Management strategies of grade I, II, III blunt pancreatic injuries: our center's experience

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Background
Pancreatic injuries are rare among solid organ injuries. Blunt pancreatic injuries are classified according to the American Association for the Surgery of Trauma. According to the American Association for the Surgery of Trauma scale, grade I and II injuries are generally managed by conservative treatment, whereas grades III, IV, and V typically require surgical treatment. Traumatic pancreatic injuries are characterized by high morbidity and mortality rates.
Patient and methods
Grade I, II, II pancreatic injury patients were included in this study and grade IV patients were excluded together with the pediatric age group. Patients of this study were divided into operative groups, where surgical exploration with drainage and/or pancreatic resection or necrosectomy and continuous saline lavage was done with application of hemostatic sealant sheets over the raw surface of pancreas and conservative groups, where conservative measures were carried out.
Results
According to The American Association for the Surgery of Trauma (AAST) grade I, seven patients, grade II, eight patients grade III two patients, 10 patients underwent operative intervention, drainage and/or pancreatic resection with continuous saline lavage, and application of hemostatic sealant material when needed. One patient developed pancreatic pseudocyst. Seven patients underwent conservative measures, with two patients having developed pseudocyst and one patient developing pancreatic fistula.
Conclusion
Operative intervention of grade II, III injuries with application of continuous saline lavage, and application of hemostatic sealant material when needed helps to decrease complications.

Keywords:
blunt pancreatic, hemostatic sealant sheets, lavage

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Introduction

Pancreatic injuries are rare among solid organ injuries as compared with liver and spleen [1]; pancreatic injuries range from 0.2% [2,3] to 5% [4,5] in blunt abdominal trauma, and from 1 to 12% in penetrating abdominal trauma [1–6].

The common mechanisms of blunt pancreatic trauma are motor vehicle accidents (steering wheel and seat belt impact injuries) in adults, and impact due to bicycle handlebar injuries in children [7,8].

Other mechanisms include fall of heavy objects over the abdomen, fall from height, and direct blunt assault to the abdomen [7–10].

Classifications

The American Association for the Surgery of Trauma (AAST) scale for pancreatic injuries was introduced in 1990 [11], and this scale is the most used grading system [11,12] (Table 1).

The AAST scale emphasizes the importance of injury to the head and to Wirsung's duct. Because of its simplicity and correlation with treatment, this scale represents a valuable tool for the management of and decision-making related to pancreatic trauma. According to the AAST scale, grade I and II injuries (representing 60 and 20% of all pancreatic injuries, respectively) are generally managed by conservative treatment, whereas grades III, IV, and V typically require surgical treatment [12]. Other grading systems for pancreatic injuries include the Lucas and the Frey and Waddell classifications. Although these systems have been adopted in the past, they have more recently been nearly completely abandoned [11].

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Serious sequelae may follow if the magnitude of the pancreatic injury is underestimated or inappropriately treated [14,15].

Traumatic pancreatic injuries are characterized by high morbidity and mortality rates [1]. The morbidity rates range from 30 to 40%, and morbidity is primarily related to injuries to other associated organs. Major pancreatic-related complications include acute necrotic hemorrhagic pancreatitis (15%), pseudocysts (9%), abscesses (6%), and fistulas (4%) [1,16]. Early mortality is most commonly due to uncontrolled bleeding from large visceral veins in close proximity to the pancreas or major injuries to the nearby solid organs [16,17]. Late mortality is generally due to infection or multiple organ failure. Neglect of a major ductal injury with retroperitoneal extravasation of pancreatic enzymes predisposes to delayed local complications [17].

Patients and methods

Patient selection

This study was carried out in Zagazig University Hospital's Trauma Unit over a period of 3 years between June 2013 and June 2016. This work was approved by the IRB/Ethics Committee in Faculty of Medicine Zagazig University. Seventeen patients were diagnosed with pancreatic injury based on the computed tomography (CT) scan or surgical findings. Among the patients with abdominal trauma, patients with penetrating injury, duodenal injury, grade IV pancreatic or major duct injury, uremia, liver cell failure, advanced cardiac disease were excluded; immunocompromised and pediatric patients were also excluded.

Management strategy

The management guideline for trauma patients in our hospital entails resuscitation according to the Advanced Trauma Life Support measures, maintaining a blood pressure of above 90/60 with intravenous fluids, with or without blood transfusion, and/or medications support and dealing with the cases according to those priorities that patients with hemodynamic instability are dealt with. According to the cause, patients with severe solid organ injury, gas under diaphragm, peritonitis, and marked internal hemorrhage underwent surgical exploration; patients with pancreatic injury were managed according to the case. We applied continuous saline lavage and drainage of the peritoneal cavity for 1 week (Berger's lavage) and hemostatic synthetic sealant materials were applied to the surface of the pancreas when needed. Hemodynamically stable patients diagnosed by CT underwent conservative measures. All pancreatic injuries were graded using the AAST classification, based predominantly on CT imaging, or operative findings in patients diagnosed on abdominal exploration. Pancreatic injury grades are changed if intraoperative findings were inconsistent with CT imaging.

All patients underwent clinical, laboratory, and ultrasound of the abdomen; CT scan follow-up, and magnetic resonance cholangiopancreatography (if needed) were arranged for further evaluation.

Admission data, laboratory, and radiological investigations, management outcome, follow-up data for the following 6 months are collected and analyzed, with a detailed review of all medical records to determine the occurrence of late pancreas-specific complications.

Results

Of the 17 patients of this study, nine were diagnosed during abdominal exploration of hemodynamically unstable patients, and eight were diagnosed after CT examination in hemodynamically stable patients.

Demographic distribution and cause of injury

Thirteen male patients and four female patients, age ranged between 11 and 48 years, mean±SD age of 28.2±10.1 years, trauma caused by road traffic accident in 13 patients, fall from height in three patients and handlebar bicycle injury in one patient as shown in Table 2.

Anatomical site and grade of injury, associated injuries

Of the eight hemodynamically stable patients, diagnosed by CT we got grade I; three patients with isolated pancreatic injury, with mild contusion. Grade II: four patients, two patients with body and tail contusion one associated with splenic hematoma and the other left renal subcapsular hematoma; and two

Table 1 Pancreatic organ injury scale: American Association for the Surgery of Trauma [13]

Grades	Injury description
I	Hematoma – minor contusion without duct injuryLaceration – superficial laceration without duct injury
II	Hematoma – major contusion without duct injury or tissue lossLaceration – major laceration without duct injury or tissue loss
III	Laceration – distal transection or parenchymal injury with duct injury
IV	Laceration – proximal transection or parenchymal injury involving the ampulla
V	Laceration – massive disruption of the pancreatic head

patients with laceration and mild internal hemorrhage without duct injury. Grade III, one patient with complete transection of the body with splenic hematoma and subcapsular hematoma of the liver (Table 3). Four of the nine patients diagnosed on exploration we got grade I, four patients; grade II, four patients; and grade III, one patient with bodytail contusion and distal duct injury, tail injured in 11 patients and body in six patients as shown in Table 3.

The spleen was injured in four patients, small intestine in two patients, colon in one patient, mesenteric vessels in two patients, upper extremity injury in two patients, brain edema in one patient (Table 4).

Table 2 General considerations

Characteristics	Number of patients
Male/female	13/4
Age (years)	
Range	11 : 48
Mean±SD	28.2±10.1
Cause of injury	
Road traffic accident	13
Fall from height	3
Handlebar injury	1

Table 3 Anatomical site and grade of injury

Characteristics	Number of patients
Grade	
I	7
II	8
III	2
Site	
Body	6
Tail	11

Table 4 Associated injuries

Associated injured organs	*N*
Spleen	6
Liver	1
Small intestine	2
Colon	1
Mesenteric vessels	2
Kidney	1
Extremities	2
Central nervous system	1

Management of hemodynamically stable patients diagnosed with computed tomography

Those patients who underwent conservative measures, the hospital stay ranged between 8 and 35 days with mean of 20.6±11.92. Grade I patients (three) passed uneventful admission course, grade II patients (four) with peripancreatic fluid underwent ultrasound-guided aspiration, one resolved completely and three of them needed insertion of pigtail catheter, two of the three developed pseudocyst formation and one developed pancreatic fistula which entailed endoscopic sphincterotomy and pancreatic duct stenting.

Grade III patient with pancreatic transection underwent distal pancreatectomy and superficial pancreatic necrosectomy, and splenectomy. Synthetic hemostatic sealant sheets (collagen hemostatic patches) were placed on the entire pancreatic surface and at the distal end. Copious peritoneal washing with saline was done. A large irrigation tube was placed over the pancreas and two drainage tubes in the bed and in the pelvis. Abdomen was closed *en mass*. The patient was shifted to the ICU where continuous irrigation and drainage was done for 1 week. Follow-up in ICU showed no pancreatic-related complications.

Management of hemodynamically unstable patients diagnosed on laparotomy

After proper resuscitation according to the guidelines the patients underwent laparotomy. Splenectomy was done in four patients; alone in two patients grade I, and with distal pancreatectomy in one patient grade II where hemostatic sealant sheets was applied to the cut end of pancreas, and in one patient grade III together with superficial pancreatic necrosectomy and application of hemostatic sealant sheets to the surface of pancreas.

Small intestinal injuries were repaired in two cases, one of grade II and one of grade I, both of which were successful.

Transverse colon repair was done without diversion in one patient of grade I, who had an uneventful course.

Ligation of bleeding omental vessels were done in two patients of grade II; one of them developed a pseudocyst.

As a rule, in our study we inserted tube drains into the pelvis and peritoneal cavity irrigation tube was inserted over the pancreas, maintaining continuous saline lavage (Berger's lavage) in all patients for 1 week.

The hospital stay ranged between 9 and 42 days with mean of 23±12.13.

Morbidity and mortality

During the admission period, and follow up in the next 6 months, no mortalities occurred in the

Table 5 Management scheme and complication rate in all patients

Grade	Total number	Operative management				Nonoperative management				
		Drainage	Pancreatectomy	Complications		No intervention	Ultrasound-guided	Endoscopic	Complications	
				Fistula	Pseudocyst				Fistula	Pseudocyst
I	7	4	0	0	0	3	0	0	0	0
II	8	3	1	0	1	0	4	1	1	2
III	2	0	2	0	0	0	0	0	0	0

17 patients, but complications do exist; in the patients managed conservatively seven patients were detected: two cases of pancreatic pseudocyst managed by operative cystogastrostomy and one case of pancreatic fistula that needed stenting of pancreatic duct.

In the operated group (10 patients), one patient developed a pancreatic pseudocyst as shown in Table 5.

Discussion

The demographic distribution of the study patients agrees with most of the other studies [2,16], the cause of injury in our study is mostly due to road traffic accident, followed by falling from height and one case caused by bicycle handlebar injury; the differences between other studies may be due to case selection of this study as the early stages only were selected for this study.

Among the 17 patients we got grade distribution I, II, III as 8, 7, 2, respectively. The percentage of degrees of injury agrees with some studies [16,17]; if there is difference, it may be due to the study design for early grades. Tail is more injured in our study because the head injuries are more associated with major duct injury grade IV, which is excluded from the study.

Regarding patient management, the nonoperative management group showed average hospital stay and rate of complications as compared with other studies. Endoscopic sphincterotomy and stenting of pancreatic duct were used to manage pancreatic fistula and cystogastrostomy was done for the patients with pancreatic pseudocysts.

The operative management group (10 patients; four grade I, four grade II, and two grade III) showed average hospital stay time and a good rate of complications. In comparison to other studies especially in grade III patients [15], this is due to the use of continuous saline lavage as it helps in the dilution of the exudated pancreatic enzymes and facilitates drainage. The use of synthetic hemostatic sealant sheets in grade III patients helps decrease the exudation of pancreatic fluid in the peritoneal cavity.

Conclusion

Nonoperative management should be applied to noncomplicated grade I and II pancreatic injuries; operative management should be applied for the higher grades and for complicated grade I and II injuries, the use of continuous saline lavage and drainage of peritoneal cavity help decrease the rate of complications.

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Conflicts of interest

There are no conflicts of interest.

References

1 Siboni S, Kwon E, Benjamin E, *et al.* Isolated blunt pancreatic trauma: a benign injury? J Trauma Acute Care Surg 2016; 81: 855–859.

2 Singh RP, Mahajan A, Selhi JS, Garg N, Chahal H, Bajwa M. Management and outcome of patients with pancreatic trauma. Niger J Surg 2017; 23:11–14.

3 Kao LS, Bulger EM, Parks DL, Byrd GF, Jurkovich GJ. Predictors of morbidity after traumatic pancreatic injury. J Trauma 2003; 55: 898–905.

4 Pata G, Casella C, di Betta E, *et al.* Extension of nonoperative management of blunt pancreatic trauma to include grade III injuries: a safety analysis. World J Surg 2009; 33:1611–1617.

5 Tyburski JG, Dente CJ, Wilson RF, *et al.* Infectious complications following duodenal and/or pancreatic trauma. Am Surg 2001; 67:227–230.

6 Wilson RH, Moorehead RJ. Current management of trauma to the pancreas. Br J Surg 1991; 78:1196–1202.

7 Kumar A, Panda A, Gamanagatti S. Blunt pancreatic trauma: a persistent diagnostic conundrum? World J Radiol 2016; 8: 159–173.

8 Cirillo RL, Koniaris LG. Detecting: blunt pancreatic injuries. J Gastrointest Surg 2002; 6:587–598.

9 Daly KP, Ho CP, Persson DL, Gay SB. Traumatic retroperitonea injuries: review of multidetector CT findings. Radiographics 2008; 28:1571–1590.

10 Arkovitz MS, Johnson N, Garcia VF. Pancreatic trauma in children: mechanisms of injury. J Trauma 1997; 42:49–53.

11 Beres AL, Wales PW, Christison-Lagay ER, *et al.* Non-operative management of high-grade pancreatic trauma: is it worth the wait? J Pediatr Surg 2013; 48:1060–1064.

12 Wales PW, Shuckett B, Kim PC. Long-term outcome after nonoperative management of complete traumatic pancreatic transection in children. J Pediatr Surg 2001; 36:823.

13 Landau A, van AS AB, Numanoglu A, *et al.* Liver injuries in children: the role of selective non-operative management. Injury 2006; 37: 66–71.

14 Krige JE, Beningfield SJ, Nicol AJ, *et al.* The management of complex pancreatic injuries. S Afr J Surg 2005; 43:92–102.

15 Krige JE, Kotze UK, Nicol AJ, *et al.* Isolated pancreatic injuries: an analysis of 49 consecutive patients treated at a Level 1 Trauma Centre. J Visc Surg 2015; 152:349–355.

16 Koganti SB, Kongara R, Boddepalli S, *et al.* Predictors of successful non-operative management of grade III & IV blunt pancreatic trauma. Ann Med Surg (Lond) 2016; 10:103–109.

17 Krige JE, Kotze UK, Nicol AJ, *et al.* Morbidity and mortality after distal pancreatectomy for trauma: a critical appraisal of 107 consecutive patients undergoing resection at a Level 1 Trauma Centre. Injury 2014; 45:1401–1408.