The Acute Abdomen in Childhood

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Two questions frequently concern all who care for children in the 2- to 12-year-old age group when listening to their complaints of acute abdominal pain often associated with nausea, vomiting, anorexia, or diarrhea: Collywobbles or acute surgical abdomen? Is a surgical consultation necessary? This article on how to manage these children is drawn from a recent review of approximately 500 patients, ages 2 to 12 years, operated on at Texas Children's Hospital in Houston for an acute surgical abdomen and from 30 years of personal experience.

Two groups of patients were readily identified: Group A, approximately 95% of the patients, were normal children without significant medical histories or current medical problems; Group B were patients who had significant medical histories or current medical problems (Table).

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Appendicitis is the most common childhood illness for which an emergency surgical consultation is obtained. One hundred years have passed since McBurney, in 1889, first reported his successful treatment of acute appendicitis by appendectomy before perforation occurred. This concept of removing the appendix before perforation occurs has been universally accepted and is the yardstick of surgical management. However, early diagnosis in childhood remains difficult, especially in the early stages of the disease and in the pre-schoolaged child in whom the national incidence of perforation at the time of surgery is currently 60% to 65%.

ETIOLOGY

Although many etiologic factors have been proposed to explain the pathophysiology of appendicitis, the most commonly held current concepts are those proposed by Wangerstein and Bowes in 1937: obstruction followed by infection results in appendicitis. Infection seriously impairs the contractility of the appendix; with organic obstruction present and the
appendiceal mucosa continuing to secrete against a significant pressure gradient, rupture eventually occurs. In as many as 60% of the cases, the obstruction may be related to lymphocytic hyperplasia. Obstruction is believed to be more common in children following infection of the gut, acute respiratory infection, measles, or mononucleosis. Less commonly, obstruction may be caused by a fecolith consisting of vegetable fibers trapped in the appendix. In about 5% of the cases, when a fecolith contains calcium it is easily identified radiographically. At the onset of symptoms the pain is usually periumbilical and colicky in nature. As mucous is secreted into the obstructed appendiceal lumen, the appendix becomes distended with the development of infection, the obstruction increases, and the pain becomes constant. The pain becomes localized in the right lower quadrant as the inflammation proceeds to include the parietal peritoneum and ileus near the cecum, and terminal ileum develops along with reflex pylorospasm producing vomiting and anorexia. 3,4

The progression of acute appendicitis to necrosis and perforation occurs in 10% of patients by 24 hours and in nearly 50% at 48 hours. Sixty-three percent of our patients less than 6 years of age were perforated at surgery, correlating with a longer duration of symptoms, usually 2 to 3 days, in this younger group of patients. A para-appendiceal abscess or generalized peritonitis develops subsequent to the inflammatory process extending through the layers of the appendix.

**DIAGNOSIS**

Early diagnosis followed by surgery is needed to avoid perforation and its associated morbidity. The recognition and diagnosis of acute appendicitis depends on the primary physician considering the possibility of the diagnosis in all children complaining of acute abdominal pain. The duration of illness and the age of the patient are highly significant. Those symptoms encountered during the first 24 hours of appendicitis are distinctly different than those seen 48 to 72 hours after the symptom onset. By understanding and correlating the pathophysiology of appendicitis with the clinical picture, the diagnosis should be more readily made. Because of the higher incidence of perforation in pre-school-age children, diagnosis by 24 to 36 hours of illness is imperative. In the early stages of appendicitis, the abdominal pain is usually periumbilical. Pain begins as generalized abdominal discomfort and then progresses to localization in the right lower quadrant, becoming constant instead of intermittent. Reflex vomiting may occur during the first few hours of illness, followed by obstructive bile-stained vomiting toward the end of the first day. Although anorexia is usually present, some children have displayed an interest in eating but, when offered food, refused to eat.

Percussable tenderness over the area of the appendix is very commonly elicited. If localization occurs a mass may be felt and involuntary guarding found. Patients with nonlocalized perforation present with generalized pain and appear quite ill. Temperature elevations to 102°F or 103°F along with an elevated white cell count of 18,000 to 25,000 can be seen. Additional signs of peritonitis can be observed in the guarded manner that these children walk or hold their abdomens while moving. They frequently ask to be helped. Although text continued on page 173
x-ray studies of the abdomen may at first appear normal, as the disease progresses suggestive gas patterns develop. These include the findings of a few loops of distended bowel, fluid levels, free air, and a mass effect in the area of the cecum (Figure 1). In approximately 3% to 5% of the patients a fecolith is seen (Figure 2). Frank intestinal obstruction is found in less than 10% of the patients with acute appendicitis (Figures 3A and 3B).

The area of localized pain will vary with the anatomic location of the appendix. If the appendix is located just under the anterior abdominal wall, pain will be readily elicited by palpation and the diagnosis made early. If, however, the appendix is retrocecal or located in the pelvis, the physical findings may not be evident until the disease has progressed and produces signs on rectal examination or flank palpation.

The most common error in early diagnosis of appendicitis is to call the illness "diarrhea" or "gastroenteritis." Approximately 15% of the patients with appendicitis complain of diarrhea, which is secondary to an inflamed appendix positioned near the colon and rectum. Inflammation results in irritation of the bowel resulting in tenesmus, causing the child to pass gas and a small amount of stool that is frequently misin-

**Figure 3A.** Supine film of abdomen demonstrating considerable small bowel dilatation. Note sparse gas in right lower quadrant.

**Figure 3B.** Upright film of abdomen shows "candy cane" effect consistent with small bowel obstruction.

**Figure 4.** Six-year-old girl; notice area of calcification in the pelvis having the appearance of teeth.
older children, ages 6 to 12 years, constipation is often seen as a cause of abdominal pain. This pain is usually more intense than that seen with appendicitis and, in these patients, rectal examination reveals impacted stool. X-ray studies will confirm this finding. These symptoms are usually relieved following an enema.

Appendicitis in the adolescent female deserves special consideration: there is a possibility that peritonitis may cause an increased incidence of infertility, and other causes of abdominal pain are frequently seen. Ovarian cyst, ovarian teratoma, menstrual and ovulatory pain, and pelvic inflammatory disease frequently mimic appendicitis. The differentiation of ovarian pathology is made by carefully noting in the history that the development of pain is abrupt and localizes at the onset to one side or the other. Vomiting is not as constantly seen in these patients nor do their white blood cell counts rise as much. Rectal examination, observation of a mucoid vaginal discharge, details of recurrent abdominal cramps associated with menstrual flow, pain in the middle of the cycle (“mittelschmerz”) and x-ray evidence of teeth or bone along with ultrasonography findings will aid in differentiating these pelvic problems (Figure 4).

Acute appendicitis was found in slightly more than 85% of the normal children seen in our series of patients aged 2 to 12 years operated on for an acute surgical abdomen. This was followed by mechanical intestinal obstruction in 6% of the patients. In these patients the chief complaint was abdominal pain that usually started abruptly and persisted in an intermittent or “crampy” manner. Histories revealed a previous abdominal surgical procedure in most of the patients, and in the few patients without abdominal scars and adhesions within their peritoneal cavities, a congenital band, the remnant of an omphalomesenteric duct, was found. In all of these patients grossly abnormal x-rays showing gas patterns consistent with intestinal obstruction were obtained (Figure 5). In the few patients with intussusception, lead points such as Meckel's diverticulum, polyps, and lymphoma were encountered. In this group, the abdominal pain was intermittent and intense. As the disease progressed, intestinal obstruction producing bile-stained vomitus and bloody stools were seen. Barium enema confirmed the diagnosis. A few patients with Meckel's diverticulum and one patient with Crohn's disease presented with complaints and physical findings preoperatively indistinguishable from appendicitis and were diagnosed at surgery.

Those patients presenting with free air in the peritoneal cavity were found to have perforation of a Meckel's diverticulum or ulceration with perforation of the small bowel or duodenum. In our series, we also saw patients presenting to the emergency room complaining of abdominal pain but who were found to have a large abdominal mass on physical examination. Further diagnostic workup revealed the masses to be neuroblastoma and Wilms' tumors. These children apparently became symptomatic secondary to hemorrhage into the tumor or capsular rupture.

Because we work in a large children's hospital, children with hemolytic disorders, renal disease, diabetes, and cystic fibrosis are frequently seen with acute abdominal pain. Familiarity with the surgical problems commonly seen in each of these categories leads to earlier diagnosis. In the presence of pulmonary disease, acute appendicitis is still a difficult diagnosis to establish and is usually made only after peritonitis has developed (Figure 6).

The diagnosis of most acute surgical abdominal conditions in childhood can be made by history and a good physical examination. The ability of the examiner to obtain the family and child's confidence in taking an accurate history and performing a complete physical examination is essential. Inspection of the head and neck; auscultation of the chest; inspection, palpation, auscultation, and percussion of the abdomen; and, in all cases, a rectal examination are essential to a complete examination. Laboratory studies routinely include a complete blood count, urinalysis, and an acute abdominal x-ray series. A white cell count of over 12,000 to 14,000 usually indicates intra-abdominal inflammation, whereas neutropenia is frequently seen in patients who have a viral syndrome. However, neutropenia may be seen late in patients with appendicitis, usually indicating the severity of the disease. Although urinalysis helps to

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BRIEF SUMMARY

TAVIST®
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INDICATIONS AND USAGE

Tavist® (clemastine fumarate) Syrup is indicated for the relief of symptoms associated with allergic rhinitis such as sneezing, rhinorrhea, pruritus and lacrimation. Tavist® (clemastine fumarate) Syrup is indicated for use in pediatric populations (age 6 years through 12) and adults (see DOSAGE AND ADMINISTRATION).

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CONTRAINDICATIONS

Antihistamines are contraindicated in patients hypersensitive to the drug or to other antihistamines of similar chemical structure (see PRECAUTIONS — Drug Interactions in a complete package insert). Antihistamines should not be used in newborn or premature infants. Because of the higher risk of antihistamines for infants generally and for newborns and prematures in particular, antihistamine therapy is contraindicated in nursing mothers (see PRECAUTIONS — Nursing Mothers in a complete package insert).

WARNINGS

Antihistamines should be used with considerable caution in patients with: narrow angle glaucoma, stenosing peptic ulcer, pyloric duodenal obstruction, symptomatic prostatic hypertrophy, and bladder neck obstruction.

Use with CNS Depressants: Tavist® (clemastine fumarate) has additive effects with alcohol and other CNS depressants (hypnotics, sedatives, tranquilizers, etc.)

Use in Activities Requiring Mental Alertness: Patients should be warned about engaging in activities requiring mental alertness such as driving a car or operating appliances, machinery, etc.

Use in the Elderly (approximately 50 years or older): Antihistamines are more likely to cause dizziness, sedation, and hypotension in elderly patients.

ADVERSE REACTIONS

The most frequent adverse reactions are underlined:

Nervous System: Sedation, sleepiness, dizziness, disturbed coordination, fatigue, confusion, restlessness, excitement, nervousness, tremor, irritability, insomnia, euphoria, parasthesia, blurred vision, diplopia, vertigo, tinnitus, acute larynghitis, hysteria, neuritis, convulsions.

Gastrointestinal System: Eosinophilic distress, anorexia, nausea, vomiting, diarrhea, constipation.

Respiratory System: Thickening of bronchial secretions, tightness of chest and wheezing, nasal stuffiness.

Cardiovascular System: Hypotension, headache, palpitations, tachycardia, extrasystoles.

Hematologic System: Hemolytic anemia, thrombocytopenia, agranulocytosis.

Genitourinary System: Urinary frequency, difficult urination, urinary retention, early menses.

General: Urticaria, drug rash, anaphylactic shock, photosensitivity, excessive perspiration, chills, dryness of mouth, nose and throat.

DOSAGE AND ADMINISTRATION

DOSAGE SHOULD BE INDIVIDUALIZED ACCORDING TO THE NEEDS AND RESPONSE OF THE PATIENT.

Pediatric: Children aged 6 to 12 years

For Symptoms of Allergic Rhinitis — The starting dose is 1 teaspoonful (0.5 mg clemastine) twice daily. Since single doses of up to 2.25 mg clemastine were well tolerated by this age group, dosage may be increased as required, but not to exceed 6 teaspoonful daily (3 mg clemastine).

For Urticaria and Angioedema — The starting dose is 2 teaspoonful (1 mg clemastine) twice daily, not to exceed 6 teaspoonful daily (3 mg clemastine).

Adults and Children 12 Years and Over

For Symptoms of Allergic Rhinitis — The starting dose is 2 teaspoonful (1 mg clemastine) twice daily. Dosage may be increased as required, but not to exceed 12 teaspoonful daily (6 mg clemastine).

For Urticaria and Angioedema — The starting dose is 4 teaspoonful (2 mg clemastine) twice daily, not to exceed 12 teaspoonful daily (6 mg clemastine).

HOW SUPPLIED

Tavist® (clemastine fumarate) Syrup Clemastine 0.5 mg/5 ml (present as clemastine fumarate 0.67 mg/5 ml). A clear, colorless liquid with a citrus flavor, in 4 fl. oz. bottles (NDC 0078-0222-31).

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Figure 6. Upright frontal view of chest and abdomen revealing air fluid levels in both large and small bowel. Note triangular density in left lower lobe (arrows) consistent with atelectasis.

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differentiate urinary tract infection from acute appendicitis, white blood cells may be present in the urine with acute appendicitis. Ketones are frequently found in the urine of patients with appendicitis. For patients appearing dehydrated or presenting with a long clinical history of vomiting, serum electrolytes, blood urea nitrogen, and serum creatinine studies are performed so that deficiencies encountered can be corrected preoperatively. A prepared patient is essential. When the history and physical findings are equivocal in patients in their second or third day of illness, barium enema and ultrasonography may be used to help establish the diagnosis of acute appendicitis.

SURGICAL TREATMENT

Once the decision to operate has been made, preparation for surgery is undertaken. The majority of our patients are in reasonably good metabolic condition and operation is usually carried out soon after all the

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required studies and administrative consents are obtained. In those patients in whom perforation or
generalized peritonitis is suspected, triple antibiotics
are started preoperatively. Ampicillin, gentamicin,
and clindamycin are presently the drugs of choice.

Appendectomy is the procedure of choice. Al-
though simple drainage without appendectomy has
been used in selected cases by some, we have not used
it in any of our patients in more than five years.
Appendectomy with drainage performed when a
localized abscess is found and if difficulty is encoun-
tered in managing the appendiceal stump. In those
patients in whom wound infection is contemplated,
the wounds are packed open with betadine pack-
and left to granulate closed for 10 to 14 days. Most
patients with uncomplicated acute appendicitis are
managed without nasogastric drainage and are dis-
charged from the hospital in 3 to 4 days. Patients with
perforation and peritonitis are maintained on anti-
biotics for 7 to 10 days and nasogastric drainage for 3 to
5 days. We rarely see wound infections because of open
packing of wounds and only occasionally see a pelvic
abscess since the use of long term antibiotics.

The complication of pelvic abscess usually occurs 10
to 12 days after the operation. It is diagnosed by the
complaint of crampy pelvic pain, temperature eleva-
tion, and a rectal examination revealing a pelvic mass
or tenderness. Ultrasonography may be helpful in con-
fiming this diagnosis. Transrectal drainage can be
accomplished by using a 20 cc Foley bag catheter
placed in the abscess cavity and then given exit
through the rectum for 48 hours. Patients so treated
with pelvic abscess are usually discharged from the
hospital 2 to 3 days after drainage. Additional surgical
procedures for the other conditions encountered in
this age group included lysis of adhesions in the man-
agement of intestinal obstruction, resection of vol-
ulus and takedown of duodenal bands for malrota-
tion, and surgical reduction of intussusception.

Although death is now rarely encountered in chil-
dren with acute abdominal surgical problems, mor-
bidity is frequently seen and anxiety in both the child
and parents may, at times, be considerable. Proper
management encourages the physician to be cognizant
of the various surgical conditions presenting in chil-
dren with acute abdominal pain so that a rational
approach may be made in taking a good history and
performing a gentle physical examination in a manner
reassuring to the parents. Because the decision to
operate is frequently made at night and often by par-
ents unfamiliar with the surgeon, it is imperative that
the parents and child have confidence in the surgeon.
Informed consent requires a discussion that states the
probability of possibilities of what may be found during
surgery and, although the vast majority of our patients
are correctly diagnosed as having appendicitis, we
have experienced an approximately 15% error in mak-
ing an accurate diagnosis. For the child complaining of
acute abdominal symptoms, the question of whether
to operate, observe, or treat for a nonsurgical problem
should be answered shortly after first being seen. If
surgical consultation is contemplated, it should be
requested and obtained immediately. For patients who
are released from the emergency room to go home for
continued observation, it is our policy to always
request that they report by phone in 12 to 18 hours and
if they are not improved to be seen for re-evaluation.

CONCLUSION

The diagnosis of an acute surgical abdomen can still
be a difficult one. In 1989, 100 years after McBurney
first reported the successful surgical treatment of a
patient with acute appendicitis, we are still striving to
accomplish appendectomy before perforation in all
children.

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