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SURGICAL TREATMENT OF PANCREATIC TRAUMA: DELINATION OF DETERMINANTS OF OUTCOME

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Abstract: *Pancreatic injuries are delayed in diagnosis, associated both with other injuries and autodigestion of both pancreatic tissue and surrounding structures. Aim of the study was to evaluate different lines of surgical treatment of pancreatic trauma and to delinate determinants of outcome.*

The study was done on 35 patients, with pancreatic trauma 28 males and 7 females, their age ranged from 6 years – 55 years with a mean age of 27.5 years at Mansoura University Hospital and Emergency Hospital, Faculty of Medicine, Mansoura University from April 1992 to August 2001. Blunt trauma in 13 (37.1%) patients , Penetrating in 15 (42.9%) patients and Gunshot in 7 (20%) patients. Head of the pancreas was injured in 9 (25.7%) patients , Body in 11 (31.4%) patients and tail in 15 (42.9%) patients.

Complete blood count, abdominal ultrasound abdominal CT were done. Serum amylase was not done. Modified Lucas classification was utilized: class I in 12 (35.3) patients , class II in 7 (20%) patients , class III in 9 (25.9%) patients , class IVa in 5 (14.3%) patients and Class IV_b in 2(5.7%) patients. Pancreaticduodecnetomy was done in 9 (25.7%) patients , closed external drainage in 15 (42.9%) patients and distal pancratectomy and splenectomy was done in 11 (31.4 %) patients .

Associated injuries were colon in 10 (28%) Splenic in 7 (20%) patients, hepatic in 5 (14 %) patients, doudenum in 9 (25.7%) patients , Gall bladder in two patients, superior mesenteric vessels in two patients , small intestine in three patients. GCS was of 10.3 and ISS was of 27.7. Complications included: pancreatic fistula in 6 (17%) patients, biliary leakage in one patient, intra- abdominal abscess in 6 (17%) patients , pancreatitis in 7 (20%) patients . pseudopancreatic cyst in 3 patients. No longer diabetes was seen. Mortality occurred in nine patients (28.7%) : Five died from multiple organ failure and one from duodenal leakage following second exploration for secondary hemorrhage after severe trauma ,three died at operation from massive hemorrhage. Pancreatic trauma can be managed by pancreatic resection, or closed external drainage with good results. Morbidity and mortality were related to associated renal failure, proximal duct injury, pancreatico-duodenectomy, Haematemesis and melena , spine injury and pancreatic fistula.

Key words: *Pancreatic trauma – management – determinants - outcome*

Abbreviations : *PD = Pancreaticoduodencetomy* *DP&S=distal pancreatecotomy and splencetomy*
ED= External Drainage. *US= Ultrasound*
CT= Computed Tomography *GCS= Galsgo Coma Scale*
ISS= injury severity score. TPN= Total Parental Nutrition

INTRODUCTION

Pancreatic trauma Justifiably causes concern for three reasons: first, the deep location of the pancreas may make diagnosis difficult and therefore delayed . Second, this location means that considerable force is needed to injure the pancreas and such force often damages the other organs (50-98 %) [1] reported. Third after injury pancreatic

enzymes may become activated and begin autodigestion of both pancreatic tissue and surrounding structures. [2]

The presence of a main pancreatic duct injury appears to be important when considering factors that lead to pancreatic morbidity [3] [4]

Pancreatic injury remains a challenge to the trauma surgeon. The mortality rate approximates 20 % and the morbidity rate remains high 36%. [5]

Most of the deaths are form massive hemorrhage usually not directly related to pancreatic injury. [6]

This study was done to evaluate different surgical lines of management of pancreatic trauma and to delinate determinants of outcome.

PATIENTS AND METHODS

Thirty – five patients , Twenty eight males and Seven females with pancreatic trauma were treated at Emergency hospital, and university hospital Faculty of Medicine , Mansoura University during the period from April 1992 to August 2001 with age ranged from 6 years to 55 years with a mean age of 27.5y. Blunt trauma in 13 patients (31.1 %) , penetrating in 15 patients (42.9 %) and Gun shot in 7 patients (20 %) .

Complete blood count , abdominal uls , abdominal CT were done in Seven patients. serum amylase was not done. Modified lucas classification was utilized.[7]

Following initial assessment and resuscitation , 28 patients with evidence of intra-abdominal hemorrhage or hollow viscus injury underwent laporatomy, in whom pancreatic injury was suspected based on strong index of suspicion,. In seven patients were operations performed more than (12) hours after injury .

Operative procedures: in 9 patients, pancreaticoduodenectomy was done. While in 11patients, DP&S was done who received long acting pencillin and pneumococcal polysaccharide polyvolent vaccine planned for five years post – operatively and in 15 patients ED was done using a Nelation tube number 28 Fr in adults and number 18 Fr in children.

Statistical analysis: Data were described by frequency. Chi-square test was used to test for association between prognosis and type of surgery. Discriminant analysis was used to select variables affecting prognosis. P was considered significant if < 0.05.

These tests were run on an IPM compatible PC using SPSS for windows statistical package. (SPSS Inc. Chicago.,IL)

RESULTS

A prospective study was conducted on 35 patients; 28 males and seven females With pancreatic trauma at Emergency hospital, and university hospital Faculty of Medicine, Mansoura University during the period from April 1992 to August 2001.

The grade and site of pancreatic injury are shown in table (1) . Class 4 injuries were occurred more in blunt and gun shot injuries. Injuries of the body were common after blunt trauma, while penetrating injuries affecting the tail more.

Table (2) shows associated injuries : visceral injuries were common after blunt trauma followed by gunshot injuries . Colonic injuries occurred in 10 patients 28%, followed by splenic injury 7 patients (20%) . In nine patients (7 immediate and 2 after 12 hours after injury) , seven with class IV pancreatic injury and two with class III injury, pancreatico-duodenectomy was done, four due to blunt trauma (road traffic accidents), three due to penetrating injury and two patients due to Gunshot injury. In whom there was major disruption of the pancreatic head and doudenum with significant injuries to the adjacent organs and major vessels (Table 2).

Three patients died intra-operatively due to exsanguinatinge hemorrhage and the other five patients died within an average period of 61days post-operatively due to multiple organ failure, one patient died for whom distal pancreatectomy & splenectomy was done due secondary hemorrhage after 27 days. Those six patients received surgical intensive care for variable periods. No mortality occurred in the drainage group. Tables (4), (5), (6),(7).

Table (1) *Mechanism, injury class and distribution:*

Mechanism	*Class of injury*					*Anatomic distribution*			*Pancreatic duct injury*			*Line of management*	
	I	*II*	*III*	*IVa*	*IVb*	*Head*	*Body*	*Tail*	*Proximal*	*Distal*	*PD*	*DP. And S.*	*D.*
Blunt N= 13	4	2	4	2	1	4	5	2	2	1	4	5	5
Penetrating N=15	5	4	3	3	0	2	3	11	1	0	3	4	7
Gunshot N=7	3	1	2	0	1	3	3	2	1	2	2	2	3
Total	12	7	9	5	2	9	11	15	4	3	9	11	15

Injury class by modified Lucas classification : PD = pancreatico – duodenectomy
DP and S. = Distal pancreatectomy and splenectomy D = Drainage.

Table (2): *Associated injuries*

	Blunt N=13	*Penetrating N= 15*	*Gun shot N= 7*	*Total N=35*
Colon	5	2	3	10 (28 %)
Duodenum	4	3	2	9 (25.7%)
Chest	2	1	5	8 (22 %)
Spleen	4	2	1	7 (20 %)
Liver	3	1	1	5 (14 %)
Limbs	2	0	3	5 (14%)
I.V.C	1	0	2	3 (8.5 %)
Small intestine	2	0	1	3 (8.5%)
Left kidney	2	0	1	3 (8.5%)
Spine	1	0	2	3 (8.5%)
Sup-mesn.vessels	1	0	1	2 (5.7 %)
Head	2	0	0	2 (5.7%)
Neck	1	0	1	2 (5.7 %)
Gall bladder	1	0	1	2 (5.7 %)
Total	31	9	24	
Mean number per patient	2.4	0.6	3.4	1.7
GCS	5.9	13	12	10.3
ISS	29	17.2	37.1	27.7

GCS = Glasgo Coma Scale. ISS = Injury Severity Score.
I.V.C. = Inferior Vena Cava .

Table (3): post- operative complications:

Complication	*Blunt N = 13*	*Penetrating N=15*	*Gun shot N=7*	*Total N =35*
Pancreatitis	3	2	2	7 (20%)
Heamatemesis & melena	3	2	2	7 (20%)
Pancreatic fistula	3	1	2	6 (17%)
Intra-abdominal abscess	4	0	2	6 (17%)
Pancreatic abscess	2	1	2	5 (14%)
Renal failure	2	1	2	5 (14%)
Pseudo pancreatic cyst	2	0	1	3 (8%)
Wound sepsis	5	2	3	10 (28%)
Atelectasis	2	0	0	2 (5.7%)
Pneumonia	1	0	1	2 (5.7%)
Post-operative hemorrhage	1	0	1	2 (2.7%)
Duod-leakage	1	0	0	1 (2.8%)
Biliary leakage	1	0	0	1 (2.8%)
Total	30	9	18	57
Mean complication Per patient	2.3	0.6	2.54	1.5

Table (4) *Mortality in relation to line of management.*

		Mortality		Total
		Survived	*Died*	
Drainage	n	15	0	15
	%	100.0%	0.0%	100
Pancreaticoduodenectomy	n	1	8	9
	%	11.1%	88.9%	100
Distal pancreatectomy	n	10	1	11
And splenectomy	%	90.9%	9.1%	100
Total	n	26	9	35
	%	74.3%	25.7	100

$X^2 = 25.59$ P<0.001

Table (5) *Discriminant function coefficient of variables predicting prognosis.*

	Unstandardized	*Standardized*
Renal failure	5.654	1.228
Proximal duct injury	4.412	1.145
Pancreaticoduodenectomy	3.417	0.809
Haematemesis and melena	2.268	0.558
Spine injury	2.114	0.584
Pancreatic fistula	-1.334	-0.516
Constant	-1.853	

Table (6) *Discriminant function group centroids (means).*

	Group centroids (means)
Survived	-1.897
Died	5.479

Table (7) *Prognosis predicted from discriminant analysis.*

			Predicted prognosis		
			Survived	*Died*	*Total*
Actual prognosis	Survived	***n***	26	0	26
		%	74.3%	0.0%	74.3%
	Died	**n**	0	9	9
		%	0.0	25.7	25.7%
	Total	**n**	26	9	35
		%	74.3%	25.7%	100.0%

Prognosis of 100 % of cases could be correctly predicted from the 6 variables included in discriminant analysis.

Associated injuries:

(Table 2) shows that, colon was injured in 10 patients, duodenum was injured in 9 patients, spleen in 7 patients, liver in five patients, fracture lumbar spine in 3 patients .The number of associated injuries per patient was more in gunshot trauma (3.4). With a mean number of 1.7 per patient.

Morbidity: (Table 3) shows post–operative complications related to pancreatic trauma: pancreatic fistula occurred in 6 (17%) patients, intra- abdominal abscess in 6 (17%) patients , Haematemesis and Melena in 7 (20%) patients, pancreatic abscess in 6 (17%) patients, pancreatitis in 7 (20%) patients. Both biliary leakage and duodenal leakage in one patient, wound sepsis in 28%. Pancreatic fistula was common in blunt trauma and in injury of the head. It was managed by drainage, total parentral nutrition, protection of the skin and somatostatin twice- daily subcutaneous injections and all closed spontaneously within an average period of 96 days.

Pancreatic duct injury was detected in 7 (20%) patients, 4 proximal and 3 distal, one was managed by PD, 2 by DP and 4 managed by drainage in whom pseudocyst developed in two patients one was managed by CT guided drainage and the other by cysto–gastrostomy. No operative pancreatography was done.

DISCUSSION

The pancreas is well protected because of its central location within the abdomen and by shielding from the resilient rib cage, so pancreatic injury is usually indicator of very severe abdominal trauma. Stab wounds of the abdomen rarely reach the pancreas; gun shot wounds injure the pancreas ten times as frequently. [8],[9] In pediatrics, pancreatic trauma occurs in up to 10% of all cases obblunt trauma. [9,10,11] and in 87% it was due to motor vehicle crashes in another studies [12,13]. In our study, mechanism of pancreatic injury was blunt in (37.1%), penetrating in 42.9% and Gunshot in 20%. Most pancreatic contusions are capsular lacerations (Grade I to III) account for about 75% of all pancreatic injuries [3] . In our study, pancreatic injuries (Grade I,II,III) account for 80%.

Injuries to the other abdominal organs including major vessels, liver, spleen, colon, duodenum, stomach are present. There is a very high incidence of associated injuries with figures of 50-98%. [5] It is usual to find many organs injured in the same patient; the main number may vary from 3.5 to 4.3 [14]. In our study it was 1.7 .Diagnosis of pancreatic injury can be extremely difficult. ACT scan may appear normal in 40% of significant pancreatic injures and serum amylase is generally unreliable as a diagnostic test [1] [9] [16]. A number of 28 patients (80%) in the study were explored due to other abdominal injuries in whom pancreatic injuries were detected, pancreas was thoroughly explored through the lesser sac, duodenal kocherization and division of the posterior layer of leino–renal ligament- this rate was 83.9% in another study [3]. In 7 patients who are haemodynamically stable, abdominal CT was done and exploratory lapratomy was done 12 hour later. In all of the patients, treatment of pancreatic injuries depended on injury class and in seven patients pancreatic duct injuries were detected. Some authors advocate stenting of duct injuries at the time of acute ERCP with avoidance of major abdominal operation in a child, distal pancreatectomy or drainage in proximal duct lesions. No either stenting of pancreatic duct, or pancreatography was done in the current study. Pancreatic fistula is the most common of pancreatic morbidity and reported in a rates from (2.3%- 26%)[16,19,20]. It occurred in 17% in the current study and was common in the group managed by external drainage.

Pancreatic abscess formation after pancreatic trauma ranges from 10% - 25% [14,16] It was 17% in our study and managed conservatively Pseudocyst: incidence of 2% was reported [16,17]. While a rate of 1% in patients treated with sump drainage, 7% in patients treated with passive drainage 3% in patients treated distal resection [18].Pancreatitis developed after pancreatic trauma in a rate 20% [17,18] with 100% mortality if haemorrhgic pancreatitis complicated. In our study, incidence of pancreatitis was 20% more common after blunt trauma. Treatment was nasogastric suction, bowel rest and TPN.

Post – operative haemorrhage: it is related to leakage of pancreatic juice or abscess development resulting in erosion of major adjacent vessel. [17] It occurred in two patients one of them died on the 27th post – operative day. Wound sepsis incidence of 10-39% reported. particularly common after colonic injuries [17] It was 28% in our study.

Hospital stay, it was reported longer in blunt and gun shot injuries than in penetrating injuries [21] in our study, hospital stay in the 26 survivors was as follows (28, 32, 19) days for blunt, gun shot and penetrating trauma respectively.

Most deaths in pancreatic injuries are related to associated injuries. Rates of 19% with blunt trauma and 22% with penetrating trauma. 67% gun shot were reported [4] [21] while mortality due to isolated injuries ranged between 3-10%. No isolated pancreatic injury was seen in this study.

Trauma to the pancreatic head had a mortality rate of 20% compared with 12% for the body and 10% for the tail, this may be due to higher incidence of trauma to the duodenum and major vascular structures [1], [2] In other studies, site of injury showed no significant difference on mortality. [3] , [5]. In our study, eight of the nine patients for whom pancreaticoduodenectomy was done were died (88-9%), while only one patient of eleven (9.1%) was died from the group of distal pancreatecotomy and splenectomy.

The number of associated injuries also affects the mortality rates; 2.5% mortality with no or one associated injury, 13.6% with two or three and 29.6% with four or more [22] In our study, incidence of associated injuries was 3.4% per patient due to gun shot injury and 2.4 per patient due to blunt trauma. Most death are due to hemorrhage and shock and occur within the first 24 – 48 hours in a rate of 65% - 75% [2] ,[17] Later deaths are usually caused by sepsis and pulmonary complications. [1] In our study, three patients (8.5%) died intra- operatively, five died within an average period of 61 days post – operatively and another patient died within 27 days post- operatively due to two explorations for control of secondary hemorrhage.

On conclusion : Priorities in treatment of pancreatic trauma were for control of associated internal hemorrhage and intestinal injury. The pancreas should be carefully evaluated intra- operatively.

- Drainage or distal pancreatectomy and splenectomy is advised to be the usual treatment for Grade I and Grade II injuries.

- Thorough exploration for pancreatic duct injuries is essential. However we do not recommend intra- operative pancreatography in the acute stage.

- Grade III, IV injuries without duct injury are best treated by external closed drainage.

- In cases of duct injury with pancreatic lacerations or uncontrollable bleeding, resection is done with accepted high mortality of pancreatic- duodenectomy.

- Determinants of outcome of treatment included the following Factors: Renal failure, proximal duct injury, pancreatioduodenectomy, Haematemesis and melena, spine injury, and pancreatic fistula.

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