

## Case Report

# Duodenal Rupture after Blunt Abdominal Trauma by Bicycle Handlebar: Case Report and Literature Review

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### ABSTRACT

Blunt abdominal trauma is most frequent in the pediatric population. Duodenal lesions after abdominal trauma in children are infrequent and tend to be secondary to traffic accidents. It is up to five times more frequent in males, with an average age between 16 and 30 years. Bicycle accidents continue to lead to morbidity and mortality in children, representing between 5% and 14% of total blunt abdominal injuries. The diagnosis of duodenal injuries after trauma is difficult and requires a high index of clinical suspicion. We present the case of a 17-year-old patient seen in the emergency room after falling off his bicycle and presented a blunt trauma in the epigastric region. On physical examination, there was a swelling in the upper right abdominal quadrant and epigastrium with tenderness on deep palpation. He presented with hematemesis without hemodynamic repercussion. A contrast abdominal computed tomography was performed and he was diagnosed with third-part duodenal rupture. A resection of the perforated third-part duodenal rupture was performed, and the transit was reconstructed using a Roux-Y duodenojejunostomy. The postoperative period was uneventful and the patient was discharged after 16 days of stay. Duodenal injury is very rare, produced by high-energy trauma. They rarely present as single lesions as other visceral lesions are usually associated. The early diagnosis is important to reduce the morbidity and mortality.

**KEYWORDS:** Blunt abdominal trauma, duodenal injury, handlebar injury

## INTRODUCTION

Duodenal injury after abdominal trauma is infrequent,<sup>[1]</sup> representing between 3% and 5% of total abdominal injuries due to trauma.<sup>[2]</sup> Blunt abdominal trauma is the leading cause of injuries in children.<sup>[3]</sup> The most frequent cause of duodenal injury is closed abdominal trauma from traffic accidents. They are up to five times more frequent in men, with an average age between 16 and 30 years.<sup>[4]</sup> The duodenal injury is diagnosed late due to the retroperitoneal location of duodenum and is associated with a high rate of complications and mortality.<sup>[4]</sup>

Duodenal injury occurs in 2%–10% of children after closed abdominal trauma.<sup>[5]</sup>

Bicycle accidents continue to be the leading cause of morbidity and mortality in children, representing

between 5% and 14% of total closed abdominal injuries. Bicycle handlebar injuries often go unnoticed or are underestimated upon arrival in the emergency room.<sup>[6]</sup>

## CASE REPORT

A 17-year-old male presented to the emergency room after an accidental fall with his bicycle. He presented with epigastric and right hypochondrium abdominal pain after injured the handlebar of the bicycle, with nausea and hematemesis.

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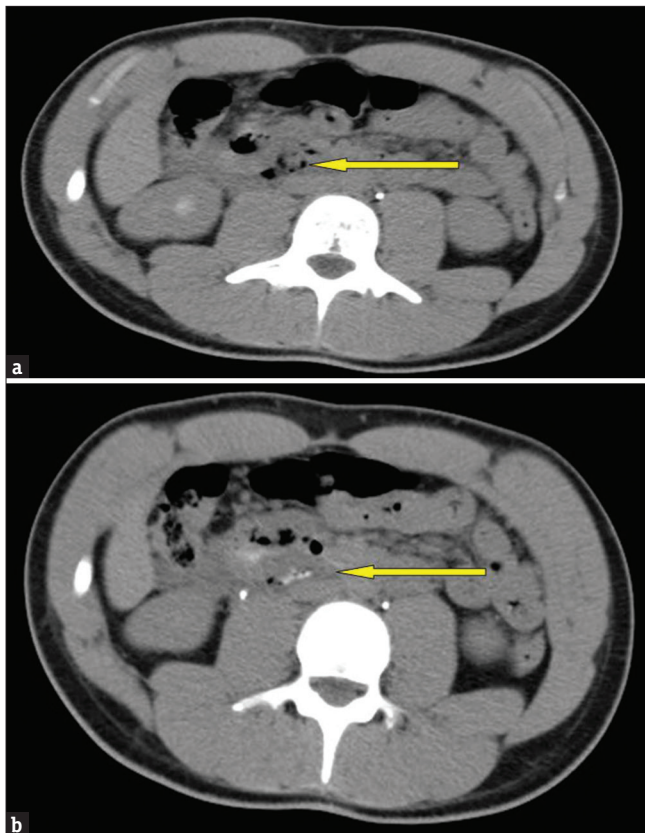
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Vital signs were as follows: blood pressure 121/64 mmHg, beats per minute 80/min, and body temperature 36.5°C. On physical examination, he had upper right abdominal quadrant and epigastrium swelling with tenderness on deep palpation.

Full blood count, electrolyte, urea and creatinine, and liver function test were within normal limits.

An abdominal ultrasound was performed that showed free fluid in Morrison space. A double contrast-enhanced (intravenous and oral) computed tomography (CT) revealed the existence of extraluminal air bubbles, adjacent to the posterior region of the third duodenal part. There was extravasation of oral contrast into the anterior pararenal space, confirming leak from the posterior wall of the third duodenal part [Figure 1].

Through transverse incision, the peritoneal cavity was accessed, and periduodenal free fluid and a nonexpansive retroperitoneal hematoma were discovered [Figure 2]. The duodenum was Kocherized, identifying perforation of about 2 cm in the posterior wall of the third part of duodenum, and no associated pancreatic lesion was observed.



**Figure 1:** Computed tomography scan findings (a) Pneumo-retroperitoneum in relation to perforation of third duodenal portion (b) Contrast extravasation at the third duodenal portion level

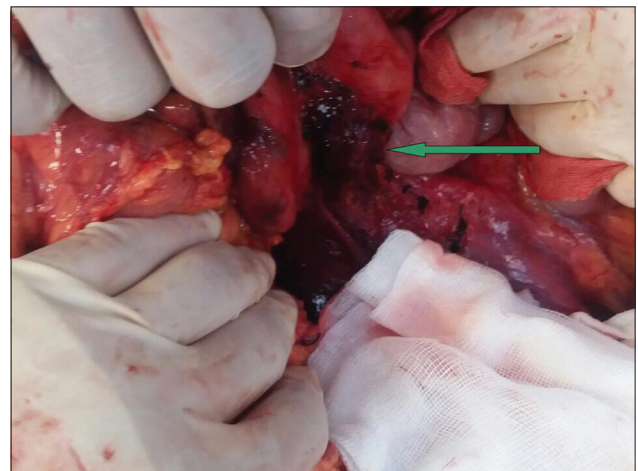
Vater ampulla was identified at the duodenal level to assess the limit of resection. Resection of the third portion of the duodenum was performed using a 80mm-3,8 mm GIA blue load (GIA Stapler Covidien®) and duodenojejunostomy using side-to-side manual biplane anastomosis. The intestinal continuity was reconstructed by means of an anastomosis between the fourth part of duodenum and the jejunum according to Y Roux [Figure 3].

In the immediate postoperative period, there was a wound hematoma that required transfusion of blood. There was biochemical evidence of pancreatic injury with elevation of amylase up to 184 U/l and lipase up to 595 U/l with subsequent reduction after some days. Abdominal-pelvic postoperative CT was performed without evidence of abdominal collections or pancreatic alterations. Progressively, the patient improved and was discharged from the hospital after 16 days.

## DISCUSSION

The first duodenal injury was successfully operated after blunt abdominal trauma was performed in 1896 by Herczel whereas the first perforation of the duodenum caused by a gunshot was described by Summers in 1904.<sup>[7]</sup> Small bowel perforation is rare in children after abdominal trauma.<sup>[3]</sup> Duodenal injury due to blunt abdominal trauma represents 20% of all duodenal injuries.<sup>[1]</sup> The main mechanism of action is by shearing (after hitting the duodenum against the spine). The second duodenal part is the most frequently affected, followed by the third, fourth, and first parts.

Duodenal injuries occur in 0.5%–5% of total abdominal trauma, being observed in 11% of gunshot wounds, in 1.6% of stab wounds, and in 6% of blunt abdominal traumas.<sup>[2]</sup> Duodenal trauma in the pediatric population is infrequent (0.14%–0.16%).<sup>[8,9]</sup>



**Figure 2:** Intraoperative findings of duodenal perforation in third portion

Its diagnosis requires a high index of suspicion. The most frequent symptom is abdominal pain due to the impact. During physical examination, guarding and tenderness are not usually found. There are no biochemical markers that relate the severity of the trauma.

Some authors suggest that persistently elevating the amylase value in blood has prognostic significance in the detection of duodenal injury.<sup>[4]</sup> Felson and Levin<sup>[10]</sup> described the sign of the spring, suggestive of duodenal intramural hematoma. The CT with double contrast (intravenous and oral) is the test of choice for its diagnosis. Despite this, Ballard describes the presence of free intraperitoneal fluid (in 73% of the patients with complete duodenal rupture after blunt trauma), duodenal hematoma (40%) and pneumoperitoneum (33%). The presence of pneumoperitoneum is not an indication for surgery by itself, whereas oral contrast extravasation is an indication.<sup>[6,11]</sup>

The performance of an abdominal ultrasound has a sensitivity of 85% for the diagnosis of abdominal injuries compared to the CT scan.<sup>[3]</sup> The BATiC score allows to assess the need to perform an imaging test (abdominal CT) in the pediatric population after abdominal trauma [Table 1]. For this, a score  $\leq 7$  points has a negative predictive value of 97%.<sup>[3]</sup> In our patient, the BATiC score was 11 points.

The treatment is fundamentally surgical, reserving nonoperative treatment for hemodynamically stable patients with duodenal lesions such as hematoma/duodenal contusion without evidence of intestinal perforation on CT scan. The presence of duodenal crepitus, periduodenal bile, choleperitoneum, or an extensive duodenal hematoma are features of suspected perforation.<sup>[4]</sup>

The type of surgery depends on the type of duodenal lesion, the portion involved, and the associated visceral

injuries. Important factors in the surgical treatment include the anatomical relation of the lesion; its severity; the circumferential involvement of the duodenum; and the associated vascular, biliary, or pancreatic damage. For this, the American Association for the Surgery of Trauma-Organ Injury Scaling Committee has established the classification for duodenal damage after trauma [Table 2].

Surgery should begin with an incision of suprainfrumbilical midline laparotomy or a transverse incision that allows appropriate access and surgical field. For this, the Kocher and Cattell–Braasch maneuvers allow a good exposure of the field.

Grade I injuries can be treated nonoperatively by nasogastric tube placement and prolonged parenteral nutrition, which are the ones with the lowest mortality (8.3%). In cases of Grade I–II injuries that affect the second or third duodenal portion, the preparation of a patch of intestinal mucosa or serosal is recommended within the first 24 h. After this time, pyloric exclusion (primary repair of the duodenal lesion, pyloric closure by gastrotomy, cholecystectomy

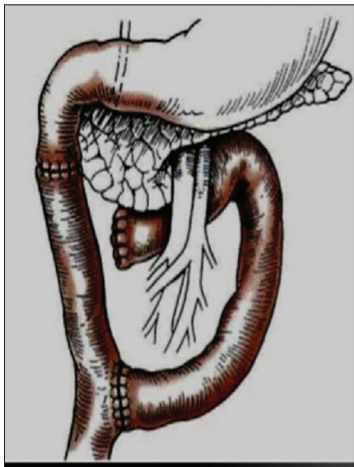
**Table 1: Blunt abdominal trauma in children Score**

	Points
Abnormal abdominal Doppler US	4
Abdominal pain	2
Signs of peritoneal irritation	2
Hemodynamic instability	2
AST >60 U/L	2
ALT >25 U/L	2
WBC count >9.5 g/l	1
LDH >330 IU/L	1
Lipase >30 IU/L	1
Creatinine >50 microgr/L	1

**Table 2: American Association for the Surgery of Trauma grading duodenal injuries**

AAST grade	Injury characteristics
I	Hematoma involving single portion of wall Laceration: Partial thickness, no perforation
II	Hematoma involving more than 1 portion Laceration: <50% circumference disruption
III	Laceration: Disruption of 50%-75% circumference of the second portion Disruption of 50%-100% circumference of the first, third, or fourth portions
IV	Laceration: Disruption of >75% circumference of the second portion Involvement of ampulla or distal common duct
V	Laceration: Massive disruption of duodenopancreatic complex Duodenal devascularization

AAST: American Association for the Surgery of Trauma



**Figure 3: Duodenojejunostomy in Y Roux**



with decompression of the bile duct by Kher tube, and gastroenteroanastomosis) described by Vaughan in 1977 is a good surgical option.

The placement of decompression probes, described by Stone and Fabian in 1979, is another surgical alternative currently used.<sup>[12]</sup>

Grade III lesions, as in our patient, can be treated by resection and primary anastomosis or by pyloric exclusion. Primary repair is successful in 80% of cases.<sup>[12]</sup> In the cases of severe duodenal lesions (Grades IV and V), the pyloric exclusion is contemplated as well as a duodenal diverticulization (described by Berné in 1968 consisting of debridement and duodenorrhaphy, antrectomy, gastrojejunostomy, truncal vagotomy, decompression of the bile duct, and jejunostomy) associated or not with pancreatotomy, representing a high morbidity and mortality rate (30.8 and 58.8%, respectively). In the case of complete duodenal transection, adequate debridement, mobilization, and end-to-end anastomosis are advised. If the first portion is affected, an antrectomy with duodenorrhaphy and a Billroth II reconstruction are enough. In cases of the third or fourth duodenal portion, a duodenojejunostomy in Y Roux is the procedure of choice.<sup>[13]</sup>

The use of laparoscopic access in duodenal trauma was first described by Tygat in 2010 when a 10-year-old child with a second duodenal lesion was successfully treated. It can be considered safe in hemodynamically stable patients without other associated lesions.<sup>[8]</sup>

Among the complications of surgery described are duodenal fistula (2%–16%), the formation of abdominal abscess (15%), intestinal obstruction (5%–8%), and acute pancreatitis (0.5%).<sup>[14]</sup> Early surgery, within the first 24 h, reduces morbidity and mortality from 60% to 30% and from 25% to 6%, respectively.<sup>[15]</sup>

## CONCLUSIONS

Duodenal rupture after blunt abdominal trauma by bicycle handlebar is a rare entity. Most of the times, it is caused by high-energy trauma. It rarely presents as single injury and other visceral lesions are usually associated. CT scan with double contrast is the test of choice for its diagnosis. Early diagnosis is important to reduce the morbidity and mortality since most of the severe duodenal injuries require surgical management.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the

patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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