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Original Research Article

Pancreaticoduodenal injuries at a tertiary care centre-clinical profile, associated injuries, management modalities, and outcomes

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ABSTRACT

Background: Pancreaticoduodenal injuries are considerably associated with high morbidity and mortality due to delayed diagnosis and subsequent delay in treatment. This makes the treatment of these injuries challenging. We have studied the presentation, diagnosis, management and outcome of these complex injuries.
Methods: A prospective observational study was done at general surgery department, Government medical college Nagpur from October 2020 to September 2022. Mortality, morbidity, and various treatment modalities were evaluated.
Results: Thirty two patients presented to the Trauma care center with history and symptoms suggestive of isolated pancreatic, duodenal, and combined pancreaticoduodenal injuries. Most of the injuries were blunt trauma cases. The ratio of hemodynamically stable: unstable was 1:1. Majority injuries were to pancreas followed by duodenum and combined organ injuries. Most of cases were diagnosed by CT scan. In this study 56% of cases had a non-operative line of treatment while 44% underwent surgical intervention. Among the patients operated 5 died, within 7 days of admission due to post-operative complications-hemorrhage, sepsis, aspiration pneumonia, and anastomotic leak. Two patients died due to delayed complications due to the development of pancreatic fistula and enterocutaneous fistula. Mortality rate was 27.2% in this study.
Conclusions: Early presentation and prompt diagnosis is the key to the management of such injuries. Patients managed conservatively need close monitoring, repeated assessments, and long-term follow-up.

Keywords: AAST injury grades, Duodenal injuries, Non operative management, Pancreatic injuries

INTRODUCTION

Injuries to the pancreas and duodenum are uncommon due to their retroperitoneal location. The incidence of blunt trauma cases is less than 2%, and this injury is linked to significantly higher rates of morbidity and mortality in situations when the injury is misdiagnosed, improperly classified, or treated slowly. Pancreatic injuries have a nearly 40% overall death rate, duodenal injuries between 16 and 18%, and a 36% overall morbidity rate. Most of the patients have multiple associated injuries and are hemodynamically unstable, which is the cause of the high early mortality in these patients. Late deaths typically result from multisystem organ failure and resistant intra-abdominal infection.[1] Majority of pancreaticoduodenal injuries are due to penetrating trauma, 70-80% is due to gunshot wounds. In cases of blunt trauma to abdomen, a combination of pancreaticoduodenal injury frequently results from stomping, boxing/karate, driving wheel/handlebar, as

well as the flexion/distraction fracture of L1-L2 vertebrae (the "chance" fracture). At the intersection of the mobile and fixed portions of the duodenum, acceleration may cause a rip.

Early deaths are caused by coexisting injuries and fatal hemorrhage, while the majority of late deaths are due to infections and multi-organ failure. Pancreatitis, pseudocysts, fistulas, intraabdominal abscesses, pneumonia, and anastomotic breakdown are common sequelae of duodenal and pancreatic injuries and are connected to the emergence of MODS and septicemia.[2-4]

About 37% of late deaths are primarily attributable to the injury itself and usually occur within 1-3 weeks of the injury or later. The time between the injury, diagnosis and definitive treatment is an important factor in the development of complications and their resulting mortality. When a definitive diagnosis is delayed more than 24 hours, up to 40% of patients are at risk of death, as opposed to 11% of those patients operated within 24 hours.[5-6]

This study broadly categorized pancreaticoduodenal injuries into isolated pancreatic injury, isolated duodenal injury and combined pancreaticoduodenal injuries. This study primarily aimed to find out various management modalities, prognosis and outcomes after pancreatoduodenal injuries in trauma care center in central India. We present our institutional experience with the pancreatoduodenal injuries in abdominal trauma.

METHODS

This prospective study was conducted at Government medical college Nagpur at trauma care center between October 2020 to September 2022. A total 32 patients were included in the study. These were patients admitted to trauma care center and general surgery ward with history suggestive of abdominal trauma.

Inclusion criteria

Inclusion criteria included patients admitted to trauma care centre and general surgery ward with history suggestive of abdominal trauma who were diagnosed as pancreaticoduodenal injuries and all diagnosed patients with these injuries referred from outside hospitals.

Exclusion criteria

Exclusion criteria included patients not consenting to participate in the study.The study was carried out after approval from the Institutional Ethics Committee and permission from the Head of Department of General surgery.

We prospectively collected the following data, which included age, sex, duration between injury and time of presentation, mode of injury, hemodynamic status, diagnostic modality, type of injury, grade of injury,associated injuries, management, hospital stay, post operative complications and outcome.

All cases of abdominal trauma were diagnosed to have pancreatoduodenal injury either by CECT scan or MRCP in hemodynamically stable patients or intraoperatively in hemodynamically unstable patients.

Table 1: Classification of pancreaticoduodenal injury was done according to American association for surgery of trauma (AAST).

AAST pancreatic injury scale		
Grade	**Injury type**	**Description of injury**
I	Hematoma	Minor contusion without duct injury
	Laceration	Superficial laceration without duct injury
II	Hematoma	Major contusion without duct injury or tissue loss
	Laceration	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 or the bile duct
V	Laceration	Massive disruption of pancreatic head

Table 2: AAST organ injury scoring for pancreatic trauma.[7]

AAST duodenal injury scale		
Grade	**Type of injury**	**Description of injury**
I	Hematoma	Involving single portion of duodenum
	Laceration	Partial thickness, no perforation
II	Hematoma	Involving more than one portion
	Laceration	Disruption <50% of circumference
III	Laceration	Disruption 50-75% of circumference of D2 Disruption 50- 100 % of circumference of D1, D3, D4
IV	Laceration	Disruption> 75 % of circumference of D2 Involving ampulla or distal common bile duct
V	Laceration	Massive disruption of duodenopancreatic complex Devascularization of duodenum

Statistical analysis

Data has been collected and entered in microsoft excel sheet and analysed using statistical software. Descriptive analysis was carried out by comparing absolute numbers and percentages in tabulated forms using Mean and Standard deviation. Pearson's chi square test and Fisher exact test were used to test statistical significance. P value <0.05 was considered statistically significant.

RESULTS

Population characteristics

In this study 32 patients were included and median age was 27.71 years. The youngest patient was 2 years and oldest patient was 65 years. Majority of the patients were present in age group <15 years i.e. 11 (34%). Men are the most affected population (84%) and female are 16%. With respect to time of presentation to the hospital, 41% patients presented within 24 hrs of injury and 59% patients after 24 hrs (Figure 1).

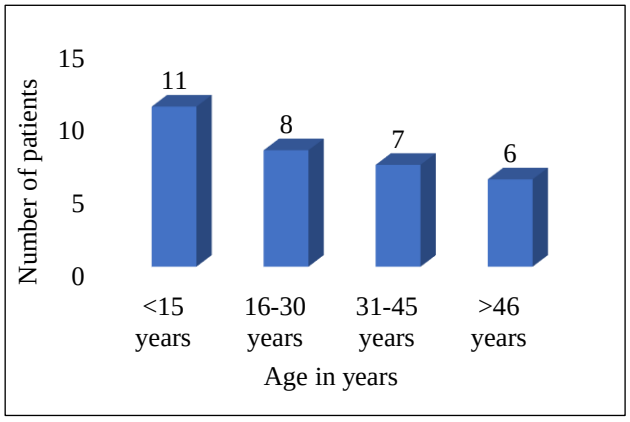

Figure 1: Distribution of patients according to age.

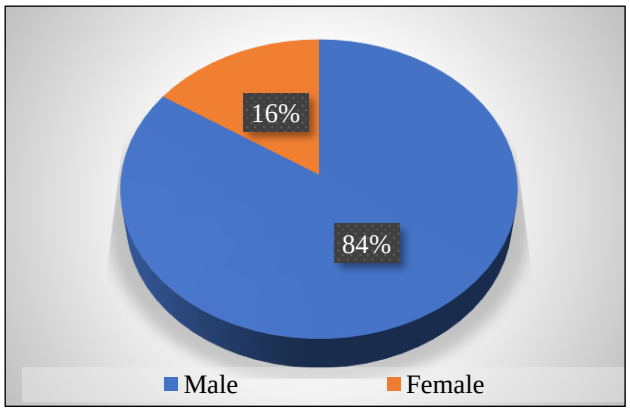

Figure 2: Gender-wise distribution of patients.

Mechanism of injury

More than half of patients (n=29) showed history of blunt trauma due to road traffic accidents, history of accidental falls and assaults. In 9.4% (n=3) patients had history of penetrating trauma. The majority of patients (n=19) were injured in a road traffic accident. Five pediatric patients had cycle handlebar injuries. Four patients were assaulted and sustained pancreaticoduodenal injuries**.**

Hemodynamic state on arrival

At the time of presentation 53% patients were hemodynamically stable while 47% patients were unstable. The diagnosis of pancreaticoduodenal injuries was made during exploratory laparotomy in 4 patients. Twenty-five patients were diagnosed preoperatively on CT scan. MRCP was done in 3 patients to confirm the diagnosis and grade of injury (Figure 3).

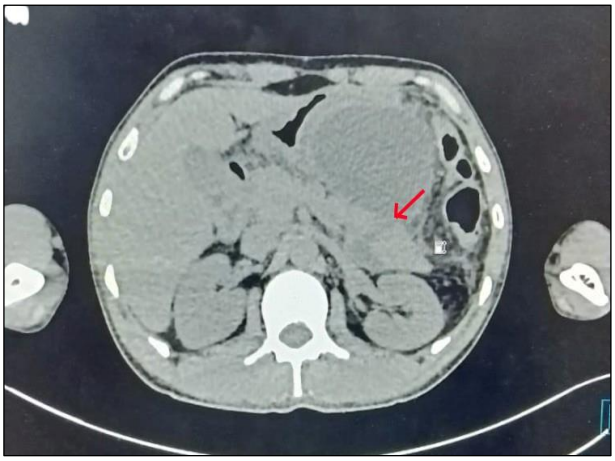

Figure 3: Pancreatic injury transection at tail of pancreas (red arrow).

Grading of injury according to AAST scale

Majority of patients 26 out of 32 were diagnosed as pancreatic injuries while 5 patients had duodenal injuries and 1 patient had combined pancreaticoduodenal injuries**.** According to AAST grading system for pancreatic trauma, 9 patients belonged to grade I injury, 6 patients in grade II, 5 patients in grade III, 3 patients each in both grade IV and grade V injury. In case of duodenal Injuries, 80% patients belonged to grade III injury and 20 % to grade II according to AAST grading system for duodenal injuries.

Characteristics of patients who underwent operative management

In duodenal trauma cases, 5 patients underwent primary repair of duodenal perforation with feeding jejunostomy (FJ). Distal pancreatectomy with splenectomy in 2 patients and without splenectomy in 1 patient was done. Pancreatic necrosectomy with FJ was done in two patients. One patient with combined pancreaticoduodenal injury, Whipple's procedure was done.

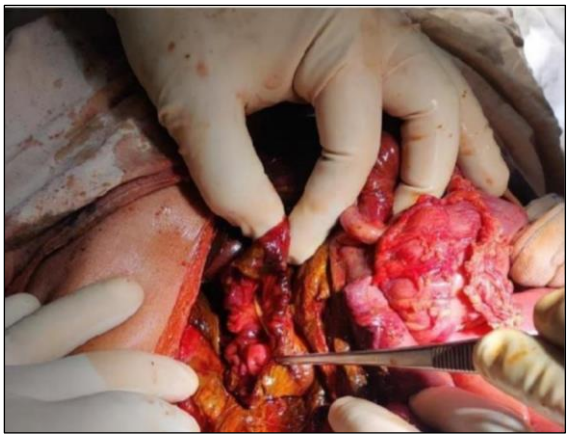

Figure 4: Perforation at 2nd part of duodenum.

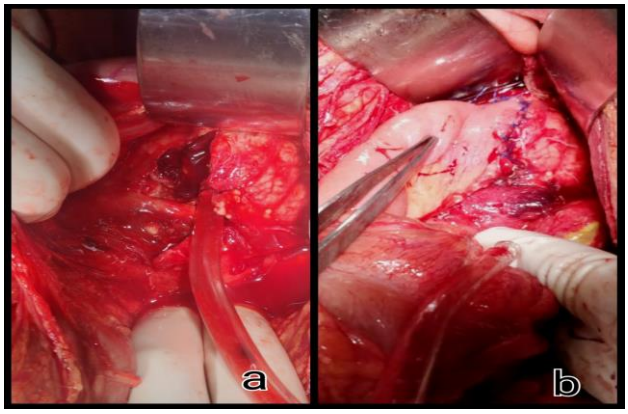

Figure 5: Pancreatic transection at head a) with distal pancreaticojejunostomy, b) done.

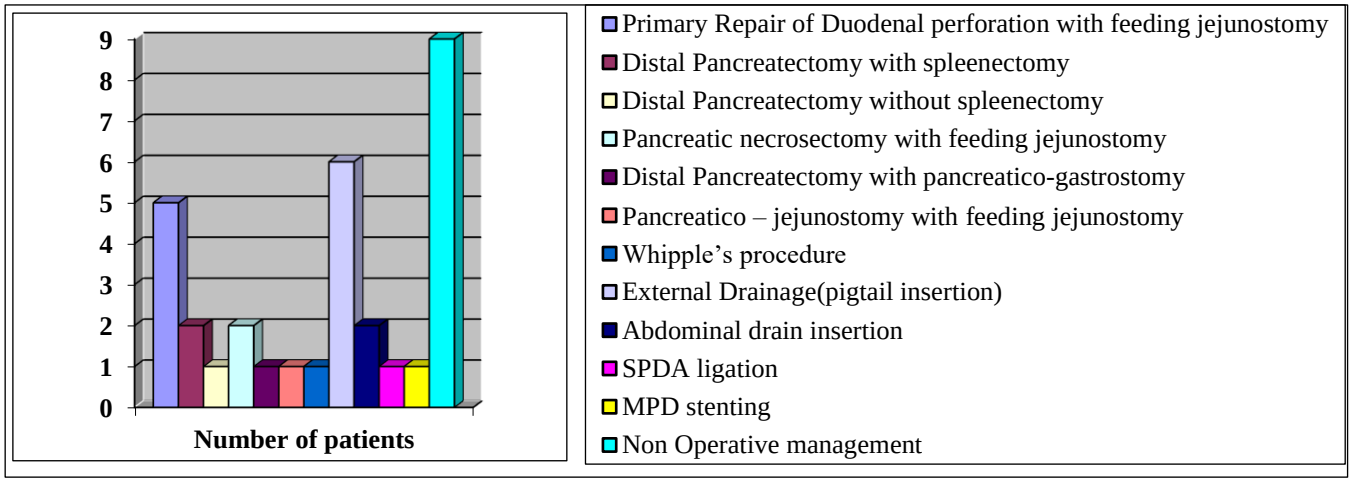

Figure 6: Distribution of patients according to management modalities.

Non operative management in pancreaticoduodenal injuries

Nine (28.1%) patients were treated with non operative management which included fluid resuscitation, pain management using opioid drugs like tramadol, monitoring of vitals and parenteral nutrition. In selected cases higher antibiotics and octreotide were given. External drainage (pigtail insertion) in peripancreatic collections was done in 6 (18.7%) patients. In 2 unstable patients bilateral abdominal drain insertion was done. One patient with delayed presentation and Grade 4 pancreatic injury with MPD stenting was done.

Postoperative morbidity and mortality

The mean hospital stay is 13 days with standard deviation of 8.6. Maximum number of patients (9) belongs to group 1-7 days. The development of complications was noted in postoperative period of patients during hospital stay, in which early complications were primary hemorrhage (n=1) and anastomotic leak (n=1). Five patients developed post-operative sepsis which was associated with aspiration pneumonia in 2 patients delayed complications included pancreatic fistula (n=2) and enterocutaneous fistula (n=3). In this study 23 patients were discharged and 9 patients died (Figure 7).

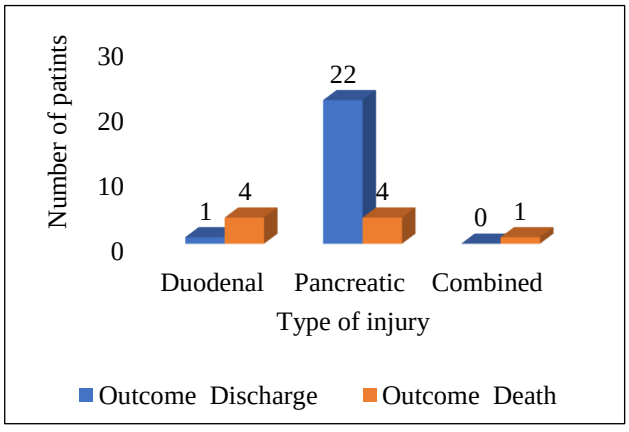

Figure 7: Association of type of injury with the outcome.

The graph above depicts the relationship between the type of injury and the outcome. In the case of pancreatic injuries, 22 patients were discharged with a death rate of

15.3% (n=4). In the case of duodenal injury one patient was discharged with an 80% (n=4) death rate. In cases of combined pancreaticoduodenal injuries, the death rate was 100%.

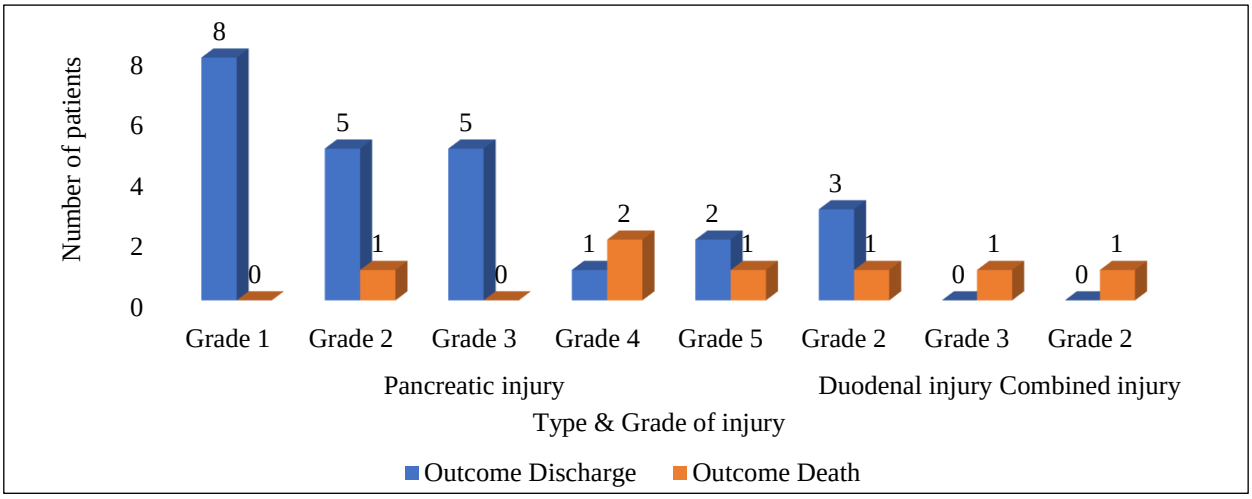

Figure 8: Association of the grade of injury with the outcome.

The above chart shows the association of various grades of injury with outcome. Grade 1, 2, 3 of pancreatic injuries have good outcomes with 1 death in grade 2 injury. In grade 4 and 5 injuries, the number of patients discharged and deaths reported are equal. In grade 2 duodenal injuries, 3 patients were discharged and 1 died. In grade 2 combined pancreaticoduodenal injury mortality was 100% (Figure 8).

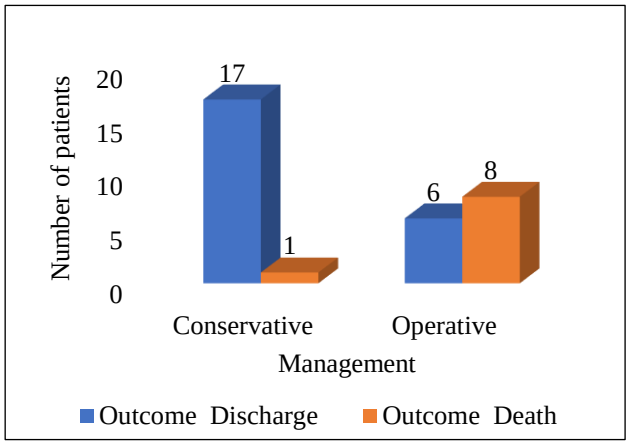

Figure 9: Association of management with outcome of patients.

The Figure 9 shows the association of management with outcome of patients which is significant with p value-0.001 in which 23 patients, non-operative management was preferred had 5.5% (n=1) mortality and 14 patients who were operated had 57.1% (n=8) mortality.

DISCUSSION

In various studies across the world, the reported incidence of pancreaticoduodenal injuries varies from 0.5 to 5.0% of all abdominal trauma.[8-9] In this study, the prevalence of pancreaticoduodenal injuries among all abdominal trauma patients hospitalized in our department was about 10%.

In the present study, 32 patients were included and median age was 27.71 years. The youngest patient was 2 years and oldest patient was 65 years. Maximum Study populations were males (84%). This was probably because males were belonging to the working class and thus were exposed to injuries. Many young males are involved in violent activities to settle down the score. Similar results were found in studies by Gupta et al and Krige et al.[10,1] Hemodynamically stable: unstable is in the ratio of 1:1. Majority of patients (59%) had delayed presentation after 24 hours of injury.

Majority of the patients were present in age group <15 years n= 11 (34%) with history of cycle handlebar injury (n=5) and accidental fall (n=6). A study by Kartz et al, which done on pediatric population, child abuse was the most common mechanism of injury (30.7%), followed by bicycle accidents (23%), motor vehicle accident (15.3%), fall (15.3%), auto vs. pedestrian (7.7%), and sports related injury (7.7%).[11]

The diagnosis of pancreaticoduodenal injuries was made during exploratory laparotomy in 4 (12.5%) patients. In these patients, focused assessment with sonography in trauma (FAST) scan was positive which indicated hemoperitoneum. Due to hemodynamically unstable status of these patients, exploratory laparotomies were done. In stable patients, 25 (78.2%) patients were diagnosed preoperatively on CT scan. MRCP was done in 3 (9.3%) patients to confirm the diagnosis and grade of injury due to inconclusive report on CECT scan. At our centre as per the protocols we first stabilize the patients as per ATLS guidelines we resuscitate the patients. After primary stabilization we perform X-ray abdomen, X-ray chest and FAST scan of all patients. We also routinely

perform CT scan with contrast wherever required and in stable patients. CECT has also helped in diagnosing the complications like pancreatic fistulas, intra-abdominal abscesses, wound infections, pancreatic pseudocysts, vascular complications and concomitant organ injuries. MRCP used in cases of diagnostic dilemma and classification of injuries according to grades. MPD status is clearly delineated in MRCP.

In this study, out of 26 patients of pancreatic injuries, according to AAST grading system 9 (34.6%) patients belonged to grade I injury, 6 (23%) patients in grade II, 5 (19.4%) patients in grade III, 3 (11.5%) patients each in both grade IV and grade V injury. In case of duodenal Injuries, 80% patients belonged to grade III injury and 20% to grade II according to AAST grading system for duodenal injuries. The most common associated organ injury was spleen followed by liver, kidney and bladder. Other associated injuries were head trauma, chest trauma, long bone injuries like femur fractures, pelvic fractures and spine fractures.

According to presentation of patient and diagnosis, 18 patients were managed conservatively (non-operative) and 14 patients under went operative intervention. Non operative management had better outcomes in low grade injuries and no involvement of pancreatic duct injuries. Duodenal perforation was repaired by primary closure and feeding jejunostomy in 5 patients. In case of complete traumatic transection of pancreatic neck, pancreatic jejunostomy with feeding jejunostomy was done. In one patient ECRP was done to confirm the pancreatic injury and main pancreatic duct stenting. External drainage is a critical component in the treatment of pancreatic injuries, and its importance cannot be overstated. To avoid retroperitoneal exposure to caustic enzymes, which will cause a massive inflammatory response and progressive organ dysfunction, pancreatic enzyme diversion is required. External drainage should be used to treat less severe pancreatic injuries that do not involve the pancreatic duct, such as hematomas, parenchymal contusions, and lacerations of the capsule or superficial parenchyma. When compared to open-style drains, closed suction systems are associated with a lower rate of abscess development.[12] Depending on the overall clinical picture, distal feeding access may be useful for providing early enteral nutrition.

Few studies in pediatric populations reported conservative approach in high grade injuries. In a study by Zhang et al, after following the suggested algorithm for the treatment of blunt pancreatic injury, the integrity of pancreas was preserved in most children.[13] According to the literature reports of other pancreatic-related diseases that require resection of the pancreas, the incidence of postoperative diabetes ranges from 20 to 83%. Current studies in adults have confirmed that in patients with pancreatic injuries, partial pancreatic tissue resection does not stimulate the proliferation of the remaining islet β cells, and glucose tolerance is significantly affected after the loss of 65% of islet β cells. Therefore, maintaining the pancreas' integrity in children with pancreatic injuries is critical to ensuring good long-term pancreatic function. Nonresection management of the pancreas may lead to a longer hospital stay and a higher incidence of pseudocysts, it could be a feasible option in children with grade III and IV blunt pancreatic injuries. They should be monitored for pancreatic function for a long period.

The choice of operative versus non-operative management is essentially dependent on hemodynamic stability and grade of injury. The association of hemodynamic stability with outcome is significant. Stable patients had 5.8% mortality while unstable patients had 53.3 % mortality.[17,1,15] In this study mortality was 27.2% mainly associated with delayed presentation, hemodynamical instability, and associated injuries.

The main limitation of this study is a small sample size. Another limitation is that duodenal and pancreatic injuries have different management where the later can be managed conservatively in selected cases whereas former requires an early surgical intervention in all cases. The two organ injuries were clubbed as combined injuries are known. Unfortunately, we only had one case of pancreatico-duodenal injury in our study. This limitation has been overcome by analysing them separately

CONCLUSION

Our study shows that mortality increases due to the presence of other factors like associated injuries severe enough to lead to death, delayed presentation, delay in diagnosis and development of complications. High index suspicion of these injuries should be kept in cases of blunt trauma abdomen in cases of cycle handlebar, steering wheel and seat belt injuries. Non operative management is preferred in low grade injuries (grade 1, 2, 3) and grade 4 injuries in selected cases. In our study few cases of high-grade pancreatic injuries with ductal disruption have been managed conservatively. Thus, conservatism can be extended to higher grades of pancreatic trauma in selected cases. In others, operative intervention is required, particularly in grade 4 and5 pancreaticoduodenal injuries. In conclusion, early hospital transit from the site of incidence to dedicated level 1 trauma care center with primary resuscitation and prompt diagnosis is need of the hour in pancreaticoduodenal injuries.

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