

Original Research Article

Management of pancreatic trauma: a single center experience

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Received: 21 July 2022

Revised: 16 August 2022

Accepted: 22 August 2022

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ABSTRACT

Background: Traumatic injury to the pancreas is rare and frequently overlooked. High index of suspicion is required in diagnosing pancreatic injury and management is challenging even with experienced trauma surgeons. The aim of this study was to report our experience in the management of pancreatic injuries.

Methods: We analyzed 39 patients with pancreatic injury managed in our center from January 2016- December 2021. Data regarding patients' demographics, mode of injury, American association for the surgery of trauma-organ injury scale (AAST-OIS) grade of pancreatic injury, associated injuries, management, morbidity and mortality were collected for analysis.

Results: The study included 39 patients who presented with blunt injury abdomen (AAST-OIS grading: grade 2 (n=6), grade 3 (n=29), grade 4 (n=4)) with mean age 28.9 years. Associated injuries were present in 41% of patients (n=16). Thirteen patients had non-operative management-5 of them were managed conservatively without any intervention; 8 of them had non-surgical intervention in the form of Percutaneous Drainage or Endoscopic Retrograde Cholangio Pancreatography with Pancreatic duct stent for peri-pancreatic collection or ductal injury. But the rate of readmission for recurrent pancreatitis and reintervention for peri-pancreatic collection was 46% and 38% respectively in these patients. Twenty-six patients underwent surgery-distal pancreateo splenectomy, laparotomy and external drainage, Roux-en Y pancreaticojejunostomy.

Conclusions: Management of high-grade pancreatic injuries needs technical expertise. Early diagnosis and appropriate surgical management in high-grade pancreatic injuries carries favorable outcomes. Delayed presentation with sepsis is associated with high mortality.

Keywords: Pancreatic injury, Distal pancreateosplenectomy, Pancreaticojejunostomy, Non-operative management

INTRODUCTION

Pancreatic injuries are uncommon and usually caused by the transmission of blunt forces to the organ or penetrating trauma. In developing countries most often it is caused by blunt injury abdomen following road traffic accidents. According to previous studies, incidence of pancreatic injury is 0.2% in blunt trauma and 1 to 12% in penetrating trauma.¹ The low prevalence of pancreatic

injury is mainly due to retroperitoneal location and its subtle clinical presentation, frequently results in delayed diagnosis and treatment.¹ Isolated injuries are common in blunt trauma, with incidence ranging from 15% to 55%, but they are rare in penetrating trauma.² Owing to retroperitoneal location of the pancreas, associated injuries are more common in penetrating trauma than blunt trauma.² Despite rarity, pancreatic injuries are associated with high rates of morbidity of 50% to 64% and mortality of 12% to 33%.^{3,4}

In this study we aimed at reporting our experience in the management of pancreatic injuries. We believe that with improved standard of care in the management of pancreatic injuries, the complication rate can be reduced with improved morbidity and mortality scores.

METHODS

Our study was a prospective observational study of patients with traumatic pancreatic injury managed in the institute of surgical gastroenterology, Madras medical college and Rajiv Gandhi government general hospital, Chennai during the period of January 2016-December 2021. The study was approved by the institutional ethics committee.

Inclusion criteria

All patients diagnosed with pancreatic trauma on contrast enhanced computed tomography (CECT) abdomen were included in the study irrespective of age, sex, mode of injury, associated organ injury or previous treatment history or co-morbidities.

Exclusion criteria

All patients with lack of consent were excluded from the study.

Data regarding patients’ demographics, mode of injury, CECT imaging study of the abdomen, AAST-OIS grade of pancreatic injury (Table 1), presence of other associated injuries, treatment given, morbidity and mortality were taken into account.

Table 1: AAST-OIS grade of pancreatic injury.

| Grade | Type of injury | Description of injury |
|-------|----------------|---|
| 1 | Hematoma | Minor contusion without duct injury or tissue loss |
| | Laceration | Superficial laceration without duct injury or tissue loss |
| 2 | Hematoma | Major contusion without duct injury or tissue loss |
| | Laceration | Major laceration without duct injury or tissue loss |
| 3 | Laceration | Distal transection or parenchymal injury with ductal injury |
| 4 | Laceration | Proximal [#] transection or parenchymal injury involving ampulla |
| 5 | Laceration | Massive disruption of pancreatic head |

[#]Proximal pancreatic injuries are injuries to the patient’s right of the superior mesenteric vein

Management

Management of pancreatic injury was based on the following factors: hemodynamic stability of the patient, associated organ injuries, presence of ductal injury and feasibility of interventional procedures. Outcome measures were based on success of proposed treatment in terms of recovery, mortality and morbidity including pseudocyst formation, peri-pancreatic fluid collection, wound infection, pancreatic leak and duration of hospital stay. The minimum postoperative follow up period was six months.

Statistical analysis

We mainly used simple descriptive statistics. Quantitative variables were expressed as mean ± standard deviation and qualitative variables were expressed as a percentage. Considering the difference in distal injuries requiring surgical management in the study by Sharpe et al where p1=0.26 and p2=0.56, keeping confidence limit at 95% and power at 80% and expected difference at 30%, the minimum sample size was calculated as 39.⁵ Hence consecutive enrolment till 39 subjects were done over five-year period.

RESULTS

Demographic details

A total of 39 patients were included in the study. Of them, 33 (85 %) patients were males and 6 (15%) patients were females. The age group of patients varied between ten years to seventy-five years with the mean age of 28.9 years (SD±13.4). All of them had blunt trauma to the abdomen mostly following road traffic accident shown in the Table 2. Sixteen patients were directly admitted in our institution, rest twenty-three were referral from elsewhere. Among the thirty-nine patients, twenty-nine patients had grade three injuries, six patients had grade two injuries and 4 patients had grade four injuries. The most common site of injury was the body of the pancreas (59%).

Of the 39 patients 28 patients (71.8%) had elevated serum amylase and serum lipase during the index admission. On correlation with CECT all of them were found to have an elevated serum amylase (Figure 1). CECT abdomen was taken in all patients and additionally magnetic resonance Cholangio pancreatography (MRCP) in 11 patients with suspected main pancreatic duct injury. Sixteen patients had associated organ injuries and underwent immediate laparotomy of whom two patients had nephrectomy for grade five renal injury, two patients had segmental resection of jejunum and transverse colon and one patient had perihepatic packing for grade five liver injury (Table 3).

Table 2: Demographic details.

| Characteristic feature | No. of patients (%) |
|--|---------------------|
| Age (Years) | |
| ≤20 | 12 (30.8) |
| 20-50 | 24 (61.5) |
| ≥ 50 | 3 (7.7) |
| Sex | |
| Male | 33 (85) |
| Female | 6 (15) |
| Cause of injury | |
| Road traffic accident | 26 (66.7) |
| Assault | 3 (7.7) |
| Accidental fall of the heavy object | 10 (25.6) |
| Type of injury | |
| Polytrauma | 8 (20.5) |
| Associated intraabdominal organ injuries | 16 (41.0) |
| Isolated pancreatic injury | 19 (48.7) |
| AAST-OIS grade of pancreatic injury | |
| Grade 1 | 0 |
| Grade 2 | 6 (15.4) |
| Grade 3 | 29 (74.4) |
| Grade 4 | 4 (10.2) |
| Grade 5 | 0 |
| Site of injury | |
| Head of pancreas | 5 (12.8) |
| Body of pancreas | 23 (59.0) |
| Tail of pancreas | 11 (28.2) |



Figure 1: CECT abdomen showing complete transection of the body of the pancreas.

Table 3: Associated injuries.

| Associated injuries | No. of patients (%) | Management |
|---------------------|---------------------|----------------------------------|
| Liver | 10 (25.6) | Peri- hepatic packing, (n=1) |
| Spleen | 6 (15.4) | DPS, (n=6) |
| Bowel | 2 (5.1) | Resection and anastomosis, (n=2) |
| Renal | 2 (5.1) | Nephrectomy, (n=2) |
| Bone | 5 (12.8) | |
| Hemothorax | 3 (7.7) | |

Management of pancreatic injuries-non-operative management:

Thirteen patients (grade 2 injury n=3, grade 3 injury n=9 and grade 4 injury n=1) were managed non-operatively (Table 4). All these patients were hemodynamically stable and treated with intravenous fluids, analgesics and intravenous antibiotics.

Eight of them had non-surgical intervention. Seven patients underwent PCD for peri-pancreatic collection. One of these patients (Grade 3 injury) underwent Endoscopic Retrograde cholangiopancreatography (ERCP) with Pancreatic Duct (PD) stent due to high output in PCD on follow up. Five out of seven patients had repeated percutaneous catheter drainage (PCD) for recurrent collections and readmissions for recurrent attack of pancreatitis but were managed without surgical intervention. One another patient (Grade 3 injury) who was referred with pseudocyst following conservative management opted for non-surgical intervention and hence underwent ERCP with PD stenting for contrast leak at body of pancreas (Figure 2). On six months follow up all patients recovered well with complete resolution of peripancreatic collection and no complications.



Figure 2: ERCP showing pancreatic duct stenting in a case of grade III pancreatic injury.

Management of pancreatic injuries- operative management

Twenty-six patients (grade 2 injury n=3, grade 3 injury n=20 and grade 4 injury n=3) were managed by surgery. Distal pancreaticosplenectomy was done in 15 patients with grade 3 pancreatic injury (Figure 3). Spleen preserving pancreatic tail resection was done in one patient with grade 3 injury.

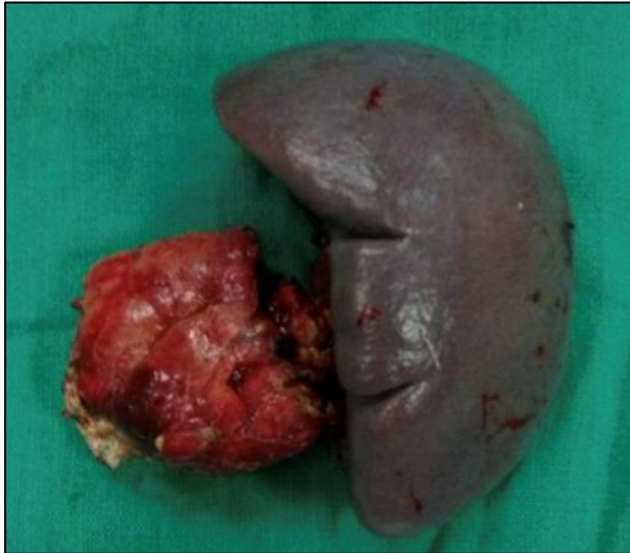


Figure 3: Distal pancreaticosplenectomy specimen in a case of grade III pancreatic injury at the junction of body and tail of pancreas.

Six patients (grade 2 injury n=2, grade 3 injury n=2 and grade 4 injury n=2) underwent laparotomy and lavage with external drainage. All of them had hemodynamic instability except one patient with grade 3 injury who had undergone laparotomy elsewhere and referred to us a month later with ill-defined peri-pancreatic collection and underwent PCD. Unfortunately, the patient had iatrogenic injury to the stomach and underwent emergency laparotomy with gastric repair and was found to have pancreatic fistula at the tail for which stapling and resection of fistulous track was done. One patient with grade 2 injury who was referred after a month of conservative management had pseudocyst at body of pancreas and underwent cystogastrostomy.

Three patients (grade 3 injury n=2 and grade 4 injury n=1) underwent Roux en Y distal pancreaticojejunostomy of the distal stump and proximal stump was managed with serosal patch closure in one patient and suture closure in 2 patients (Figure 4).

One of them developed persistent fistula and underwent fistulo jejunostomy. The disruption site in two patients with grade 3 injury was at neck or to the right of superior mesenteric vessels hence Roux en Y PJ was done.

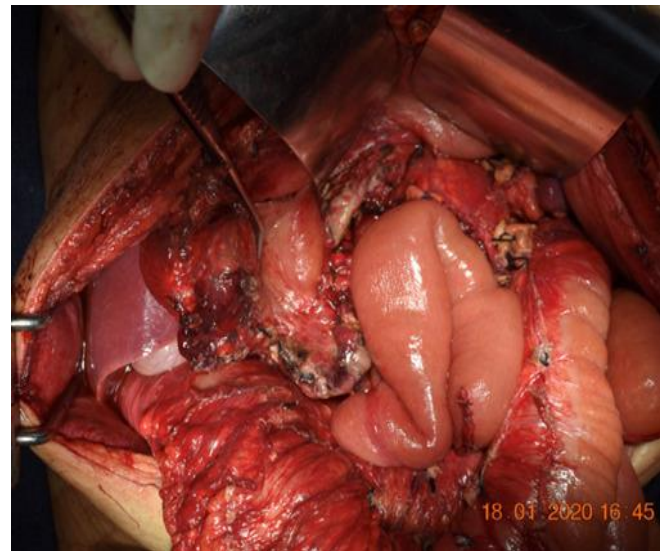


Figure 4: Roux en Y pancreaticojejunostomy with proximal stump closure in a case of grade III pancreatic injury at the neck of pancreas with minimal peripancreatic inflammation.

Morbidity, mortality and long-term survival

The mean duration of hospital stay was 20.8 days and 14.1 days in patients of non-operative and operative management respectively. The mean duration of initial in-patient care before being referred to our center was 24 days for the non-operative patients (n=6) and 5 days for the operative patients (n=17). Seven patients developed surgical site infection (6 patients with grade 2 and 1 patient with grade 3a as per Clavien Dindo classification) and were managed conservatively.

Table 4: Management of pancreatic injuries.

| Grade of injury | N=39 | Non-operative management (NOM), (n=13) | | | | Operative management, (n=26) | | | | |
|-----------------|------|--|-----------|----------------------------|-----------------------|------------------------------|------------|--|---------------------|-------------------------|
| | | No. inter-vention, (n=5) | PCD (n=6) | ERCP + PD stent +PCD (n=1) | ERCP + PD stent (n=1) | PL [#] + ED* (n=6) | DPS (n=15) | Spleen preserving DP ^{\$} (n=1) | Roux -en Y PJ (n=3) | Cysto-gastrostomy (n=1) |
| 2 | 6 | 1 | 2 | - | - | 2 | - | - | - | 1 |
| 3 | 29 | 3 | 4 | 1 | 1 | 2 | 15 | 1 | 2 | - |
| 4 | 4 | 1 | - | - | - | 2 | - | - | 1 | - |

#PL-Peritoneal lavage*, ED-External drainage, \$DP-Distal pancreatectomy, ERCP-Endoscopic retrograde cholangio-pancreatography, DPS- Distal pancreatico-splenectomy, Roux-en Y Pancreatico jejunostomy (PJ).

Table 5: Morbidity data.

| Management category | Morbidity | Grade 2 | Grade 3 | Grade 4 | Management | |
|---|--|---------|---------|---------|--------------------------------------|---------------|
| Non-operative management, (n=13) | Pseudocyst and acute fluid collection (n=9, 69.2%) | 3 | 6 | - | PCD/ ERCP PD stent/ cystogastrostomy | |
| Operative management, (n=26) | Pancreatic leak (n=16, 61.5%) | Grade A | - | 7 | - | Conservative |
| | | Grade B | 1 | 5 | 2 | PCD |
| | | Grade C | - | - | 1 | Re-Laparotomy |

In non-operative management, 69.2% patients had either pseudocyst or acute fluid collection (grade 2 injury n=3 and grade 3 injury n=6) and had to be managed by non-surgical intervention. Only one patient of grade 2 injury with pseudocyst was managed without any intervention owing to small size. The rate of readmission for recurrent pancreatitis and reintervention for peri-pancreatic collection was 46% and 38% respectively in non-operatively managed patients (Table 5).

Among the 26 patients treated surgically, 7 patients had grade A pancreatic leak and were managed conservatively; 8 patients had grade B pancreatic leak for which PCD was inserted; one patient had grade C pancreatic leak and underwent laparotomy with necrosectomy.

Overall mortality rate was 5.1% (grade 3 injury n=2, one patient who was managed conservatively for 45 days elsewhere and referred to our center with severe sepsis; another patient with multiple associated injuries who underwent DPS and eventually developed multi organ dysfunction syndrome (MODS) and sepsis).

DISCUSSION

Pancreatic injury is more common in males (68-90% male) and in the young (mean age 27-35 years).⁶ The demography of patients in our study is concordant with the existing literature. Since most of the patients are economically active, the management of pancreatic trauma must be done by experts for better outcomes.

Pancreatic trauma is caused by acceleration deceleration injury and direct compression force in the upper abdomen.⁶ The pancreas is compressed against the lumbar vertebral column when a crushing force to the epigastrium is applied, resulting in crush injury or transection in the pancreatic neck region.^{6,7}

About 42% of pancreatic injuries in adults are caused by motor vehicle accidents, whereas the most prevalent mechanism in children is a direct blow to the epigastrium from bicycle handlebars.^{8,9} The liver, major vascular structures, colon or small bowel, duodenum, stomach, spleen, and kidney are the most commonly associated intra-abdominal injuries.^{2,8} We also encountered similar injuries and the most common organ involved was liver alike a study by Petrone et al whereas spleen was the most commonly associated intra-abdominal injury in a

study by Gupta et al.^{2,8} We have reported a greater number of isolated pancreatic injuries in our study which is rare according to previous literature.¹⁰

The determination of serum amylase levels within 3 hours of trauma is not diagnostic, regardless of the type of trauma.¹¹ Serum amylase will be elevated in around 65-75% of pancreatic injuries whereas after a three-hour delay following injury, this increases to 84%.¹² Furthermore, elevated serum amylase or lipase levels occur in patients without pancreatic injury.¹³ All patients in our study also had raised serum amylase level on correlation with CECT abdomen and it helped in identifying pancreatic injuries.

CECT abdomen remains the gold standard diagnostic modality for pancreatic injury. In about 20-40% of patients with pancreatic injury, the initial CECT can be normal, although a sensitivity of 87% and specificity of 98% with the new generation helical CECT has been reported.^{12,14} CECT abdomen in the early stage of pancreatic trauma can underestimate or miss the depth of pancreatic laceration owing to either fluid collection from edema or Main pancreatic duct (MPD) injury or hematoma from vascular or splenic injury.^{15,16} Hence, serial CT scans may be required in patients with low grade pancreatic injury on conservative management. In our study initial CECT helped to diagnose pancreatic injury in 79% of patients.

ERCP has been the most precise diagnostic modality for detecting the site and extent of pancreatic ductal injury in the hemodynamically stable patient, by demonstrating extravasations of contrast medium from the pancreatic duct system especially in patients with delayed presentation.¹⁷ As therapeutic modality ERCP allows stent placement as primary and early treatment in the presence of ductal injury. According to Thomson et al, with the potential of direct image guided therapy ERCP is valuable for stent placement in late presentations of pseudocyst and pancreatic fistula.¹⁸ In our study two patients with grade 3 injury and delayed presentation were managed with ERCP and PD stenting with good recovery.

MRI detects injuries missed by CT and also allows better delineation of the site and extent of pancreatic laceration.¹⁹ Also, operative management of patients depends on main pancreatic duct status, demonstrated by ERCP or MRCP.^{19,20} In our study, MRCP was done in 11

patients with suspected (partial) ductal injury on CT. The limited availability of MRI, increased cost, and longer scanning time do not make MRI, the workhorse of initial assessment in pancreatic trauma. However, it enables complete evaluation of pancreatic duct and soft tissues especially in setting of necrosis/ vascular compromise.¹⁴

The key determinant in management of pancreatic trauma is ductal integrity. Most of the distal pancreatic injuries with MPD disruption (Grade III) are managed primarily by distal pancreatectomy and drainage.⁷ The transected margin of the pancreas can be controlled with a stapling device or permanent sutures with no difference in outcome with regard to post-operative pancreatic fistula.²¹ Spleen preservation should be attempted in otherwise stable patients with uninjured spleen.^{21,22} In our series we did spleen preserving resection in 1 patient. We did distalpancreatico-splenectomy in rest of the patients, because at the time of trauma this procedure is performed with rapidity considering the general condition of the patient. A Roux-en-Y pancreatojejunostomy of the distal stump of pancreas is an alternative to distal pancreatectomy in the hemodynamically stable patient with transection of the pancreas at the neck or to the right of superior mesenteric vessels and few / no associated injuries.²¹ In our series, we had done Roux-en-Y pancreatojejunostomy of the distal stump of pancreas in three of our patients.

Patients with low grade (AAST grade 1 and 2) injuries and patients with grade 3 and grade 4 injury with partial MPD disruption without delayed presentation/

hemodynamic instability/ multi-visceral injury can be managed non-operatively including PCD/ ERCP with PD stent with favorable outcomes provided serial clinical and radiological monitoring is done.⁶

Patients who present with pancreatic pseudocyst following trauma should be considered to have a missed ductal injury until proven otherwise.²³ Patients were referred to our center either due to missed ductal injury or complications following conservative management. In our study, 11 patients were referred from other centers with a minimum time lapse period of 2 weeks. The treatment duration is long in such patients (Table 6). Also, during the period of non-operative management in these patients, recurrent attacks of pancreatitis and symptoms secondary to pseudocysts over all affected their quality of life. Hence, in patients with delayed referral / presentation with peri pancreatic collection, pseudocyst or sepsis morbidity is high in terms of prolonged hospital stay, need for repeated interventions, complications and failed measures. This is in concordance with previous studies which also report increase in morbidity from 45% to 60% due to delay in diagnosis and management of pancreatic injuries.²⁴ Conditional recommendation for grade 3/4 injuries as per management guidelines from the Eastern Association for the Surgery of Trauma was also in favor of operative management.²⁵ We had one mortality in a patient with grade 3 injury managed conservatively elsewhere and presented with intra-abdominal sepsis. As such we recommend early surgical management in grade 3 injuries.

Table 6: Patients with delayed referral with time lapse of at least 2 weeks.

| Grade of injury | N | Clinical presentation | Management | | Mean duration of hospital stay |
|-----------------|---|--|-------------------------------|---|--------------------------------|
| | | | Intervention | N | |
| 2 | 3 | Pseudocyst, peri-pancreatic collection | No intervention | 2 | 31.6 days |
| | | | Cystogastrostomy | 1 | |
| 3 | 8 | Pseudocyst, peri-pancreatic collection | PCD | 2 | |
| | | | ERCP+PD stent | 2 | |
| | | Hemodynamic instability, sepsis | Resuscitation followed by DPS | 4 | |

Limitation

Limitation of our study is that we did not encounter any grade V pancreatic injuries. In such scenarios damage control surgery holds the key to the management. As long-term outcomes of a large sample of patients who had undergone resection for pancreatic injury are not available, the results can only be extrapolated from studies on patients who had undergone resection for pancreatitis or other benign conditions of the pancreas.²⁶

CONCLUSION

Patients with low grade blunt pancreatic trauma without hemodynamic instability can be managed non operatively in centers of expertise provided frequent clinical as well

radiological monitoring is possible. Early identification of pancreatic ductal injury along with early surgery carries favorable outcome even in the setting of multi visceral injuries. When operative intervention is required, efforts should be made to preserve the pancreatic substance. Delayed presentation with sepsis is associated with high mortality.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kaman L, Iqbal J, Pall M, Bhukal I, Behera A, Singh G, Singh R. Current management of pancreatic

- trauma. *Tropical Gastroenterology.* 2012;33(3):200-6.
2. Petrone P, Álvarez SM, Pérez MG, Esparragón JC, Marini CP. Management of pancreatic trauma: a literature review. *Cirugía Española (English Edition).* 2017;95(3):123-30.
 3. Krige JE, Kotze UK, Setshedi M, Nicol AJ, Navsaria PH. Prognostic factors, morbidity and mortality in pancreatic trauma: a critical appraisal of 432 consecutive patients treated at a Level 1 Trauma Centre. *Injury.* 2015;46(5):830-6.
 4. Kao LS, Bulger EM, Parks DL, Byrd GF, Jurkovich GJ. Predictors of morbidity after traumatic pancreatic injury. *J Trauma Acute Care Surg.* 2003;55(5):898-905.
 5. Agarwal H, Gupta A, Kumar S. An overview of Pancreatic Trauma. *J Pancreatol.* 2020;3:139-46.
 6. Sharpe JP, Magnotti LJ, Weinberg JA, Zarzaur BL, Stickley SM, Scott SE et al. Impact of a defined management algorithm on outcome after traumatic pancreatic injury. *J Trauma Acute Care Surg.* 2012 Jan;72(1):100-5.
 7. Potoka DA, Gaines BA, Leppäniemi A, Peitzman AB. Management of blunt pancreatic trauma: what's new? *Eur J Trauma Emergency Surg.* 2015;41(3):239-50.
 8. Gupta A, Kumar S, Yadav SK, Mishra B, Singhal M, Kumar A et al. Magnitude, Severity, and Outcome of Traumatic Pancreatic Injury at a Level I Trauma Center in India. *Indian J Surg.* 2017;79(6):515-20.
 9. Ahmad S, Singh V, Pandey VK, Kumar S, Alam T, Pratap P. Step up approach for the management of late presentation of pancreatic trauma patients. *Int Surg J.* 2020;7:1065-70.
 10. Menahem B, Lim C, Lahat E, Salloum C, Osseis M, Lacaze L et al. Conservative and surgical management of pancreatic trauma in adult patients. *Hepato Biliary Surg Nutr.* 2016;5(6):470-77.
 11. Takishima T, Sugimoto K, Hirata M, Asari Y, Ohwada T, Kakita A. Serum amylase level on admission in the diagnosis of blunt injury to the pancreas: its significance and limitations. *Ann Surg.* 1997;226(1):70-6.
 12. Fleming WR, Collier NA, Banting SW. Pancreatic trauma: Universities of Melbourne HPB group. *Aus N Zeal J Surg.* 1999;69(5):357-62.
 13. Odedra D, Mellnick VM, Patlas MN. Michael. Imaging of Blunt Pancreatic Trauma: A Systematic Review. *Can Assoc Radiol J.* 2020;71(3):344-51.
 14. Hubbard C, Kocher MR, Hardie AD. The use of MRI digital subtraction technique in the diagnosis of traumatic pancreatic injury. *Radiol Case Rep.* 2019;14(5):639-45.
 15. Ayoob AR, Lee JT, Herr K, LeBedis CA, Jain A, Soto JA et al. Pancreatic trauma: imaging review and management update. *Radiographics.* 2021;41:58-74.
 16. Joshua WS, Stephan WA, Jorge AS. Blunt Abdominal Trauma: Current Imaging Techniques and CT Findings in Patients with Solid Organ, Bowel, and Mesenteric Injury, *Seminars in Ultrasound, CT and MRI.* 2007;28(2):115-29.
 17. Debi U, Kaur R, Prasad KK, Sinha SK, Sinha A, Singh K. Pancreatic trauma: A concise review. *World J Gastroenterol.* 2013;19(47):9003-11.
 18. Thomason DA, Krige JEJ, Thomson SR, Bornman PC. The role of endoscopic retrograde pancreatography in pancreatic trauma: a critical appraisal of 48 patients treated at a tertiary institution. *J Trauma Acute Care Surg.* 2014;76:1362-6.
 19. Panda A, Kumar A, Gamanagatti S, Bhalla A Seith, Sharma R, Kumar S et al. Evaluation of diagnostic utility of multidetector computed tomography and magnetic resonance imaging in blunt pancreatic trauma: a prospective study. *Acta Radiol.* 2015;56(4):387-96.
 20. Fulcher AS, Turner MA, Yelon JA. Magnetic resonance cholangiopancreatography (MRCP) in the assessment of pancreatic duct trauma and its sequelae: preliminary findings. *J Trauma.* 2000;48(6):1001-7.
 21. Subramanian A, Dente CJ, Feliciano DV. The management of pancreatic trauma in the modern era. *Surg Clin N Am.* 2007;87(6):1515-32.
 22. Pachter HL, Hofstetter SR, Liang HG, Hoballah J. Traumatic injuries to the pancreas: the role of distal pancreatectomy with splenic preservation. *J Trauma Acute Care Surg.* 1989;29:1352-5.
 23. DiGiacomo L, Schreiber M.A. Penetrating Pancreatic Injury. *Curr Trauma Rep.* 2015;1:85-91.
 24. Singh RP, Mahajan A, Selhi JS, Garg N, Chahal H, Bajwa M. Management and Outcome of Patients with Pancreatic Trauma. *Nig J Surgery.* 2017;23(1):11-4.
 25. Ho VP, Patel NJ, Bokhari F, Madbak FG, Hambly JE, Yon JR et al. Management of adult pancreatic injuries: A practice management guideline from the Eastern Association for the Surgery of Trauma. *J Trauma Acute Care Surg.* 2017;82(1):185-99.
 26. Søreide K, Weiser TG, Parks RW. Clinical update on management of pancreatic trauma. *HPB (Oxford).* 2018;20(12):1099-08.

Cite this article as: Mathiyalagan A, Subbarayan S, Rosemary LJJ, Kalyanashanmugam S, Raju P, Chidambaranathan S et al. Management of pancreatic trauma: a single center experience. *Int Surg J* 2022;9:1596-602.