International Surgery Journal
Leal C et al. Int Surg J. 2026 Mar;13(3):405-408
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20260465

Case Report

Gunshot-induced retroperitoneal trauma with complex duodenal injury: a case report

Clara Leal*, Pedro Pinheiro, Juliana Ribeiro, Margarida Dupont, Carolina Marques, Bruno Vieira, João Pinto-de-Sousa

Department of General Surgery, Unidade Local de Saúde de Trás-os-Montes e Alto Douro, Vila Real, Portugal

Received: 15 January 2026
Accepted: 16 February 2026

***Correspondence:**
Dr. Clara Leal,
E-mail: cmsleal@chtmad.min-saude.pt

ABSTRACT

Duodenal trauma is rare and frequently associated with severe concomitant injuries, particularly in penetrating retroperitoneal mechanisms. Management is complex and often requires staged surgical strategies, diversion, and multidisciplinary care. Herein the case of a middle-aged male who sustained a shotgun injury is reported, using review of electronic medical records and relevant literature to contextualize diagnostic and therapeutic decision-making. Initial evaluation revealed a retroperitoneal zone-2 hematoma without intraperitoneal contamination, and the patient underwent exploratory laparotomy with damage control surgery. Within 48 hours, he developed hemodynamic instability with active retroperitoneal and pancreaticoduodenal bleeding. Reoperation demonstrated expanding zone-1 and zone-2 hematomas, right renal injury, transverse colon perforation, and a complex duodenal lesion with devascularization. Management included arterial ligation, right nephrectomy, bowel repair, duodenal diversion, retroperitoneal drainage through the lumbar incision, and temporary abdominal closure. Persistent bile and enteric leakage required a hybrid surgical-endoscopic approach with endoscopic closure, pyloric exclusion, jejunostomy feeding access, and maintained retroperitoneal diversion. With prolonged multidisciplinary intensive care, infection control, nutritional optimization, and negative-pressure therapy, the patient achieved clinical stabilization and was discharged after 126 days. Severe duodenal trauma, although uncommon, carries substantial morbidity. Early application of damage control principles, selective repair and diversion, expert hepatobiliary involvement, and sustained multidisciplinary management are essential to sepsis control, physiologic recovery, and survival in complex retroperitoneal penetrating trauma.

Keywords: Retroperitoneal trauma, Abdominal trauma, Penetrating trauma, Trauma surgery, Damage control surgery, Duodenal injury

INTRODUCTION

Trauma remains a leading cause of death worldwide. Abdominal trauma, whether blunt or penetrating, may pose a significant challenge in both the emergency department and the operating room. Although the mechanisms of injury vary geographically, most studies indicate that blunt abdominal trauma is more common than penetrating trauma, which accounts for fewer than 15% of all trauma presentations.[1,2] Despite its lower incidence, penetrating abdominal trauma is associated with substantial mortality, particularly in cases of gunshot wounds, due to the high kinetic energy transferred to tissues by the projectile.[2]

The management of patients with abdominal trauma requires prompt resuscitation combined with rapid and complex decision-making.[2] Pancreaticoduodenal trauma is rare and is associated with high morbidity and mortality, largely owing to the frequent presence of concomitant injuries to adjacent vascular and visceral structures.[3] When operative approach is required, trauma pancreaticoduodenectomy remains one of the most challenging procedures in emergency surgery, with

reported morbidity and mortality rates reaching up to 80% and 50%, respectively.[4]

The case of a middle-aged male patient who presented to the emergency department with a shotgun wound to the abdomen, resulting in injuries to the duodenum, pancreas, and both small and large bowel is reported. Complexity of duodenal injury necessitated a prolonged hospital stay, and this report describes its multidisciplinary management and ultimately favorable outcome.

CASE REPORT

A 50-year-old previously healthy male, independent in daily activities, presented to the emergency department following an accidental shotgun discharge toward the ground with projectile ricochet, resulting in penetrating trauma to the right flank and significant external hemorrhage partially controlled with local compression. Prehospital care included analgesia, crystalloids and tranexamic acid.

On arrival, the patient was alert, hemodynamically stable (BP 160/92 mmHg, HR 87 bpm), tachypneic at 22 breaths/min, and oxygen saturation was 100% with a non-rebreather mask. Peripheral perfusion was slightly compromised (capillary refill ≈3 s). Lactate was 2.8 mmol/L; hemoglobin 13.9 g/dL; urea mildly elevated; and transaminases and myoglobin values were increased.

Whole-body CT demonstrated extensive right thoracolumbar soft tissue thickening with subcutaneous emphysema, innumerable metallic fragments, and projectile penetration into the hepatic parenchyma, right pararenal and perirenal spaces, renal parenchyma, and adjacent peritoneal compartments, with suspected active retroperitoneal and right lumbar wall bleeding (Figure 1).

Figure 1: Whole-body CT.

*Demonstrating extensive right thoracolumbar soft-tissue disruption with subcutaneous emphysema, multiple metallic fragments, and projectile penetration involving right pararenal and perirenal spaces, renal parenchyma, and adjacent peritoneal compartments.

The patient underwent emergent exploratory laparotomy, revealing an uncontaminated peritoneal cavity, a zone-2 retroperitoneal hematoma, and two millimetric small-bowel perforations 20 cm and 30 cm distal to the ligament of Treitz, which were primarily repaired. A laparostomy was performed. Right flank retroperitoneal exploration demonstrated active hemorrhage without identifiable vessel injury and significant muscular destruction (Figure 2); retroperitoneal packing was executed.

Figure 2: Inspection of the right flank and thoracolumbar region revealed a gunshot entry wound without an identifiable exit wound.

*The patient was positioned in the right lateral decubitus position, and retroperitoneal exploration was performed through a lumbar incision, demonstrating active hemorrhage without an identifiable vascular injury and extensive muscular destruction.

Within 24-48 hours, the patient developed hemodynamic deterioration requiring vasopressor support. Angio-CT demonstrated active hemorrhage from the right iliopsoas muscle, pancreaticoduodenal arcade, and right perirenal region. Reoperation revealed expanding zone I and zone II retroperitoneal hematomas, active bleeding from the gastroduodenal and posterior inferior pancreaticoduodenal arteries, a transverse colon perforation, and a 50-75% circumferential duodenal laceration at the D2-D3 junction. A right nephrectomy was performed due to renal perihilar bleeding and multiple intrarenal pellets; arterial ligation was completed; bowel injuries were primarily repaired; duodenal diversion with cerclage and intraluminal Foley tube was undertaken; retroperitoneal drainage was placed through the lumbotomy incision; and abdominal packing with laparostomy was maintained.

A subsequent hybrid surgical-endoscopic intervention was performed to control the bile leak, including endoscopic clip repair of the duodenal defect (Figure 3), percutaneous endoscopic gastrostomy, pyloric exclusion with stapling (TA-60), and jejunostomy feeding access. A Pezzer tube was placed to externally divert the duodenal fistula, exiting through the retroperitoneal space and the

pre-existing lumbar incision. Despite initial control, persistent bile leakage and new enteric drainage required revision of the external diversion and local sealing of the duodenal orifice using gauze wrapped in adhesive surgical drape. Multiple reinterventions for debridement, dressing revision, and infection control followed, and later negative-pressure therapy was applied until definitive closure was achieved.

Figure 3: Endoscopic identification of a duodenal defect involving the posterolateral wall of the second portion of the duodenum (D2).

The prolonged clinical course required ICU admission with multidisciplinary management, including treatment of intra-abdominal abscesses by interventional radiology, temporary renal replacement therapy, prolonged mechanical ventilation with tracheostomy (decannulated on day 52), nutritional optimization, intensive physiotherapy for critical illness myopathy, and psychological support.

The patient was discharged after 126 days of hospitalization. At 3- and 6-month follow-up, he remains in rehabilitation and nutritional support and will later be evaluated for restoration of gastrointestinal continuity. Repeated upper endoscopy showed no duodenal lesions.

DISCUSSION

Abdominal trauma, whether blunt or penetrating, accounts for approximately 10% of torso trauma, with retroperitoneal injuries associated with the highest mortality rates.[5]

Although incidence varies, the most frequently injured abdominal organs in penetrating trauma are the liver and colon, followed by vascular structures and the pancreas.[5] Duodenal injuries are rare, occurring in 1-4.7% of abdominal trauma, with penetrating mechanisms responsible for 53.6-90% of cases, and associated injuries present in up to 86% of patients.[6,7]

The retroperitoneum is classically divided into three zones. Zone I (central) extends from the diaphragm to the aortic bifurcation and contains the aorta, major vessels, duodenum, and pancreas. Zone II (lateral) extends from the diaphragm to the aortic bifurcation laterally between the renal vessels and Toldt fascia, containing the adrenal glands, kidneys, renal vessels, ureters, and ascending/descending colon. Zone III (pelvic) extends inferiorly from the aortic bifurcation and includes the iliac vessels, distal ureters, distal sigmoid colon, and rectum.[5]

Initial management follows principles of primary survey and damage control surgery (DCS), prioritizing haemorrhage and contamination control. After physiological stabilization, subsequent stages focus on definitive reconstruction, restoration of gastrointestinal continuity and nutritional access.[6]

In this case, the patient was initially hemodynamically stable, allowing for thoracic-abdominal-pelvic CT evaluation. Imaging and clinical findings prompted exploratory laparotomy. A clean peritoneal cavity was identified, and a retroperitoneal hematoma-believed to be confined to zone II-was noted. Given the penetrating mechanism, hemodynamic stability, and absence of an expanding hematoma, initial non-exploration was considered acceptable. However, subsequent hemodynamic deterioration with vasopressor requirement and repeat imaging demonstrating active haemorrhage in the right iliopsoas region, perirenal area, and pancreaticoduodenal arcade mandated early re-exploration. Laparostomy review revealed expanding Zone I and II hematomas, which were explored with Kocher manoeuvre and Cattell-Braasch mobilization. Bleeding from the posterior inferior pancreaticoduodenal and gastroduodenal arteries, renal hilar bleeding, transverse colon perforation, and a complex duodenal injury with devascularization of the duodenum and pancreatic head were identified. Small bowel perforations were repaired, arterial bleeding was controlled, and right nephrectomy was performed.

According to the American association for the surgery of trauma (AAST) organ injury scale, the described duodenal lesion corresponds to a complex duodenal injury (Grade III-V), characterized by ≥50% circumferential laceration, devascularization, and involvement of the pancreaticoduodenal complex.[7] Current world society of emergency surgery (WSES) and AAST recommendations support DCS in hemodynamically unstable patients with duodenal injury, particularly when associated injuries and physiological derangement are present. Primary repair should be performed whenever feasible; however, ancillary procedures such as pyloric exclusion, biliary diversion, external drainage, and staged reconstruction may be warranted in grade III-V injuries.[7] Pancreaticoduodenectomy is typically reserved for extensive destructive injuries and is usually staged, given

the frequent association with severe physiological insult.[6,7]

Because of the high risk of anastomotic leakage in devascularized tissue, external drainage and diversion are critical for sepsis control and fistula management. In young trauma patients, small pancreatic ducts and soft pancreatic tissue complicate reconstruction and increase the risk of anastomotic failure.[5]

In this case, an initial DCS approach with laparostomy and retroperitoneal packing was performed. Clinical deterioration led to early reoperation, revealing the duodenal lesion, which was managed with cerclage, intraluminal Foley diversion, and drainage. Persistent bile and enteric leakage necessitated a subsequent hybrid surgical-endoscopic intervention, including endoscopic clip repair of the duodenal defect, percutaneous endoscopic gastrostomy, pyloric exclusion, jejunostomy feeding access, and external fistula diversion with a Pezzer tube exiting through the retroperitoneal tract and lumbar incision. A later small dehiscence required revision of external diversion and local sealing of the duodenal orifice with gauze wrapped in adhesive surgical drape, which proved effective. Stepwise reinterventions, infection control, and negative-pressure therapy ultimately led to closure.

This case highlights a successful combined staged surgical and endoscopic strategy for managing a complex duodenal fistula in the context of severe retroperitoneal penetrating trauma.

CONCLUSION

Duodenal trauma is an uncommon but highly challenging clinical entity, frequently associated with severe concomitant injuries and substantial morbidity. In cases of complex duodenal disruption, timely application of damage control principles, direct repair when feasible, and appropriate diversion remain fundamental strategies to control contamination, protect repairs, and stabilize physiology. Despite optimal management, significant duodenal injuries carry a considerable risk of postoperative leakage and suture dehiscence, often necessitating staged procedures and prolonged clinical support. This case underscores the critical importance of a multidisciplinary approach-integrating surgery, intensive care, gastroenterology, intervention radiology, nutrition, and rehabilitation-in achieving sepsis control, organ support, and eventual recovery. Tailored surgical decision-making, combined with coordinated multidisciplinary expertise, is essential to improving outcomes in complex duodenopancreatic trauma.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Petrowsky H, Raeder S, Zuercher L, Platz A, Simmen HP, Puhan MA, et al. A quarter century experience in liver trauma: a plea for early computed tomography and conservative management for all hemodynamically stable patients. World J Surg. 2012;36(2):247-54.
2. Kyle E, Grice S, Naumann DN. Penetrating abdominal trauma. Br J Surg. 2024;111(8):znae206.
3. Choron RL, Piplani C, Kuzinar J, Teichman AL, Bargoud C, Sciarretta JD, et al. Pancreaticoduodenectomy in trauma patients with grade IV-V duodenal or pancreatic injuries: a post hoc analysis of an EAST multicenter trial. Trauma Surg Acute Care Open. 2024;9(1):e001438.
4. Grigorian A, Dosch AR, Delaplain PT, Imagawa D, Jutric Z, Wolf RF, et al. The modern trauma pancreaticoduodenectomy for penetrating trauma: a propensity-matched analysis. Updates Surg. 2021;73(2):711-8.
5. Petrone P, Magadán Álvarez C, Joseph D, Cartagena L, Ali F, C EMB. Approach and Management of Traumatic Retroperitoneal Injuries. Cir Esp (Engl Ed). 2018;96(5):250-9.
6. Bolaji T, Ratnasekera A, Ferrada P. Management of the complex duodenal injury. Am J Surg. 2023;225(4):639-44.
7. 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 J Emerg Surg. 2019;14:56.

Cite this article as: Leal C, Pinheiro P, Ribeiro J, Dupont M, Marques C, Vieira B, et al. Gunshot-induced retroperitoneal trauma with complex duodenal injury: a case report. Int Surg J 2026;13:405-8.