

## Clinical Suspicion in Delayed Isolated Duodenal Perforation in a Child: A Case Report

Semaa Mohammed Jabbar<sup>1,\*</sup> and Sawsan M Jabbar AL-Hasnawi<sup>2</sup>

<sup>1</sup>Department of Surgery/Paediatric Surgery, College of Medicine, University of Kerbala, Karbala, Iraq.

<sup>2</sup>Department of Microbiology, College of Medicine, University of Kerbala, Karbala, Iraq.

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### ABSTRACT

After blunt abdominal trauma, severe injuries to the duodenum are rare but can be serious. As the duodenum lies retroperitoneally, perforation may not cause noticeable symptoms, leading to delayed diagnosis. Isolated duodenal perforation (IDP) is difficult to diagnose due to nonspecific symptoms. Early detection with a computed tomography (CT) scan is fundamental for saving lives. In prior studies, approximately 100 cases of IDP in children have been reported. The present study highlights the high index of clinical suspicion, along with the crucial role of the CT scan in detecting this injury. A 7-year-old boy arrived with worsening right abdominal pain, fever, and vomiting 9 days after a road traffic accident. Upon admission, leukocytosis ( $28.44 \times 10^3/\mu\text{L}$ ) and contrast-enhanced abdominal CT findings revealed retroperitoneal free air and suspected bowel perforation. Exploratory laparotomy confirmed a 3 cm duodenal perforation, repaired by two-layer duodenorrhaphy and omental patch. Postoperative recovery was successful with multidisciplinary care. Therefore, isolated duodenal perforation warrants a high degree of suspicion in pediatric patients with blunt trauma. Early contrast-enhanced abdominal CT and prompt surgical intervention are crucial to reduce morbidity and mortality.

**Keywords:** : Case report; Isolated duodenal perforation; Delayed diagnosis; Contrast-enhanced computed tomography scan; Duodenography.

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### INTRODUCTION

In pediatric surgery, trauma remains an important top problem for child health and survival. It is often classified based on how they occur, whether they were accidental or intentional [1]. Most of the trauma in children (more than 90%) involves blunt force to the abdomen [2]. Within this category, injuries to the duodenum are particularly rare and challenging. They constitute only a small fraction of trauma operations and rarely occur in isolation [3]. The duodenal retroperitoneal location and its exposure to powerful digestive juices make it especially vulnerable. If it is perforated, it can cause a severe inflammatory reaction, and sadly, these complex cases have been linked to mortality rates as high as 19% [4]. Diagnosis of duodenal injuries

remains difficult due to its anatomical position, and the symptoms and signs are often vague, including upper abdominal pain, tenderness, and vomiting especially in kids, these signs and symptoms may be easy to miss, requiring a high index of suspicion. Any delay in the diagnosis or appropriate management of more than 24 hours after trauma has been correlated with increased morbidity and mortality in children [5]. This is why an appropriate choice of imaging modality plays a critical role in helping to visualize what the physical exam cannot [6]. Doctors should use the Organ Injury Scale (AAST OIS), developed by the American Association for the Surgery of Trauma, to identify and assess the severity of these injuries [7]. This grading system has become an essential guide for trauma surgeons, helping to make both diagnosis and treatment decisions (Table 1).

Therefore, this study aims to clarify the importance of isolated duodenal injury in children, focusing on clinical suspicion even when symptoms are minimal. Highlighting the role of an early abdominal CT scan with contrast for rapid and

\* Corresponding author: E-mail: [seemaa.m@uokerbala.edu.iq](mailto:seemaa.m@uokerbala.edu.iq)  
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Table 1. Duodenal injury grading.

Grade	Type	Injury description
1	Hematoma laceration	Affecting a single portion of the duodenum Partial thickness with no perforation
2	Hematoma laceration	Affecting > 1 portion Disruption of less than fifty percent of the circumference
3	laceration laceration	Disruption of fifty to seventy-five percent of the circumference of the 2 <sup>nd</sup> portion Disruption of fifty to one hundred percent of the circumference of the 1 <sup>st</sup> , 3 <sup>rd</sup> , and 4 <sup>th</sup> portions
4	laceration	Disruption of more than seventy-five percent of the circumference of the 2 <sup>nd</sup> portion Affecting the ampulla or the distal common bile duct
5	laceration vascular	Massive disruption of the duodeno-pancreatic complex Devascularization of the duodenum

accurate diagnosis and its role in improving patient outcomes.

CASE PRESENTATION

On 31<sup>st</sup> of January 2025, a 7-year-old boy was brought to the Pediatric Surgical Emergency Department/Imam AL-Hussain Medical City in Karbala, Iraq, with a 9-day history of right-sided abdominal pain that began 24 hours after blunt abdominal trauma in a motor vehicle accident. The pain was vague, but gradually localized to the right iliac fossa. It is accompanied by fever, abdominal distension, non-bilious vomiting, and frequent episodes of watery diarrhea with decreased urine output. Despite two previous hospital evaluations at other healthcare facilities involving imaging assessment and supportive treatment, he was discharged without a diagnosis.

On arrival at our hospital, he was presented with acute shock, fever, tachycardia, and pallor. Physical exam of the abdomen showed soft but significantly tender on deep palpation of the right side, but no rebound tenderness. He showed signs of dehydration but was stable after resuscitation and oxygen support.

Laboratory findings

Initial blood tests showed a white blood cell count of 28.44 ×10<sup>3</sup>/μL (82% neutrophils), hemoglobin of 9.5 g/dL, and thrombocytosis (platelets: 512 ×10<sup>5</sup>/μL). C-reactive protein (CRP) was elevated at 119 mg/L. Electrolyte levels were: sodium 132 mmol/L, potassium 4.31 mmol/L, and chloride 98.6 mmol/L. Liver function tests showed mild elevation in (AST) aspartate aminotransferase (53 U/L) with normal (ALT) alanine aminotransferase (14 U/L) and (ALP) alkaline phosphatase (136 U/L). Renal function was preserved (serum creatinine 0.35 mg/dL, blood urea 17.08 mg/dL). Coagulation studies were within normal range [Prothrombin time (PT): 12.6 sec, partial thromboplastin time (PTT): 32.6 sec, international normalized ratio (INR): 1.18]. Urinalysis was unremarkable, viral screening was negative, and the patient's blood group was O positive.

Imaging

An abdominal ultrasound revealed mild hepatomegaly (liver span: 16 cm), right renal hydronephrosis with a dilated upper ureter, and a thick-walled fluid collection (11 × 1 cm) extending from near the left liver lobe to the right iliac fossa. The omentum appeared thickened, and there was evidence of inflamed right inguinal lymph nodes and mild intraperitoneal free fluid. Bowel peristalsis was notably absent on the

right side, and a small right-sided pleural effusion was also detected. An erect abdominal X-ray showed multiple air-fluid levels on the right, but no evidence of free subdiaphragmatic air (Figure 1).

Due to the unavailability of a CT scan during nighttime and based on clinical suspicion of right-sided retroperitoneal injury, initial supportive care was done, including bowel rest, nasogastric decompression, intravenous fluids, and broad-spectrum antibiotics. The next day, a CT scan revealed free fluid collections in the pre-hepatic space, the right paracolic

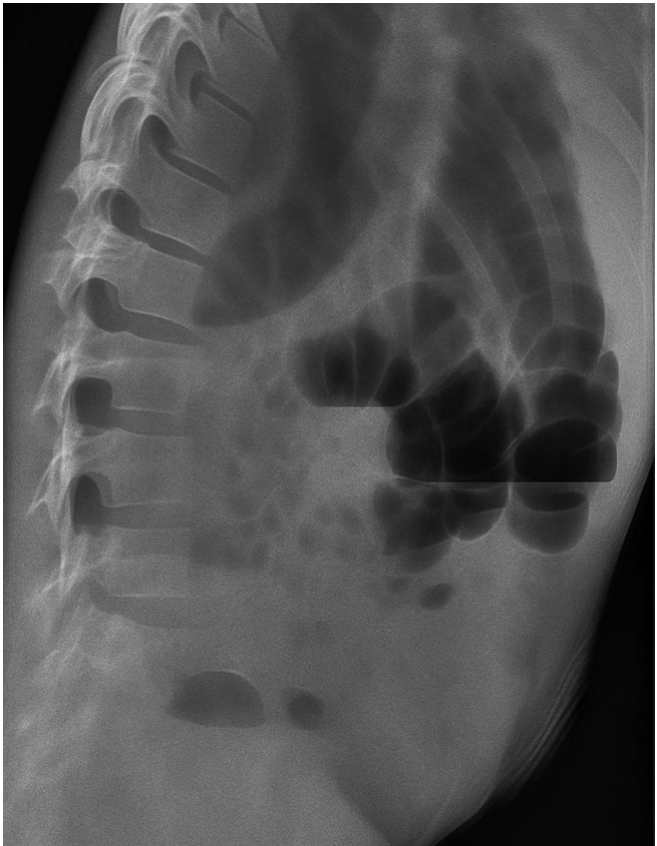


Figure 1. An erect abdominal X-ray showing multiple air-fluid levels on the right lower abdomen, but no evidence of free subdiaphragmatic air.



**Figure 2.** Intraoperative photo shows transverse perforation, approximately 3 cm in length, on the lateral wall of the duodenum at the 2<sup>nd</sup>-3<sup>rd</sup> part junction.

gutter, and the pelvis with air-fluid levels and abscesses, suggesting a perforation of a hollow viscus. The patient underwent an exploratory laparotomy.

### Operative findings

Under general anesthesia with rapid sequence induction, a midline laparotomy was performed. The omentum was thickened, inflamed, and gangrenous with adhesions to the anterior liver surface and right abdominal wall. A suspicious blackish-green discoloration over the posterolateral cecal wall prompted further exploration. Mobilization of the cecum along the white line of Toldt exposed approximately 500 mL of black-green bilious fluid within the retroperitoneal space, suggestive of a bile leak. Fluid samples were collected for culture. No feculent odor was noted. The cecum and ascending colon appeared intact. Further mobilization of the hepatic flexure and careful inspection and exposure of the area revealed a transverse perforation, approximately 3 cm in length, on the lateral wall of the duodenum at the 2<sup>nd</sup>-3<sup>rd</sup> part junction. The surrounding tissues were edematous and friable. A Grade II duodenal injury (less than 50% circumference) was confirmed (Figure 2).

Due to the surrounding tissue being edematous and friable, the repair was performed using a two-layer duodenorrhaphy with 4-0 Vicryl sutures, which was then reinforced with an omental patch. The procedure was completed with peritoneal lavage, placement of a right pelvic drain, and layered abdominal closure. The appendix, right colon, kidney, and ureter were all noted to be normal.

### Postoperative course

The patient received postoperative care in the ICU (intensive care unit), was kept nil per oral (NPO) status with nasogastric decompression, total parenteral nutrition (TPN), intravenous antibiotics adjusted based on culture sensitivity,

octreotide, proton pump inhibitors, and supportive analgesia. Oral feeding was successfully restarted, and the patient was discharged on day 14 in good general condition following treatment of a minor wound infection.

The case report had been approved by the Karbala Health Directorate, Training and Human Development Center Research Committee, Karbala, Iraq (Reference number: 202522 on 2<sup>nd</sup> February 2025). For publication purposes, informed consent from the patient's parents was obtained for the case and its images.

## DISCUSSION

The duodenal bulb, which constitutes the first part of the duodenum, is intraperitoneal and presents some degree of mobility. Unlike the first portion, the second, third, and fourth portions of the duodenum, fixed in the retroperitoneal region. This singular anatomy constitutes a double-edged weapon; while it offers some safety, it also makes this area susceptible to a specific kind of damage. When a significant compressive force crushes the duodenum against the spine, perforation can occur. Similarly, injury can happen from a rapid rise in intraluminal pressure if a traumatic event causes both the entrance to and exit from the duodenum to close at the same time [8].

This case scenario highlights why diagnosing these injuries in children is so important. However, it is difficult because the injury occurs in a hidden, retroperitoneal space, and the classic signs of a perforated bowel are often absent. Instead, a child may present with vague, non-specific symptoms that can easily be misdiagnosed as something less serious [8].

The timing of intervention is crucial; delays in surgical management beyond 24 hours after injury are strongly associated with increased risk of mortality [9].

A strong suspicion is required for any child with a non-penetrating abdominal injury presenting clinically with upper abdominal pain, vomiting, and leukocytosis [3]. Consequently, a low threshold for early abdominal CT imaging is imperative, as physical examination and standard imaging are frequently inadequate [10].

Children could develop septic shock after duodenal rupture; therefore, consistent postoperative management is crucial [11]. Further information could be obtained by a CT scan in a shorter time [8].

Severity of injury and the hemodynamic state of the patient are the primary outcome determinants of the patient with delayed presentation of duodenal trauma [12].

Successful management requires a multidisciplinary strategy. This includes prompt surgical repair (as primary repair, resection, or diversion) combined with mandatory postoperative drainage. Aggressive medical management is also crucial with empirical administration of broad-spectrum antibiotics to combat septic shock [3]. In addition to the initiation of total parenteral nutrition due to anticipated prolonged gastrointestinal rest. Meticulous postoperative care is needed to monitor complications. Operative treatment is affected by the type of blunt duodenal trauma, for example, in the case of a forceful blow to the upper abdomen, leading to mobilization of the duodenum against the spine [3].

Primary closure could manage fifty-five to eighty-five percent of duodenal trauma [13].

Finally, the sole dependence on non-specific symptoms could be confusing. Therefore, advanced imaging should be ordered in cases of persistent symptoms to confirm the diagnosis and ensure correct intervention to improve the outcome.

## CONCLUSION

Early diagnosis and prompt surgical intervention of the traumatic duodenal rupture in children are essential for favorable outcomes. Clinicians should maintain a high index of suspicion in stable patients with persistent abdominal symptoms and leukocytosis. When duodenal injury is suspected, early contrast-enhanced CT scanning is crucial to ensure timely diagnosis and reduce complications.

## ETHICAL DECLARATIONS

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### Ethics Approval and Consent to Participate

The case report had been approved by the Karbala Health Directorate, Training and Human Development Center Research Committee, Karbala/Iraq (Reference number: 202522 on 2<sup>nd</sup> February 2025). Informed consent from the patient's father had been obtained for the publication of the case with its images.

### Consent for Publication

Informed consent was obtained from the patient's parents/legal guardian for participation, publication, and any accompanying images.

### Availability of Data and Material

The data and material are available in the Cerner documentation system in Imam Alhussain Medical Corporation.

### Competing Interests

The authors declare that there is no conflict of interest.

### Funding

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

### Use of Artificial Intelligence

Artificial intelligence has been used in a limited way to correct of spelling, grammar, and punctuation, as well as in specific texts with editing.

### Authors' Contributions

Jabbar SM contributed to the concept and design of the study. AL-Hasnawi SMJ collects and analyzes data. Drafting and critical approval were done by both of them. Both authors read and approved the final version of the manuscript.

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