

An Approach to Acute Abdomen in Pediatric Patients Revisited

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Abstract: *Acute pain abdomen is the most common presenting symptom to visit a pediatric outpatient department or pediatric surgery emergency. It ranges from trivial to life threatening conditions. A meticulous evaluation is necessary to prevent catastrophes. This article focuses on common conditions which need to be kept as differential diagnosis during clinical evaluation.*

Keywords: Acute abdomen; Abdominal emergencies; Bilious vomiting; Constipation; Pain abdomen

1. Introduction

The acute abdomen is defined as a group of conditions (other than abdominal trauma) which present with sudden onset of pain abdomen that require emergency medical or more often surgical management. There are myriad of conditions which present as acute abdomen, from trivial to potentially life threatening ones thus posing great diagnostic dilemma [1]. As a general rule, any abdominal pain in children which is lasting more than four hours duration should be regarded as evidence of potential abdominal emergency unless proved otherwise [2].

2. General approach to children with Acute Abdomen

Differentiating a child with a benign abdominal process from a child with a more serious or potentially fatal condition is the proverbial Gordian knot. Because non-verbal and young children cannot describe their pain, proper history taking and meticulous physical examinations make the important initial step in evaluation of acute abdomen. The objectives of evaluation of acute abdomen are threefold including rapid cardiopulmonary assessment, exclusion of life threatening conditions and lastly formulation of specific diagnosis [3]. The examiner must be very patient while examining the pediatric patients. Most of them require repeated examinations and it has been seen observed that most children with acute abdomen have self limiting course. Only a small subset of patients demands emergency treatment including emergency surgery. Some useful information can be elicited even before talking to the parents by observing in the decubitus and behavior of the patients. For example, if an infant resists any movement during examination or lying stand still may have underlying peritonitis.

The initial step for assessment of acute abdomen in children is to know the age of the child. In different age group disease pattern varies. For example, a ten day old child may have malrotation of gut as etiology whereas in the ten month old child it may be intussusception as the underlying cause

of colic. A ten year old child might be suffering from recurrent pain abdomen due to appendicitis [4].

A proper history about the frequency of episodes, duration of pain, the site and character of pain and the presence of associated symptoms for example, bilious vomiting, headache, fever, constipation, anorexia as well as factors that precipitate or exacerbate or alternate the pain is essential with this history in the background. A child with bilious vomiting more than 30 ml in a day might be suffering from acute intestinal obstruction. The possibility of non-accidental trauma (abuse) must be kept in mind as in this case the history would be unreliable; tell-tale evidence of bruising, old fractures or burn marks may be the only clues. While it's imperative to look for abdominal signs of distension, visible peristalsis, tenderness, guarding, and bowel sounds etc; a meticulous examination revealing extra-abdominal findings such as crepitations in the chest, muffled heart sounds, gallop rhythm or a characteristic rash of vasculitis is equally important [5]. Specific laboratory and radiologic studies are often asked to confirm the diagnosis. Primary imaging of abdominal emergencies in childhood is a radiograph of the abdomen, followed by ultrasound. Ultrasound is extremely beneficial in the evaluation of acute pediatric abdominal disease, such as infantile hypertrophic pyloric stenosis, intussusceptions, and acute appendicitis. Due to the radiation risk and cost factor, a selective use of computed tomography (CT) imaging is recommended in pediatric patients. Common causes of acute abdomen in pediatric populations are discussed below:

1) Appendicitis

Appendicitis is the most common cause of pain abdomen in children requiring surgical exploration. It is also the most common condition in children admitted with acute abdominal pain [6] and ironically also the most common condition to be misdiagnosed [7]. The most common findings of appendicitis in children are right lower quadrant pain, abdominal tenderness, guarding and vomiting. Because of the difficulty in evaluating young children who have abdominal pain, perforation rates for appendicitis are higher than in the general adult population (30–65%).

Moreover, because the omentum is less developed in children, perforations are less likely to be “walled-off” or localized, leading to generalized peritonitis [8]. An appendicitis score has been devised which incorporates eight factors e.g. right lower quadrant pain and tenderness, leucocytosis, pain migration, left shift of neutrophil, fever, nausea, vomiting, anorexia, peritoneal irritation, if applied in the practice, improves diagnostic accuracy [9],[10]. This scoring system has sensitivity in the range of 76 to 100% and its specificity ranges from 79 to 87 % [11], [12]. Ultrasound has sensitivity of greater than 85% and specificity greater than 90 % in diagnosing appendicitis [13]. In evaluation of children with equivocal clinical finding of appendicitis, the combination of pelvic ultrasound followed by limited CT with rectal contrast yielded a sensitivity of 94 % and a specificity of 94 % [14]. The abdominal CT scan can demonstrate thickened appendix, calcified fecoliths, thickening of the cecal wall, and peri-appendiceal fluid collections in cases of appendiceal rupture. In some institutions, CT scan of the right lower quadrant is used if US findings are equivocal or if an abscess is suspected. Equivocal cases may rarely warrant leukocyte imaging studies or technetium scans [15]. In a prospective study, Surana and colleague showed no increase in morbidity with appendicitis after active observation in a hospital compared with urgent appendectomy [16]. Advantage of laparoscopic appendectomy over the open technique varies widely, especially in children; Laparoscopic appendectomy seems to be a safe and effective means of performing an appendectomy [17].

2) Intussusception

Intussusception is defined as telescoping of one segment of intestine into another adjacent portion of bowel. It is the second most common cause of acute abdominal pain in the infants and preschool children. The typical clinical presentation is described as pulling the legs up to the abdomen during attacks of colic, facial pallor and the passage of red currant jelly stools. Abdominal radiographs and ultrasonography are the primary adjunct to the clinical diagnosis.

Patients with intussusception (usually ileocolic in 95 %) are best managed by hydrostatic or pneumatic enema reduction. If these fail, operative repair is preferred. Laparoscopy has been applied in diagnosis, reduction and also for confirming the adequacy of reduction [18],[19]. Delay in diagnosis is the primary avoidable factor that contributes to morbidity and mortality [20].

3) Mesenteric Adenitis

Inflamed mesenteric node is frequent cause of severe abdominal pain in children. The combination of high fever, mild abdominal tenderness which varies in location, absence of guarding suggests mesenteric adenitis. Lymphocytosis may be noted on the differential blood count. The abdominal sonographic finding is enlarged mesenteric node more than 10mm in longitudinal diameter and increased in number of nodes [21].

4) Malrotation of Gut with midgut volvulus

When the intestine return from the physiological hernia in the intrauterine period around tenth week of gestation, a

failure of rotation and fixation of gut with retroperitoneum will give rise to intestinal malrotation [22]. The narrow attachment of midgut to retroperitoneum leads to clockwise twisting from the duodenum to the transverse colon, known as midgut volvulus. This volvulus may lead to bowel ischemia and gangrene and hence is a true surgical emergency. The incidence of volvulus peaks during the first month of life but can present anytime in childhood. The common presentation of malrotation is the sudden onset of bilious vomiting in a previously thriving healthy baby [23]. Infants who had abdominal distension and features of hypovolemic shock usually have intestinal ischemia with complete obstruction with increasing vascular compromise, abdominal tenderness increases with signs of peritonitis [24]. In grown up children, it has been seen that due to partial or intermittent midgut volvulus leads to venous and lymphatic stasis. These boys usually presents with protein – energy malnutrition [25]. As a general rule, bilious vomiting is associated with abdominal pain means a surgical emergency [26]. Plain abdominal radiography may show “double – bubble sign” of acute duodenal obstruction. If volvulus is associated, a “gasless” abdomen may be seen. On color Doppler study, “whirlpool sign” may be seen which arises due to whirl pooling of superior mesenteric vein and mesentery around superior mesenteric artery [27]. Upper GI contrast study reveals a sharply angulated, to and fro course of the duodenum and jejunum and duodeno-jejunal junction lying right of midline. Operative treatment consists of five steps, collectively known as Ladd’s procedure. These are: -

- a) Evaluation of the bowel and inspection of the mesentery root for knotting.
- b) Counter clockwise derotation of the midgut volvulus.
- c) Lysis of the Ladd’s peritoneal bands, with straightening of the duodenum along the right abdominal gutter.
- d) Inversion appendectomy.
- e) Placement of the caecum in the left lower quadrant to maximally widen the mesentery.

5) Constipation

Constipation is seen commonly in the children. The presentation can be acute in small babies when hard stool may lead to acute and fissure. It may occur in older children with organic disease such as spinal cord lesion or following ano-rectal surgery. Chronic constipation presents with a history of many months or years with abdominal pain and abdominal distension. The factors which predispose to chronic constipation are low fiber diet and less fluid intake, poor toilet training, illness, postoperative stress, organic causes of constipation includes Hirschsprung’s disease, spina bifida with spinal cord anomaly and sacral agenesis. Anatomical abnormality may also be looked for example anal stenosis, pyloric tumor, postoperative anorectal anomaly. Management of acute constipation requires disimpaction by laxatives and enema. Chronic constipation requires behavioral therapy with good laxatives. For anal fissure, frequent & gentle cleansing of the anus and lubrication with petroleum jelly is required. Stool softener and topical anesthetic ointment will help in cessation of vicious cycle of pain and stool retention. If patients on conservative treatment don’t respond over 6 months period, organic lesion must be looked for.

6) Intestinal obstruction

Common causes of intestinal obstruction in children include incarcerated hernia, pyloric stenosis, duodenal stenosis, intussusceptions, and peritonitis due to perforated appendix. Identification of the underlying etiology is as important as identification of obstruction itself. Patient may present with abdominal pain, distension and vomiting which is usually bile stained. Small bowel obstruction is more common in the infants and children than large bowel obstruction. Round worm (*Ascaris lumbricoides*) is one of the common worm infestations in the tropics. Heavy infestation i.e. around 60 worms or more can cause partial or complete obstruction of the gastrointestinal tract or biliary tree [28]. On plain abdominal radiograph it may give cigarette case appearance. Ultrasonography also can demonstrate worms in the biliary tree, pancreas or intestine. If worms are in the biliary tree, endoscopic retrograde cholangiopancreatography (ERCP) can be used to extract worms from the biliary tree. The mass of worms can be fragmented and propelled into the colon, if not possible, enterotomy may be done. Surgical intervention should be followed by mebendazole, albendazole, levamisole or pyrantel pamoate. Intestinal pseudo-obstruction is a condition where there are no organic lesion giving rise to obstruction but patients have the features of intestinal obstruction. The etiology, though, is not very clear, but it is attributed to histopathological or histochemical abnormality of the intestine. Abdominal radiograph shows massively dilated bowel loops on contrast study, the movement of contrast is not propulsive and fluid moves to and fro.

7) Pancreatitis

Acute pancreatitis is an uncommon condition for acute abdomen in children. The most common cause of pancreatitis in children is trauma. Other common causes include drugs particularly steroids and azathioprine, viral infection, biliary tract disorders particularly choledochal cyst, gallstone, hyperlipidemia and hereditary. Plain abdominal radiograph is required to exclude perforation of gut and gas pattern in the bowel. Chest X-ray may show left basal pleural effusion [29]. Ultrasound and CT are useful for detecting pancreatic anomaly and trauma related injury to the pancreas [30]. Magnetic resonance cholangiopancreatography (MRCP) is very useful in identifying structural abnormalities of the pancreaticobiliary tract in children [31].

The management of acute pancreatitis is based upon achieving two goals. First to minimizing the effect of any causative factors and second, to provide supportive care by liberal use of analgesics, administration of parenteral fluids, maintenance of nutrition, prevention of infection, and inhibition of endocrine or exocrine activity [32].

8) Hepato-biliary pathology

These are uncommon cause of acute abdomen [33]. The common conditions include cholecystitis (acute or chronic), choledocholithiasis, choledochal cysts, hepatitis and sometimes liver abscess. Jaundice with high grade fever or a palpable right upper quadrant lump or Murphy's sign may indicate cholangitis due to a common bile duct stone or Choledochal cyst, or acute cholecystitis. Choledochal cysts are congenital dilatation of biliary tree. These depending upon dilatations in the extrahepatic or intrahepatic or

structural abnormality are classified in five types. In US study, dilatation of common bile duct with associated dilatation of right and left hepatic ducts but no dilatation of intra hepatic radicles is noted. MRCP more clearly demonstrates anomalous union of common bile duct and pancreatic duct. Treatment of most common type choledochal cyst e.g. Type I, is excision of cyst and Roux-en-Y hepaticojejunostomy.

9) Renal Disease

The conditions which give rise to acute abdomen in children are pyelonephritis, acute presentation of a pelvi-ureteric junction obstruction and a calculus in renal tract giving rise to colicky pain. Usually such pain is localized by the children in the abdomen rather than flank.

10) Ovarian and testicular Disease

Mittelschmerz or ruptured follicular cyst may produce pain of intensity varying from mild discomfort to severe pain and profound hemorrhage. Other causes of pain are ovarian torsion and large uterine tumors which has grown bigger due to hemorrhagic necrosis. Ovarian torsion typically presents with an acute onset of pain on the side of the torsion; however, pain can radiate to the flank, back, or groin. Associated symptoms might include nausea, vomiting, constipation, urinary tract symptoms, and fever. Pelvic examination in older girls will reveal adnexal tenderness with a mass.

Torsion of the testes or spermatic cord is more common than ovarian torsion, occurring in one of 4000 males, with a peak incidence at age 13. Delay in diagnosis and treatment can result in a loss of spermatogenesis or necrotic, gangrenous testes. Testicular salvage rates are time-dependent, with a 96% success rate if detorsion is performed within 4 hours of symptom onset decreasing to less than 10% at 24 hours [34].

11) Acid-Peptic disease:

Included in this spectrum are esophagitis, GERD, Gastritis, Peptic ulcer and they account for about 15% of all cases of acute abdomen in children. Pain is usually in epigastric or right upper quadrant region. Treatment is with acid suppression, typically with proton pump inhibitors (PPIs).

12) Henoch-Schonlein Purpura

This small vessel vasculitis initially presents as acute abdomen with the "tell-tale" palpable purpura appearing later [35]. The condition is mostly self limited but gastro intestinal bleeds may be a complication warranting systemic steroids.

13) Pneumonia:

Lower lobe pneumonia can present as acute abdomen due to visceral innervations hence it's imperative to auscultate the lung fields carefully in a febrile child with acute abdomen.

14) Other Medical Emergencies

DKA (diabetic ketoacidosis) and Sick cell crisis are two medical emergencies whose presentation initially may be acute abdominal pain¹ and an astute clinical evaluation may unravel the underlying etiology.

3. Summary

Acute abdominal pain in children is a common manifestation with myriad of possible etiologies. Though mostly self limiting; overlooking a possible surgical catastrophe may be fatal. Therefore understanding of underlying conditions and differentiation of surgical emergencies is of utmost importance.

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