

Penetrating Duodenal Injuries – Our Experience

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This prospective study was conducted over a period of two years from January 2000 to December 2001 in West Surgical Ward, Mayo Hospital, Lahore. Thirteen patients were admitted through Accident and Emergency Department with firearm and stab injuries of abdomen. All patients were male and underwent exploratory laparotomy. Seven (53.84%) patients had grade II duodenal injuries. Among surgical options duodenorrhaphy in two layers was carried out in 9 (69.23%) patients, pyloric exclusion in 1(7.69%), Whipple's procedure in 1(7.69%) patient. Major postoperative complications noted in the series were duodenal fistula in 2 (15.38%) and intra-abdominal abscess in 2 (15.38%) patients. There were 3 (23.07%) deaths in the study.

Key words: Penetrating injury, duodenorrhaphy, gastrojejunostomy, Whipple's procedure, duodenal fistula.

Fortunately for mankind medical scientists have constantly come forward with methods to conquer many of the man's most serious illnesses and for a number of years a steady increase in life span attests to a positive balance in this battle with disease. But as diseases rise and fall in prevalence and virulence, trauma is one of mankind's bodily afflictions which seems destined to remain with us forever or at least for as long as the human spirit occupies a body in the solid state.

Trauma as a disease has been ignored by many for too long. Many still believe that trauma only affects the poor, the criminal element and minorities yet nothing could be further from the truth. Armed conflict has always provided the surgeon with an opportunity to advance the science of trauma surgery. Trauma is a worldwide phenomenon with a host of different modalities from war and violent crime to road and domestic accidents.

Treating a patient with multiple organ injuries is truly a team activity bringing to bear expertise from a wide variety of disciplines to minimize morbidity and mortality.

Duodenal injuries can pose a formidable challenge to the surgeon and failure to manage it properly may have devastating results. The surgeon is confronted with dilemma of choosing between several pre-operative investigations and surgical procedures. Detailed knowledge of available operative options and their correct application is the milestone while managing duodenal injuries. Among penetrating duodenal injuries 75-80% are due to gunshot wounds¹.

The retroperitoneal location of the organ and its close proximity to a number of other viscera and major vascular structures means that isolated penetrating injury of the duodenum itself is rare. Exploration is usually dictated due to associated organ injuries and diagnosis is usually made on operation table. Particularly for gunshot wounds a trajectory into abdomen always warrants exploration.

Patients and methods

Aims and objectives of the study were to highlight the various operative procedures for treating the penetrating duodenal injuries according to their severity, their efficacy

and early detection and management of post-operative complications. The study was conducted in West Surgical Ward, Mayo Hospital, Lahore for a period of two years. All the patients presenting in emergency with firearm and stab injuries of the abdomen having duodenal injury per-operatively were included in the series. Haemodynamically unstable patients (46.15%) were directly shifted to emergency operation theatre for on-table resuscitation and exploration while stable patients (53.85%) were shifted for exploration after necessary and relevant investigations. Exploratory laparotomy was done in all patients and associated organ injuries were managed according to their own protocols. Antibiotics, Tetanus toxoid and analgesics were given to all patients and were kept nil by mouth post-operatively for 5 to 7 days. Hospital stay varied from 7 to 29 days with the mean of 13.67.

Results

Thirteen patients were included in the study in whom duodenal injury was detected per-operatively. Age of the patients ranged from 18 to 45 years with the mean of 30.27 (Table 1). All patients in the series were male.

Table 1: Age/sex incidence

Age in years	n=	%age
18-30	7	53.85
31-40	4	30.77
>41	2	15.38
Sex		
Male	13	100
Female	-	-

Cause of injury in 11(84.62%) patients was firearm and in 2(15.38%) stab injury. Regarding the parts of the duodenum involved, 2nd and 3rd parts either alone or in combination were mainly injured in the series (Table 2).

Duodenal injury was graded according to the Moore EE et al² and the American Association for the Surgery of Trauma (Table 3).

After grading the severity of the duodenal injury, various operative procedures were performed (Table 4). Associated organ injuries were detected and managed

according to their own priority. Stomach, small and large intestine, pancreas, inferior vena cava, superior mesenteric vein, femoral artery and kidney were among associated injured organs.

Table 2: Parts of the duodenum injured

Part injured	n=	%age
1 st	-	-
2 nd	4	30.77
3 rd	4	30.77
4 th	1	7.69
2 nd and 3 rd	4	30.77

Table 3: Grades of duodenal injury (According to Moore's organ injury scale II)

Grade	n=	%age
I	-	-
II	7	53.85
III	4	30.77
IV	1	7.69
V	1	7.69

Table 4: Operative procedures performed.

Procedure	n=	%age
Duodenorrhaphy in two layers	9	69.24
Repair, pyloric exclusion and gastrojejunostomy	1	7.69
Repair and gastrojejunostomy	1	7.69
Partial duodenectomy with gastrojejunostomy and cholecystojejunostomy	1	7.69
Whipple's procedure	1	7.69

All the patients were kept nil by mouth post-operatively for 5 to 7 days. Daily progress of all patients was observed keenly for immediate detection of post-operative complications, if any and their management (Table 5).

Table 5: Post-operative complications along with management

Complication	n=	Management
Duodenal fistula	2	Conservative (7.69%) Re-exploration (7.69%)
Intra-abdominal abscess	2	Conservative (7.69%) US guided aspiration (7.69%)
Acute pancreatitis	1	Conservative (7.69%)
Respiratory tract infections	4	Conservative (30.77%)
Wound infection	1	Conservative (7.69%)

There were 3(23.07%) deaths in the series. There were two on-table deaths and third patient died on 15th post-operative day due to sepsis and multiple organ failure.

Discussion

Lying deep within the abdomen, the duodenum is well protected in the retroperitoneal space. The duodenum shares its blood supply with the head of pancreas, derived

from the celiac and superior mesenteric vessels. Duodenum is a hot organ. The amount of fluid passing through the duodenum exceeds 6 liters / 24 hours. Duodenal fistula may cause serious fluid and electrolyte imbalance with destruction of surrounding structures and excoriation of skin.

Duodenal injuries are uncommon and are found in only 3.7% of all laparotomies for trauma. Primary repair is successful in the majority of duodenal injuries but in complex duodenal injuries or massive injury to pancreatic-duodenal-biliary complex, the management is very difficult and confronting problem for a trauma surgeon.

Cause of injury was firearm in 11(84.62%) and stab in 2(15.38%) patients. This is in comparison with the study conducted by Asensio JA et al³ where firearm was a cause of injury in 80.5% of cases and stab in 19.5% of patients.

In our study 2nd part was found to be injured in 4(30.77%), 3rd part in 4(30.77%), 2nd and 3rd parts in combination in 4(30.77%) and fourth part in 1(7.69%) patients. This compares with the study conducted by Ivatury RR et al⁴ and Ivatury RR et al⁵ where they found that 2nd part of the duodenum was injured in 35% of the cases, 3rd and 4th parts were each injured in 15% of the cases and 1st part in 10% of their cases.

The appropriate technique of repair for duodenal injuries depends on injury severity and elapsed time from injury to treatment. Approximately 80 to 85% of duodenal injuries can be primarily repaired by simple procedures like debridement and primary repair^{4,6} or resection and end to end anastomosis without or with tube decompression⁷. The incidence of complex duodenal injuries is fortunately low ranging from 15-20% that require more complex procedures as duodenal diverticulization⁸, pyloric exclusion⁹ to exclude the duodenal repair from gastric secretions and allow time for adequate healing of the duodenal repair and Whipple's procedure¹⁰ for massively destructive lesions.

In our study duodenorrhaphy in two layers was done in 9(69.24%), duodenal repair with pyloric exclusion in 1(7.69%), resection, closure of ends, pyloric exclusion and tube duodenostomy in 1(7.69%) and Whipple's operation in 1(7.69%) patients. Flynn WJ et al¹¹ treated 19(100%) of their patients with duodenal injury by duodenorrhaphy with or without tube decompression. This is in comparison with our study in which we treated 9(69.24%) patients with duodenorrhaphy. In our series, complex operative procedures were applied in 4(30.76%) patients which compares with the study conducted by Marten TD et al¹² and Kashuk JL et al¹³ where they noted that 41% and 48% of their patients required complex procedures for duodenal injury repair. Whipple's operation was done in 1(7.69%) patient in our series which is in comparison with the study conducted by Feliciano DV et al¹⁴ where they performed this procedure in their 10.07% patients.

The incidence of complications after duodenal injury is very high ranging from 30% to 100%^{6,15}. The most

significant complication following the treatment of duodenal injury is the development of duodenal fistula from suture line dehiscence which occurs in 5 to 15% of cases¹⁶ which is in resemblance with our study where duodenal fistula was observed in 2 (15.38%) patients. One patient was managed by making him nil by mouth, nasogastric aspiration, total parenteral nutrition and antibiotics and re-exploration was done in other patient in whom pyloric exclusion, tube duodenostomy and gastrojejunostomy was done. Acute pancreatitis in 1(7.69%) and intra-abdominal abscess in 2(15.38%) patients which is in resemblance with the study carried out by Asensio JA et al³ where they noted acute pancreatitis in 2.5 to 14.9% and intra-abdominal abscess in 10.9 to 18.4% of their cases. Other post-operative complications observed in the series were respiratory tract infections in 4 (30.77%) and wound infection in 1(7.69%) patients.

Mortality rate in our study was 23.07% (3 deaths). Two were on-table deaths due to exsanguination, massive trauma and major vascular injury. One patient died on 15th post-operative day due to development of duodenal fistula with sepsis and multiple organ failure. This is in comparison with the study conducted by Asensio JA et al³ and Shorr RM et al⁸ where they noted 17% mortality in their series.

Due to retroperitoneal location of the organ, the pre-operative diagnosis of duodenal injury is quite difficult. On-table exploration after mobilisation of hepatic flexure and Kocherization of duodenum is the mainstay of the diagnosis of these injuries. Duodenal trauma with early presentation and diagnosis can be managed by simple surgical techniques. Severe duodenal injuries and those associated with major destruction of adjacent structures like pancreas, biliary tree and abdominal vessels require a more thoughtful strategy that incorporates a careful consideration of the physiological stability of the patient and the extent of local destruction. Earlier presentation of the patient within 6 hours of the injury, resuscitation, appropriate surgical procedure according to the severity of injury and early detection of post-operative complications

along with their immediate and accurate management will definitely reduce both morbidity and mortality.

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