ORIGINAL ARTICLE

Traumatic pancreatic injury - an elusive diagnosis: experience from a developing country urban trauma referral centre

Ayaz Ahmed Memon, Hasnain Zafar, Rushna Raza, Ghulam Murtaza

Abstract

Objective: To determine the frequency of pancreatic injury in patients presenting with trauma and to review the mechanism of injury, management, subsequent complications and in-hospital mortality rate associated with these patients.

Methods: The retrospective study included all patients over 18 years of age presenting with pancreatic injury due to trauma at the Aga Khan University Hospital, Karachi, between January 1990 and December 2009. Patients with iatrogenic pancreatic injury were excluded. The severity of the injury was assessed using the Injury Severity Score, while it was graded according to the scale defined by the American Association for the Surgery of Trauma. SPSS 17 was used for statistical analysis.

Results: A total of 30 patients were identified representing just 1.5% of the total adult abdominal trauma patients. The mean age of the patients was 28±9.7 years. There were 28 (93.3%) males and just 2 (6.6%) females. The complication rate was 80% (n=24) and the mortality rate was 23.3% (n=7). Of the 30 patients, 19 (63%) had been transferred from some other medical facility. The mean length of hospital stay was 16.4±20.6 days (range 5-97 days).

Conclusion: Surgical management in pancreatic trauma patients should be dictated by the degree and location of pancreatic injury, associated injuries and time from event to presentation. Mortality was primarily determined by associated life-threatening injuries.

Keywords: Pancreatic trauma, Pancreatic fistula, Pancreatic pseudocyst, Developing country. (JPMA 63: 440; 2013)

Introduction

Pancreatic injuries continue to challenge trauma surgeons. The relative rarity of these unforgiving injuries with an incidence of around 3-4% in patients with abdominal trauma,[1] compounded with the difficulty of diagnosing them in a timely manner, and the high morbidity and mortality associated with them explain some of the anxiety they evoke.

The deep, central, and retroperitoneal location of the pancreas confers protection to this organ, but it also means that pancreatic injuries rarely occur alone and are often associated with other intra-abdominal injuries.[2] Mortality of pancreatic trauma ranges from 9% to 46% and is related to the associated injuries, as much as to the pancreatic injury itself; hence wisdom dictates that the patients must be managed as all other trauma patients with the aim of ensuring haemodynamic stability first, before any specific treatment of the pancreatic injury is undertaken. Early recognition, adherence to the basic concepts of haemostasis of associated vascular injury, minimising bacterial contamination, accurate assessment of the pancreatic injury, judicious resection and adequate drainage can significantly diminish morbidity and mortality.[3,4]

The relative dearth of data on pancreatic trauma in international literature is compounded by a virtual absence of information about the epidemiology and outcomes of such injuries from the developing world. The likelihood of missed diagnoses, delayed intervention and, therefore, poorer outcomes seems higher in the face of limited resources, diagnostic capabilities and uneven inter-institutional referral that is prevalent in these setups. We, therefore, reviewed our own institutional experience as a major urban referral centre for complex multi-organ trauma from the last two decades.

Patients and Methods

The retrospective analytical study was conducted at the Aga Khan University Hospital, Karachi, and reviewed the medical records of all patients aged 18 years and older, who presented with pancreatic trauma over the last 20 years i.e. 1990-2009. The study was exempted from Ethical Review Committee approval as per institutional guidelines as it was a retrospective review of patient files. Patient consent that data can be used for any scientific study is taken as a routine at the institute. The data was retrieved from hospital records using International Classification of Diseases (ICD) code 863.81-84, 863.91-94. Patients with iatrogenic pancreatic injuries were excluded

Department of General Surgery, Aga Khan University Hospital, Karachi.
Correspondence: Ayaz Ahmed Memon. Email: memonayaz2002@yahoo.com

from the study. The variables collected included socio-demographic parameters, clinical indicators, laboratory and radiological investigations, hospital management and its outcomes. Total hospital stay, complications and in-hospital mortality were considered major outcomes. The severity of the injury was assessed using the Injury Severity Score (ISS) and the pancreatic injury was graded using the American Association for the Surgery of Trauma (AAST) pancreatic injury scale (Table-1).[5]

Table 1: Pancreatic injury scale (American Association for the Surgery of Trauma).[5]

Grade	Description	No. of patients
I	Minor contusion without duct injury superficial laceration	2
II	Major contusion without duct injury or tissue loss	
	Major laceration without duct injury or tissue loss	7
III	Distal transection or parenchymal injury with duct injury	12
IV	Proximal transection or parenchymal injury involving ampulla	8
V	Massive destruction of pancreatic head	1

Data were analysed using SPSS 17.0. Continuous variables were analysed as means and standard deviations, whereas categorical variables were analysed as frequencies and percentages. Correlation of pancreatic injury with ISS was determined by Pearson correlation coefficient.

Results

Thirty patients were identified with objective radiological or operative evidence of pancreatic trauma during the study period. The mean age of these patients was 28±9.7 years with male predominance (n=28; 93.3%). Pancreatic injury was observed in 1.5% of the total patients presenting with trauma. Of the 30 patients, 19 (63%) had been transferred from some other medical facility, while 11 (36.6%) patients primarily presented to our emergency department.

Eleven (36.6%) patients had blunt trauma out of which 9 (30%) were involved in road traffic accidents, and 2 (6.6%) had fallen from a height. Besides, 19 (63%) patients received penetrating injuries, out of which 14 (46.6%) had gunshot injuries, 3 (10%) had stab wounds and 2 (6.66%) individuals sustained secondary bomb blast injuries.

The mean revised trauma score of the injured at the time of Emergency Room (ER) presentation was 7.43±0.4 (range 3.47-7.84). Eight (26.7%) patients presented with profound shock; 12 (40%) had vitals corresponding to mild shock; and 27 (90%) had signs of acute surgical abdomen.

The mean ISS at presentation was 24.7±11.7 (1–75) with 5 (16.67%) patients having a score of 75 (considered non-survivable). Only 2 (6.6%) patients had isolated pancreatic injury, whereas all other patients had associated injuries to bowel, solid organs or vascular structures. Altogether 46.7% patients presented within 1-2 hours of injury. Mean length of hospital stay was 16.4±20.6 days, and was higher in patients transferred from other hospitals.

On arrival at ER, serum amylase was done in 10 (33.3%) patients and was found raised in 7 (23.3%). Focussed abdominal sonography for trauma (FAST) was done in 9 (30%) patients and was positive in all. Computed

Table 2: Details of patients with blunt pancreatic injury (n=11).

Pancreatic Injury Grading	Time (hours) between injury and presentation	Associated injuries	Complications	Pancreas specific management
2 (1 cases)	600	None	Traumatic pancreatitis and pseudocyst	CT guided drainage of pseudocyst
3 (8 cases)	5	Grade V splenic injury	None	Distal pancreatectomy and splenectomy
	72	Grade I splenic injury	Traumatic pancreatitis	Pancreatic necrosectomy, surgical drainage + lavage feeding jej., loop colostomy
	1	Grade IV splenic, Grade II kidney injury, lacerated mesocolon	Wound abscess	Distal pancreatectomy and splenectomy
	16	Grade II liver and kidney injury, Grade III splenic injury	Sepsis	Distal pancreatectomy and splenectomy
	264	Grade III colonic injury plus gastric perforation	Pancreatic abscess, wound dehiscence, pancreatic pseudocyst	Surgical drainage in primary hospital, U/S-guided drain placed
	12	Grade III splenic injury, Grade I kidney injury and lacerated mesocolon	Hypocalcaemia, hypothermia, wound infection, subphrenic abscess, duodenitis	Distal pancreatectomy and splenectomy
	2	Grade II liver and abdvasc injury, grade IV splenic and grade V kidney injury	Pancreatic fistula, sepsis and ATN	Distal pancreatectomy and splenectomy; ileostomy with mesh closure
	72	Grade II liver injury	Sepsis, wound infection	Surgical drainage + lavage
4 (2 cases)	2	Small bowel perforation	Pancreatic pseudocyst	Surgical drainage, feeding jej, mesh closure
	17	Grade I kidney injury, anal canal laceration	Infected pancreatic pseudocyst, sepsis, subacute intestinal obstruction	Pancreatic necrosectomy, surgical drainage, feeding jej

Table 3: Details of patients with Penetrating Pancreatic Injury (n=19).

Pancreatic Injury Grading	Time (hours) between injury and presentation	Associated injuries	Complications	Pancreas specific management
1 (2 cases)	1	Grade II injury liver, spleen , diaphragm and colon plus gastric perforation	None	Surgical drainage
	1	None	None	Conservative management
2 (6 cases)	4	None	None	Surgical drainage
	24	Grade III colonic perforation plus stomach perforation	None	Surgical drainage
	2	Grade II colonic perforation plus stomach perforation	None	Surgical drainage, ileostomy
	288	Grade III colonic perforation plus stomach perforation	Pancreatic necrosis, intra-abdominal abscess, septic shock	Surgical drainage + lavage, feeding jejunostomy
	480	Grade IV AbdVasc* injury, gastric perforation	Pancreatic abscess and pseudocyst, sepsis, IVC thrombosis, CBD stricture	Exploratory laparoscopy in primary hosp, redo lap; cysto-gastrostomy, hepatico-jejonostomy
	0.5	Grade IV AbdVasc. Injury, Grade II diaphragm injury, gastric perforation	Sepsis	Surgical drainage
3 (4 cases)	144	Grade IV kidney injury	Pancreatic fistula	Nephrectomy and pancreatic drainage in primary hospital
	1.5	Gastric perforation and omentum lacerated	Pancreatic fistula	Surgical drainage
	120	Grade III liver injury, Grade V kidney injury, gastric, duodenal and gall bladder perforation	Pancreatitis	Pancreatic necrosectomy, mesh closure, feeding jej
	0.3	Grade III liver, Grade II splenic, Grade V AbdVasc., Grade II diaphragmatic injury,	Hypovolaemic shock and death	Distal pancreatectomy and splenectomy
4 (6 cases)	2	Grade II kidney, Grade III colonic injury, Gastric perforation	Pancreatitis, wound dehiscence, pancreatic abscess, pleural effusion	Surgical drainage, feeding jej., loop colostomy
	7	Grade V AbdVasc. Injury, Grade III duodenal Injury plus Gastric perforation	Pancreatic fistula, duodenal fistula	Distal pancreatectomy, drain placed with mesh closure.
	2	Grade III liver injury, gastric duodenal and colonic perforation	Pancreatic fistula and septic shock	Surgical drainage +lavage, gastrojejonostomy colostomy
	5	Grade IV liver, Grade V kidney injury, Grade II duodenal Injury , Gastric perforation	Hypovolaemic shock and death	Damage-control surgery
	0.5	Grade IV liver, Grade II AbdVasc. and diaphragm	Hypovolaemic shock and death	Damage-control surgery
	0.3	Grade V AbdVasc., gastric perforation	Hypovolaemic shock and death	Damage-control surgery
5 (1 case)	0.6	Grade IV colonic injury	Coagulopathy, Hypovolaemic shock, death	Damage-control surgery

*AbdVasc: Abdominal-vascular.

tomography (CT) scan was done on 13 (43.3%) patients, and pancreatic trauma was diagnosed in 10 (76%) of them, while in the other 3 (10%), initial CT scans were inconclusive. Subsequent CT scans of 2 (6.6%) of these patients revealed pancreatic injury. Endoscopic retrograde cholangiopancreatography (ERCP) and magnetic resonance cholangiopancreatography (MRCP) were not done in any of the 30 patients.

Most of the patients had grade 3 or 4 injuries (n=16; 53.3%) out of which 14 (46.6%) underwent surgery. However, 27 (90%) patients required surgical intervention regardless of their pancreatic injury grade as the indication for surgery was primarily due to associated injuries. Pancreatic resection was done in 5 (16.6%) patients with injury to the distal part of pancreas, and drainage procedures were carried out in 18 (60%) patients with injuries of lesser severity. There was a moderate correlation between ISS and the grade of pancreatic injury (Pearson Correlation coefficient= 0.62; p-value <0.012) with higher ISS predicting higher grades.

Individual details of all patients presenting with blunt and penetrating pancreatic trauma were noted (Table-2, 3). Isolated pancreatic injury was identified in 2 (6.6%) patients; one of them had a grade 2 injury secondary to blunt trauma. The patient had a delayed presentation after developing pseudocyst as a complication. The other victim had grade 1 pancreatic injury due to penetrating trauma. Both of these patients were managed

conservatively.

Complications observed in this study included pancreatic fistula (n=5, 16.7%), paralytic ileus (n=4, 13.3%), pancreatic abscess (n=4, 13.3%), pseudocyst (n=5, 16.6%), and sepsis (n=2, 6.6%). All of them were witnessed in patients transferred from other facilities. Mortality rate was 23.3% (n=7), but none of the deaths were considered to be a direct consequence of pancreatic injury. Five (16.6%) deaths were due to exsanguinations, while sepsis and multi-organ failure secondary to other associated injuries was established as a cause of death in 2 (6.6%) patients.

Discussion

In our study, the frequency of pancreatic injury was 1.5% of total adult trauma patients per year with a complication rate of 80% and mortality of 23.3%.

Trauma is one of the leading causes of morbidity and mortality in under-developed and developed countries. Likewise, in Pakistan, trauma is a major reason for morbidity and mortality in early age groups. As with all previous pancreatic trauma series reporting incidence rate ranging from 0.21%-1%,[4,6-8] this study also demonstrated the rarity of pancreatic injury in trauma patients.

The male predominance found in our study has also been reported in other studies from different regions of the world. Literature shows that males accounted for 88%, 76%, and 75% of the patients.[8-10] This higher proportion may be explained by the higher percentage of males involved in trauma incidents.

Penetrating trauma was the leading cause of injury to pancreas in our study group. The mechanism of injury reported varies from region to region, depicting the type of trauma received. Studies from the United Kingdom have demonstrated blunt trauma as the mechanism of injury in around 82% of the patients with pancreatic injury.[4,8] However, results from US and South Africa demonstrate penetrating trauma as the leading cause.[11,12]

As experienced by other trauma series, our study also validated the fact that victims belonged to young age group with a mean age of 28 years.

Isolated pancreatic injuries are uncommon.[11,13] Such injuries, especially those which are low-grade in nature, maybe sub-clinical or present with delayed complications, can be managed conservatively with favourable outcomes, as also experienced in another series.[13]

Most patients in our study sustained grade 2-4 injury. However, a trauma series published from Scotland identified grade 2 injuries as the major burden of injury (i.e. 84% in their experience). Other published series showed that grade 1-3 pancreatic injuries were predominantly present.[3,6] Our institute is a major tertiary care centre receiving referrals from surrounding hospitals. The higher injury grade in this study might be related to a greater proportion of transferred patients, as they also had greater severity or complexity of injury. This fact is also established in other studies which showed that the transferred group had grade 3-4 injuries as compared to the victims presenting primarily to the trauma centre.[4] More than 90% of the patients in our study had associated injuries to other abdominal organs; most commonly hepatic, splenic and gastric injuries. Due to the unique anatomical position of the pancreas, the incidence of associated injuries has been reported to range between 73-100% of patients who have sustained pancreatic trauma.[7,10,14,15]

Interestingly, we identified combined pancreaticoduodenal injury in 16.7% of cases; all were the result of penetrating trauma. A study reported simultaneous duodenal injuries in 6% of its patients,[8] while in cases of penetrating trauma the incidence of pancreaticoduodenal injury was between 12-21%.[14,15]

Although the highest concentration of amylase in the human body is in the pancreas, hyper-amylasaemia is not a reliable indicator of pancreatic trauma. In addition, there is evidence that isolated brain injury can cause elevated amylase levels through a central mechanism that remains to be clarified.[16] Nonetheless, the presence of hyper-amylasaemia should raise the index of suspicion for pancreatic injury. In a report of 73 patients with documented blunt injury to the pancreas, serum amylase levels were elevated in 61 (84%) patients and normal in 12 (16%).[17] Similar results were also experienced in this study. CT scan was done on 13 patients and pancreatic trauma was diagnosed in 10 (76%) of them. Although the sensitivity of CT scan in this study is higher compared to other series i.e. 45.4%,[18] but in the other 3, initial CT scans were inconclusive. Subsequent, CT scans of 2 of these patients revealed pancreatic injury.

We did damage control surgery in 4 patients because they were hypovolaemic shock secondary to associated severe intra-abdominal vascular and other organ injuries. All of them died and their early mortality was the result of haemorrhagic shock with concomitant injuries. Other series have also commented on this finding.[12,19-21]

Complications were seen in 80% of our cases. Pancreatic fistula, abscess and pseudocyst predominated, and these were mostly seen in patients who were transferred from other hospitals with severe pancreatic injuries. These

findings may indicate delay in treatment of more than 24 hours. Published series have reported complication rates between 12-62% and with a higher rate of complications in patients with delayed treatment.[22-25]

We failed to find any correlation between either the grade of pancreatic injury or the ISS with the length of hospital stay. This is probably reflective of the fact that the most grievously injured patients died shortly after presentation, while most moderately injured ones had a prolonged and complicated hospital stay with the minimally injured having an intermediate length of hospital stay.

Mortality after pancreatic trauma ranges from 9%-46%[7] and is usually the result of haemorrhagic shock and sepsis. It is rare for isolated pancreatic trauma to directly result in death. In this study, mortality was either a result of haemodynamic shock or multi-organ failure secondary to sepsis. Mortality rate in this study was 23.3%; however, severity of injury to pancreas does not reflect higher mortality.[4,7,8,11]

Conclusion

Pancreatic trauma is a rare entity and rarely found in isolation. Delayed presentation and diagnosis leads to increased morbidity. Initial CT scan might be inconclusive, so the injury must be presumed by the mechanism of injury. Surgical management in such patients should be dictated by the degree and location of pancreatic injury, associated injuries and time from event to presentation. The demographics, management and outcomes of pancreatic trauma from a limited-volume urban trauma referral centre in Pakistan compared favourably with literature from the West.

References

1. Boffard KD, Brooks AJ. Pancreatic trauma-injuries to the pancreas and pancreatic duct. Eur J Surg 2000; 166: 4-12.
2. Miller PR, Croce MA, Bee TK, Malhotra AK, Fabian TC. Associated injuries in blunt abdominal trauma: implications for missed injury in nonoperative management. J Trauma 2002; 53: 238-42.
3. Fleming WR, Collier NA, Banting SW. Pancreatic trauma: Universities of Melbourne HPB group. Aust N Z J Surg 1999; 69: 357-62.
4. Thomas H, Madanur M, Bartlett A, Marangoni G, Heaton N, Rela M. Pancreatic trauma-12-years experience from a tertiary centre. Pancreas 2009; 38:113-6.
5. Moore EE, Cogbill TH, Malangoni MA, Jurkovich GJ, Shackford SR, Champion HR, McAninch JW. Organ injury scaling. Surg Clin N A 1995; 75: 293-303.
6. AL-Ahmadi K, Ahmed N. Outcomes after pancreatic trauma: experience at a single institution. Can J Surg 2008; 51: 118-24.
7. Akhrass R, Yaffe MB, Brandt CP, Reigle M, Fallon WF Jr, Malangoni MA. Pancreatic trauma: a ten-year multi-institutional experience. Am Surg 1997; 63: 598-604.
8. Scollay JM, Yip VS, Garden OJ, Parks RW. A population-based study of pancreatic trauma in Scotland. World J Surg 2006; 30: 2136-41.
9. Rickard MJ, Brohi K, Bautz PC. Pancreatic and duodenal injuries: keep it simple. ANZ J Surg 2005; 75: 581-6.
10. Tan KK, Chan DX, Vijayan A, Chiu MT. Management of pancreatic injuries after blunt abdominal trauma. Experience at a single institution. JOP 2009; 10: 657-63.
11. Farrell RJ, Krige JE, Bornman PC, Knottenbelt JD, Terblanche J. Operative strategies in pancreatic trauma. Br J Surg 1996; 83: 934-7.
12. Seamon MJ, Kim PK, Stawicki SP, dabrowski GP, Goldberg AJ, Reilly PM, et al. Pancreatic injury in damage control laparatomies: Is pancreatic resection safe during initial laparotomy? Injury 2009; 40: 61-5.
13. Lochan R, Sen G, Barrett AM, Scott J, Charnley RM. Management strategies in isolated pancreatic trauma. J Hepatobiliary Pancreat Surg 2009; 16: 189-96.
14. Degiannis E, Levy RD, Potokar T, Lennox H, Rowse A, Saadia R. Distal pancreatectomy for gunshot injuries of the distal pancreas. Br J Surg 1995; 82: 1240-2.
15. Vasquez JC, Coimbra R, Hoyt DB, Fortlage D. Management of penetrating pancreatic trauma: an 11-year experience of a level-1 trauma centre. Injury 2001; 32: 753-9.
16. Vitale GC, Larson GM, Davidson PR, Bouwman DL, Weaver DW. Analysis of hyperamylasemia in patients with severe head injury. J Surg Res 1987; 43: 226-33.
17. Takishima T, Hirata M, Kataoka Y, Asari Y, Sato K, Ohwada T, et al. Pancreatographic classification of pancreatic ductal injuries caused by blunt injuries to the pancreas. J Trauma 2000; 48: 745-51.
18. Salimi J, Bakhtaver K, Solimani M, Khashayar P, Meysamie AP Zargar M. Diagnostic accuracy of CT scan in abdominal blunt trauma. Chin J Traumatol 2009; 12: 67-70.
19. Kao LS, Bulger EM, Parks DL, Byrd GF, Jurkovich GJ. Predictors of morbidity after traumatic pancreatic injury. J Trauma 2003; 55: 898-905.
20. Krige JE, Beningfield SJ, Nicol AJ, Navsaria P. The management of complex pancreatic injuries. S Afr J Surg 2005; 43: 92-102.
21. Brooks A, Shukla A, Beckingham I. Pancreatic trauma. Trauma 2003; 5: 1-8.
22. Patton JH Jr, Fabian TC. Complex pancreatic injuries. Surg Clin North Am 1996; 76: 783-95.
23. Rotondo MF, Zonies DH. The damage control sequence and underlying logic. Surg Clin North Am 1997; 77: 761-77.
24. Wolf A, Bernhardt J, Patrzyk M, Heidecke CD. The value of endoscopic diagnosis and the treatment of pancreas injuries following blunt abdominal trauma. Surg Endosc 2005; 19: 665-9.
25. Lin BC, Chen RJ, Fang JF, Hsu YP, Kao YC, Kao JL. Management of blunt major pancreatic injury. J Trauma 2004; 56: 774-8.