Our experience with pancreatic injury due to trauma in a rural area

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Aim
We aimed to analyze The pancreatic injuries due to trauma and their treatment.
Material and methods
This study includes the data of ten patients who were operated on due to abdominal trauma and were further diagnosed with pancreatic trauma in the General Surgery Service between January 2016 and December 2019.
Results
Of the 472 patients admitted to our hospital with abdominal trauma, 10 had pancreatic injuries. Seven (70%) of these patients were male and three (30%) were female. When the causes of the injuries were examined, six (60%) had gunshot wounds (GSW), three (30%) had stab wounds (SW), and one (10%) had a pancreatic injury due to falling from a height.
Abdominal computed tomography (CT) scans were performed in eight (80%) patients. One patient's CT was reported as normal. Other scans indicated findings suggestive of abdominal injury, such as free air and free fluid in the abdomen.
Following the pancreas, the stomach was the most injured organ (80%), followed by the liver, spleen and kidney, respectively. An isolated pancreatic injury was observed in only one case. Complications developed in eight (80%) patients, Three (30%) of our patients died in the postoperative period. The mean hospital stay of the patients was 9.8±6.14 (min: 3, max: 24) days.
Conclusion
The pancreas is not commonly injured in abdominal trauma.. Even if preoperative imaging methods are normal, the pancreas should be explored in order not to miss pancreatic injuries in trauma patients who were operated on.

Keywords:
morbidity, mortality, pancreatic injuries

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Introduction

The pancreas is a rarely injured organ due to trauma, occurring in less than 5% of all abdominal injuries and less than 2% of blunt abdominal trauma cases. Pancreatic injuries are associated with very high morbidity and mortality due to the lack of generally accepted classifications showing the degree of injury, delayed diagnosis and treatment [1].

The American Association for the Surgery of Trauma (AAST) has recommended the universally accepted Pancreatic Organ Injury Scale (POIS) for assessing pancreatic injury [2] (Table 1).

Pancreatic injuries can occur due to blunt force trauma (e.g. assaults, motor vehicle accidents) or penetrating injuries (e.g. gunshot wounds, stabbings) [3] Due to its close proximity and relationship to large upper abdominal vessels, pancreatic injuries are often associated with serious morbidity and mortality [4]. A timely diagnosis of pancreatic trauma is difficult due to the retroperitoneal location of the pancreas and duodenum, the non-specific nature of accompanying symptoms, and the lack of accurate serological tests (serum amylase and lipas are diagnostic in first 48 hrs of trauma) and imaging methods [5].

While serum amylase and lipase levels are screening tools that can be used to diagnose pancreatic damage, published reports on serum amylase and lipase levels in patients with abdominal trauma, have shown mixed results. Some studies have demonstrated the importance of serum amylase and lipase levels in diagnosing pancreatic damage. Still, others have shown that baseline amylase and lipase measurements are not helpful screening tools for detecting pancreatic damage [6].

A comprehensive knowledge of the pancreas is required to effectively identify, classify and treat a traumatic

pancreas injury [2]. This article reviews the evaluation and management of pancreatic trauma.

Aim

The aim of this study was to evaluate the incidence, injury mechanisms, treatments and outcomes of patients who had pancreatic trauma in a tertiary care centres in Diyarbakır between 2016 and 2019.

The objectives of the current study are outlined below.

(1) To define the aetiology of pancreatic injuries.
(2) To review the clinical manifestations of patients with pancreatic trauma.
(3) To review our current treatment options for patients with pancreatic injury (PI).
(4) To review patients' postoperative complications, treatments and follow-ups.

Materials and methods

This study includes the data of ten patients who were operated on due to abdominal trauma and were further diagnosed with pancreatic trauma in the General Surgery Service between January 2016 and December 2019.This study was conducted following the principles of the 2008 Helsinki Declaration, and approval was obtained from the Gazi Yaşargil Training and Research Hospital ethics committee before the study (ethics committee date and number: 29.05.2021/762). All patients had applied to the Gazi Yaşargil Training and Research Hospital Emergency Service.

Hospital records and surgery reports were reviewed retrospectively. From these, the data we recorded included age, sex, cause of trauma, the presence of any additional organ injury and the blood transfusion status. Additionally, we recorded the ISS (Injury Severity Score), laboratory and radiological imaging methods, preoperative time, presence of shock, additional disease status, length of stay in the hospital, surgery performed, morbidity and mortality.

Numerical data obtained in the study were expressed as arithmetic mean ± standard deviation, and categorical data were expressed as frequency (percentage). Statistical analyses were performed using the SPSS 16.0 (Chicago, IL, USA) statistical package program. Compliance of numerical data with a normal distribution was tested with the Shapiro-Wilk test, while homogeneity was tested with the Levene test. Chi-square tests, independent Student's *t*-tests, one-way analysis of variance (one-way ANOVA), and Tukey's honestly significant difference (HSD) post hoc tests were used for statistical analysis. A $P<0.05$ value was accepted for statistical significance.

Results

Of the 472 patients admitted to our hospital with abdominal trauma, 10 had pancreatic injuries. Seven (70%) of these patients were male and three (30%) were female. The mean age of the patients was 28.00±11.17 (range: 18–55) years (Table 2).

When the causes of the injuries were examined, six (60%) had gunshot wounds (GSW), three (30%) had stab wounds (SW), and one (10%) had a pancreatic injury due to blunt abdominal trauma (falling from a height). In the emergency department, three (30%) patients had hemodynamic instability and seven (70%) were hemodynamically stable.

Hemogram and biochemical parameters of all patients were studied in the emergency department. The mean WBC (white blood cell) value was 16.07±6.59 mcL (min: 3.45, max: 26.8) and the mean amylase value was 174.0±127.76 U/L (min: 0.0, max: 411.0). The mean Ranson criteria of the patients at the time of admission were 1.3±1.15 (min: 0.0- max: 3.0).

Abdominal computed tomography (CT) scans were performed in eight (80%) patients. One patient's CT was reported as normal. Other scans indicated findings

Table 1 American association for the surgery of trauma (AAST) [2]

The proximal pancreas is defined as the gland to the right of the superior mesenteric vein (SMV)-portal vein axis whereas the distal pancreas is to the left of the axis. The term deep refers to an injury down to the level of the duct whereas superficial implies the injury is superficial to the duct
Grade I: Hematoma with minor contusion or superficial laceration without duct injury
Grade II: Major contusion or laceration without duct injury
Grade III: Distal transection or deep parenchymal injury with duct injury
Grade IV: Proximal transection or deep parenchymal injury involving the ampulla (and/or intrapancreatic common bile duct)
Grade V: Massive disruption of the pancreatic head ('shattered pancreas')

N.b. advance one grade for multiple injuries up to grade 3. Grades I and II do not involve the duct and are considered low-grade injuries. Grades III, IV and V involve the duct and constitute high-grade injuries.

suggestive of abdominal injury, such as free air and free fluid in the abdomen.

All of the patients subsequently underwent an emergency operation (Table 3).

Following the pancreas, the most injured organ was the stomach (80%). An isolated pancreatic injury was observed in only one case. This patient was injured due to falling from a height. Thus, our additional organ injury rate was 90% (Table 4).

Complications developed in eight (80%) patients. The most common complications in the postoperative period were sepsis and atelectasis (Table 5).

Three (30%) of our patients died in the postoperative period. The mean hospital stay of the patients was 9.8 ±6.14 (min: 3, max: 24) days.

Discussion

Pancreatic injuries (PIs) are seen in less than 5% of major abdominal injuries [3]. In the study of O'Reilly *et al.*, pancreatic injuries constituted 4.7% of all abdominal traumas [5]. In our study, the rate of pancreatic injury with abdominal trauma was 2.1%, a figure comparable with their results.

Table 2 General characteristics of the patients

Sex	Men; 7 (%70) Women; 3 (%30)
Age (years)	28,00 ±11,17 (min:18-max:55)
GKS	12,20±3,73571 (min:6-max:15)
ISS	32,7±24,44 (min:8-max:66)
White blood count (mcL)	16,07±6,59 (min: 3,45-max:26,8)
Amilaz (U/L)	174,0±127,76 (min:0,0-max:411,0)
Ranson criteria	1,3±1,15 (min:0,0-max:3,0)
Hospital length of stay (days)	9,8±6,14 (min: 3-max: 24)

GKS, Glasgow Coma Scale; ISS, Injury Severity Score.

PI was mostly seen in men (70%) in our study. The mean age was 28.0 years. O'Reilly *et al.* reported a mean age 27 years and a male:female ratio of 2.5 in their study [5]. Moreover, Bedirli *et al.* found a male: female ratio of 9:2 with a mean age of 32 years [7]. We attribute this dominance of young males to their susceptibility to trauma.

Six of our patients (60%) had GSW, three (30%) had SW and one (10%) had a pancreatic injury due to falling from a height. In their study of 11 cases, Bedirli *et al.* reported that PI occurred due to stabbing in six patients (54.54%), GSW in two patients (18.18%) and traffic accidents in three patients (27.27%) [7]. In the 13-case study of Çağlayan *et al.*, PI occurred due to stab wounds in seven patients (53.84%), firearm injuries in three patients (23.07%) and blunt abdominal trauma in three patients (23.07%) [8]. 63% of pancreatic injuries

Table 4 Additional organ injury

Organ	*n*/(%)
Stomach	8/ (%80)
duodenum	1/ (%10)
Liver	4/ (%40)
Spleen	3/ (%30)
Small intestine	2/ (%20)
Large bowel	2/ (%20)
Diaphragm	1/ (%10)
Kidney	3/ (%30)
vertebra	1/ (%10)
costa	1/ (%10)
Lungs	1/ (%10)

Table 5 Postoperative complications

Complication	*n*/(%)
Sepsis	4 (%40)
Atelectasis	3 (%30)
Wound infection	2 (%20)
Kidney failure	3 (%30
Pancreatic fistula	1 (%10)
Intraabdominal abscess	1 (%10)

Table 3 Applied surgeries

Operation	Number
Stomach + pancreas primary repair	3
Distal pancreatectomy	1
Liver+ stomach + pancreas primary repair	1
Liver and stomach primary repair + small intestine primary repair + splenectomy + distal pancreatectomy + colon resection and anastomosis + tube jejunostomy + bogota bag application	1
Left nephrectomy + distal pancreatectomy + diaphragm + stomach + liver primary suture, thorax tube	1
Left nephrectomy + distal pancreatectomy + stomach primary repair + splenectomy + liver segmentectomy + left thorax tube + total bowel ischemia follow-up + second look	1
Splenectomy + nephrectomy + duodenum and pancreas primary repair + thorax tube + packing + second look (duodenum primary suture + pack removal)	1
Subtotal pancreatectomy + stomach primary repair	1

are caused by penetrating mechanisms such as firearms and knives, and the remaining 37% are caused by blunt abdominal trauma [2]. Penetrating traumas are more common than blunt traumas in causing pancreatic injuries . We attribute this to the fact that the pancreas is fairly well protected by both the vertebral column and its overall anatomical location. Counteraction Effect in blunt abdominal Trauma.

Laboratory tests are of little value in the early diagnosis of pancreatic trauma. However, serum amylase levels have been extensively studied. An increase in serum amylase is time dependent and has been found to be elevated after three hours in all patients with pancreatic injury [9]. However, there is conflicting evidence with another study that shows that more than 30% of patients with severe pancreatic trauma have serum amylase levels within normal values [10]. In our study, the average amylase value, which was one of the biochemical parameters taken in the emergency room, was 174.0±127.76 (min: 0.0, max: 411.0) U/L. Amylase values did not exceed 500 U/L in any of our patients at the time of admission to the emergency department.

In the study by Lin *et al.*, shock was observed in 3% of patients with blunt pancreatic injury at the time of admission [10]. Furthermore, Bedirli *et al.* found hemodynamic instability at a rate of 45.45% [7]. In our results, hemodynamic instability was observed at a rate of 30%. We attribute this hemodynamic instability to the degree of additional organ injury.

CT scans are the backbone of pancreatic imaging. Intravenous contrast is almost always indicated, with multiphase-enhanced imaging best suited to identify and characterize pancreatic trauma. Three-phase CT scans have been shown to have a sensitivity and specificity of up to 80% in detecting pancreatic damage in hemodynamically stable patients [11]. The ability of CT scans to show pancreatic injuries has been reported at 55%–70% [12]. In our study, abdominal CT scans were performed in eight patients . The CT scan of one patient was reported as normal. Many intraabdominal organ injuries, including the pancreas, were seen in one patient injured by a gunshot. While there was no finding suggesting pancreatic injury in the other eight patients, intraoperative pancreatic injury was observed in all of them. In these patients, intraabdominal free air and free fluid were seen on MSCT, suggesting intraabdominal solid organ injuries and intraabdominal lumen organ injury. Others indicated findings such as free air and free fluid, suggestive of an intraâ abdominal injury. Specific information about the pancreatic trauma was not given in the reports.

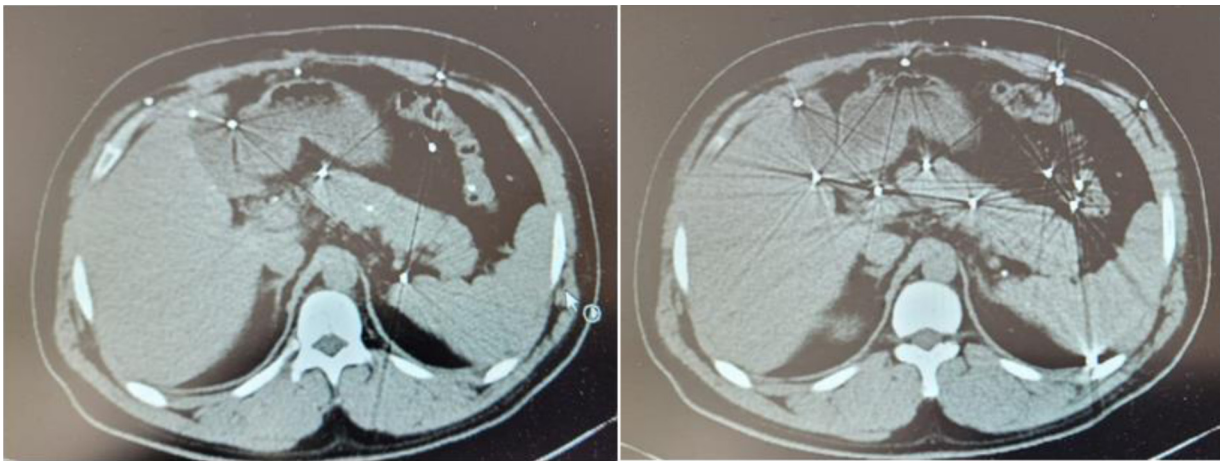
Isolated pancreatic injuries are rare. Most are associated with other intra-abdominal or extraâ abdominal injuries. The most frequently injured intra-abdominal organs are the liver, spleen and kidneys [5]. The most to least affected additional organs in our study included the stomach, liver, spleen and kidneys, respectively.

Pancreas examination is routinely performed by opening the gastrocolic ligament in all patients operated on for trauma in our clinic. In this way, even if MSCT is reported as usual, the possibility of missing possible pancreatic injuries is minimized. This is perhaps the most critical aspect of this study. While pancreatic damage was not observed in MSCT in 90% of our patients, possible morbidity and mortality were prevented due to our routine pancreas examination. Primary repair was performed in five patients with superficial pancreas injury, distal pancreatectomy and splenectomy were performed in one patient, distal pancreatectomy, splenectomy, and left nephrectomy in two patients, and subtotal pancreatectomy in one patient due to distal pancreas injury and extensive injury.

Complications rates due to pancreatic injuries vary between 34–45% [7]. Postoperative pancreatic fistulae are seen at a rate of 10–17% [4]. In our study, our complication rate was 80% and a pancreatic fistula was observed in one (10%) patient. Additionally, an intraâ abdominal abscess developed in one patient. Additionally, one patient developed an intra-abdominal fistula, which was percutaneously drained under USG guideance. We attribute the high complication rate to the number and degree of additional organs affected by the trauma.

Mortality rates with pancreatic injuries range from 10% to 24% [1,7]. Bedirli *et al.* [7] reported a mortality rate of 18%, while in our study; the mortality rate was 30%. Patients were taken to emergency operation with a shock table; Three of our patients, who had intestinal and multiple organ injuries and who were found to have intra-abdominal bleeding due to intraoperative injuries, died as a result of postoperative sepsis and related septic shock and MODS (mods multiorgan syndrome dysfunction).We often attribute the cause of mortality to the degree of pancreatic and additional organ injuries.

Figure 1



CT of pancreatic trauma.

Conclusion

The retroperitoneal location of the pancreas and its anatomical integrity with major vascular structures, which are not commonly injured in abdominal trauma, make treatment intervention important in case of injury. Apart from efforts to improve patient haemodynamics, surgical treatment options in stable patients are closely related to the degree and localization of the injury. Additional organ injuries are more responsible than pancreatic injuries in increasing morbidity and mortality. Even if preoperative imaging methods are normal, the pancreas should be explored in order not to miss pancreatic injuries in trauma patients who were operated on (Fig. 1).

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Conflicts of interest

There are no conflicts of interest.

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