ORIGINAL ARTICLE

Mortality patterns and postoperative outcomes of trauma-induced pancreatic resections: A pilot study

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ABSTRACT

BACKGROUND: Pancreatic surgery is one of the most challenging and complex types of surgery. Mortality rates for trauma-induced resective pancreatic surgery are higher than those for elective pancreatic surgical procedures. Factors that increase mortality due to high-energy trauma include additional organ damage and hypovolemic shock, and complications of resective surgery can also be considered. There are few studies on this in the literature. This study aims to analyze resective pancreatic surgery outcomes and mortality patterns at a tertiary high-volume trauma and hepatobiliary surgery center.

METHODS: Patients who underwent resection due to pancreatic trauma between 2019 and 2024 were retrospectively reviewed. Preoperative clinical findings, laboratory tests, and radiologic images were evaluated, and trauma scores were calculated. The surgeries, as well as postoperative morbidities and mortalities, were examined. Mortality within the first three days postoperatively was considered early, while mortality occurring thereafter was classified as late operative mortality.

RESULTS: According to the American Association for the Surgery of Trauma grading, 10 patients (55.5%) had Grade 4–5 blunt trauma, and 4 patients (22.2%) each had Grade 3 blunt trauma and Grade 4–5 penetrating trauma. Furthermore, 7 of the operated patients (38.88%) had fatal outcomes. The mortality rates were 57.14% for hemorrhagic shock-related deaths, 14.28% for pancreatic fistula-related deaths, and 28.56% for deaths unrelated to pancreatic fistulas.

CONCLUSION: In our study, early mortality was particularly high in patients presenting with shock from vascular injury, while late-term mortality was due to sepsis from pancreatic fistula and other complications. Effective management of shock at the time of arrival and postoperative complication management can help reduce morbidity and mortality in trauma-related pancreatic resections.

Keywords: Hemorrhagic shock; pancreatic fistula; pancreatic trauma.

INTRODUCTION

Pancreatic surgery is one of the most challenging and complex surgical procedures. Many studies have emphasized the necessity of performing such surgeries in specialized centers.[1-3] One of the significant advantages of centralizing pancreatic surgery is that operative mortality rates remain below 5%.[3-5] However, mortality rates for trauma-induced pancreatic surgery are considerably high, ranging from 34.7% to 54%.[6-9]

Despite the high operative mortality, emergency pancreatic surgery may be necessary in cases of blunt or penetrating abdominal trauma, tumor hemorrhage, or complex perforated or bleeding peptic ulcers.[8] In the early phase of the postoperative period, the primary causes of high mortality are uncontrolled major vascular bleeding and associated organ injuries, whereas in the late phase, infection and multiorgan failure are commonly reported.[10] However, unlike elective pancreatic surgeries, in which the root causes of mortality have been extensively studied, the prevailing general consensus is that investigations into the causes of mortality in trauma-related pancreatic surgeries are less comprehensive.[4,5]

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In cases of pancreatic trauma, emergency resective surgery is believed to exacerbate an already compromised metabolism, worsening hypothermia, hypercoagulopathy, and acidosis, thereby increasing mortality.[10,11] Therefore, based on the severity of pancreatic injury, it is generally recommended to avoid resective surgery as much as possible and opt for a multidisciplinary approach (gastroenterology, interventional radiology, etc.), with resective surgery considered a last resort. However, there is no clear consensus on this approach.[11,12]

In this study, we investigated the morbidity and mortality of patients with pancreatic trauma who subsequently underwent pancreatic resection at our hospital, a high-volume center for hepatobiliary and trauma surgery. We also analyzed mortality patterns of trauma-related pancreatic resections.

MATERIALS AND METHODS

Patient Data

We retrospectively reviewed patients who were followed up for pancreatic trauma between March 2019 and April 2024 at the General Surgery Clinic of our hospital. We screened 83 patients who were hospitalized for pancreatic trauma. Of these, 2 patients (2.40%) with Grade 4 pancreatic injuries developed periampullary perforations during treatment with endoscopic retrograde cholangiopancreatography (ERCP). A total of 18 patients (7.05%) who had pancreatic resections were included in the study. Approval for the study was obtained from our hospital's Scientific and Ethical Evaluation Committee under approval number TABED 2-24-210, which complied with the Declaration of Helsinki.

The demographic characteristics of the patients (age, gender, and cause of trauma) were recorded. For patients followed up due to trauma, the revised trauma score (RTS), injury severity score (ISS), and American Association for the Surgery of Trauma (AAST) score were calculated. For those who developed ERCP-related injuries, Stapfer scores were assessed. Additionally, laboratory parameters, radiological findings, endoscopic or radiological interventions, surgeries performed, hospital length of stay, duration of intensive care unit stay, operative and nonoperative complications, and mortality rates were evaluated.

Pancreas-specific complications in patients were classified according to the International Study Group of Pancreas Surgery (ISGPS) classifications. Surgeries in which pancreatic resection was not performed, without addressing other organs, were defined as conservative surgery, while patients who underwent pancreatic resection were categorized as having undergone resective surgery. In evaluating mortality, deaths occurring within the first three days post-trauma were classified as "early mortality," while those occurring on the fourth day or later were termed "late mortality."

Statistical Analysis

For data analysis, descriptive statistics and normality tests were performed. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as median, mean, standard deviation, minimum, and maximum values. The independent samples t-test was used to compare the means of continuous variables with normal distributions, while the Mann–Whitney U test was applied for continuous variables with non-normal distributions. Fisher's exact test was used to examine the relationships between the categorical variables. For all tests, a 95% confidence interval was applied, and a p-value of less than 0.05 was considered statistically significant. Statistical Package for the Social Sciences (SPSS) version 27.0.1 (IBM Corp., Armonk, NY, USA) was used for the statistical analyses.

RESULTS

Demographic Data

Of the 18 patients included in the study, 7 (38.9%) were female and 11 (61.1%) were male. The average age was 45 years (minimum: 22 years; maximum: 89 years). The trauma mechanism was blunt trauma in 12 (66.7%) patients, penetrating trauma in 4 (22.2%) patients, and ERCP-related trauma due to Grade 4 pancreatic injury in 2 (11.1%) patients. Trauma involving the pancreatic head occurred in 14 (77.8%) patients, and left-sided pancreatic trauma occurred in 4 (22.2%) patients. Mortality occurred in 7 (38.9%) patients. Of these, 3 patients (42.85%) had blunt trauma, 3 (42.85%) had penetrating trauma, and 1 (14.28%) had blunt trauma and ERCP-related perforation (Table 1).

Condition at Admission

At the time of admission, 12 (66.7%) patients were in hemorrhagic shock. Based on the AAST scores, 4 (25%), 7 (43.75%), and 5 (32.25%) patients had Grade 3, Grade 4, and Grade 5 pancreatic trauma, respectively. Associated injuries included luminal organ injuries in 22.2%, vascular injuries in 27.8%, and solid organ injuries in 55.6% of cases. The average RTS score of patients presenting was 5.8 ± 1.6. The median ISS score was 33. Of the 12 patients who presented with shock, 11 (91.6%) had hemorrhagic shock and 1 (8.4%) had septic shock (Table 1).

Administered Treatments

Primary Procedure: Emergency Whipple surgery was performed on 5 (27.7%) patients with Grade 4–5 pancreatic injuries, and emergency distal pancreatectomy was performed on 3 (16.6%) patients with Grade 3 injuries. Endoscopic interventions were initially applied to the patients followed up for ERCP perforation after Grade 3–4 pancreatic injury. For the remaining 10 (56.3%) patients, nonoperative procedures were performed based on injury location and severity (Table 1).

Secondary Procedure: Conservative treatment failed in 10 (55.55%) patients. In 4 (40%) of these patients, the Whip-

ple procedure was performed as a secondary intervention. Of these, 3 (75%) had Grade 4–5 pancreatic trauma and 1 (25%) was followed up after presenting with ERCP perforation post-pancreatic trauma. Distal pancreatectomy was performed on 1 patient (10%) with Grade 3 pancreatic injury. Among the remaining patients with Grade 4–5 pancreatic injuries, primary suturing and omentopexy were performed instead of resection in 2 (20%) patients. In 2 (20%) patients, interventional radiology procedures were performed to revise catheter placements, while ERCP with stent revision was performed in another patient with ERCP perforation following pancreatic trauma.

Tertiary Procedure: The Whipple procedure was performed on all 5 (27.7%) remaining patients who were followed up for traumatic injury or post-traumatic ERCP perforation.

Morbidity

Postoperative pancreatic fistula (POPF) occurred in 6 (33.8%) patients, while sepsis and other complications occurred in 7 (38.9%) and 5 (27.8%) patients, respectively. A significant relationship was found between the development of POPF and the patient's shock status at admission (p=0.004), high RTS (p=0.026) and ISS (p=0.031) scores, nonresective index surgeries (p=0.038), and young age (p=0.049). A significant association was also observed between the development of postoperative shock and the patient's shock status (p=0.025) at admission and vascular organ injury (p=0.002). Based on the ISGPS, POPF was classified as Grade C, Grade B, and Grade A in 2 (33.3%) patients each. A fatal outcome was recorded in 1 (50%) patient with a Grade C fistula, while the other patient underwent operative debridement. Intra-abdominal abscesses unrelated to POPF developed in 3 (16.6%) patients. Of these, 1 patient each had a Whipple procedure, a splenectomy with distal pancreatectomy, and a distal pancreatectomy–splenectomy with colon resection. Only 1 (5.55%) patient developed a Grade C hepaticojejunostomy leak, and the same patient also developed Grade B delayed gastric emptying syndrome. Pneumonia occurred in 1 (5.55%) patient, who was diagnosed with methicillin-resistant Staphylococcus aureus (MRSA) (Table 1).

Management of Post-Resection Complications

The patient with a Grade C POPF was initially managed using radiological intervention with intra-abdominal catheterization. However, due to a lack of clinical improvement, operative debridement and suturing of the pancreaticojejunal anastomosis were performed. Patients with Grade B POPFs were treated with percutaneous catheter drainage, while no intervention was required for those with Grade A POPFs.

Patients who developed intra-abdominal abscesses unrelated to POPF were initially managed with radiological intervention, and those who did not benefit from this treatment underwent surgery. One patient experienced a Grade C hepaticojejunostomy leak and a Grade B delayed gastric emptying syndrome. This patient was reoperated on for a hepaticojejunostomy leak, with suturing of the leak site. Delayed gastric emptying syndrome was managed by halting the patient's oral intake and initiating nasogastric decompression.

Mortality

Among the patients who underwent surgery, 7 (38.88%) had fatal outcomes. Of the 6 patients who presented with hemorrhagic shock, 4 (66.6%) died due to hemorrhagic shock, while the remaining 2 (33.3%) died from sepsis following resective surgery. All of these patients had major vascular or mesenteric injuries. A total of 3 patients died of sepsis, and 1 (33.3%) patient each developed sepsis from POPF, intra-abdominal abscess following bowel perforation, and MRSA pneumonia. One patient who had pancreatic trauma followed by ERCP perforation developed sepsis attributed to POPF after a Whipple procedure. A positive correlation was found between mortality and the presence of shock at admission, vascular injury, and penetrating trauma (p<0.005) (Figure 1).

Mortality Patterns

Hemorrhagic Shock-Related Mortality: Patients in this group presented primarily with hemorrhagic shock, mainly due to vascular injuries, and underwent immediate resective surgery. Of the 9 patients who presented with vascular injury and shock, 4 (44.44%) had a fatal outcome. Hemorrhagic shock accounted for 57.14% of the total mortality. Of these patients, 3 (75%) died within the first 24 hours postoperatively, while 1 (25%) died on postoperative day 3 (Table 1).

POPF-Related Sepsis: Among the 7 patients who had a fatal outcome, 1 (14.28%) died due to sepsis caused by a Grade C POPF. This patient had Grade 4 pancreatic trauma and was treated with an ERCP, during which a Stapfer 2 ERCP perforation occurred, leading to sepsis. The initial treatment involved endoscopic stent revision of the bile duct and pancreas. However, due to the failure of endoscopic intervention, resective surgery was performed, which subsequently led to a pancreaticojejunal anastomotic leak. Despite drainage of the collection via interventional radiology, the patient died on postoperative day 11, four days after the drainage procedure (Table 1).

Non-POPF-Related Sepsis: In this group, 2 patients died from sepsis unrelated to POPF. One patient with a Grade 4 pancreatic injury had a Whipple procedure, while the other patient with a Grade 3 pancreatic injury had a distal/subtotal pancreatectomy. The patient with Grade 4 pancreatic injury also had a Grade 3 liver injury, small bowel injury, and injuries to the mesentery and mesenteric vessels. Initially, gastroenterological and radiological interventions were attempted (Table 1). However, due to the failure of conservative treatment, a Whipple procedure was performed. Despite these efforts, the patient developed MRSA pneumonia during the postoperative period and died on postoperative day 7. The patient with Grade 3 pancreatic injury also had a Grade 2 gastric injury and a Grade 3 colon injury. The initial treatment

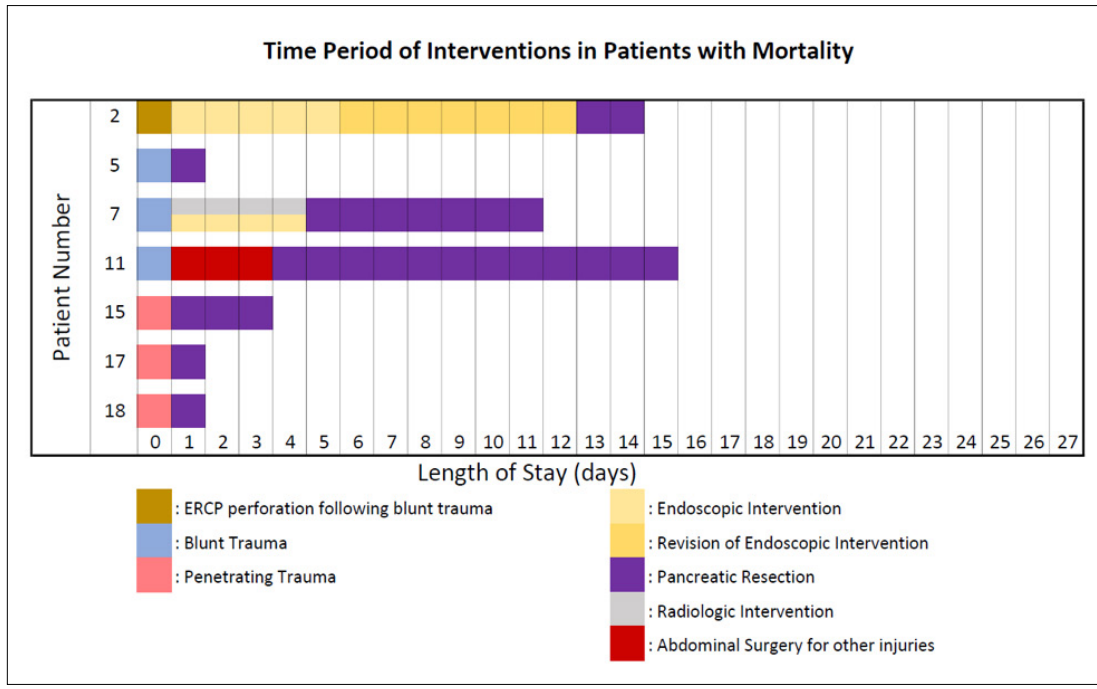

Figure 1. Day to day interventions for patients with mortality.

involved primary suturing of the pancreas and stomach, segmental colon resection, and the creation of an end colostomy. During follow-up, intra-abdominal sepsis was suspected, and distal pancreatectomy was added 3 days after the initial procedure. Despite subsequent drainage of an intra-abdominal abscess via interventional radiology, the patient died 12 days after the second surgery (Table 1).

DISCUSSION

Trauma-related pancreatic resections are relatively rare, with only 18 cases (3.94%) out of 456 pancreatic surgeries performed in our center over the last 5 years. Additionally, 21.68% of patients admitted for pancreatic trauma underwent resective surgery. The existing literature provides limited data regarding emergency pancreatic surgery, and morbidity and mortality rates are much higher than those from elective surgeries. Information on the factors influencing morbidity and mortality in such cases is also limited.[6,13,14] This study represents one of the larger cohorts reported in the literature and is exceptional in documenting ERCP-related perforations occurring during the treatment of pancreatic trauma, as such reports are rare. A positive correlation was found between mortality and the presence of vascular injury, hemorrhagic shock, and penetrating trauma at the time of admission. Mortality pattern evaluations showed that 51.74% of patients experienced hemorrhagic shock at admission, 25.67% of patients died from sepsis unrelated to POPF, and 12.53% of patients died from complications specific to pancreaticoduodenectomy.

The mortality rates in patients admitted to the hospital with abdominal vascular trauma, aside from pancreatic injuries, range from 12.6% to 43.5%.[15] Mortality increases significantly if the patient presents with shock at admission.[16-18] The periampullary region and the pancreas are not only highly vascularized but also closely situated to major vascular structures. Therefore, major or minor vascular injuries are frequently associated with pancreatic trauma. Pancreatic injuries are often not isolated and are commonly accompanied by multiorgan trauma. This is another reason why patients might present with hemorrhagic shock, even without vascular injury.[19] Vascular injury and hemorrhagic shock have a high mortality rate that further increases when pancreatic injury is present. Kuza et al.[13] reported a strong correlation between mortality and the presence of vascular injury and shock at admission among patients with pancreatic trauma in the UK between 2007 and 2011. Similarly, Krige et al.[10] observed a relationship between vascular injury, shock at presentation, and increased mortality. Our study supports these findings, showing that early mortality rates were high (50%) in patients presenting with hemorrhagic shock. It is noteworthy that in our study, patients who presented with hemorrhagic shock due to solid organ trauma, as opposed to vascular injury, tolerated surgery better, with lower early mortality rates. Although the two patients who died in the late period due to sepsis initially presented with hemorrhagic shock, it can be hypothesized that their hemodynamic instability at presentation contributed to metabolic disturbances that ultimately affected mortality. This suggests that while sepsis was the direct cause of death, the initial shock and metabolic imbalance likely played a critical role in the outcome.

One of the most feared complications of pancreatic surgery is POPF, particularly ISGPS Grade C, which has a mortality rate of 25%-40%.[4,5] Several scoring systems have been developed to predict the risk of POPF. Risk factors for its development include soft pancreatic tissue, a pancreatic duct diameter smaller than 3 mm, excessive intraoperative bleeding, and a high body mass index.[20-22] Soft pancreatic tissue is often associated with the absence of chronic pancreatitis, and the size of the pancreatic duct is typically linked to obstructive lesions.[20] In our study, none of the patients had primary pancreatic disease, meaning they had soft pancreatic tissue and small pancreatic ducts. Additionally, many of the patients experienced significant blood loss due to hemorrhagic shock. Although perioperative blood loss is associated with POPF development, one patient in our study who died from Grade C POPF presented with septic shock at admission without notable preoperative or perioperative surgical bleeding. This patient had undergone ERCP for the treatment of Grade 4 pancreatic trauma at another facility, which caused ERCP perforation and subsequent stent revision. Upon transfer to our center, another ERCP stent revision was performed. Thus, hemorrhagic shock, sepsis, and septic shock in the preoperative period may contribute to mortality in such cases.

Another cause of mortality is hospital-acquired pneumonia, which has a postoperative mortality rate of about 3% in elective Whipple procedures.[4] In our series, 1 (14.8%) patient died from pneumonia in the late period, which may be attributed to the high incidence of hospital-acquired infections in patients operated on under emergency conditions. This situation highlights the importance of early initiation of broad-spectrum antibiotics, ensuring adequate drainage, and meticulous implementation of infection control measures, especially in trauma patients.[12]

In left-sided pancreatectomy, typically performed for tumors of the pancreatic body and tail, mortality rates are below 5%, while complication rates reach up to 40%.[23] The complications of left-sided pancreatectomy are generally easier to manage than those following pancreaticoduodenectomy. The incidence of intra-abdominal abscesses after left-sided pancreatectomy is reported to be around 6%-8%.[24] In our study, the only patient with left-sided pancreatectomy and a fatal outcome died from an intra-abdominal abscess unrelated to POPF. This outcome was despite attempts to drain the abscess via interventional radiology and later through surgical debridement. This patient's additional colon injury and the presence of hemorrhagic shock at the time of admission increased the risk of mortality. These findings suggest that in trauma-related pancreatic surgeries, the early use of broad-spectrum antibiotics is crucial. The patient's condition underscores the heightened risk associated with complex injuries and highlights the need for aggressive infection control and management strategies, particularly when multiple organ systems are involved.

Conservative management of pancreatic trauma using interventional radiology and gastroenterology to achieve damage control, rather than traditional laparotomy, has provided significant advantages in reducing morbidity and mortality. Many studies have suggested that less invasive procedures, such as ultrasound-guided percutaneous drainage and ERCP with bile duct and pancreatic stenting, are associated with much lower morbidity and mortality compared to surgery.[25-28] It is evident that this approach has been effective in managing patients and reducing negative outcomes. However, these nonoperative interventions tend to be most successful in patients with low AAST scores.[1-2] In patients with high AAST scores,[4-5] conservative methods are sometimes attempted in stable cases, but the failure rate is higher.[25,27,28] Moreover, these interventions are generally unsuitable for patients who are hemodynamically unstable, have additional organ injuries, or have luminal organ perforations.[25,27] In our study, endoscopic and radiologic interventions were prioritized for stable patients. When these failed, nonresective surgeries were considered, with pancreatic resection being the last option. As a result, the overall mortality rate for patients with pancreatic trauma was 7.22%. Although we found no statistically significant difference regarding the use of less invasive treatments (ERCP or percutaneous drainage) prior to resective surgery in patients with fatal outcomes, there was a trend toward lower mortality rates in these cases. This likely reflects the limited sample size of our study.

The most significant limitation of this study is its retrospective nature, which may have led to gaps in electronic records and tracking systems. As a result, certain critical details, such as the amount of blood products administered, intraoperative blood loss, the day oral intake was initiated, and the start of enteral nutrition, could not be retrieved. These missing data points may have impacted the completeness of the analysis. Another limitation is the small sample size. Pancreatic traumas are rare, not only in our center but also worldwide. High-volume trauma and hepatobiliary surgery centers can contribute to the creation of a more extensive dataset by publishing their cases in the literature. This would help build a broader evidence base and improve the understanding of the management and outcomes of pancreatic trauma.

CONCLUSION

Pancreatic resections due to trauma are sometimes unavoidable. In this study, the mortality of patients undergoing trauma-related pancreatic resection was associated with shock at presentation, vascular injury, and penetrating trauma. Mortality patterns were defined as those due to shock and vascular injury, POPF-related sepsis, and non-POPF-related sepsis. Effective management of shock at the time of arrival and postoperative complication management can help reduce morbidity and mortality in trauma-related pancreatic resections. It can be concluded that the use of conservative interventions as the first line of treatment not only aids in managing trauma but also reduces the mortality risk following potential resec-

tive surgeries, except in hemodynamically unstable patients.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Travma nedenli pankreas rezeksiyonu yapılan hastaların postoperatif sonuçları ve mortalite paternleri: Pilot çalışma

AMAÇ: Pankreas cerrahisi zor bir cerrahidir ve acil ameliyatlar elektif cerrahilere kıyasla daha yüksek mortalite oranlarına sahiptir. Hemorajik şok, ek organ hasarı ve rezektif cerrahinin komplikasyonları, mortaliteyi artıran faktörlerdir. Bu çalışma, yüksek hacimli travma ve hepatobiliyer cerrahi merkezinde pankreas travmasına bağlı rezektif cerrahilerin sonuçlarını ve mortalite paternlerini analiz etmeyi amaçlamaktadır.

GEREÇ VE YÖNTEM: Şubat 2019-Mart 2024 yılları arasında pankreas travması nedeniyle rezeksiyon yapılan hastalar retrospektif olarak incelenmiştir. Preoperatif klinik veriler, laboratuvar testleri ve radyolojik görüntüler değerlendirilmiş ve travma skorlama yapılmıştır. Cerrahi sonuçlar, postoperatif morbiditeler ve mortaliteler incelenmiştir. Erken mortalite, postoperatif ilk üç gün içinde gerçekleşen ölümler olarak tanımlanmış, geç mortalite ise sonrasındaki ölümler olarak sınıflandırılmıştır.

BULGULAR: Amerikan Travma Cerrahisi Derneğinin derecelendirmesine göre, 10 hasta (%55.5) Grade 4-5 travma, 4 hasta (%22.2) Grade 3 travma, 4 hasta (%22.2) ise Grade 4-5 penetran travma geçirdi. Operasyon geçiren hastaların 7'si (%38.88) mortal seyretti. Mortalite oranları; hemorajik şokla ilişkili ölümler %57.14, pankreatik fistül kaynaklı ölümler %14.28 ve pankreatik fistüllerle ilişkili olmayan ölümler %28.56 olarak saptandı.

SONUÇ: Çalışmamızda, vasküler yaralanmadan kaynaklanan şok ile başvuran hastalarda erken mortalite özellikle yüksektir, geç dönem mortalite ise pankreatik fistül ve diğer komplikasyonlara bağlıdır. Gelen hastalarda şok yönetiminin etkin bir şekilde yapılması ve postoperatif komplikasyonların yönetilmesi, travma kaynaklı pankreas rezeksiyonlarında morbidite ve mortaliteyi azaltmada yardımcı olabilir.

Anahtar sözcükler: Acil pankreas cerrahisi; hemorajik şok; pankreas travması; pankreatik fistül.

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Table 1: Details of patients who underwent emergency surgery for pancreatic trauma

Patient and Trauma Characteristics											Interventions			Post-Pancreatectomy Data						
Patient Number	Sex	Age	Trauma Mechanism	Anatomical Location	AAST-OIS Grade	Stapfer Classification	Concomitant Abdominal Organ/Vascular Injury	Shock on admission	Revised Trauma Score (RTS)	Injury Severity Score (ISS)	Primary Intervention	Secondary Intervention	Tertiary Intervention	Length of Stay (days)	Post Pancreatectomy Radiologic Intervention	Post Pancreatectomy Endoscopic Intervention	Post Pancreatectomy Surgical Intervention	Clavien Dindo Classification	Postoperative Morbidity	Outcome
1	F	66	Blunt Trauma/ ERCP Perforation	Head of Pancreas	2	1 and 2	No	No	N/A	N/A	• Endoscopic Clipping • Choledocal Stenting via ERCP	• PD		28	N/A	N/A	N/A	1	No	Survival
2	F	89	Blunt Trauma/ ERCP Perforation	Head of Pancreas	2	2	No	Yes	N/A	N/A	• Endoscopic Choledocal Stenting	• Revision of Endoscopic Choledocal Stenting	• PD	14	N/A	N/A	N/A	5	• POPF-C • Septic Shock	Death
3	M	44	Blunt Trauma	Head of Pancreas	4	N/A	• Grade III Liver Injury • Grade III Spleen Injury	Yes	7	33	• Splenic Artery Embolization • Pancreatic Stenting via ERCP • Choledocal Stenting via ERCP	• Primary Repair • Omentopexy • Drainage	• PD • Splenectomy	38	• Closed Suction Drainage	N/A	N/A	3	• Intraabdominal abscess • Diabetes Mellitus	Survival
4	F	45	Blunt Trauma	Head of Pancreas	4	N/A	No	No	8	24	• Closed Suction Drainage	• PD		36	• Closed Suction Drainage	N/A	• Drainage • Debridement • Primary Suturation of PJ	3	• POPF-C	Survival
5	F	55	Blunt Trauma	Head of Pancreas	5	N/A	• Duodenal Perforation • Mesenteric Injury	Yes	6	75	• PD			1	N/A	N/A	N/A	5	• Hemorrhagic Shock	Death

6	F	39	Blunt Trauma	Head of Pancreas	4	N/A	No	No	8	21	• Closed Suction Drainage • Pancreatic Stenting via ERCP • Choledocal Stenting via ERCP	• Revision of Closed Suction Drainage	• PD	24	N/A	N/A	N/A	1	• POPF-A	Survival
7	M	42	Blunt Trauma	Head of Pancreas	4	N/A	• Grade III Liver Injury • Mesenteric Injury	Yes	8	20	• Closed Suction Drainage • Pancreatic Stenting via ERCP • Choledocal Stenting via ERCP	• PD		11	N/A	N/A	N/A	3	• Pneumonia • Sepsis	Death
8	M	37	Blunt Trauma	Head of Pancreas	4	N/A	• Grade II Liver Injury • Grade II Spleen Injury	No	7	24	• Closed Suction Drainage • Pancreatic Stenting via ERCP • Choledocal Stenting via ERCP	• Revision of Closed Suction Drainage	• PD	66	• Closed Suction Drainage	• Nasojejunal Tube Insertion	• Drainage • Debridement • Primary Suturation of HJ	3	• DGE-B • POPF-B • BL-C	Survival
9	F	24	Blunt Trauma	Head of Pancreas	4	N/A	• Grade III Liver Injury	No	7	29	• Closed Suction Drainage • Pancreatic Stenting via ERCP • Choledocal Stenting via ERCP	• Primary Repair • Omentopexy • Drainage	• PD	50	• Closed Suction Drainage	N/A	N/A	3	• POPF-B	Survival
10	M	27	Blunt Trauma	Head of Pancreas	5	N/A	• Grade III Liver Injury • Grade III Right Kidney Injury	Yes	6	35	• PD • Liver Primary Repair • Renal Primary Repair			14	N/A	N/A	N/A	1	• POPF-A	Survival

11	M	40	Blunt Trauma	Body of Pancreas	3	N/A	• Gastric Perforation • Colonic Perforation • SMV Injury	Yes	4	45	• Gastric Primary Repair • Drainage • Colon Segmental Resection + End Colostomy	• Subtotal Pancreatectomy		15	• Closed Suction Drainage	N/A	• Debridement	5	• Intraabdominal abscess • Sepsis	Death
12	M	51	Blunt Trauma	Body and Tail of Pancreas	3	N/A	• Grade II Liver Injury • Grade II Spleen Injury	Yes	5	33	• DP • Splenectomy			26	• Closed Suction Drainage	• Pancreatic Stenting via ERCP	N/A	3	•Intraabdominal abscess	Survival
13	M	22	Blunt Trauma	Tail of Pancreas	3	N/A	• Grade V Spleen Injury • Grade II Liver Injury	Yes	5	38	• DP • Splenectomy • Left Nefrectomy • Liver Primary Repair			22	• Closed Suction Drainage	N/A	• Debridement	3	No	Survival
14	M	49	Blunt Trauma	Tail of Pancreas	3	N/A	• Grade IV Spleen Injury	Yes	5	33	• DP • Splenectomy			22	• Closed Suction Drainage	• Pancreatic Stenting via ERCP	N/A	3	No	Survival
15	M	67	Penetrating Trauma	Head of Pancreas	5	N/A	• Grade III Liver Injury • SMV Injury	Yes	5	38	• PD			3	N/A	N/A	N/A	5	• Hemorrhagic Shock	Death
16	F	34	Penetrating Trauma	Head of Pancreas	4	N/A	• Ileum Perforation • Omental Laceration	No	6	33	• Drainage • Ileum Segmental Resection • Primary Anastamosis • Omentectomy	• PD		52	• Closed Suction Drainage	N/A	N/A	3	• POPF-B	Survival

17	M	41	Penetrating Trauma	Head of Pancreas	5	N/A	• Gastric Perforation • IVC Injury	Yes	2	75	• PD • Vascular Repair			1	N/A	N/A	N/A	5	• Hemorrhagic Shock	Death
18	M	38	Penetrating Trauma	Head of Pancreas	5	N/A	• Duodenal Perforation • IVC Injury • Grade III Liver Injury	Yes	5	45	• PD • Vascular Repair • Liver Primary Repair			1	N/A	N/A	N/A	5	• Hemorrhagic Shock	Death

F: Female, M: Male, ERCP: Endoscopic Retrograde Cholangiopancreatography, AAST-OIS: The American Association of Surgery of Trauma grading - Organ Injury Scale, PD: Pancreaticoduodenectomy, DP: Distal Pancreatectomy, POPF: Post-Operative Pancreatic Fistula Grades A/B/C, DGE: Delayed Gastric Emptying, BL: Biliary Leak, N/A: Not Applicable