

Spectrum of Pain Abdomen in Adolescents

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Abstract: Adolescence is a time of transition between childhood and adulthood. It is often divided into three phases: early (10 to 13 years), middle (14 to 16 years), and late (17 to 21 years) (Felice 1983). This time is marked by the maturation of cognitive functioning, changes in social and family interaction and by major physiological, endocrinological and physical changes. Here we focus on the interface between the developmental stage of adolescence and the experience of pain by using radiological imaging. The study includes all adolescents who presented to our hospital with abdominal pain during a period of 3 months. It includes 140 patients who are investigated using ultrasonography. The spectrum ranges from functional pain to emergency conditions requiring urgent surgery.

Keywords: adolescence, pain abdomen, radiological imaging

1. Introduction

Acute abdominal pain is a common complaint in childhood and adolescents and is associated with a variety of surgical and nonsurgical conditions.[1-4] The challenge for the clinician is to identify those few patients with abdominal pain who have potentially life-threatening conditions (table 1). The diagnosis is often suggested by the patient's age and clinical features (ie, associated symptoms and physical examination findings). However imaging plays an important

role in the treatment and management of patients because clinical evaluation results can be inaccurate. Symptoms and signs that increase the likelihood of a surgical cause for pain include fever, bilious vomiting, bloody diarrhea, absent bowel sounds, voluntary guarding, rigidity, and rebound tenderness. Fever at the onset of acute illness is less likely to indicate a surgical abdomen, whereas fever after the onset of vomiting or pain is consistent with developing peritonitis. Chronic, intermittent abdominal pain is less likely to be related to a surgical cause than a first episode of acute pain.

Table 1: List of the pain abdomen in the age group is summarized in the table

Gastrointestinal Causes	Genitourinary Causes	Metabolic Disorders	Liver Spleen And Biliary Tract Disorders	Hematologic Disorders
Gastroenteritis	UTI	Diabetic ketoacidosis	Hepatitis	Sickle cell anemia
Appendicitis	Urinary calculi	Hypoglycemia	Cholecystitis	Henoch Schonlein Purpura
Constipation	Dysmenorrhea and mittelschmerz	Porphyrias	Cholelithiasis	Hemolytic Uremic syndrome
Abdominal trauma	PID	Acute adrenal insufficiency	Pancreatitis	
Intestinal obstruction	Threatened abortions and ectopic pregnancy		Splenic /hepatic trauma	
Peptic ulcer	Ovarian/testicular torsion			
Peritonitis	Hematocolpos			

2. Neurologic Basis of Abdominal Pain

Pain receptors in the abdomen include visceral receptors (located on serosal surfaces, within the mesentery, and within the walls of hollow viscera) and mucosal receptors. Visceral receptors respond to mechanical and chemical stimuli whereas mucosal receptors respond primarily to chemical stimuli. Visceral pain is usually poorly localized. Most visceral digestive tract pain is perceived in the midline because of bilaterally symmetric innervation. In some conditions, such as appendicitis, precise localization of the pain may develop once the overlying parietal peritoneum (which is somatically innervated) becomes inflamed. Pain originating in the viscera may sometimes be perceived as originating from a site distant from the affected organ. Referred pain usually is located in the cutaneous dermatomes sharing the same spinal cord level as the visceral inputs.

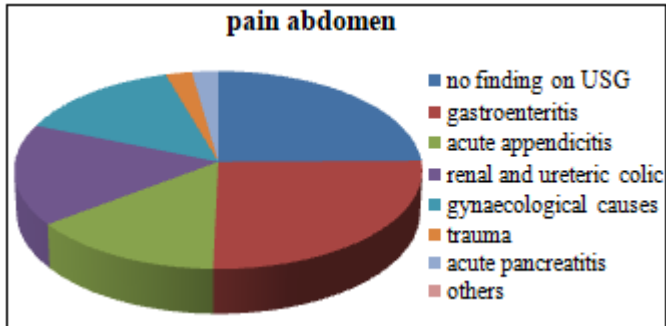
3. Material and Methods

Study was done for 3 months and adolescents who presented with pain abdomen in our hospital were reviewed using radiological imaging. In most of the surgical cases diagnosis was made using ultrasonography while few of them required CT abdomen for confirmation. In total 140 patients were included in the study and result was formulated using the causes of pain abdomen in these patients.

4. Results

List of the causes of pain abdomen is given in the table 1. Important of these are discussed in detail. 33 patients show normal USG. Gastroenteritis was the cause of pain abdomen in 34 patients. 19 patients were diagnosed with acute appendicitis of which 12 were females and 7 were males. 22 were diagnosed with renal and ureteric colic showing almost equal sex predilection. Among gynecological causes 14 females were with simple ovarian cysts. 5 females were diagnosed with hemorrhagic ovarian cyst. 3 males presented after road side accident and 1 of these was diagnosed with

hepatic lacerations. Transient intussusception was seen in a 11 year old male. Hydatid cyst liver was diagnosed in a 17 year old female. Umbilical-urachal sinus was seen in a 17 year old male. Acute Cholecystitis was seen in 18 year old girl. Acute hepatitis was diagnosed in 3 patients. Acute pancreatitis was the cause in 3 patients and all 3 of these were males. 1 of these 3 patients presented with pain abdomen along with distention and inability to pass flatus.



5. Acute Appendicitis

It is one of the most common causes of acute right lower quadrant abdominal pain and in majority of cases diagnosis of acute appendicitis can largely be made on the basis of history and physical examination. Though decreasing, still a large number of appendices at surgery are found to be normal, leading to a high rate of negative appendectomies (8- 30%). This is because of similar signs and symptoms of a wide range of acute abdominal clinical disorders and nonspecific laboratory and conventional radiographic findings. In recent years however with the availability of various cross-sectional imaging techniques viz. Ultrasonography, Spiral CT and MRI, false positive

diagnosis of acute appendicitis has reduced therefore also reducing rate of negative appendectomies. The overall accuracy of cross-sectional imaging techniques in diagnosing acute appendicitis varies from 87%-98%. (5)

Graded compression technique described by Puylaert is the standard method for sonographic evaluation of acute appendicitis. The inflamed appendix is seen as a blind-ended, aperistaltic, noncompressible, tubular structure that arises from the base of the cecum having a diameter greater than 6 mms. [Figure - 1] Presence of a fecalith may aid in arriving at a positive diagnosis.

In early acute appendicitis (catarrhal stage) five layers can be identified-

- 1) Central, thin hyper echoic line representing the collapsed lumen and superficial lining of the mucosa of the appendix,
- 2) Hypo echoic layer (2-3mms) representing edematous lamina propria and muscularis mucosa.
- 3) Hyper echoic sub mucosa (2-3 mms).
- 4) Hypo echoic muscular layer (2-3-mms).
- 5) Outer thin hyper echoic line representing the serosa.

In late (suppurative) stage the lumen of the appendix is distended with pus/ fluid and there is increased thickening of the sub mucosa and muscular wall in the range of 3-6 mms. Circumferential color in the wall of the inflamed appendix on color Doppler US images is strongly supportive evidence of active inflammation [4]. Loculated pericecal fluid, phlegmon or abscess, prominent pericecal fat and circumferential loss of the sub mucosal layer of appendix are associated with appendiceal perforation.



Figure 1: image showing distended aperistaltic blind ended tubular structure in RIF. Appendicolith is seen within

6. Gastroenteritis

Gastroenteritis, also known as infectious diarrhea, is inflammation of the gastrointestinal tract that involves the stomach and small intestine. Signs and symptoms include combination of diarrhea, vomiting, and abdominal pain. [6] Gastroenteritis can be due to infections by viruses,

bacteria, parasites, and fungus. [7] The most common cause is viruses. In children rotavirus is the most common cause of severe disease. In adults, norovirus and Campylobacter are common. [8]. No distinct radiological findings are seen in cases of gastroenteritis except for few cases with thickening of bowel wall.

7. Acute Pancreatitis

Acute pancreatitis is not necessarily a rare disease, even in children and adolescents, and may be life-threatening if it is severe. Therefore, acute pancreatitis should always be considered during the differential diagnosis of abdominal pain in children, and appropriate treatment should be started promptly when necessary. The etiology in adolescents includes drugs, infections, trauma, hereditary and anatomic anomalies such as choledochal cysts and abnormal union of the pancreatobiliary junction, pancreatic divisum. (9)

When acute pancreatitis is suspected, plain chest and abdominal X-rays are essential. A plain chest X-ray may show a pleural effusion, ARDS, or pneumonia. Although these findings are not specific for acute pancreatitis, they are important for the assessment of disease severity. A plain abdominal X-ray may show an ileus, colon cut-off sign, sentinel loop sign, calcified gallstones, pancreatic stones, or retroperitoneal gas. Pancreatitis in children is often caused by pancreatobiliary tract anomalies such as a choledochal cyst or abnormal union of the pancreatobiliary junction. Therefore, ERCP should be performed in pancreatitis of unknown cause. MRCP imaging has also improved and is useful in searching for a cause of acute pancreatitis in children and adolescents. (9)

Imaging findings include -focal or diffuse parenchymal enlargement, change in density because of edema, indistinct pancreatic margins owing to inflammation, surrounding retroperitoneal fat stranding and peripancreatic fluid collection..

8. Intussusception

Intussusception is defined as the invagination of a proximal segment of the gastrointestinal tract, into the lumen of the contiguous distal segment. Intussusception can occur at any age but it is most common in children. About 5% of cases of intussusception are present in adults and causes 1%-5% of intestinal obstructions in this population. The prevalence is equal between adult genders. Adult intussusception is usually caused by a pathologic lead point within the bowel and over half of the cases were triggered by a malignant lesion [10].

The mechanism behind intussusception could be explained by the presence of a bowel lesion that alters the normal peristaltic movements and serves as a lead point for intussusception. On the other hand, the mechanism of the rare entity of transient small bowel intussusception, as in our case, is not well described in medical literature. Transient intermittent intussusceptions were reported in literature in patients with celiac or Crohn's disease. However, they are

frequently idiopathic and reduce spontaneously without any surgical intervention. They may become symptomatic when spontaneous reduction is unsuccessful. (10).



Figure 4: Transient intussusception -a case of 11 year old male presenting with pain abdomen and vomiting. Imaging shows classic target sign with a loop of a bowel telescoping into adjacent loop and causing the symptoms. Spontaneous reduction was seen in the case.

Gynecological Causes

A simple cyst is a round or oval anechoic space with smooth thin walls, posterior acoustic enhancement, no solid component or septations, and no internal flow at color Doppler US. Simple adnexal cysts up to 10 cm in a patient of any age are highly likely to be benign, with malignancy rates of less than 1% [11]

Hemorrhagic ovarian cysts are generally due to expanding hemorrhage within a corpus luteum or other functional cyst. Sonographic features that are considered classic for a hemorrhagic ovarian cyst and that allow a confident diagnosis are: a complex cystic mass with a reticular pattern of internal echoes (also known as fishnet, cobweb, spider web, or lacy appearance, generally due to fibrin strands) and/or a solid-appearing area with concave margins, no internal flow at color Doppler US, and usually circumferential flow in the wall of the cyst. [12]

List further includes PID, incomplete abortions and ectopic pregnancy.

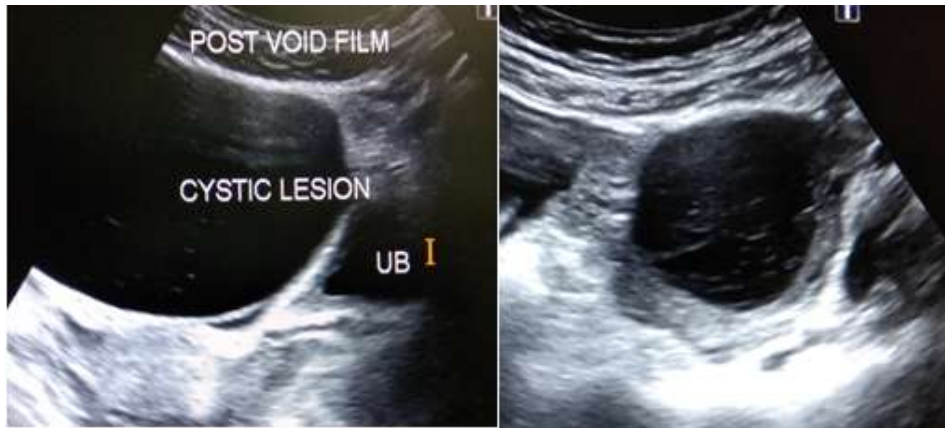


Figure 2 (a): post void film showing a well-defined cystic lesion anterior to uterus in a 16 year old girl. (b) Image showing hemorrhagic cyst in a 13 year old girl- A cyst with reticular pattern of internal echoes seen in left adnexa.

Renal Colic – renal colic is one of the major causes of pain abdomen in adolescents. It is a condition affecting relatively young individuals with an almost equal sex ratio and high tendency to recur. Renal colic is secondary to obstruction

caused by the stones. They are a common cause among adolescents for a visit to emergency department and frequently requiring imaging evaluation.

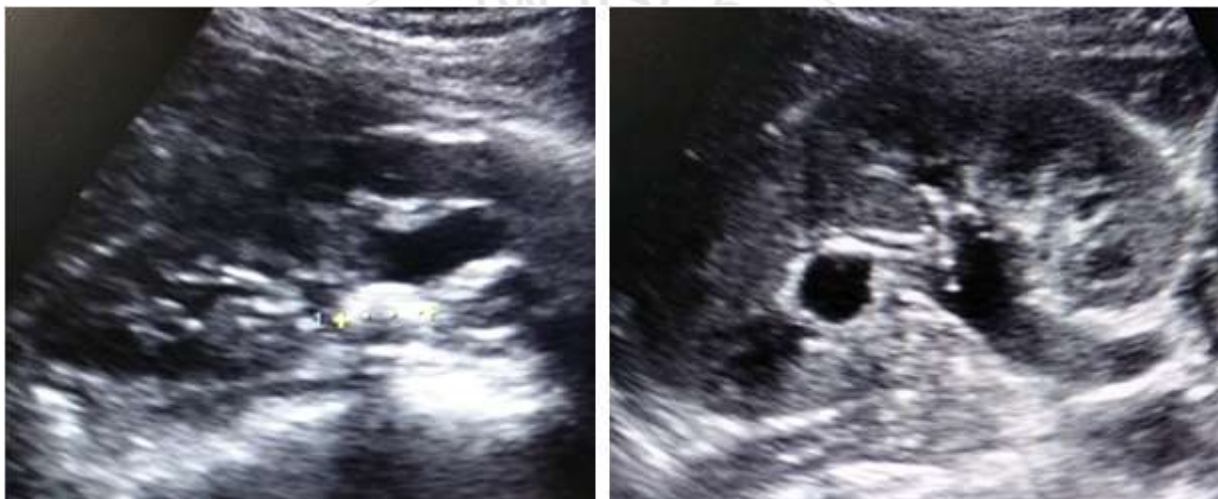


Figure 4: Images showing (a) renal calculus causing obstruction, (b) distal ureteric calculus causing dilatation of pelvicalyceal system and ureter.

Other miscellaneous cases we came across includes hydatid cyst in liver, umbilico-urachus sinus.

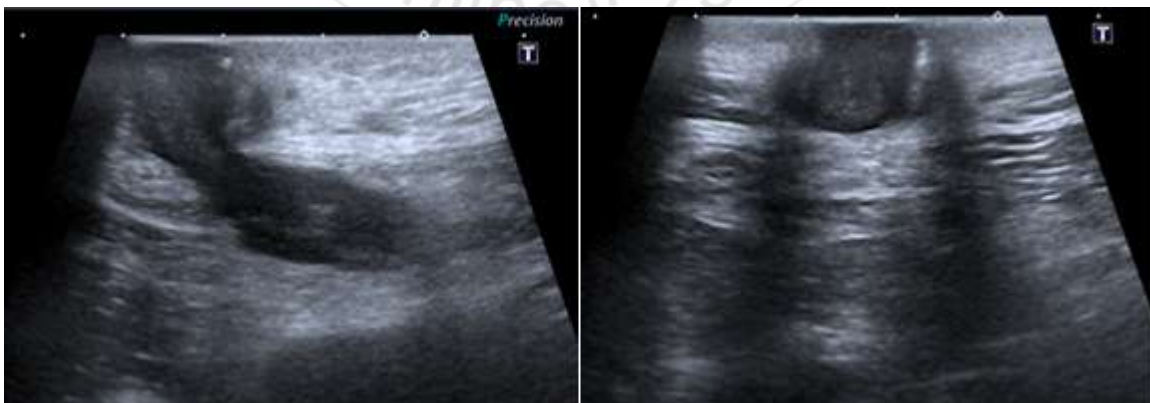


Figure 5: URACHO-UMBILICAL FISTULA a 18 year old male presented with chronic umbilical discharge and pain abdomen. Imaging confirms thickened blind ended tubular structure along midline below umbilicus.



Figure 6: Hydatid Cyst liver -Note the multiloculated appearance of the cyst due to the presence of multiple daughter cysts in a 17 year old young girl presented with vague abdominal pain.

9. Conclusion

In adolescent's age group presenting with abdominal pain, gastroenteritis includes the bulk of the patients. While acute appendicitis is one of the important surgical causes of pain abdomen. However in many of these cases imaging plays an important role in evaluation of patients and deciding which one of these requires surgery and to rule out the functional causes. US is a well-established modality which could provide us the diagnosis in majority of the patients, while some requiring CT for confirmation.

No Conflicts of Interest are there, to the Best of my Knowledge.

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