Operative dilemmas in pancreaticoduodenal injuries

Dr. Haithem Abd Al.Khazrajee
University of Missan-College of Medicine

Abstract:

A prospective study of 20 patients with pancreaticoduodenal injury over a period of more than 10 years, in this study we try to assess the best operative intervention for management of these injuries, minimal surgical intervention with simple gastroduodenal diversion like gastrojejunostomy was easy, simple and rapid method for management of these injuries with postoperative complications and mortality rate comparable to other studies worldwide and in nearby countries.

Key words: pancreatic injury, duodenal injury, operative treatment.

Introduction:

Injury of pancreas is relatively rare. Its incidence is about (1-2%) in both closed and open abdominal injury [1],this is probably related to its retroperitoneal position. And because of its relation to the duodenum, injuries of the pancreas may be associated with injury to the duodenum and the management of these injuries will affect both organs from both physiological and anatomical point of view. Deferent scaling systems are available to assess the severity of injury, The American Association for the Surgery of Trauma - Organ Injury Scoring Scale is currently used nowadays for assessment of these injuries [tables 1,2].

Table 1:The American Association for the Surgery of Trauma - Organ Injury Scoring Scale for the pancreas[2].

Grade*	Type of Injury	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 ampulla
V	Laceration	Massive disruption of pancreatic head

*Advance one grade for multiple injuries up to grade III.

Table 2:The American Association for the Surgery of Trauma - Organ Injury Scoring Scale for the duodenum[2].

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
	Vascular	Devascularization of duodenum

*Advance one grade for multiple injuries up to grade III.

Pancreatic injuries can be treated by:

1. External drainage alone. Or,
2. Simple suture plus drainage (pancreatorrhaphy). Or,
3. Distal pancreatectomy with and without splenic preservation.

(All pancreatic injuries must have their ductal integrity evaluated. When pancreatic resections are performed, all attempts should be made to locate the pancreatic duct and individually ligate it).

Duodenal injuries can be treated by:

1. Primary repair with external drainage. Or,
2. Primary repair with tube duodenostomy.
3. Jejunal serosal patch pedicled grafts (ileum, jejunum, stomach),
4. Segmental resection (duodenoduodenostomy,duodenojejunostomy),

5. Duodenal diverticulization (vagotomy, antrectomy, gastrojejunostomy, duodenorrhaphy, and external drainage).
6. Pyloric exclusion (closure of the pylorus with a non-absorbable suture and gastrojejunostomy.
7. Pancreaticoduodenectomy (Whipple's procedure) for massive and uncontrollable bleeding from the head of the pancreas, adjacent vascular structures, or both, unreconstructable ductal injury in the head of the pancreas and/or combined unreconstructable injuries of the duodenum, head of the pancreas, and common bile duct.[3]

The aims of the study:

1. To verify the best operative procedure that can be used for treatment of different pancreaticoduodenal injuries.
2. To assess the possible post-operative complications that occur in association with these procedures.

Patients and methods:

This is a prospective study of 20 patients with pancreaticoduodenal injury who have been diagnosed operatively at Al-Zahrawi surgical hospital ;in Maisan, Iraq, for about 13 years; from June 2003 To March 2015.

Most of these patients have been followed for about 3- years postoperatively for their outcome, postoperative complications aiming to verify, if there is any factor which is related to different operative procedures; which might have an impact on postoperative coarse of these patients.

The factors that have been evaluated are, demographic features, grades of injury, type of operative procedure, associated organ injury and postoperative complications including mortality.

The operative procedures used in this study were one or more of the following:

1. Simple repair of the pancreatic or duodenal injury with tube drain.
2. Repair of the duodenal injury with decompressive tube duodenostomy.
3. repair of the pancreatic or duodenal injury with diversion (gastrojujenostomy or cholecystojujenostomy).
4. Distal pancreatectomy with splenectomy.
5. Whipple 's procedure.

Statistical analysis:

Fisher s exact test was used for Statistical analysis and p-value < 0.05 considered Statistically significant.

Results:

20 patients with pancreaticoduodenal injury 15 males; 5 females undergone operative management, common age groups were 2nd and 3rd decade of life [figure 1].

Gradings shows these patients are mainly grades II- IV. And they are mainly affected by penetrating injury [table 3] .

Primary repair of duodenal injury with simple tube drain done in 5 patients.

Pancreatic wound debridement with simple tube drain done in 3 patients.

Decompressive tube duodenostomy was done for two patients; the first patient with isolated duodenal injury (this patient was suffered from extensive loss of duodenal wall in the second part of duodenum). The second patient was suffered from combined pancreatic and duodenal injury of the second part of duodenum (duct was apparently intact).

Gastrojejunostomy done in 6 patients with duodenal injury, whereas 4 patients with pancreatic injury requires gastrojejunostomy as a part of their surgical procedure.

Cholecystojujnostomy was done in one patient who had injury to supraduodenal part of common bile duct, first part of duodenum and pancreatic head(bullet injury) ;T-tube drain used for common bile duct injury; unfortunately this patient died on 8th post-operative day because of septicemia.

One patient with grade III blunt pancreatic injury undergone damage control surgery; then a second stage surgery done as distal pancreatectomy and splenectomy, this patient was admitted to hospital 5 years later as a case of upper gastrointestinal hemorrhage and portal hypertension.

Whipple s operation was done in one patient with grade IV pancreatic injury (this was referred to Medical City, Baghdad, where they do this complicated surgery for him).[Table 4].

Small bowel; colon and stomach were the commonest associated injury. 2 patients had non expandable lateral zone retroperitoneal hematoma, one patient suffer from head injury (subarachnoid hemorrhage with Glasgow coma scale of 9). [Table 5].

The commonest postoperative complication was adult respiratory distress (ARDS) (55%). Fistula formation (35%). Wound infection (15%) and postoperative pneumonia (15%).[Table 6].

3 patients died postoperative within one week postoperatively (mortality rate 15%). One patient because of ARDS on 7th post-operative day the other two patients died because of septicemia and multiple organ failure on 8th postoperative day.

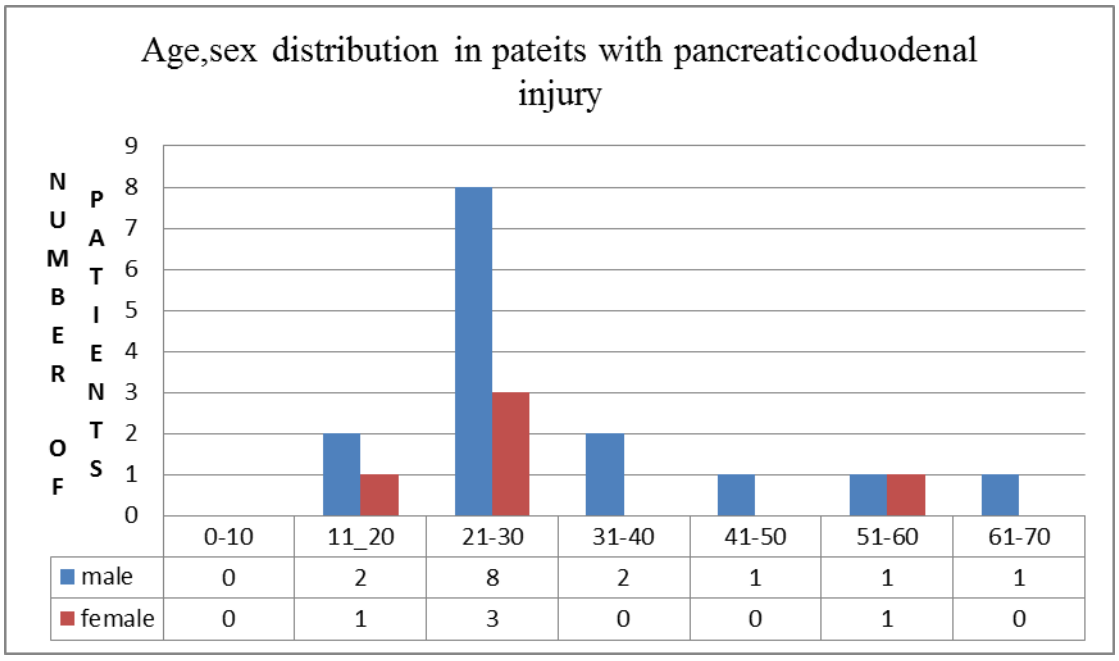

Figure.1

Table 3: Injury scoring scale for patients with pancreaticoduodenal injury.

AAST Grading	Duodenal injury		Pancreatic injury	
	Blunt injury	Penetrating injury	Blunt injury	Penetrating injury
Grade I	0	1	0	0
Grade II	1	3	1	2
Grade III	0	6	1	3
Grade IV	0	1	1	0
Grade V	0	0	0	0
Total	12		8	

Table 4:Operative procedures in 20 patients with pancreaticoduodenal injury

Operative procedure	Site of injury	Grade of injury				
		I	II	III	IV	V
Repair with tube duodenostomy	Duodenal injury				1	
	Pancreatic injury			1		
Repair with gastrojejunostomy	Duodenal injury			6		
	Pancreatic injury		2	2		
Cholycystojejunostomy	Duodenal injury				1	
	Pancreatic injury					
Repair with simple tube drainage only	Duodenal injury	1	4			
	Pancreatic injury		2	1		
Distal pancreatectomy and splenectomy	Duodenal injury					
	Pancreatic injury			1		
Whipple s operation	Duodenal injury					
	Pancreatic injury				1	

*One patient may have more than one operative modality.

Table 5:Associated pancreaticoduodenal injury in patients with injury

site	Number of patients
diaphragm	1
Bile duct	2
liver	2
stomach	6
Small bowel	7
colon	5
Retroperitoneal hematoma	2
Inferior vena cava	1
Subarachnoid hemorrhage	1

Table 6:Post-operative complications in patients with pancreaticoduodenal injury.

Complications	Site of injury	Grade of injury					Total (%)
		I	II	III	IV	V	
Wound infection	Duodenal injury			2			3 (15%)
	Pancreatic injury			1			
Wound dehiscence	Duodenal injury		1				2 (10%)
	Pancreatic injury			1			
Incisional hearnia	Duodenal injury		1				1 (5%)
	Pancreatic injury						
Fistula formation	Duodenal injury		2	3			7 (35%)
	Pancreatic injury			2			
Pleural effusion	Duodenal injury						2 (10%)
	Pancreatic injury		2				
Pneumonia	Duodenal injury						3 (15%)
	Pancreatic injury		2	1			
Gastrointestinal hemorrhage	Duodenal injury		1				2(10%)
	Pancreatic injury			1			
Peritoneal abscess	Duodenal injury						1 (5%)
	Pancreatic injury			1			
Adult respiratory distress syndrome	Duodenal injury		3	5			11 (55%)
	Pancreatic injury		1	2			
Deep vein thrombosis	Duodenal injury			1			2 (10%)

	Pancreatic injury			1			
Portal hypertension	Duodenal injury						1 (5%)
	Pancreatic injury			1			
Death	Duodenal injury		1	2			3 (15%)
	Pancreatic injury						

Discussion:

This study shows that the majority of pancreatico-duodenal injuries are of grade II and III (AAST). This can be explained by the fact that most of patients with grade I may be managed by conservative treatment[4]; whereas patients with grade V they may be so severely injured and die before reaching operating room. The main operative strategy was primary repair of the injured site with gastro-jejunostomy diversion. Other series use gastrojujenostomy diversion as a part of duodenal diverticulizatin of injured duodenum.[5]

More complex procedure may be required for treatment of extensive pancreaticoduodenal injury, an important point to be remembered that most of patients with pancreaticoduodenal injury are severely injured patients and they will benefit a lot from short course simple and rapid surgical procedure, and some of them may require damage control surgery as first stage then followed by definitive surgery as a second stage surgery[6].

One patient in our study need cholecystojejunostomy and T- tube drainage for gunshot injury to the pancreas ,the 1st part of duodenum and the supraduodenal portion of the common bile duct, Lopez et al they were use cholecystojejunostomy in patients with common bile duct injuries associated with combined pancreaticoduodenal injury (as a method of internal biliary decompression) [7]. Wilson R.F. et al they were use biliary and pancreatic system decompression by cholecystostomy in patients with combined pacreaticoduodenal injury with a survival rate of 86% [8].

Because of the anatomically protected site of duodenum and pancreas, associated organ injury will be a rule rather than an exclusion, and injuring force should be so severe that will result in injury to other organs, in our study the most frequent associated injury was in the small bowel; where as in other series may be the stomach [9,10] ,or the liver [11].

In this study the main post-operative complication was adult respiratory distress syndrome (55%), even though the response to conservative treatment of

ARDS was good response, we thought this is attributed to the fact that diversion of gastroduodenal contents (by gastro-jejunostomy), makes area of injury at a relative rest which permits rapid and easy healing of the injured site. Other series shows that adult respiratory distress syndrome occur in about 7% of their patients; Jansen A. et al. and Farrell et al [12,13].

Postoperative fistula was found in 35% of the patients which is higher than others like Madiba T. E. et al they found that postoperative fistula formation occur in the range of 7-20% [11]. All patients with fistula in our study respond to conservative treatment with parenteral nutrition and antibiotic and their fistulae closed after 2-6 weeks.

Thrombotic disease seen in two patients as deep vein thrombosis; and they received warfarin for more than 2 years. M. Ashraf Mansour, et al. shows axillary vein thrombosis in one patients[14], Jansen A. et al., They had one patient with pulmonary embolism[12].

One patient in our study suffers from portal hypertension and upper gastrointestinal hemorrhage 2 years after distal pancreatectomy and splenectomy for pancreatic transection , this is may be attributed to splenic vein thrombosis[15,16].

The mortality rate of our study is 15% is comparable to other studies in nearby countries and other studies in the world [table 7].

study	Year of the study	Number of patients	Mortality	p-value*
Mansour [14]	1989	62	19%	p-value< 0.05**
Farrell [13]	1996	51	10%	p-value< 0.05
El-Boghdadly S.[17]	2000	22	22.7%	p-value> 0.05***
Lopez[7]	2005	33	18%	p-value> 0.05
Present study	2015	20	15%	

Table 7:Comparison of mortality rate of deferent studies

* p. value was obtained as compared to present study.
** p. value is significant.
*** p. value is not significant.

Limitations of the study:

1. This type of injury is relatively uncommon injury ,so our experience in the best approach for management is still limited.
2. Most of the series that discuss this subject are of small number of patients samples.
3. The anatomical site of the pancreas and duodenum makes the list of the opinion about the management of their injury a long list.

Conclusions:

1. Simple surgical repaire (primary repaire with tube duodnostomy or gastrojejunostomy) of pancreaticocoduodenal injury is effective option in majority of patients .
2. More complex repair (pyloric exclusion,duodenal diverticulazation, pancreaticoduodenectomy) may be needed for high grade injury (grade IV,V).

REFERENCES:

1. Northrup WF, Simmons R.L. : Pancreatic trauma: a review. Surgery. 1972 Jan;71: Page 27-43.
2. Moore EE , Cogbill TH, Malangoni MA , Jurkovich GJ , Champion HR , Gennarelli TA , McAninch JW , Pachter HL , Shackford SR ,Trafton PG: Organ injury scaling, II: Pancreas, duodenum, small bowel, colon, and rectum. The Journal of Trauma 1990; 30(11): Page 1427-1429.
3. J. A. Asensio, P. Petrone, G. Roldán, R. Pak-art, A. Salim: Pancreatic and duodenal injuries; complex and lethal. Scandinavian Journal of Surgery 2002; 91: Page 81–86.

4. George C. Velmahos , Malek Tabbara, Ronald Gross, Yuchiao Chang: Blunt Pancreatoduodenal Injury. Archives of Surgery 2009; 144(5): page 413-419.
5. John Anane- Sefah M D ; Lawrence W. Norton, M D; Ben Eiseman, M D. Operative choice and technique following pancreatic injury: Archive of Surgery1975 ; 110 :Page 162- 166.
6. A. Hirsberg, K. L. Mattox. 'Damage control' in trauma surgery: British Journal of Surgery. 1993 December ;80(12): page 1501-1502.
7. Lopez Peter P.; Benjamin Robert; Cockburn Mark; Amortegui Jose D; Schulman Carl I. ; Soffer Dror; Blackbourne Lorne H.; Habib Fahim ; Jerokhimov Igor; Trankel Susan ; Cohn Stephen M. Recent Trends in the Management of Combined Pancreatoduodenal Injuries: The American Surgeon, Volume 71, Number 10, October 2005, page 847-852.
8. Wilson, R.F. ; Tagett J. P. ; Pucelik, J. P.; Walt, A. J. Pancreatic trauma: Journal of Trauma. September 1967 - Volume 7 - Issue 5 – page 643-651.
9. Thomas H. Cogbill, MD; Ernest E. Moore, MD; Jeffry L. Kashuk, MD: Changing Trends in the Management of Pancreatic Trauma. Archives of Surgery. 1982;117(5):page 722-728.
10. Fabian TC, Kudsk KA, Croce MA, Payne LW, Mangiante EC, Voeller GR, Britt LG. Superiority of closed suction drainage for pancreatic trauma. Annuls Surgery. 1990 June ;211(6): page 724-728.
11. T. E. Madiba , T.R. Mokoena. Favorable prognosis after surgical drainage of gunshot, stab or blunt trauma of the pancreas. British Journal of Surgery. 1995 September;82(9): page 1236-1239.
12. Jansen M, Du Toit DF, Warren BL. Duodenal injuries: surgical management adapted to circumstances. Injury. 2002, 33(7): page 611-615.
13. R. J. Farrell, J. E. J. Krige, P. C. Bornman, J. D. Knottenbelt and J. Terblanche. Operative strategies in pancreatic trauma. British Journal of Surgery. 1996 July ;83(7): page 934-937.
14. M. Ashraf Mansour, MD, John B. Moore, MD, Ernest E. Moore, MD Frederick A. Moore, MD. Conservative management of combined pancreatoduodenal injuries: The American Journal of Surgery. Volume 158, Issue 6, December 1989, Pages 531-535.
15. Debi U, Kaur R, Prasad KK, Sinha SK, Sinha A, Singh K. Pancreatic trauma: A concise review: World Journal of Gastroenterology. 2013 December 21;19(47): page 9003-9011.
16. Kantharia C.V., Prabhu R.Y., Dalvi A.N., Raut A., Bapat R.D., Supe A.N. Spectrum and outcome of pancreatic trauma: Tropical Gastroenterology. 2007 July-September;28(3): page 105-108.

17. Sami El-Boghdadly, Zyad Al-Yousef, Khalid Al Bedah. Pancreatic injury: an audit and a practical approach: Annuls of Royal College of Surgery of England. 2000; 82: page 258-262.

العلاج بالجراحة في جروح الاثني عشري والبنكرياس

الخلاصة:

الدراسة شملت عشرين مريضا على مدى اكثر من عشر سنوات لمرضى يعانون من جروح مختلفة الشدة لمنطقة الاثني عشري و البنكرياس . خلال الدراسة تم البحث في الطرق الجراحية المختلفة لعلاج هذه الحالات، وكذلك تقييم المضاعفات التي تحدث ما بعد التداخل الجراحي. و قد بينت النتائج ان استعمال اساليب جراحية بسيطة وسريعة تعطي نتائج مقبولة ونسب وفيات مقاربة ومقارنة لنتائج مستحصلة في مناطق مختلفة من العالم والمناطق المجاورة للعراق.