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Pancreas Injury in Multiorgan Trauma Patients

Surgery Section

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ABSTRACT

Introduction: Pancreas injuries remain rare. However, when they occurr, they are extremely serious with a high mortality rate. For higher grades of pancreatic injuries surgical management, including damage control laparotomy, is recommended.

Aim: We present a series of patients with co existing pancreas trauma receiving surgery due to multiorgan trauma.

Materials and Methods: This retrospective study was conducted in the Department of General, Vascular and Trauma Surgery, Regional Specialist Hospital. 10191 patients have been hospitalised. Total 53 patients received surgery due to multiorgan trauma with co existing pancreas injury were evaluated.

Results: Patients had blunt trauma (92.4%), with a predominance of motor vehicle injuries (75.5%) as the cause. The pancreas injury specific sub scale of the American Association for the Surgery of Trauma proposed Organ Injury Scale, concomitant injuries, surgical management and mortality were presented.

Conclusion: Pancreas injuries are rare and mainly concern younger males and follow blunt abdominal traumas, predominantly from motor vehicle accidents. They are associated with a high mortality rate. The co existing injuries to other abdominal parenchymal organs are mostly severe. The surgery based on damage control concept is a treatment of choice for the most severe pancreatic injuries.

Keywords: Multiorgan trauma patients, Pancreatic injury, Polytrauma, Surgery

INTRODUCTION

Pancreas is a retroperitoneal gland, surrounded by other organs: duodenum, pylorus, spleen and vessels. Although, during abdominal trauma, pancreas is the most frequently injured endocrine organ, its injuries remain rare and are revealed in 0.2% of blunt abdominal traumas [1-4]. However, when occurred, they are extremely serious with a high mortality rate. When diagnosis of pancreas involvement in multiorgan trauma is delayed the mortality rates remain even higher. The rate of concomitant organ injuries is significant [5-7]. For higher grades of pancreatic injuries surgical management, based on damage control laparotomy for the most severe cases, is usually recommended [5,8-12].

We present a series of patients with co existing pancreas trauma receiving surgery due to multiorgan trauma. The demographic and clinical data, treatment modalities and outcome in this important, life threatening condition have been presented and discussed.

MATERIALS AND METHODS

The study was designed to evaluate the treatment modalities and outcome of multiorgan trauma patients with concomitant pancreas injury, undergoing surgery in the Level 1 Trauma centre. The retrospective study took into account 9 years of activity of the Department of General, Vascular and Trauma Surgery, since 2007. The data base including 10191 hospitalised patients had been searched. The inclusion criteria were multiorgan trauma with concomitant pancreas injury and surgical management. The exclusion criteria were isolated pancreas injury and non-surgical management. The evaluated parameters were gender, age, severity and location of pancreas injury, concomitant injuries, surgical approach and mortality.

We present a series of patients with co existing pancreas trauma receiving surgery due to multiorgan trauma. Patients who were not operated were not evaluated.

Out of 1091, 393 patients (3.9%) received surgery due to multiorgan trauma, while in 53 patients (13.5% of multiorgan trauma patients receiving surgery; 0.5% of all patients) co existing injury to the pancreas was revealed [Table/Fig-1]. These 53 patients receiving surgery due to multiorgan trauma with co existing pancreas injury were further evaluated.

Trauma	Number of Patients	% of Hospitalised	% of Trauma-related Hospitalisation	% of Multiorgan Trauma
Trauma-related Hospitalisations	1702	16.7		
Multiorgan Trauma	393	3.9	23.1	
Pancreas Trauma	53	0.5	3.1	13.5

[Table/Fig-1]: Injury to the pancreas.
Note: Total number of patients=10191

RESULTS

The 53 evaluated patients were 30 males (56.6%) and 23 females (43.4%), aged 18-74, with a mean age of 35 (23 years old for males, 37 years old for females). The forces leading to a multiorgan injury were blunt in the majority of cases (n=49, 92.4%), with a predominance of motor-vehicle injuries (n=40, 75.5% of all traumas, 81.6% of blunt traumas). The admittance of the other four patients (7.6%) followed penetrating traumas. Two of them (3.8%) underwent a gunshot injury.

The American Association for the Surgery of Trauma proposed Organ Injury Scale (AAST-OIS) [13] including pancreas injury specific sub scale [Table/Fig-2], which is a 5-point scale evaluating presence and extent of pancreatic hematoma and laceration. The extent of hematoma (minor or major, without duct injury or tissue loss) corresponds to the AAST-OIS Grades I-II. The depth of pancreatic laceration (from superficial without duct injury, through distal and proximal transection of pancreas, to massive disruption of pancreatic head) assign the injury to the AAST-OIS Grades from I to V [Table/Fig-2] [13]. In presented series the pancreas injury evaluation included:

AAST-OIS Grade of Pancreas Injury	Type of Injury	
	Haematoma	Laceration
I	Minor contusion without duct injury	Superficial laceration without duct injury
II	Major contusion without duct injury or tissue loss	Major laceration without duct injury or tissue loss
III		Distal transection or parenchymal injury with duct injury
IV		Proximala transection or parenchymal injury involving ampulla
V		Massive disruption of pancreatic head

[Table/Fig-2]: The American Association for the Surgery of Trauma - Organ Injury Scale (AAST-OIS) - the Pancreas Injury sub scale [13].

location of an injury and the AAST-OIS pancreas specific subscale [Table/Fig-3]. The most often injured part of pancreas was tail (n=28, 52.8%) and head (n=21, 39.6%), with 22.6% of injuries of its body (n=12). Out of our 53 patients, 23 (43.3%) presented with the AAST-OIS Grade I pancreatic injury, 16 patients (30.2%) with Grade II, 10 patients (18.9%) with Grade III, 2 patients (3.8%) with Grade IV and 2 patients (3.8%) with Grade V [Table/Fig-3].

AAST-OIS Grades of Pancreas Injury	n (%)
I	23 (43.3)
II	16 (30.2)
III	10 (18.9)
IV	2 (3.8)
V	2 (3.8)

[Table/Fig-3]: The quantity of consecutive grades of pancreas injury according to the American Association for the Surgery of Trauma - Organ Injury Scale (AAST-OIS) [13].

All our patients underwent a surgery due to multiorgan trauma. The most frequently co-injured organs were: spleen (n=43, 81.1%, with predominance of the AAST-OIS Grades III-IV), liver (n=38, 71.7%, with a predominance of the AAST-OIS grades III-IV), kidney (n=18, 34.0%, with a predominance of the AAST-OIS Grades III-IV), diaphragm (n=12, 22.6%), transverse colon (n=11, 20.7%), adrenal glands (n=8, 15.1%), urinary bladder (n=8, 15.1%), small bowel (n=7, 13.2%), ICV (n=6, 11.3%), stomach (n=2, 3.8%). There were also 12 cases (22.6%) of rib fractures and pneumothorax or pneumo-haemothorax [Table/Fig-4].

Organs Injured	n (%)	AAST-OIS Scaling system for organ specific injuries [13]
Spleen	43 (81.1)	I n=3; II n=9; III n=15; IV n=10; V n=6
Liver	38 (71.7)	I n=2; II n=8; III n=10; IV n=13; V n=5
Kidney	18 (34.0)	I n=1; II n=3; III n=6; IV n=5; V n=2
Diaphragm	12 (22.6)	-
Rib fracture	12 (22.6)	-
Pneumothorax and Pneumo-haemothorax	12 (22.6)	-
Colon	11 (20.7)	-
Adrenals	8 (15.1)	-
Bladder	8 (15.1)	-
Small Intestine	7 (13.2)	-
Inferior Caval Vein	6 (11.3)	-
Stomach	2 (3.8)	-

[Table/Fig-4]: Concomitant organ injuries in multiorgan trauma patients undergoing surgery.

The surgical approach to manage pancreas in the multiorgan trauma patients was laparotomy in each case. In 4 cases (7.6%) laparotomy needed to be completed with thoracotomy due to co-existing injury to the thorax. During the surgery the pancreas was managed with electrocoagulation (n=10, 18.9%), parenchymal sutures (n=32, 60.4%), tail resection (n=7, 13.2%) or damage control abdominal packing (n=4, 7.5%) in the most severe cases.

We noticed 19 in hospital deaths that equals 35.8% of in-hospital death rate, with 20.7% of intra-operative (n=11) and 15.1% of postoperative (n=8) death rates.

DISCUSSION

Due to its retroperitoneal location, pancreas is rarely injured. Despite improvement in diagnostic, that has been observed in recent years, injuries to the pancreas remain difficult to diagnose and are revealed in only 0.2% of blunt abdominal traumas [1-4,7]. They are almost always accompanied by injuries to the other organs and vessels [2,7]. Although, in the series presented in literature about three-fourth of patients treated with pancreatic trauma could be managed non-operatively, surgery may be avoided only in haemodynamically stable, repeatedly examined patients whose vital signs are monitored [6,13,14]. In present study only multiorgan trauma patients undergoing surgery were included to the evaluation.

In our group of 393 multiorgan trauma patients receiving surgery, the pancreas injuries were revealed in 13.5% of cases [Table/Fig-1]. There was a predominance of males (56.6%) in this group. The injured males were younger than females (32 vs 37 years old), what corresponds to the statistics showing predominance of males and younger individuals receiving treatment due to trauma, who are mostly victims of motor-vehicle accidents. Most cases of pancreas injury presented in literature followed blunt abdominal traumas [4,9,15,16]. In presented series the force leading to the multiorgan trauma and pancreas injury was blunt in 92.4%, with a predominance of motor vehicle accidents (81.6%). In 7.6% of cases the pancreas injury followed penetrating trauma. Out of them 50% were gunshot injuries. Although, gunshot injuries constitute half of penetrating traumas, they constitute only 3.8% of all trauma cases. This small percentage of gunshot injuries may be a result of a fact that possession of firearm is illegal. We could suppose that victims of the most severe motor vehicle traumas or gunshot injuries did not reach the hospital.

Although, the pancreas injury may be revealed and assessed on CT, it is much more difficult than injuries to the other abdominal parenchymal organs: liver, spleen, kidneys [1,5]. The most commonly used diagnostic modality in trauma patients is ultrasonography. It may detect a free fluid in the peritoneum, but in evaluation of parenchymal lesions is not very sensitive. Thus, CT remains a gold standard imaging modality for evaluating patients with pancreatic trauma [17]. Additionally, within several hours following the trauma, CT scans may reveal post-traumatic pancreatitis [1,9].

Number of complications corresponds to the severity of pancreas injury. For these, non operative management should be recommended for less severe pancreatic injuries (AAST-OIS Grades I-II), unless the surgery is required due to the injury to other organs. Operative management is usually recommended for the most severe pancreatic injuries AAST-OIS Grade III or higher [5]. Management of Grades III-IV is usually pancreatic resection, while Grade V usually needs a damage control abdominal packing [5,11,12].

We noticed that predominately involved were a head (39.6%) and a tail (52.8%) of pancreas. We also noticed a predominance of the AAST-OIS pancreas injury grades I-II (n=39, 73.5%) [Table/Fig-3]. The most severe injuries with proximal transaction of pancreas or massive disruption of pancreatic head (Grades IV-V) stated 7.6% (n=4). This proportion may go from a fact that the pancreas is not the only injured organ in multiorgan trauma patients. The large force, which cause the most severe injury to the pancreas, cause in the same time severe and potentially fatal injuries to the other organs [5,7].

When pancreas is involved, the trauma is always severe and extensive. The other organs are usually co-involved [2]. The associated injuries to other abdominal, thoracic and cranial organs are widely reported in the literature [1,2,9,14,15,18]. In our series we have observed a high percentage of injuries to other abdominal parenchymal organs: spleen (81.1%), liver (71.7%) and kidney (34.0%) [Table/Fig-4]. The injuries to these organs were predominantly in the AAST-OIS Grades III-IV, which stated 58.1%, 60.5% and 61.1% of all spleen, liver and kidney traumas, respectively. The co existing traumas to the digestive tube included stomach (3.8%), small bowel (13.2%) and colon (20.7%) injuries. We have also noticed 11.3% of ICV injuries and in these cases a vascular intervention was necessary. There were 12 patients with co existing thoracic traumas with rib fracture and pneumothorax or pneumo-haemothorax.

Damage control laparotomy is a significant advancement in modern trauma management [8]. This concept may be applicable in the management of severe multiorgan injuries including pancreas. In pancreatic injuries the damage control concept includes a haemorrhage control, an abdominal packing and a rapid abdominal closure [8,9,12]. Initially, the damage control laparotomy may save patient's life focusing the operation on life saving maneuvers, including bowel closure, external drainage of bile and pancreatic ducts and allows hypothermia, acidosis and coagulopathy correction [8,9]. Then, patients may undergo their planned laparotomy

and definitive pancreatic surgery with a final reconstruction within 48 hours following the initial damage control procedure [8,9,19]. This also allows to avoid extensive pancreatic surgery done by not experienced enough surgeon in the middle of the night [10]. In severe pancreatic trauma, surgery, including laparoscopy in selected cases, is a recommended treatment modality since it is associated with a lower mortality and a shorter hospital stay [6,20-22]. Presented series included a multiorgan trauma patients receiving surgery. They received laparotomy (100%) with a long midline incision, which is a widely recommended in the literature surgical approach [10]. In 4 cases (7.6%) laparotomy needed to be completed with thoracotomy due to the injury of thoracic organs, which needed to be treated as well. In the majority of cases the electrocoagulation (28.3%) or parenchymal sutures (60.4%) were used. In six cases tail resection was unavoidable [23], while 5 patients (9.4%) received the damage control packing. Packing is required in haemodynamically unstable patients in extremely bad condition, with severe pancreas injury, who can not receive an extensive pancreatic surgery. We have noticed 4 cases (7.5%) of the AAST-OIS Grades IV-V [Table/Fig-3] and these patients received damage control packing.

Pancreatic injuries are rare, yet their mortality rate is reported high [6,7]. Reported in literature mortality rates become even higher in case of delayed diagnosis and surgery. We have reported mortality rate of 35.8%, with 20.7% of intra-operative and 15.1% of postoperative mortality. The mortality rates are correlated with associated vascular, major visceral and extra-abdominal injuries, age over 55, shock on admission, ductal injury and delayed laparotomy as well as AAST-OIS pancreatic injury scale and a total number of co injured organs [7,15,19,24].

LIMITATION

The limitation of the study is a size of a sample. The sample is limited to 53 cases since only multiorgan trauma patients who receive surgery were evaluated (0.5% of all 10191 hospitalized patients). Continuation of this study may enlarge this sample and provide additional data in this rare, but important and life threatening condition, which pancreatic injury in multiorgan trauma patient is.

CONCLUSION

Pancreas injuries are rare, but when appear they are associated with a high mortality rate. In hospital, intraoperative and postoperative death rates are high and correspond to a severity of pancreas injury and a number of co injured organs. The pancreas injuries in the multiorgan trauma patients mainly concern younger males and follow blunt abdominal traumas, which predominantly are caused by motor-vehicle accidents. The co existing injuries to other abdominal parenchymal organs are mostly severe and are graded III and IV according to AAST-OIS. Despite good results of conservative treatment in less severe cases, the surgery including damage control concept is a treatment of choice for the most severe injuries. In severe pancreatic injuries surgery reduces mortality rates. In majority of cases pancreatic parenchymal sutures are sufficient, although in the most severe injuries the damage control abdominal packing saves a patient's life.

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