

Simple Repair is Sufficient for Most Injuries to the Duodenum – a case series of 23 patients

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Background: Duodenal injury is the most important hollow viscus injury in the abdomen. The study analysed the outcome of duodenal injuries at the unit. **Patients & Methods:** Prospectively collected data on a case series involving 23 patients over 3 years. It involved demographic details, part of duodenum injured, injury severity according to the AAST, injury-operation time lag, mode of repair, and the extent of significant associated injuries. **Results:** M:F ratio was 4.75:1. Mean age 33yrs. Patients with non-perforating injury were excluded. All were operated by a senior registrar or senior. 7/23 were blunt, 13/23 firearm & 3/23 stab injuries. D2 was involved in 87%. Injury severity was graded according to AAST (American Association for Surgery of Trauma). 17/23 were Grade II/III, 3 Grade IV & 3 Grade V injuries. Four had injury-operation lag of >18hrs. Two injuries were missed. All injuries up to Grade IV had simple repair. Two of them had T-tube duodenostomy. None had pyloric exclusion. Complex repairs were required for 3/23 patients. Five patients died, as a result of associated insults. One delayed repair developed duodenal fistula. Intra-abdominal abscess, septicaemia and wound dehiscence were seen in two patients each. Duodenum-related mortality was zero. Adverse prognostic factors towards morbidity were injury severity >GIII and injury-operation lag >18hrs. The mortality was related to associated injuries. **Conclusion:** Primary repair is sufficient for most non-resectional duodenal injuries.

Key words: duodenum, injuries, repair,

Duodenal injuries are uncommon in developing countries and rare in the West - except in the USA. They form three to five percent of all abdominal injuries and blunt duodenal trauma forms 0.2% of the same¹. Isolated duodenal injury is almost a surgical curiosity. The anatomical risk of associated injuries to the main pancreatic duct (MPD), common bile duct (CBD), the portal vein, abdominal aorta & inferior vena cava, superior mesenteric vessels and some association to spleen & ruptured diaphragm make the injury potentially fatal. The retroperitoneal location of the organ leaves the injury prone to be missed - and this has been a sad tradition, which lives to date. In the authors' view, therefore, it is the most important hollow viscus injury to the abdomen. This retrospective study was carried out to evaluate the outcome of duodenal injuries presenting to the unit.

Patients and methods:

This study was carried out at the Departments of Surgery and of A&E, Mayo Hospital Lahore over a three-year period. The hospital is a tertiary referral centre as well as the largest teaching institution in the country. The data was collected prospectively and analysed retrospectively. It involved 23 consecutive patients over the age of 12 years and with full-thickness duodenal injury. All cases of duodenal haematoma without perforation were excluded from the study. The included patients therefore correspond to the AAST (American Association for Surgery of Trauma) Grade >I as shown in Table 1. The data included demographic details, part of duodenum injured, injury severity according to the AAST, injury-operation time lag, mode of repair, and the extent of significant associated

injuries. All procedures were conducted by senior registrar or a more senior surgeon.

The resuscitation was carried out to an optimum point in either the emergency room or in the operating theatre. At laparotomy haemorrhage was dealt with first. The indications to expose the duodenum were penetrating injury between xiphi and umbilicus, hemetemesis after injury, bile in the peritoneal cavity, midline retroperitoneal haematoma, visual evidence of duodenal injury and vectors of injury resembling 'seat-belt' trauma. The duodenum took priority over other hollow organ injuries. During this phase the small bowel and colonic injuries were soft-clamped. Generous mobilization was done for adequate exposure. It involved division of the gastro-colic omentum and mobilization of the hepatic flexure of the colon. Extensive Kocherization of the duodenum and mobilization of duodeno-jejunal flexure was then carried out. All limits of the injury were defined. Only minimal debridement of the edges was needed. Trimming of pouting mucosa was sometimes necessary. Healthy perfusion at the injured site was visually confirmed. Injuries were closed in two-layer inverting fashion. The inner all layers and outer sero-muscular layer was the method adopted for all. The suture employed was polyglactin (Vicryl) 2/0 atraumatic. Para-duodenal drainage (closed, non-suction) was established for all. Associated injuries were treated on merits. Post-operatively, all patients had nasogastric decompression, urinary catheter, fasting >3 days, H2-blockade (ranitidine), IV antibiotics for five days and attention to serum biochemistry. The end-point of the study was discharge from the hospital or death.

Results:

Nineteen out of 23 were males (M:F ratio 4.75:1). Mean age was 33yrs (14-80yrs). Seven out of 23 (31%) were as a result of blunt trauma. Penetrating injuries (16/23 - 69%) included 13 firearm and three stab injuries. Two patients (8%) had isolated duodenal injury. Seventeen out of 23 had injury severity of Grade III or less (<75% circumference lacerated). Three had Grade IV and three Grade V injuries. The injury-operation time lag was >18hrs in four patients and less in the rest. Eighty seven percent had injury to D2.

Twenty out of 23 patients had simple repair including all 3 Grade IV injuries. In 2 out of the 3 Grade IV, T-tube duodenostomy (18 French) was established for anastomotic decompression (Fig. 2). The tube was removed seven days post-operatively after confirmatory T-tube duodenogram and when further 24hr trial of clamping was successful. The three Grade V injuries were treated individually by duodenal diverticulization (n=1) (Fig. 3), resection of D3 & 4 followed by D2 duodeno-jejunosomy (n=1) (Fig. 1) and lastly, long resection with end-end anastomosis D1-D2 (n=1). Associated pancreatic lacerations were seen but none had demonstrable involvement of MPD or CBD. They required drainage.

The injury was missed in two patients (8%). One with blunt trauma went on to develop the only duodenal fistula of the study. This patient had a delayed laparotomy (>24hrs). The second who was diabetic with heart disease required a second laparotomy. It was done more than eight hours after the injury was missed at the primary laparotomy. He had extensive high velocity firearm multi-organ injuries and succumbed to them.

Five of the 23 patients died. Of these three died within the first 48hrs as a result of injury load secondary to firearm injury. Between the remaining two, one patient with blunt injury (Grade V) died after he had a delayed laparotomy (>24h after injury). He died of pulmonary embolism shortly before discharge. The other was an 80yr old male and died of a stroke in the third week after having recovered uneventfully from the injury & operation. This patient also had a blunt injury. In addition to the duodenal fistula (n=1), there were intra-abdominal abscesses (n=2). An abscess in the supra-colic compartment was taken as duodenum-related until proved otherwise. Septicaemia in the absence of demonstrable abscess was seen (n=2) and abdominal wound dehiscence (n=2). None developed post-traumatic pancreatitis or a pancreatic fistula. Pressure sores, skin excoriation, depression and opiate dependence were seen in one patient. The patients who had injury severity >GIII and injury-operation time lag >18hrs were two to three times more likely to develop duodenum-related morbidity (Table 2). The patients who died were independent of these factors. They however were related to the magnitude of associated trauma. While there was definite overall mortality (n=5), there was no duodenum-related death.

Table 1: American Organ Injury Scale–by AAST (American Association of Surgery for Trauma)

Grade I	Haematoma, Partial thickness laceration - no perforation
Grade II	Haematoma >1 portion <50% Circumference lacerated
Grade III	50-70% Circumference of D2 disrupted 50-100% of D1, 3, 4
Grade IV	>75% Circumference D2 Injury to ampulla /distal CBD
Grade V	Massive disruption of duodenopancreatic complex Duodenal devascularization

Table 2: The break-up of patients according to the American Association of Surgery for Trauma (AAST) Organ Injury Scale

AAST Severity	n=	Blunt / Penetrating
Grade II/III	17	3 / 14
Grade IV	3	1 / 2
Grade V	3	2 / 1

Table 3: Effect of injury severity & of delay on the incidence of non-fatal complications.

	n=23	Morbidity (n=6)
AAST Grade III or less	17	3 (17%)
Grade IV / V	6	3(50%)
Injury-operation time lag <18hrs	19	4(21%)
>18hrs	4	2(50%)

Table 4: Overall- and Duodenum-related mortality (DRM).

	Overall mortality	DRM
<i>This study</i>	22%	0
Carrel 1990 ³	-	9.5%
Cogbill 1990 ⁴	18%	1%
Nesbakken 1989 ¹¹	10%	0
Adkins 1985 ¹⁷	6%	-
Wynn 1985 ¹²	64%	2%
Ivatury 1985 ¹⁸	25%	2%
Shorr 1987 ¹⁹	12%	3.5%
Cone 1994 ²⁰	-	0
Kline 1994 ⁵	19%	-
Nassoura 1994 ⁶	6%	1.7%
Moncure 1993 ⁷	13.6%	-
Buck 1992 ⁹	23.5%	-
Fang 1998 ¹⁰	0	0
Ginzburg 1997 ¹⁵	-	2%
Ballard 1997 ¹⁶	13%	6.6%
Asensio 2000 ²	5-30%	-

Fig 1:Grade IV injury to D2 – Two-layered inverting repair & T-tube duodenostomy (n=2). Note paraduodenal & nasogastric drainage

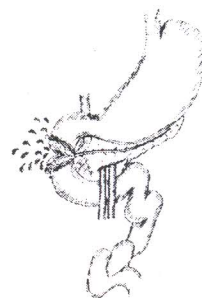
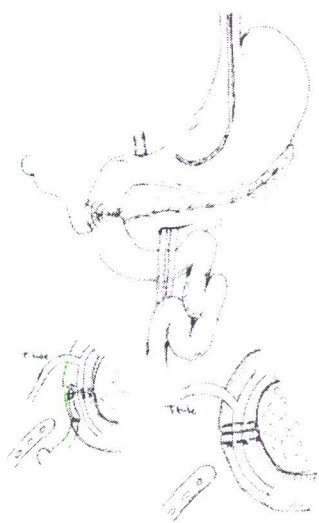


Fig 2: Grade IV injury to D2 – Two-layered inverting repair & T-tube duodenostomy (n=2). Note para-duodenal & naso-gastric drainage.



Discussion:

The diagnosis is prone to be missed especially in blunt trauma or in the rare event of isolated duodenal injury. They may also be missed at a laparotomy. The retroperitoneal location of the organ may mask the clinical signs of even a severe injury. The diagnosis is known to be overlooked despite evident CT findings¹ and the false negative rate is reported between 4-22%.^{2,3,4}

Majority of duodenal injuries is known to be simple and requiring simple repair.^{2,5,6} Only a minority is likely to require duodenal diverticulization (Fig 4). Classically antrectomy is advised. However conservative procedures are done, the division being performed at the pylorus. This is a resectional procedure for GIII/IV supra-papillary injuries involving loss of length. It may take time. Any suture line could result in leakage – the most catastrophic being duodenal stump blow-out. Prophylactic tube duodenostomy (controlled fistula) may be established. We had to carry out diverticulization for a delayed (missed) Grade V supra-papillary injury to D2. It resulted in duodenal fistula. It required 38-day treatment with para-duodenal low-pressure sump suction drainage, TPN, octreotide H2-blockade and antibiotics. When it comes to diverticulization there may not be alternative except Whipple's operation. A Roux-en-Y reconstruction is also possible.

Intra-luminal air is the most detrimental factor for an anastomosis, creating physical tension and secondary ischemia, which may result in suture-line dehiscence. The T-tube (18-French) was introduced proximal to the repair / anastomosis and brought out via the shortest route to the skin.

Duodenum-related morbidity tends to be low to moderate. The most important is a duodenal fistula. It is a potentially fatal complication. The incidence varies from

2% to 12%.^{2,4,6-13} Coexisting pancreatic injury is associated with higher risk of duodenal leak. Pyloric exclusion is considered to be beneficial in this scenario¹³. Factors associated with increased duodenal morbidity were injury severity (>Grade III) and injury-operation time lag >18hrs (Table 2). Shilyansky (1997) experienced the same for time lag of >24hrs¹⁴.

Duodenum-Related Mortality (DRM) is consistently low – zero to 9.5% (Table 5). Most of the studies have reached the conclusion that the leading cause of death is associated trauma leading to shock and multi-organ failure. Pancreatic, liver, splenic and colonic injuries have an adverse bearing^{2,9,15,16}. In this study duodenal morbidity did not translate into mortality.

Conclusion

Index of suspicion is vital in the diagnosis of duodenal injury. Most of the duodenal injuries can be managed with simple repair. Severe injuries need individualised treatment depending on injury anatomy. Operative treatment is guided by basic principles of surgery. Adverse prognostic factors towards duodenum-related morbidity were AAST injury severity of >Grade III and injury-operation time lag of >18hrs. The overall mortality was related to associated injuries. Missed injuries continue to haunt trauma surgeons.

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Fig 3: Outline of the study.

