pancreas and duodenum,³⁰ and duodenal diversion by pyloric exclusion.^{25,30} In our series, of the 7 patients with grade III trauma, 3 with ductal injury underwent distal pancreatectomy and splenectomy. The other 4 patients were treated conservatively. Of the 2 patients with grade IV trauma, 1 patient with stab injury and associated vascular injury was subjected to distal pancreatectomy and splenectomy, while the other patient was subjected to pyloric exclusion with gastro-jejunostomy. However, both patients died.

The rate of morbidity is very high and varies according to the nature of associated injuries. The overall complication rate varies from 30% to 60%.^{23,25,26} The commonest complications occurring are: (1) Pancreatic fistula: Its incidence varies from 7–20%.^{23,32} In our series pancreatic fistula formation was seen in 3 (17.05%) patients. (2) Pancreatitis: This is the most common complication and often leads to death.^{18,21,27} In our series, 2 patients (11.7%) of grade III trauma, who were treated conservatively, had pancreatitis, which was also treated conservatively. (3) Pseudocyst formation: The reported

incidence of pseudocyst formation is 2% with rate of formation depending on the adequacy of control of pancreatic secretion achieved by drainage or surgery.^{22,26,31} In our series, one patient with grade III trauma and treated conservatively, developed a pseudocyst, which was treated by endoscopic cystogastrostomy after 8 weeks when it failed to resolve spontaneously.

Isolated pancreatic injuries are uncommon and carry mortality rates of between 3–10%.^{22,26} In our series death occurred in 4 (23.5%) patients, 2 patients with grade IV trauma, and 2 patients with grade III trauma who had undergone distal pancreatectomy with splenectomy. The patients with grade IV trauma succumbed following surgery within 48 hours while two patients with grade III injury succumbed due to post-operative pancreatitis with multi-organ failure.

In conclusion, penetrating pancreatic injuries need immediate surgical treatment while blunt pancreatic trauma needs clinico-radiological assessment and exploration if necessary. Continued observation when the duct is intact or urgent surgery when the ductal system has been breached is warranted. Associated vascular and bowel injury warrants emergency exploration. Immediate diagnosis of an isolated grade I pancreatic trauma is difficult and may be confirmed by the persistence of symptoms or complications like pseudocyst formation. The development of hyperamylasaemia suggests pancreatic injury and serves as an indicator for determining the integrity of the pancreatic ductal system.

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