

Duodenojejunal Flexure Perforation Following Blunt Abdominal Trauma: A Series of Three Surgically Confirmed Cases

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ABSTRACT

Duodenojejunal (DJ) flexure perforation due to blunt abdominal trauma is a relatively uncommon condition, but it carries significant morbidity and mortality. Such cases are challenging to diagnose due to their subtle presentation and retroperitoneal location. This case series presents three surgically confirmed cases of DJ flexure perforation, each demonstrating distinct radiological findings on Contrast-Enhanced Computed Tomography (CECT). Key imaging features included free intraperitoneal air, bowel wall thickening, mesenteric fat stranding, and intramural haematoma. The cases underscore the importance of maintaining a high index of suspicion in trauma patients with vague abdominal symptoms. Early identification of these radiological signs led to timely surgical interventions, resulting in favourable outcomes. Through detailed imaging and clinical correlation, this series provides valuable insights for radiologists and emergency clinicians, emphasising the critical role of CECT in diagnosing traumatic bowel perforations at anatomically complex regions like the DJ flexure. Improved awareness and interdisciplinary coordination can significantly enhance early detection and reduce complications from delayed treatment.

Keywords: Bowel perforation, Contrast-enhanced CT, Hollow viscus injury

CASE REPORT

Blunt abdominal trauma is a significant contributor to emergency presentations, and it encompasses a broad range of possible internal injuries. While the majority involve solid organs, injury to hollow viscera like the small bowel is relatively rare and diagnostically challenging. Within the small bowel, the DJ flexure is specifically vulnerable because of its fixed anatomical location at the transition from the retroperitoneal duodenum to the intraperitoneal jejunum, anchored by the ligament of Treitz [1]. Overall, blunt small bowel injury accounts for only 1%-5% of all blunt abdominal trauma cases, and perforation at the DJ flexure represents an even smaller subset, with a reported incidence of <1% of all traumatic bowel perforations worldwide [2].

Injury to this area is typically caused by high-impact trauma, such as motor vehicle collisions or falls from a height [3]. Because the initial symptoms are often non-specific and can be masked by more apparent injuries, these perforations are frequently overlooked [4].

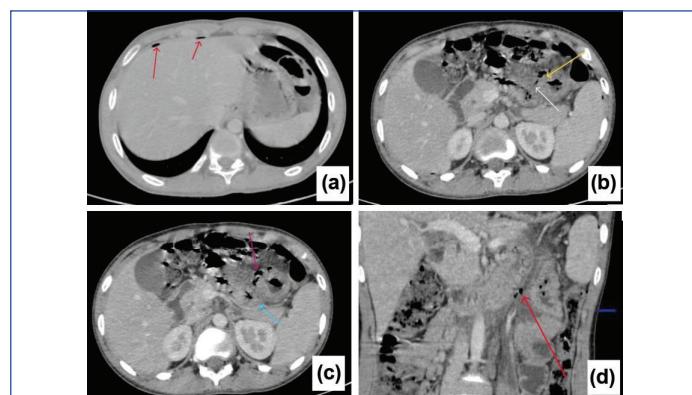
Imaging plays a crucial role in early detection. CECT is particularly valuable, as it can identify free air, bowel wall changes, and localised fluid collections that are suggestive of perforation. Even minimal findings, such as mild wall thickening or air foci, can be significant when correlated with clinical presentation [5].

Case 1

A 15-year-old male presented to the emergency Outpatient Department (OPD) following blunt abdominal trauma sustained in a road-traffic collision. He complained of generalised abdominal pain that began approximately 2-3 hours after the injury and progressively worsened. The pain was diffuse, non-radiating, and aggravated by movement. On arrival, vital parameters were stable {pulse 96/min, Blood Pressure (BP) 110/70 mmHg, Respiratory Rate (RR) 20/min, SpO_2 98%}. Abdominal examination revealed diffuse tenderness with mild guarding, more prominent in the upper abdomen, and sluggish bowel sounds. Laboratory investigations showed leukocytosis {White Blood Cells (WBC) 15,200/ μL } and

mildly elevated serum lactate, while other parameters were within normal limits.

CECT of the abdomen revealed a small volume of slightly hyperdense free fluid predominantly in the pelvic region, along with multiple small free air foci suggestive of a post-traumatic hollow viscus perforation and small haemoperitoneum. The fourth part of the duodenum and adjacent jejunum appeared mildly edematous with adjacent tiny air foci, suggestive of a perforation at the DJ flexure. No solid organ injury was noted [Table/Fig-1].



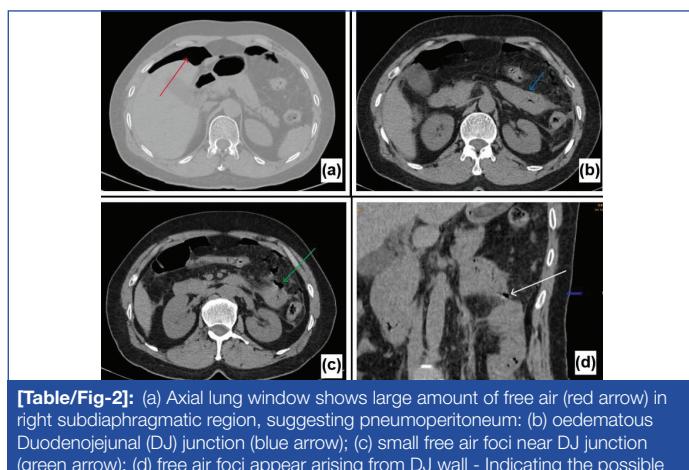
[Table/Fig-1]: CECT images of 15-year-old male patient with history of blunt abdominal trauma showing (a) free air foci (red arrow) in right subdiaphragmatic region suggesting pneumoperitoneum; (b) oedematous Duodenojejunal (DJ) junction (white arrow) with adjacent free air foci (yellow arrow); (c) tracking of free air foci near DJ junction; (d) free air foci (red arrow) appears arising from DJ wall (blue arrow), indicating the possible perforation site.

The patient was taken to the emergency operating theatre. Emergency laparotomy revealed a 0.5-1 cm perforation at the DJ flexure with localised contamination and a small intraperitoneal haematoma. Primary repair with serosal reinforcement was performed, followed by peritoneal lavage and drain placement. Postoperative recovery was uneventful. Oral feeds were started on postoperative day 4, and the patient was discharged on day 7. At 4-week follow-up, he remained asymptomatic with no postoperative complications.

Case 2

A 50-year-old male patient presented with a history of blunt abdominal trauma, accompanied by diffuse abdominal pain that began around 4-5 hours after a road traffic accident and progressively worsened; pain was diffuse and non-radiating. He also had clinical signs of peritonitis on examination (diffuse tenderness, guarding, and rigidity). On arrival, vital parameters were stable (pulse 102/min, BP 118/74 mmHg, RR 22/min). Laboratory tests showed leukocytosis (WBC 17,400/ μ L) and mildly elevated C-Reactive Protein (CRP).

Non-contrast CT (NCCT) of the whole abdomen showed a large amount of free intraperitoneal air, a classic sign of bowel perforation. Additionally, the proximal jejunal loops were markedly oedematous with adjacent hypodense fluid collections, suggestive of acute post-traumatic changes. No injuries to solid organs were identified. The DJ flexure was markedly thickened with adjacent mesenteric fat stranding, raising the suspicion of perforation [Table/Fig-2].



[Table/Fig-2]: (a) Axial lung window shows large amount of free air (red arrow) in right subdiaphragmatic region, suggesting pneumoperitoneum; (b) oedematous Duodenojejunal (DJ) junction (blue arrow); (c) small free air foci near DJ junction (green arrow); (d) free air foci appear arising from DJ wall - Indicating the possible perforation site (white arrow).

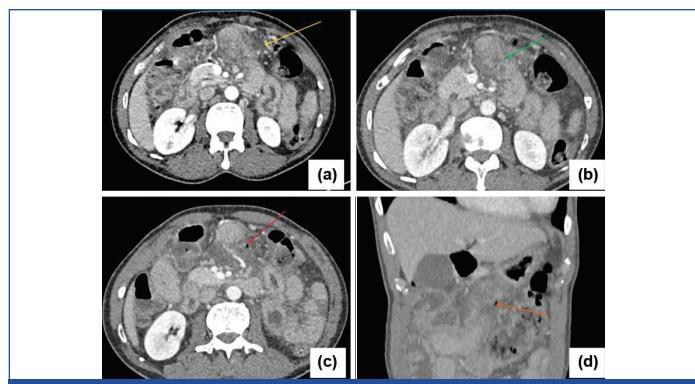
This finding was confirmed by the emergency surgeons during surgical exploration. Intraoperatively, a perforation at the DJ flexure with localised contamination was identified, and primary repair was performed.

The large volume of free air in this case highlighted the severity of the perforation, making radiological diagnosis more straightforward compared to the subtler findings in Case 1. Postoperative hospitalisation was uneventful, and the patient was discharged on postoperative day 8.

Case 3

The third case is of a 52-year-old male patient with blunt abdominal trauma during a motor vehicle collision. He received initial primary care at a local hospital within one hour of the collision. A CECT abdomen was performed to assess for haemoperitoneum and visceral injuries approximately three hours after the injury. Initially, the call radiologist missed the presence of extraluminal air. However, when the patient failed to improve on conservative management, the scan was re-evaluated, which confirmed the presence of small pneumoperitoneum and free intraperitoneal fluid, both highly suggestive of hollow viscus injury. The fourth part of the duodenum and the proximal jejunal loops at the DJ flexure exhibited marked mural thickening. Surrounding mesenteric fat stranding and ill-defined fluid collection supported the diagnosis of DJ flexure perforation. Importantly, the presence of a hyperattenuating intramural haematoma on post-contrast images confirmed bowel wall injury [Table/Fig-3].

Surgical intervention validated the imaging findings, identifying a perforation at the DJ flexure and associated haematoma. Primary repair with haematoma evacuation and peritoneal lavage was performed. The patient improved considerably after surgical intervention. He was discharged on postoperative day 9 and remained asymptomatic during a 4-week follow-up.



[Table/Fig-3]: CECT images of 52-year-old male patient: (a) Slightly hyperdense free fluid collection in left hypochondrial region (yellow arrow) suggesting haemoperitoneum; (b) markedly oedematous Duodenojejunal (DJ) junction with heterogeneous appearance suggesting bowel haematoma (green arrow); (c), small free air foci near DJ junction (red arrow); (d) free air foci appear arising from DJ wall, indicating the possible perforation site (red arrow).

DISCUSSION

The DJ flexure injuries are very rare with considerable clinical risk. This segment of the bowel, positioned at the junction of retroperitoneal and intraperitoneal regions, is less mobile and thus more susceptible to blunt abdominal trauma with shearing forces [5]. Pathophysiological, sudden deceleration or compression forces create a fixed-point shearing effect at the ligament of Treitz, predisposing the DJ flexure to full-thickness tears, mesenteric avulsion, and intramural haematoma formation. Injury to this segment can result in a full-thickness bowel wall perforation, necessitating surgical management [6].

Similar recent case reports also describe DJ flexure perforation following high-impact blunt trauma, with CT demonstrating focal wall discontinuity, adjacent free air, and mesenteric fat stranding as key diagnostic markers [7,8]. Notably, Koshariya M et al., (2021) reported a surgically confirmed DJ flexure transection after blunt trauma, highlighting the same mechanism of shearing forces and the importance of early CT evaluation [2]. Appelbaum RD et al., also described delayed duodenal perforation after blunt trauma, showing that early CT findings may be subtle and easily missed, underscoring the need for vigilant interpretation in borderline cases [9]. Collectively, these reports reinforce that CT features in our second and third cases- particularly extensive free air and mural haematoma- are well-recognised indicators of significant bowel injury.

CECT abdomen is the most reliable modality for assessing trauma to the abdominal viscera. Contrast CT abdomen is highly sensitive for the detection of pneumoperitoneum, wall discontinuity, mesenteric fat stranding, and fluid accumulation; hence, it is critical for the diagnosis of bowel perforation, especially in subtle cases, where only a small amount of air has leaked outside the bowel, making the diagnosis difficult on an erect abdominal X-ray [10]. In particular, CT's ability to detect minimal extraluminal air was crucial in our first case, preventing diagnostic delay.

Differential diagnoses for radiological signs of free air or wall changes include non-traumatic causes such as ulcerative perforation or Crohn's disease. In the trauma setting, however, free peritoneal air may also arise from penetrating abdominal injury or an associated diaphragmatic tear. Recognising the mechanism of injury and combining it with imaging findings can narrow down the differential diagnosis. In our cases, penetrating trauma and diaphragmatic injury were ruled out clinically and radiologically, and the combination of haemoperitoneum with free air in the setting of blunt trauma was diagnostic of bowel perforation. This correlation between the mechanism of injury and CT findings is consistently emphasised across similar case reports and serves as a key determinant in avoiding missed or delayed diagnosis.

Surgical intervention remains the cornerstone of management. Prompt repair minimises the risk of postoperative complications. In

this series, all patients underwent timely operations and recovered well, demonstrating that with accurate diagnosis and early management, outcomes can be significantly improved. Depending on the extent of injury, surgical options include primary perforation repair, serosal reinforcement, resection with anastomosis for devitalised segments, and evacuation of associated intramural haematomas. DJ flexure injuries generally carry a good prognosis when treated early; however, delayed diagnosis increases the risk of sepsis, prolonged ileus, and re-operation [2,11]. The favourable postoperative outcomes in our series are comparable to other recent DJ and duodenal trauma cases, further supporting the role of early CT detection, rapid surgical decision-making, and operative management in improving prognosis.

CONCLUSION(S)

Perforation at the DJ flexure following blunt trauma is a rare but serious condition that requires prompt diagnosis and management. CECT is the most effective imaging modality to detect these injuries, and even subtle findings should not be overlooked in the context of significant trauma. Increased vigilance and interdisciplinary coordination are crucial for improving outcomes in patients with traumatic bowel perforation at the DJ flexure.

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