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CASE REPORT

Acquired Duodenal Obstruction in Children

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Traumatic intramural hematoma of the duodenum is a rare cause of acquired duodenal obstruction in children, and a high degree of suspicion is therefore required to make an early and accurate diagnosis. We report a 6-year-old boy whose epigastrium was impacted by the handlebar of his bicycle during a traffic accident. The boy then experienced epigastralgia. Six days later, progressive bilious vomiting suggestive of gastrointestinal obstruction was noted. Imaging studies revealed a large hematoma extending from the fourth portion of the duodenum to the jejunum. Conservative methods of treatment failed to manage his condition. He underwent laparoscopic surgery to evacuate the hematoma. We also report a case of duodenal obstruction in a previously healthy 2-year-old girl who presented for the first time with acute symptoms of proximal intestinal obstruction. Contrast examinations showed apparent barium retention over the stomach and proximal duodenum. She underwent surgery due to persistent obstruction, and a mushroom-like foreign body was detected embedded in the orifice of the windsock duodenal web. After duodenoduodenostomy and removal of the bezoar, she had a smooth recovery and tolerated feeding well. We conclude that blunt abdominal trauma and incomplete duodenal obstruction, such as that caused by duodenal web, should be considered as possible causes of acquired proximal gastrointestinal obstruction in previously healthy children, despite their rarity.

1. Introduction

Duodenal obstruction is characterized by a failure of food to pass through the duodenum, due either to complete or partial obstruction.[1] The duodenum is the first part of the intestine into which the stomach, gall bladder, and the pancreas empty their contents. The pylorus connects the duodenum with the stomach and contains the valve that regulates stomach emptying. Obstructions usually occur at this outlet.

The causes of duodenal obstruction can be classified as congenital or acquired, and the latter can be subdivided into benign and malignant causes. In the modern era of proton pump inhibitors, benign duodenal strictures are a rare cause of duodenal obstruction, and malignancy is the main cause.[2]

We report on two cases that should serve as reminders to clinicians to consider the possibilities of intramural hematoma of the duodenum and duodenal web, as causes of acquired duodenal obstruction,

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even though duodenal web usually begins in infancy, or during the neonatal period.

2. Case Reports

2.1. Case 1

A 6-year-old boy reported progressively increasing abdominal pain, nausea, and vomiting for 3 days prior to presentation. He had previously been sent to another medical center and admitted with suspected gastroenteritis with electrolyte imbalance. However, he was transferred to our emergency department on the same day. On arrival, his vital signs and laboratory test results were normal, with the exception of leukocytosis; 18,150 white blood cells/μL, hyponatremia; 131 mmol/L, and hypokalemia; 2.4 mmol/L, with an inverted T-wave on electrocardiography. Plain radiographs of the abdomen showed a mild distention of the stomach without evidence of perforation. He was admitted to our ward for further evaluation.

After admission, frequent bilious vomiting and hypokalemia persisted despite supportive medical therapy and a potassium supplement. On the fourth day after admission, we arranged an abdominal computed tomography (CT) scan, which revealed an intestinal obstruction over the third–fourth, portion of the duodenum. The stomach and proximal duodenum were dilated and a large intramural cyst extending from the fourth portion of the duodenum to the jejunum was noted. The suspected cause was the intramural duodenal hematoma, causing the enlarged fourth portion of the duodenum to be clamped between the superior mesenteric artery and the abdominal aorta posteriorly. Superior mesenteric artery (SMA) syndrome was highly suspected (Figure 1). We investigated the cause of the intramural duodenal hematoma and SMA syndrome and the family recalled that the patient had suffered a bicycle accident 6 days before admission, with blunt trauma to the epigastric region caused by the bicycle handlebars.

The patient was then transferred to a medical center for further evaluation and surgical management. He underwent another abdominal CT scan which revealed similar results. The physician decided to pursue conservative treatment using intravenous fluids and nasogastric tube decompression, while waiting for the absorption of the intramural duodenal hematoma. On the third day after transfer to the medical center (about 2 weeks since the bicycle accident), vomiting persisted, and the intramural duodenal hematoma had not been absorbed, and the patient underwent surgery because of the persistent vomiting and potential risk of rupture.

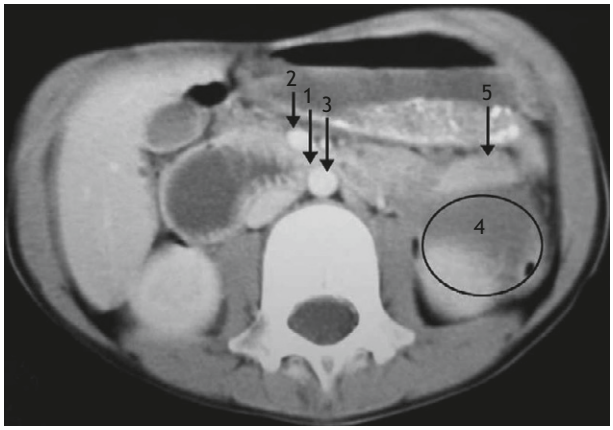

Figure 1 Abdominal computed tomography revealed dilatation of stomach and duodenum with obstruction site (arrow 1) between superior mesenteric artery (arrow 2) anteriorly, and abdominal aorta (arrow 3) posteriorly. Presence of a cystic mass about 3–4 cm is also seen in the left upper quadrant (circle 4) with jejunal lumen compressed anteriorly (arrow 5).

Figure 2 During laparoscopic surgery, an intramural hematoma extending from the fourth portion of the duodenum to the jejunum was found (black arrow). The intramural hematoma was evacuated smoothly without violation of the mucosa.

During laparoscopic surgery, an intramural hematoma extending from the fourth portion of duodenum to the jejunum was found (Figure 2). The serosa was opened and the intramural hematoma was evacuated, without violation of the mucosa.

The nasogastric tube was removed on the third postoperative day, and feeding was attempted. Feeding gradually improved and the patient was discharged on the sixth post-operative day.

2.2. Case 2

The patient was a 2-year-old girl. She had been suffering from persistent bilious vomiting for 3 days before admission, and had experienced no previous

similar episodes. She was initially sent to another hospital and was admitted for 3 days. Due to the persistence of her symptoms, she was transferred to our hospital.

When admitted, her vital signs were; pulse rate; 112/min, respiratory rate; 36/min, and body temperature; 36.9ºC. She presented with an acutely ill-looking appearance. Physical examination of the abdomen showed a soft and mildly ovoid abdomen, no palpable mass, no hepatosplenomegaly, and no peritoneal signs. The initial laboratory data were generally within the normal range, with the exception of hypokalemia and hyponatremia (Na/K= 133/2.9 mmol/L). Abdominal sonography was performed on the third day after admission due to persistent vomiting. Sonography revealed food and fluid retention in the stomach, and proximal intestinal obstruction was suspected. On the following day, an abdominal CT scan was performed, which revealed an obstruction at the level of the second-third portion of the duodenum.

The patient was then transferred to another medical center for further management due to suspected proximal intestinal obstruction. On the day of transfer, the patient received an upper gastrointestinal series, which revealed retention of contrast medium in the stomach and second portion of the duodenum, with a windsock formation (Figure 3).

She underwent surgery the same day. The operation was performed smoothly, and a mushroom-like bezoar, approximately 6.0×1.2×1.2 cm, was found to be embedded in the orifice of the duodenal web. Due to the presence of the duodenal web, the surgeon also performed a duodenoduodenostomy for duodenal reconstruction.

After the operation, vomiting subsided and oral feeding was well tolerated. The patient was discharged 5 days after the operation.

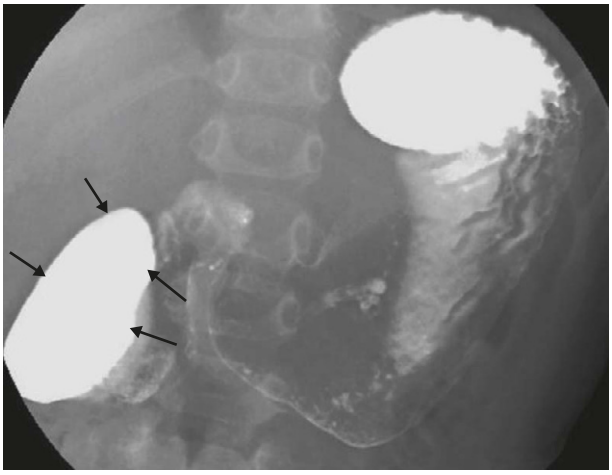

Figure 3 Contrast study revealed retention of contrast in the stomach and second portion of the duodenum with a windsock formation (black arrow).

3. Discussion

Obstruction of the duodenum occurs in adults and infants, usually for different reasons. The usual cause in adults is a peptic ulcer caused by repeated cycles of injury and scarring, resulting in a narrowing of the duodenal lumen. Modern medical treatments for ulcers mean that ulcer diseases are now rarely the cause of duodenal obstructions. In infants, obstructions are usually congenital; either the channel is underdeveloped or the pylorus is overdeveloped. The adult type is therefore sometimes referred to as acquired, while the infant type is congenital. Acquired obstructions form the focus of this report, and can be subdivided into benign and malignant causes. Intramural duodenal hematoma is a benign cause of acquired duodenal obstruction and is more common in children than in adults: Child abuse should always be considered as a potential cause.

A review of the patient's history, along with detailed physical examinations, can help to determine the cause of duodenal obstruction. Vomiting is a constant symptom and may be preceded by nausea, as the stomach attempts to squeeze its contents through a narrowing outlet. The presence of bilious vomiting may suggest that the obstruction level is distal to the ampulla of Vater.

Radiologic examination of the stomach using contrast media readily demonstrates the site of the blockage, and often a causative ulcer. Plain radiography may reveal a "double bubble" sign, indicative of a duodenal web.[3] An absence of gas in the remaining small and large bowels suggests atresia, whereas scattered amounts of gas distal to the obstruction suggests stenosis or malrotation/volvulus. Gastroscopy is another diagnostic approach. Abdominal sonography can assess duodenal integrity and associated injury, and is also useful in following hematoma resolution.[4,5] Ultrasonographic results of duodenal webs usually show the "double bubble" sign, and in older patients, a "windsock" appearance.[6] Prenatal ultrasonography may reveal polyhydramnios, but the absence of these findings does not rule out duodenal obstruction.[7] Abdominal CT can assess paraduodenal hemorrhage as well as air or contrast leak.

It is essential to establish a diagnosis of a benign disease. Although the benign nature of the stricture may be readily evident, confirmation of a benign etiology often poses a diagnostic dilemma. Endoscopic evaluation with repeated biopsies, a barium study to examine the length, morphology, and location of the stricture, and cross-sectional imaging to exclude a tumor mass are essential investigations.

In patients with benign duodenal strictures, it is initially worthwhile exploring non-surgical treatment

options. Nasogastric tube decompression and total parenteral nutrition (TPN) are often the first choice of non-surgical approaches for duodenal obstruction due to intramural hematoma.[8] If the duodenal obstruction fails to respond to medical therapy, endoscopic therapy may resolve it successfully, without the need for laparotomy. The obstruction can be simply relieved in the majority of patients by laparoscopic gastroenterostomy. Laparoscopic surgery has its applications in the management of benign duodenal conditions in adults and children. The indications that surgery is required for intramural duodenal hematoma include: hematoma that does not resolve after 2–3 weeks, other associated injuries requiring surgical management, and the presence of perforation and leakage. Laparoscopic surgical procedures used for intramural duodenal hematoma include opening of the serosa, evacuation of the hematoma without violation of the mucosa, and repair of the bowel wall, though there is concern is that this may convert a partial tear of the duodenal wall to a full-thickness tear. Duodenal rupture can be managed in most cases by primary closure. Surgeons can consider placing a jejunal feeding tube for post-operative enteral feeding.

In pediatric patients, laparoscopic duodenoduodenostomy has been performed for duodenal atresia and duodenal web, as well as laparoscopic division of congenital Ladd's bands, which cause intermittent duodenal obstruction in neonates with malrotation of the gut.[9] All treatments for duodenal web are surgical, and surgical repair is urgent, but not emergent. Contraindications to immediate surgical repair include electrolyte or fluid imbalance, severe cardiac defects (which should be repaired first), and severe respiratory insufficiency. Duodenoduodenostomy is the most commonly performed procedure, and is usually performed by exploratory laparotomy.[10] The laparoscopic procedure can be performed on infants of a reasonable size (>2.5 kg), without significant congenital cardiac disease. Endoscopic excision of a duodenal web is possible, but not widely practiced because of the precision required to avoid damaging the ampulla.

In conclusion, intramural duodenal hematoma has many clinical and therapeutic aspects. Sports injuries and traffic accidents, including bicycle handlebar impacts, are the main etiologic factors in children, but the possibility of child abuse should be kept in mind.[11] Associated traumatic pancreatitis is common.[12,13] Gastroduodenal endoscopy may be useful in confirming doubtful cases. In our case, a traffic accident with blunt trauma of the epigastric region caused by bicycle handlebars was an important clue to the correct diagnosis. Physicians should increase their awareness of intramural duodenal hematoma in order to reduce delays in diagnosis and the subsequent need for surgical decompression.

For children with the classic appearance of a 'double bubble' sign, additional radiological investigation is unnecessary for the diagnosis of duodenal obstruction, and physicians should plan for surgery, since all congenital causes of duodenal obstruction require surgery. The duodenal web should be classified as a congenital type of duodenal obstruction, which usually presents with symptoms from infancy. Our patient, however, had no symptoms until this episode caused by an embedded bezoar. These cases illustrate that it is not possible to classify duodenal obstructions as congenital or acquired solely on the basis of the time of the onset of symptoms.

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