

**SURGICAL APPROACHES, MORBIDITY, AND MORTALITY IN PENETRATING
DUODENAL INJURIES****Dr. Lena Zeyad Tareq Al-Azzawi*¹, Dr. Samer Thaeer Ahmed², Dr. Mohammed Abed Mohammed³**¹MBChB, FICMS, CABS, General Surgeon, Baghdad Teaching Hospital, Medical City, Baghdad, Iraq.²MBChB, CABS, General Surgeon, Baghdad Teaching Hospital, Medical City, Baghdad, Iraq.³MBChB, CABS, General Surgeon, Specialized Burn Hospital, Medical City, Baghdad, Iraq.***Corresponding Author: Dr. Lena Zeyad Tareq Al-Azzawi**

MBChB, FICMS, CABS, General Surgeon, Baghdad Teaching Hospital, Medical City, Baghdad, Iraq.

DOI: <https://doi.org/10.5281/zenodo.22160108>**How to cite this Article:** Dr. Lena Zeyad Tareq Al-Azzawi*¹, Dr. Samer Thaeer Ahmed², Dr. Mohammed Abed Mohammed³ (2026). Surgical Approaches, Morbidity, And Mortality In Penetrating Duodenal Injuries. World Journal of Pharmaceutical and Medical Research, 12(9), 161–165.

This work is licensed under Creative Commons Attribution 4.0 International license.



Article Received on 31/07/2026

Article Revised on 20/08/2026

Article Published on 01/09/2026

ABSTRACT

Background: For trauma or acute care surgeons, penetrating duodenal injuries can be a challenging case. The ensuing wounds and complications may have disastrous outcomes. **Aim of study:** To assess the surgical options, morbidity and mortality in penetrating duodenal injuries. **Patients and methods:** A prospective study conducted in the General Surgery Department in Al-Yarmouk Teaching Hospital during a period of three years from (February 2019 to February 2022). It included 30 patients attended the surgical casualty department and presented with penetrating abdominal injury. **Results:** The most common cause of injury was gunshot (80%); 50% of injuries were graded II by DIS score; 40% of cases were associated with one organ injury; primary repair was performed in 46.7% of cases; 76.7% of cases didn't show any complication; and 43.3% were died. Small bowel was the most common associated abdominal organ injury (36.7%); followed by kidney (33.3%). Associated factors with mortality were high severity of injury (PATI Score), injury grade III or more, and in PR, gastrojejunostomy and pyloric exclusion. **Conclusion:** Primary repair is a viable management option for most duodenal injuries. Because these injuries are highly complex, prompt diagnosis, early surgical intervention, and abbreviated surgical procedures are critical to reducing morbidity and death.

KEYWORDS: Duodenal, injury, mortality, penetrating, trauma.**INTRODUCTION**

Rarely, duodenal injuries account for 0.2 to 0.6% of patients with severely injured trauma and 3 to 5% of patients with abdominal trauma.^[1] They are particularly prevalent in young boys, as with most trauma, 70% of the population is between the ages of 16 and 30, with a male to female ratio of 5 to 1.^[2] Most of the duodenal injuries caused by penetrating traumas (75%).^[3] Of the penetrating wounds, 81% resulted from gunshot wounds and 19% from stab wounds. In 85% of cases of blunt abdominal injuries, auto accidents were the most common mechanism^[4] due to crushing of the duodenum between the steering wheel and the spine.^[5] The majority of the duodenum is found in the retroperitoneal area, close to important organs and major blood vessels. Due to this anatomical position, diagnoses are delayed, and duodenal traumas are linked to severe injuries to vital organs^[6], so duodenal injury rarely occurs in isolation. The most common associated injury is to the liver (17%),

followed by the colon (13%), pancreas (12%), other small bowel (11%), and stomach (9%).^[7] Pancreaticoduodenal injuries are common. Due to the higher failure rate of duodenal repairs compared to other intestinal repairs, these patients are more susceptible to anastomotic leaks and the related morbidity.^[8] The World Society of Emergency Surgery (WSES) divides injury into four classes, considering the AAST classification and the hemodynamic status: Mild (AAST I), Moderate (AAST II), Severe (AAST III-V), and Hemodynamic instability (AAST I-V of duodenal-biliary-pancreatic injury).^[9] When treating duodenal injuries, wide drainage of the anastomotic site and early exploration with primary closure are recommended. More complicated injuries or situations where the possible healing of an anastomotic site is required call for a more involved procedure. In this sense, methods for treating such injuries frequently include pyloric exclusion, decompressive tube duodenostomy implantation, and

Roux-en-Y reconstruction.^[10] Moreover, pancreaticoduodenectomy may be necessary in cases of severe injuries involving uncontrollable bleeding or devascularization of the pancreatic head and duodenum. Patients with duodenal injuries frequently have challenging postoperative recovery periods. Therefore, the key to survival is quick resuscitation, vigorous treatment of shock, and early detection of any complications.^[11] It is advised to continue using antibiotics after surgery, though it is unclear how long treatment will last. Long-term bowel rest and early nutritional support, such as enteral or parenteral nutrition, are frequently required for these patients.^[6] The aim of this study is to assess the surgical options, morbidity and mortality in penetrating duodenal injuries.

PATIENTS AND METHODS

This was a prospective study conducted in the General Surgery Department in Al-Yarmouk Teaching Hospital, Baghdad, Iraq during a period of three years from (February 2019 to February 2022).

The study included 30 patients attended the surgical casualty department and presented with penetrating abdominal injury. The following data were recorded from the documents (Age, gender, grade of duodenal injury, number and size of organ injuries, anatomic location of duodenal injury, surgical procedure performed, presence and type of complications and duodenum-related morbidity and mortality).

An informed consent was obtained from the relatives of the patients which allowed us to record their information for research purposes as long as the patient anonymity and confidentiality of their medical records are maintained.

Severity of duodenal injuries and other organs was quantified by the Penetrating Abdominal Index (PATI).^[12] Injury Severity Score (ISS), Reverse Trauma Score (RTS), and Trauma Injury Severity Score (TRISS) were also used to estimate the mortality in relation to severity of the injury.

The injury classification in this study was based upon the severity of duodenal injury and the anatomic location,

morbidity and mortality were evaluated according to the Duodenal Injury Scale (DIS) and operative technique.^[10]

All operations were performed in the operating theatres of the Surgical Department at Al-Yarmouk Teaching Hospital by the surgical team on call. The duodenal injury repair methods used were; primary repair (PR), PR with gastrojejunostomy and pyloric exclusion, PR with jejunostomy feeding tube, Roux-en-Y procedure. PR was done by suturing the duodenal wall in a transverse direction in tension free double layers using polydioxanone (PDS) and polyglycolic acid (Safil) sutures, the first layer sutured continuously while the second with interrupted sutures regardless whether the PR was done with duodenal diversion or not, with respecting the circumferential blood supply of the duodenum, most of the sutured injuries were augmented by an omental patch.

All patients received antibiotics before and during surgery (i.e. a combination of cefoxitum and metronidazole or ampicillin, gentamycin and metronidazole), antibiotic therapy was continued in the postoperative period. All patients had peritoneal drainage by closed tube drains placed in the vicinity of the duodenal suture line and others in the dependent parts or nearby other organ injury.

Statistical analysis: It was performed using SPSS windows version 26 Software. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Chi square test was used to assess the association between mortality and certain information, while fisher exact test was used instead when the expected frequency was less than 5. A level of p-Value less than 0.05 was considered significant.

RESULTS

In this study, mean age was 28.21 ± 8.5 years; 60% of them were aged < 40 years; 83.3% were males; the most common cause of injury was gunshot (80%); the injuries were low in severity in 43.3% of cases; 50% of injuries were graded II by DIS score; portion of duodenum injured was D2 in 50% of cases; 40% of cases were associated with one organ injury; primary repair was performed in 46.7% of cases; 76.7% of cases didn't show any complication; and 43.3% were died (Table 1).

Table 1: Distribution of study patients by certain characteristics.

Variable	No. (n= 30)	Percentage (%)
Age (Year)		
< 40	18	60.0
≥ 40	12	40.0
Gender		
Male	25	83.3
Female	5	16.7
Cause of injury		
Gunshot	24	80.0
Shell injury	6	20.0
Severity of injury (PATI Score)		

Low	13	43.3
Intermediate	6	20.0
High	11	36.7
Grade of injury (DIS score)		
II	15	50.0
III	9	30.0
IV	5	16.7
V	1	3.3
Number of associated abdominal organ injury		
No associated abdominal organ injury	2	6.7
One	12	40.0
Two	7	23.3
Three	5	16.7
Four or more	4	13.3
Portion of duodenum injured		
D1	2	6.7
D2	15	50.0
D3	4	13.3
D4	4	13.3
More than one portion	5	16.7
Type of operation performed		
Primary repair	14	46.7
PR, gastrojejunostomy and pyloric exclusion	11	36.7
PR and gastrojejunostomy feeding tube	4	13.3
Roux-en-Y	1	3.3
Morbidity		
Fistula	3	10.0
Sepsis	2	6.7
Obstructive jaundice	1	3.3
Abscess	1	3.3
No complication	23	76.7
Mortality		
Died	13	43.3
Alive	17	56.7
Time of death n= 13		
On table	4	30.8
Within 1 st 24 hrs.	5	38.4
Later on	4	30.8

As shown in figure (1), small bowel was the most common associated abdominal organ injury (36.7%); followed by kidney (33.3%).

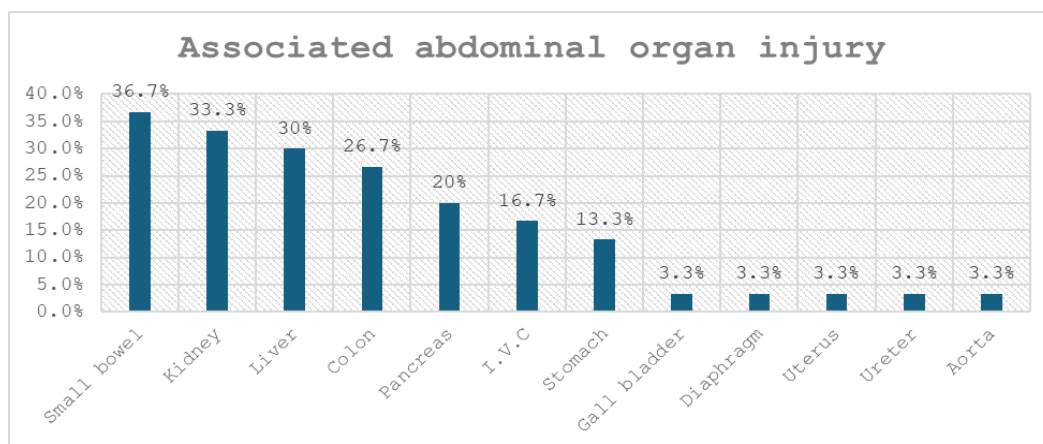


Figure 1: Associated abdominal organ injury.

As shown in table (2), the highest prevalence of death was seen significantly in patients with high severity of injury (PATI Score) (81.8%, $P= 0.001$), in patients with

injury grade III or more (86.7%, $P= 0.001$), and in patients underwent PR, gastrojejunostomy and pyloric exclusion (81.8%, $P= 0.008$).

Table 2: Association between mortality and certain characteristics.

Variable	Death		Total (%) n= 30	P - value
	Yes (%) n= 13	No (%) n= 17		
Severity of injury (PATI Score)				
Low	2 (15.4)	11 (84.6)	13 (43.3)	0.001
Intermediate	2 (33.3)	4 (66.7)	6 (20.0)	
High	9 (81.8)	2 (18.2)	11 (36.7)	
Number of associated abdominal organ injury				
No or one	4 (28.6)	10 (71.4)	14 (46.7)	0.126
Two or more	9 (56.3)	7 (43.8)	16 (53.3)	
Grade of injury (DIS score)				
< III	0 (0)	15 (100.0)	15 (50.0)	0.001
≥ III	13 (86.7)	2 (13.3)	15 (50.0)	
Type of operation performed				
Primary repair	4 (28.6)	10 (71.4)	14 (46.7)	0.008
PR, gastrojejunostomy and pyloric exclusion	9 (81.8)	2 (18.2)	11 (36.7)	
PR and gastrojejunostomy feeding tube	0 (0)	4 (100.0)	4 (13.3)	
Roux-en-Y	0 (0)	1 (100.0)	1 (3.3)	

DISCUSSION

Duodenal perforation is an uncommon but potentially fatal illness. Duodenal perforations have several etiologies, including trauma, iatrogenic causes, and peptic ulcer disease. Utilising intravenous and oral contrast in computed tomography is the most effective imaging modality for detecting duodenal perforation.^[13]

In this study, males were the largest portion of the population affected by these injuries which is similar to most of studies as that conducted by Neto JC et al 2014^[14], Turan U et al 2020^[3], and by Bojanapu S et al.^[15] Among penetrating injuries, 80% were caused by gunshot wounds and 20% by shell injury and this is similar to most of studies.^[4,6]

The overall mortality rate in this study was 43.3%. This result was higher than rates described in studies conducted by Turan U et al 2020 (19.2%)^[3], Ordoñez CA et al 2021 (12%)^[1], Ordoñez CA et al 2014 (11.1%).^[16] High injury severity and grade were associated with higher death rates. While infections, duodenal fistulas, and multiorgan failure are linked to late deaths, significant bleeding from large vascular injuries causing hemorrhagic shock or concomitant head trauma is the cause of early mortality. Since the longest time between diagnosis and treatment is the primary risk factor linked to mortality, it is critical to identify these kinds of injuries as soon as possible.^[17]

When the level of duodenal damage was examined among the affected parts of the duodenum, it was found that most of the injuries were grade II (50%) lesions which is agreed with Fraga GP et al study in 2008.^[18] Typically, these lesions have been associated with

injuries to other organs, and it is rare to find the presence of an isolated injury, so the most associated organ injury is small bowel (36.7%) while Pandey S et al study 2011, the liver is the organ most affected, followed by colon (43%) and pancreas (14%).^[19]

Treatment for duodenal lesions varies depending on how extensive the lesion is in each case; it can range from primary closure to devascularization of the pancreatic head and duodenum or a pancreaticoduodenectomy (Whipple procedure) in cases of severe injuries with uncontrollable bleeding.^[20] Postoperative difficulties persist despite the use of all available surgical procedures and the decrease of time between the patient's arrival at the facility and the surgical intervention. The most frequent of these complications is the formation of fistulas. In conclusion, selecting the best surgical procedure for duodenal trauma might be challenging. The surgeon must decide whether to undertake intricate repairs, which can lengthen the procedure or just be too much, or to use simple procedures, which might not be sufficient given the severity of the lesion. Primary repair is a viable management option for most duodenal injuries. Usually, the laparotomy done for a suspected abdominal injury yielded the proper diagnosis. Because these injuries are highly complex, prompt diagnosis, early surgical intervention, and abbreviated surgical procedures are critical to reducing morbidity and death. This highlights the critical role that emergency services play in being flexible in the short period of time before surgery.

REFERENCES

1. Ordoñez CA, Parra MW, Millán M, Caicedo Y, Padilla N, García A, et al. Damage control in

- penetrating duodenal trauma: less is better-the sequel. *Colombia Médica*, 2021; 52(2).
2. García Santos E, Soto Sánchez A, Verde JM, Marini CP, Asensio JA, Petrone P. Duodenal injuries due to trauma: Review of the literature. *Cir Esp*, 2015; 93(2): 68-74.
 3. Turan U, Kilavuz H. Surgical management of penetrating duodenal injury: role of primary repair. *Liver*, 2020; 16: 61.
 4. Santos EG, Sánchez AS, Verde JM, Marini CP, Asensio JA, Petrone P. Lesiones duodenales secundarias a traumatismo: revisión de la literatura. *Cirugía Española*, 2015; 93(2): 68-74.
 5. Sánchez IJM, Núñez LMG. Alternativas de manejo del trauma duodenal. *Cirujano General*, 2013; 35(S1): 34-7.
 6. McCague A, Patterson B, Taggart T. Management of Complex Duodenal Injuries After Penetrating Trauma. *Cureus*, 2023; 15(6).
 7. José Miguel A-A, David Jacob Á-C, Clara Elizabeth V-C, Cristhian Felipe M-S, Carlos Alfredo B-L, Cesar Alberto O-O, et al. Management of Duodenal Injuries. In: Selim S, editor. *Topics in Trauma Surgery*. Rijeka: IntechOpen; 2022. p. Ch. 3.
 8. Malhotra A, Biffl WL, Moore EE, Schreiber M, Albrecht RA, Cohen M, et al. Western trauma association critical decisions in trauma: diagnosis and management of duodenal injuries. *Journal of Trauma and Acute Care Surgery*, 2015; 79(6): 1096-101.
 9. Coccolini F, Kobayashi L, Kluger Y, Moore EE, Ansaloni L, Biffl W, et al. Duodeno-pancreatic and extrahepatic biliary tree trauma: WSES-AAST guidelines. *World Journal of Emergency Surgery*, 2019; 14: 1-23.
 10. Lucas CE. The therapeutic challenges in treating duodenal injury. *Panamerican Journal of Trauma, Critical Care and Emergency Surgery*, 2013; 2(3): 126.
 11. Luo Y, He X, Geng L, Ouyang R, Xu Y, Liang Y, et al. Diagnosis and treatment of traumatic duodenal rupture in children. *BMC gastroenterology*, 2022; 22(1): 61.
 12. Dogjani A, Petrela E, Jonuzi E, Blenarda H, Kallashi N. PATI Index & Injury Severity Score, as predictive factors in management of Penetrating abdominal Trauma 2016.
 13. Ansari D, Torén W, Lindberg S, Pyrhönen H-S, Andersson R. Diagnosis and management of duodenal perforations: a narrative review. *Scandinavian journal of gastroenterology*, 2019; 54(8): 939-44.
 14. Cruvinel Neto J, Pereira BMT, Ribeiro Jr MAF, Rizoli S, Fraga GP, Rezende-Neto JB. Existe lugar para a exclusão pilórica no trauma duodenal grave? *Revista do Colégio Brasileiro de Cirurgiões*, 2014; 41: 228-31.
 15. Bojanapu S, Malani RA, Ray S, Mangla V, Mehta N, Nundy S. Duodenal Perforation: Outcomes after Surgical Management at a Tertiary Care Centre-A Retrospective Cross-Sectional Study. *Surgery research and practice*, 2020; 2020: 8392716.
 16. Ordonez C, García A, Parra MW, Scavo D, Pino LF, Millán M, et al. Complex penetrating duodenal injuries: less is better. *Journal of Trauma and Acute Care Surgery*, 2014; 76(5): 1177-83.
 17. Ratnasekera A, Ferrada P. Traumatic duodenal injury: Current management update. *Current Surgery Reports*, 2020; 8: 1-6.
 18. Fraga GP, Biazotto G, Villaça MP, Andreollo NA, Mantovani M. Duodenal trauma: factors related to morbimortality. *Revista do Colégio Brasileiro de Cirurgiões*, 2008; 35: 94-102.
 19. Pandey S, Niranjana A, Mishra S, Agrawal T, Singhal BM, Prakash A, et al. Retrospective analysis of duodenal injuries: a comprehensive overview. *Saudi Journal of Gastroenterology: Official Journal of the Saudi Gastroenterology Association*, 2011; 17(2): 142.
 20. Galdino DT, Welter CdS, Frainer DA, Theis C, Haas IGF, Fiamoncini H. Surgical management of complex duodenal trauma using laterolateral duodenum enteroanastomosis: A case report. *International Journal of Surgery Case Reports*, 2021; 89: 106648.