CASE REPORT

Duodenal perforation as result of blunt abdominal trauma in childhood

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SUMMARY

Blunt abdominal trauma may cause severe intra-abdominal injuries, while clinical findings could be mild or absent directly after the trauma. The absence of clinical findings could mislead physicians into underestimating the severity of the injury at the primary survey, and inevitably leads to a delay in the diagnosis. The Blunt Abdominal Trauma in Children (BATiC) score may help to identify children who are at a high risk for intra-abdominal injuries in an early stage and requires additional tests directly. A case of a 10-year-old girl with a duodenal perforation after a blunt abdominal trauma is presented. A delay in diagnosis may lead to an increased morbidity and mortality rate. A low admission threshold for children with abdominal pain after a blunt trauma is recommended.

BACKGROUND

In the USA, around 600 000 persons are hospitalised with trauma-related injuries annually. Approximately 20–30% of these patients have abdominal injuries. Blunt, rather than penetrating, trauma causes the most abdominal injuries in children.¹

It may be difficult to diagnose abdominal pathology at the initial presentation following blunt abdominal trauma, especially in children. Possible contributing factors are misinterpretation or the absence of symptoms at the initial presentation, as well as the absence of free intra-abdominal fluid on the ultrasound, and inappropriate or inconsistent child–physician communication may cause underestimation of injury severity. A delay in diagnosis and related treatment is associated with a prolonged hospital stay, more extensive therapy and an increased complication rate.^{2–4} A case of blunt abdominal trauma in a young girl is presented. Besides mild abdominal pain, there were no abnormalities at the primary survey.

CASE PRESENTATION

A 10-year-old girl presented at the emergency department, with abdominal pain and nausea after a fall from a 2 m height. She fell down from a tree and landed striking her abdomen on a raised curb stone. Her medical history consisted of attention deficit hyperactivity disorder (ADHD), for which she was on methylphenidate treatment. The initial vital signs were normal: a heart rate of 99 bpm and blood pressure 112/70 mm Hg. Trauma screening, according to Advanced Trauma Life Support (ATLS) protocol,⁵ revealed no abnormalities

besides mild abdominal tenderness. There were no signs of peritoneal irritation.

INVESTIGATIONS

A Focused Assessment with Sonography for Trauma (FAST) of the abdomen, performed by an experienced radiologist, showed no injuries to the hollow organs and no free intra-abdominal fluids. A chest X-ray showed no traumatic injuries and no free gas under the diaphragm. Laboratory tests showed slightly elevated serum amylase 125 U/L (normal 0–100 U/L), aspartate aminotransferase (ASAT) 75 U/L (normal 0–31 U/L) and alanine aminotransferase (ALAT) 50 U/L (normal 0–31 U/L). Urine screening tests showed no abnormalities.

DIFFERENTIAL DIAGNOSIS

Owing to the trauma mechanism, several injuries were possible: haematoma/bleeding, contusion, perforation of a hollow organ, laceration of a solid intra-abdominal organ or retroperitoneal injuries. Slightly elevated liver enzymes and serum amylase levels might also be explained as side effects of methylphenidate usage.

TREATMENT

The patient was admitted to the paediatric surgical ward for observation because of her sustained trauma and mild abdominal pain in combination with slightly elevated liver enzymes. Her vital signs and pain score were measured at 4 h intervals, and

Figure 1 CT scan of free abdominal fluid lateral of the colon ascendens (transversal).

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Figure 2 CT scan of free abdominal fluid lateral of the colon ascendens (coronal).

remained stable during the evening and night. The following morning, she developed a temperature of 39.8°C, increased abdominal pain, involuntary muscle guarding and rebound tenderness. The ultrasound was repeated and revealed free fluid in Douglas' pouch and Morrison's pouch. Following these results, an abdominal CT was conducted, showing free gas and fluid retroperitoneal fluid (figures 1 and 2). Although haemodynamically stable, she was taken directly to the operation theatre, because abdominal sepsis was imminent. A laparoscopy was performed with mobilisation of the hepatic flexure. During the laparoscopy, a duodenal perforation was found (figures 3 and 4), which was primarily closed through a small transverse incision. A correction under direct view was preferred because of limited experience with laparoscopic closure of the duodenum and to limit the duration of the surgery. Recovery after the operation was slow, and complicated by a paralytic ileus.

OUTCOME AND FOLLOW-UP

On the 11th day after admittance, the patient developed a fascia dehiscence, which was corrected operatively without a mesh. At 19 days after admittance, the patient was discharged in good condition.

DISCUSSION

A perforation of the small intestine after blunt abdominal trauma is rare, especially in children. However, the diagnosis of

Figure 4 Close-up of the duodenal perforation seen during laparoscopy.

these injuries is often delayed^{2–4} due to the absence of symptoms and clinical findings directly after the trauma. Delay in the diagnosis and increased time to treatment is associated with increased morbidity and mortality.

Our patient presented with minimal symptoms of abdominal pain, and slightly elevated levels of liver enzymes and serum amylase. The FAST showed no abnormalities during the primary survey.

Additional tests or clinical findings might help to identify patients with a high risk of intra-abdominal pathology after a blunt abdominal trauma. Holmes *et al*, reviewed the medical records of 1095 children after a trauma. The following symptoms were associated with an increased risk of abdominal injuries: low systolic blood pressure (OR 4.1; 95% CI 1.1 to 15.2), abdominal tenderness (adjusted OR 5.8; 95% CI 3.2 to 10.4), femur fracture (adjusted OR 1.3; 95% CI 0.5 to 3.7), serum ASAT >200 U/L or ALAT >125 U/L (OR 17.4; 95% CI 9.4 to 32.1), urinalysis with more than five red blood cells per high-powered field (OR 4.8; 95% CI 2.7 to 8.4) and initial haematocrit of less than 30% (adjusted OR 2.6; 95% CI 0.9 to 7.5).⁶

Our patient had an elevated serum amylase level. The role of amylase in blunt abdominal trauma cases is currently not clear. Fakhry *et al* showed that serum amylase was significantly elevated in patients with a small bowel injury. However, serum amylase did not discriminate between patients with or without bowel injury.⁷ McAnena *et al* presented a study revealing that amylase ≥ 20 U/L and alkaline phosphatase ≥ 3 U/L in an

Figure 3 Duodenal perforation seen during laparoscopy.

Table 1 Blunt Abdominal Trauma in Children (BATiC) score, by Kumar *et al*¹¹

Variables	Value	Points
Abnormal ultrasound	Yes	4
Abdominal pain	Yes	2
Peritoneal irritation	Yes	2
Haemodynamic instability	Yes	2
ASAT	>60 U/L	2
ALAT	>25 U/L	2
WCC	>9.5 g/L	1
LDH	>330 U/L	1
Lipase	>30 U/L	1
Creatinine	>50 µg/L	1

ALAT, alanine aminotransferase; LDH, lactate dehydrogenase; WCC, white cell count.

abdominal lavage had a positive predictive value of 88% for significant bowel injury. The addition of those tests in patients with equivocal findings could help to provide the diagnosis.⁸ Kumar *et al*⁹ demonstrated that amylase and lipase levels in serum and urine, coupled with other laboratory tests such as liver enzymes, may be significant in predicting intra-abdominal injury.⁹

Abdominal CT scans are currently considered as 'the' imaging study to diagnose intra-abdominal injuries. Although, abdominal CT scans are upcoming in Emergency Medicine, they have several disadvantages. Disadvantages include, among others: radiation exposure, need for contrast or sedation, and high costs, also, CT scans are not (directly) available in all hospitals.

Taş *et al*, studied 96 haemodynamic stable children after blunt abdominal trauma. All patients underwent both, an abdominal CT scan and an abdominal ultrasound. In 15%, abdominal injuries were missed on the ultrasound, but it showed a high sensitivity for liver, spleen and kidney injuries. Pancreas or gastrointestinal injuries were more easily missed.¹⁰ As ultrasound is often directly available, and does not have the disadvantages of a CT scan, it is a helpful diagnostic tool after Blunt Abdominal Trauma in Children (BATiC).

To avoid unnecessary CT scans in haemodynamically stable children with blunt abdominal trauma, the BATiC score can be used. It is a simple 10-item list (table 1) to determine if an immediate CT scan is indicated or whether it can be replaced by clinical observation. The variables of the BATiC score are routinely collected and readily available. The variables include findings of clinical examination, abdominal ultrasound and standard laboratory parameters. When the BATiC score is ≤ 7 , intra-abdominal lesions are very unlikely, and clinical observation is advised. The negative predictive value is 97% (95% CI 89% to 99%).¹¹ An external validation of BATiC score confirmed these promising results.¹²

The major limitation of the current 'routine' work up at the emergency department is that injuries due to BATiC could be missed at initial presentation. Possible explanations are that there has not been enough time between the trauma and presentation to develop symptoms or reactions to the injury, and child-physician interaction/interpretation. In order to diagnose abdominal injuries in children as early as possible, we suggest a low admission threshold for clinical observation after blunt abdominal trauma. If there is an increased suspicion for intra-abdominal pathology during admission, repeat all investigations.

Learning points

- ▶ Abdominal injuries after blunt abdominal trauma in children (BATiC) constitute serious pathology.
- ▶ Clinical presentation is often not straightforward, since symptoms are difficult to identify.
- ▶ We suggest a low admission threshold for children with abdominal pain after a blunt trauma, for 24 h of observation.
- ▶ The BATiC score can be used to avoid unnecessary CT scans in haemodynamically stable patients.

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