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## Case report

# Injury to the duodenum following blunt abdominal trauma – Literature review and case report



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## ABSTRACT

**Introduction:** Injuries to the duodenum present a very serious diagnostic problem. Consequently, such are detected and treated in the very late stage, resulting in increased mortality rates. Such injuries account for 4.3% of all abdominal injuries. They often co-occur with injuries to other organs, and therefore are rarely found in isolation. Two types of injuries to the duodenum are differentiated: penetrating and blunt.

**Aim:** To present a case of duodenal injury following a blunt impact to the abdomen.

**Case study:** A female patient, 19 years of age, was admitted to the Clinical Department of General Surgery in a serious condition. The Emergency Response Team stated that this patient had reported severe abdominal pain in the epigastrium lasting for some hours and hematemesis. The patient's explanations as to the occurrence of injury were vague. A CT scan revealed injury to the duodenum.

**Results:** The patient was qualified for life saving surgery. Extensive transversal rupture of the anterior duodenal wall was detected. The injury was closed with double-layer tension-free sutures.

**Discussion:** The identified transversal rupture of the anterior duodenal wall was most likely the result of being beaten up or due to participation in a fight. Consequently, the patient experienced blunt injury to the abdomen causing the described trauma.

**Conclusions:** (1) We wish to emphasize the possibility of injury to the duodenum following blunt abdominal trauma that is difficult to diagnose and not always capable of being confirmed by information obtained during a patient interview as to its specific cause. (2) We draw attention to the necessity of taking a carefully detailed interview with the patient.

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## 1. Introduction

Duodenal injury (DI) is a very serious diagnostic challenge for surgeons due to the retroperitoneal location of the duodenum. Such injuries are detected and treated at a rather late stage, which unfortunately increases mortality rates. DIs account for 4.3% of all injuries to the abdominal organs.<sup>1</sup> They often co-occur with serious traumas to other abdominal organs.<sup>2</sup> Hence, they are rarely found in isolation. The ratio of DIs found in males to those in females is 5:1.<sup>1</sup> They are rare in children.<sup>3</sup> Such injuries most frequently occur between ages 16 and 35 years. An increased incidence of DI in this range of ages is associated with a larger number of traffic accidents and assaults employing blunt instruments and aggressive attacks.<sup>1</sup>

Two types of DI are differentiated: penetrating injury and blunt injury. The former is revealed during laparotomy as damage to the duodenal wall (caused, for instance, by a knife) or as a penetrating wound dispersed by the kinetic energy of a bullet. The mechanism of blunt injury is more complex. This results from the crushing injury to the duodenum. Crush injuries usually occur at the moment of direct impact to the abdominal wall, the power then being transferred to the duodenum. They may also appear as a result of the impact of power associated with acceleration and deceleration on the movable and immovable parts of the duodenum, for instance during a fall from a considerable height.

Santos et al. reviewed literature on DI published in the last 46 years at PubMed. They described in total 1760 cases of DI. Penetrating trauma accounted for 80% of injuries, and blunt trauma for 20%. Out of 1400 cases of penetrating DI, the most frequent cause was gunshot (81%) and knife stabbing (19%). Out of 360 cases of DI due to blunt trauma, the most common cause was car accident (85%). In multi-organ injuries, apart from the duodenum, the most frequently affected abdominal organs included: liver (17%), large intestine (13%), pancreas (12%), small intestine (11%) and stomach (9%). Injuries to blood vessels – arteries and veins – accounted for 15% of cases. In the same study, Santos et al. also analyzed 1042 cases of DI in terms of the anatomical location of the injury. Most commonly damage was done to the descending part of the duodenum (36%), then the horizontal part (18%) and finally the ascending part (15%). The superior part of the duodenum (13%) was least frequently injured. Injury to more than one part of the duodenum was reported in 18% of such cases.<sup>1</sup>

## 2. Aim

To present the case of a female patient with injury to the duodenum following blunt trauma to the abdomen owing to an uncertain cause.

## 3. Case study

A female patient, 19 years of age, was admitted urgently in a serious condition to the Clinical Department of General Surgery of the Faculty of Medical Sciences at the University of Warmia and Mazury. The Emergency Response Team's

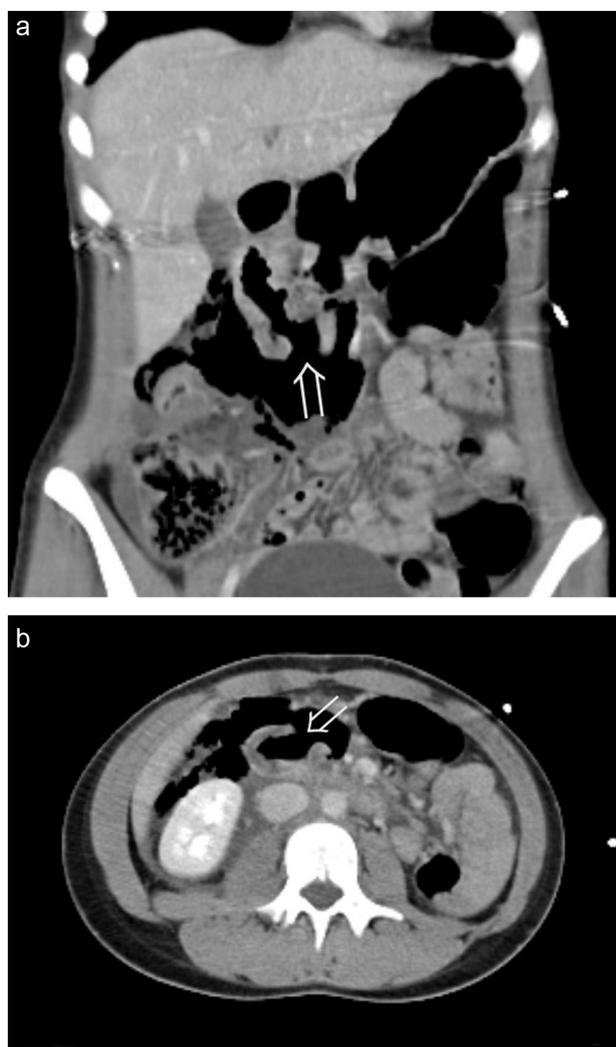
account stated that the patient had reported severe abdominal pain in the epigastrium lasting for some hours and concomitant 'bloody vomiting,' as the condition was described. The patient stated that on the way home with her friends she was injured in a traffic accident. According to her account, during the collision she had been in the car, seated in the front passenger seat with her seatbelt fastened. It was unknown how much time had elapsed between the incident and her arrival at the Hospital Emergency Unit. The patient did not remember detailed circumstances concerning the accident or did not wish to remember them and so to provide any specific information on the subject. The ambulance was called for by the patient's parents, worried about her serious condition.

The physical examination on admittance revealed tense abdominal integuments, positive peritoneal signs, inaudible peristaltic movement. Moreover, the patient had her front upper teeth (1 – right side, 2, 3 – left side) 'knocked out' and her oral cavity was covered in blood. On both sides at the base of her neck small abrasions of the skin were visible as well as abrasion (5 × 5 cm) on the right hip, hematoma in the middle epigastrium, sized 10 × 8 cm.

A contrast-enhanced CT scan of the abdomen revealed the presence of free gas and fluid in the retroperitoneal space and in the peritoneal cavity. The wall thickening in the right half of the transverse colon was also detected. No pathological lesions in other parenchymal organs, large vessels of the abdominal cavity and bone structures were identified (Fig. 1). CT scans of the head, cervical spine and chest also did not reveal post-traumatic changes. Laboratory tests yielded the following results: WBC  $20.02 \times 10^3/\mu\text{L}$ , RBC  $3.89 \times 10^6/\mu\text{L}$ , HGB 10.4 g/dL, HCT 31.5%, CRP 315.5 mg/L, lipase 78 U/L.

## 4. Results

The patient was urgently qualified for life saving surgery. During the surgery, approx. 500 mL of intestinal contents and transudate were removed by sucking from the peritoneal cavity. The entire retroperitoneal space on the right side in the prerenal region and along the descending colon and its mesentery in the small pelvis were ecchymosed and stained with intestinal contents, with the presence of air. The diaphragm and parenchymal organs did not demonstrate traumatic damage (the head of the pancreas was difficult to assess in terms of contusion). Two linear serosal tears in the transverse colon were found. Single sutures were applied. The debridement of the retroperitoneal space was begun on the external side of the duodenum, reaching the duodenal knee and the horizontal part of the duodenum. Extensive transversal rupture in the anterior wall of the horizontal duodenum was detected. The posterior wall was continuous at a length of approx. 7–10 mm. The Flocare tube was inserted below the ligament of Treitz to introduce enteral nutrition during the postoperative period (Fig. 2). The duodenum was closed with double-layer tension-free sutures. A stomach tube was inserted into the duodenum above the anastomosis. Two drains were placed into the peritoneal cavity with separate incisions. One was placed below the sutured duodenum to drain the retroperitoneal space, the other to the small pelvis.



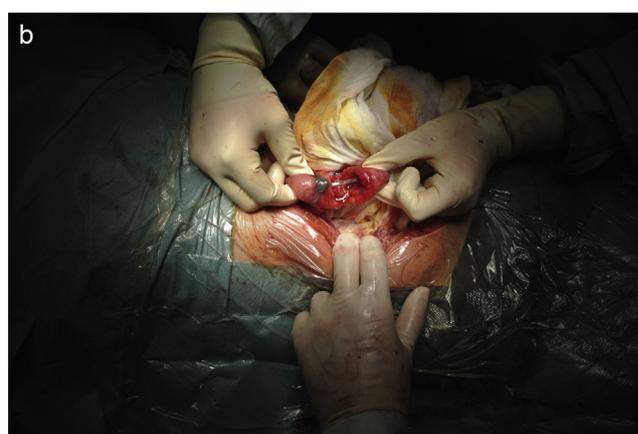
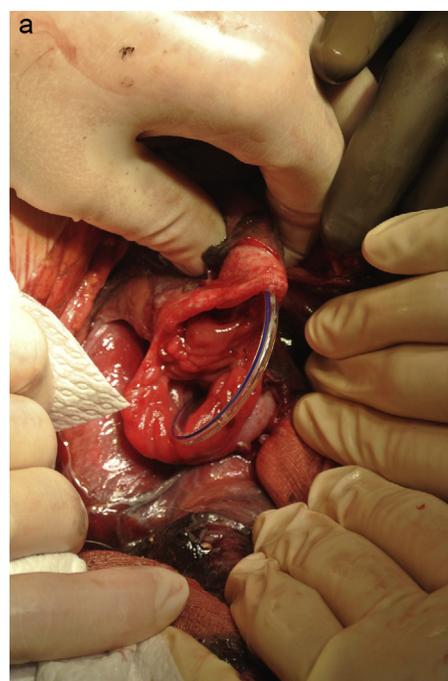
**Fig. 1 – Contrast-enhanced abdominal CT. Duodenal injury.**

Parenteral and enteral nutrition, antibiotic therapy and analgesics were introduced during the postoperative period.

No complications occurred during the postoperative period. The abdominal ultrasound performed after surgery revealed no presence of fluid, and the anastomotic site was described as not leaking. Laboratory tests taken 10 days after admittance to hospital yielded the following results: WBC  $13.6 \times 10^3/\mu\text{L}$ , PLT  $1150 \times 10^3/\mu\text{L}$ , CRP 30.18 mg/L, PCT 0.091 ng/mL. The patient was discharged 18 days following surgery; her general clinical condition was good; the wound was healed by first intention and her biochemical parameters (inflammatory markers) were normal. She was recommended to report for a follow-up in the University Outpatient Surgery Clinic and for thrombocytopenia diagnostics in the Hematology Outpatient Clinic.

## 5. Discussion

Injuries to the duodenum are rare, but can be life threatening.<sup>2</sup> They often co-occur with injuries to other abdominal organs.



**Fig. 2 – Intraoperative image. Ruptured duodenal wall with FloCare tube.**

They are difficult to diagnose and treat,<sup>4</sup> consequently a very careful and detailed interview concerning the circumstances of possible abdominal trauma is extremely important. Blunt abdominal trauma in particular may lead to serious injuries, and clinical symptoms may be mild or may not appear directly following the trauma. The absence of clinical symptoms may mislead physicians as to the assessment of the severity of the injury and thus may delay surgical treatment, leading to increased mortality rates.<sup>5</sup> Mortality rates range from 5.3% to 30.0%.<sup>1</sup> Lucas and Ledgerwood suggest that delayed diagnosis and surgical treatment of DI beyond 24 h increase mortality rates from 11% to 40%.<sup>6</sup> In the case of our patient, because of the vague interview, it was difficult to determine precisely the time of trauma and whether she was admitted to hospital within 24 h following the incident. The intraoperative condition suggests that she appeared in hospital within this period of time. Symptoms of abdominal guarding, increased tension

of abdominal muscles and the absence of audible peristaltic movements indicate an acute inflammatory process in the abdominal cavity. The retrospective study performed by Sanjay et al. demonstrated that severe abdominal pain and vomiting are key symptoms in DI. Back pain, meteorism and symptoms of peritonitis occur in less than half of all such cases.<sup>7</sup> Also are listed other clinical symptoms indicating the possibility of damage to the duodenum like: transverse vertebral body fractures of the low thoracic or lumbar spine, unexplained hypotension, proximal small bowel obstruction, abdominal sepsis and leukocytosis.

On admittance of a patient suspected with DI the following laboratory tests should be performed: complete blood count, coagulation and blood typing and crossmatching. In patients with injury to the pancreas, duodenum and small intestine, a non-specific increased activity of serum and urine amylase may be viewed as an indicator of the trauma.

Detecting DI in the CT scan or MRI scan is difficult because of the non-specific symptoms of this injury.<sup>2</sup> Contrast-enhanced computed tomography is the examination of choice in order to visualize injury to the retroperitoneal part of the duodenum.<sup>1</sup> Blood or intestinal content leaks to the peritoneal cavity are revealed then or the presence of free air, retroperitoneal hematoma or contrast extravasation. Such results of CT along with classical recommendations are indications for exploratory laparotomy. Abdominal X-ray and focused assessment with sonography for trauma (FAST) are also employed at departments of surgery with no access to imaging examinations such as CT and MRI.

The gold standard in abdominal traumatic surgery is laparotomy combined with controlling vascular and parenchymal hemorrhaging as well as antibiotic prophylaxis. During laparotomy, the entire duodenum should be visualized and carefully examined, searching for duodenal wall hematoma, retroperitoneal hematoma around the duodenum and perirenal hematoma.

DI should be treated surgically depending on the extent of the injury, but optimal treatment remains controversial.<sup>8</sup> Multiple techniques for the closure of the duodenum lumen are enumerated.

In the literature there are described: triple-ostomy technique (gastrostomy, duodenostomy and jejunostomy), jejunal serosal patch, jejunal mucosal patch, vascular pedicles, duodenal resection (duodenal duodenostomy, duodenal jejunostomy), duodenal diverticulization (antrectomy and gastro-jejunostomy), truncular vagotomy, wound excision and duodenorrhaphy, duodenostomy, Kehr's tube and feeding jejunostomy), pyloric exclusion (temporary pyloric closure and transit reconstruction by gastrojejunostomy) and duodenal pancreatectomy (Whipple procedure).<sup>1</sup> Primary suture repair should be the initial approach considered for most injuries.<sup>9</sup>

We suspect that the actual mechanism for DI in the described patient was blunt abdominal trauma in the middle epigastrium caused by a severe impact in this region. Literature provides cases of injuries to the intestinal wall (ruptures, contusions) caused by the compression of abdominal integuments by the hip strap of the safety belt.<sup>10</sup> The physical examination of the patient revealed external injuries (bruises and abrasions) to the neck, to the chest near the right and left clavicles, to the abdomen and near the hips on both

sides, yet these injuries do not necessarily suggest that the patient had had her seatbelt fastened during the collision.

It is also interesting that the patient had her front upper teeth (1 – right side, 2, 3 – left side) 'knocked out' and her oral cavity was covered in blood. These are not typical injuries following a car crash. The relations as to the patient's participation in a traffic accident are also vague. The patient did not provide the specific date, time and place of the incident, type and brand of the car in which she had traveled as well as the names of people who had participated in this event. She only claimed that she had not remembered anything from that time.

We believe that the patient was beaten up or participated in a fight, as a result of which she experienced blunt abdominal trauma that caused the rupture of the anterior wall in the horizontal duodenum. This may be confirmed by the presence of ecchymosis in the middle epigastrium (most likely a knee kick in the epigastrium) and injury to the oral cavity and knocked out teeth, typical of a fist punch to the face.

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## 6. Conclusions

(1) In this case report we wish to emphasize the possibility of injury to the duodenum following blunt abdominal trauma that is difficult to diagnose and not always capable of being confirmed by information obtained during a patient interview as to its specific cause. This is a rare injury to abdominal organs that may result in serious life threatening complications. (2) We draw attention to the necessity of taking a carefully detailed interview with the patient as to the specific circumstances resulting in abdominal trauma, thus helpful in determining further diagnostic procedures and identifying the cause of the trauma.

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## Conflict of interest

None declared.

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