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Pediatric abdominal pain: It's not always 'just a tummy ache'

BY STEPHAN R. PAUL, MD, JD, WHITE & WILLIAMS LLP, PHILADELPHIA

Editor's note: This article completes a four-part series on abdominal pain that began with the January issue of *ED Legal Letter*. The first two parts outlined risk management strategies for dealing with adult abdominal pain. The third part detailed obstetric emergencies and the difficulty in caring for both mother and unborn child. This concluding segment will review the evaluation and management of pediatric abdominal pain. Emergency department (ED) presentations of pediatric abdominal pain may range from an innocuous illness, such as gastroenteritis, to life-threatening emergencies such as intestinal volvulus. This month's issue will remind emergency practitioners of the hidden diagnosis that may be discovered in children presenting with abdominal pain.

Overview

One of the most common complaints of children coming to the ED is abdominal pain. Because abdominal pain can be a symptom of multiple diseases, it is important for the emergency physician (EP) to be able to distinguish between mild nonspecific illnesses and catastrophic surgical emergencies. A misdiagnosis of abdominal pain leading to severe sequelae in the child is a frequent cause of litigation.

The most urgent consideration of that in a child with acute abdominal pain is to determine whether there is an underlying condition that would require surgical therapy or an "acute abdomen." The etiology of abdominal pain most commonly is relatively mild illnesses. Certain clinical features, however, may suggest a more serious condition such as sudden vomiting, abdominal distension, absent or high-pitched bowel sounds, or signs of peritonitis. Complicating the picture is the fact that there are sources of pain outside the abdomen that also can lead to severe abdominal pain.

There are obviously age and sex considerations as in any emergency presentation. For example, an acute abdomen often is more difficult to diagnose in

children younger than age 2. Likewise, abdominal pain in the adolescent female may be caused by myriad gynecologic conditions, making an accurate diagnosis more difficult. The majority of causes of acute abdominal pain do not require surgery. Viral gastroenteritis commonly is seen in EDs and may cause a constellation of signs and symptoms, including abdominal pain. The symptoms also usually include diarrhea, vomiting, and fever. Alternatively, surgical causes of abdominal pain can vary from appendicitis to intestinal obstruction. In addition, urologic conditions in the male such as torsion of the testicle also can lead to abdominal pain. (See Table on differential diagnosis, p. 75.)

The evaluation of abdominal pain in the ED is consistent with detailed evaluations performed during the history and physical examination. The key is a careful history and physical exam. Generally in the ED setting, the history is taken from the parent; however, the child may be involved in providing a history as he or she

reaches later developmental stages. This is, of course, even more important in children who may be able to provide information not accessible from the parent. This would include potential sexual activity or information regarding child abuse and neglect. In addition, in young children, it is important to ask questions to focus on the manner in which a symptom would appear to an observer. For example, questions about loss of appetite or signs such as drawing legs into a fetal position and sudden onset of crying may provide information regarding abdominal pain in the child.¹

The physical abdominal examination also may be difficult, particularly in younger children. Children often will tense their abdominal musculature, specifically while crying. It may be necessary to distract the child or have the child comforted by a parent during the abdominal exam to prevent this from occurring. A patient examination of all four quadrants of the abdomen is necessary for a complete abdominal exam after listening to abdominal bowel sounds. This examination requires that the patient lie flat on an examination table or on the lap of a parent. It often is important to observe the patient and perform serial physical exams to determine the etiology of any particular condition. Laboratory and radiologic testing can be helpful, although the results can be nonspecific.

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Appendicitis

It is critical for the EP or nurse taking care of children to be cognizant of the more serious diseases manifested initially by abdominal pain. The definitive diagnosis of appendicitis is made in only 50-70% of children at the time of the initial assessment.^{2,3} Acute appendicitis is among the five leading causes of litigation against EPs and accounts for 5% of the total dollars lost by insurers of EPs in the United States.⁴

Patients in misdiagnosed cases appeared less acutely ill, had fewer complaints of right lower quadrant pain, received fewer rectal examinations, received intramuscular narcotic pain medication for undiagnosed abdominal pain symptoms, and most often received an ED discharge diagnosis of gastroenteritis. These patients had a 91% incidence of ruptured appendices as a complication.⁵

The diagnosis in children, specifically for those younger than the age of 2, is particularly difficult. Initial misdiagnosis rates range from 28% to 57% for children 12 years old or younger to nearly 100% for those 2 years or younger.^{6,7} To complicate the

TABLE: Differential Diagnoses of Pediatric Abdominal Pain*22

Condition	Onset	Location	Quality	Other
Appendicitis	Acute	Periumbilical with localization to right lower quadrant Diffuse with peritonitis	Continuous	Loss of appetite, nausea, localized tenderness, fever, leukocytosis
Urinary tract infection	Acute, sudden	Bilateral lower quadrant	Sharp, dull	Fever leukocytosis; back pain with pyelonephritis, dysuria, and polyuria
Intestinal obstruction	Gradual or acute	Bilateral lower quadrant	Colicky	Abdominal distention or change in quality of bowel sounds
Sickle cell crisis, abdominal crisis	Acute	Generalized	Dull to sharp	History of sickle cell disease; check complete blood count
Pancreatitis	Acute	Epigastric, left upper quadrant	Constant	Nausea, generalized tenderness
Pelvic inflammatory disease; salpingitis, tubo-ovarian abscess	Acute or sudden	Generally lower quadrant, periumbilical generalized with peritonitis	Sharp, intermittent	Pelvic pain, vaginal discharge leukocytosis, important to acquire sexual history
Torsion of testicle	Acute or sudden	Lower abdominal or testicular	Usually sharp or intermittent cramping	Often presents with testicular swelling

Other conditions causing abdominal pain can be associated with hepatitis, rheumatic disease, or inflammatory bowel disease.

*Not all-inclusive.

issue, it has been reported that recent health trends have influenced the presentation of pediatric appendicitis. From the 1980s to the 1990s, the time of a child's first visit to a physician until surgery increased by 12-15 hours.⁸

Appendicitis is the most common atraumatic surgical abdominal disorder in children age 2 years and older. Appendicitis ultimately is diagnosed in 1-8% of children that present to pediatric EDs with acute abdominal pain.^{9,10} Classic symptoms of appendicitis, that is periumbilical pain followed by nausea, right lower quadrant pain, and later vomiting and fever, are seen more frequently in adults than children.² Interestingly, appendiceal perforation is extraordinarily common, if not universal, in children younger than age

3.^{11,12} The most common symptoms in children 2 years or younger are vomiting (85-90%), pain (35-77%), diarrhea (18-46%), and fever (40-60%).¹³

After 2 years of age, as children begin to talk, they can communicate their pain. Children 5 years of age or younger account for fewer than 5% of all pediatric appendicitis. Many of these children have symptoms for up to six days.¹⁴ As children become older, the incidence of appendicitis increases, as does the ability to diagnose. It is important to distinguish appendicitis in adolescent females from other considerations such as pregnancy, ovarian cysts, ovarian torsion, or pelvic inflammatory disease.¹⁵

The common initial misdiagnoses in childhood appendicitis include gastroenteritis, upper respiratory

tract infection, pneumonia, sepsis, urinary tract infection, encephalitis, encephalopathy, febrile seizure, and blunt abdominal trauma.² Laboratory assistance in diagnosis is notoriously unreliable. White blood cell counts are nonspecific and insensitive for this disorder. Not only will a complete blood count (CBC) not distinguish between patients with appendicitis and other infections, but it also can't distinguish between a perforated and nonperforated appendix.

Radiologic diagnosis also is unreliable. Abdominal films only are potentially useful if they show evidence of rightward scoliosis, soft tissue masses, or free peritoneal air. Ultrasonography has been found to be variably sensitive and specific for this disease.^{16,17}

Radioisotope-labeled white blood cell scanning in children also has had variable sensitivity and specificity and generally is not recommended for the diagnosis of appendicitis in children.^{18,19} Of all the radiologic studies, computed tomography (CT) scanning appears to be the most reliable in the presence of suggestive findings such as abscess or appendicolith.^{20,21}

Case #1: *Wilson v. Knight, MD.*²³ Minor plaintiff William Wilson filed a medical malpractice claim against a physician regarding his alleged malpractice surrounding the diagnosis of appendicitis. On Aug. 30, 1990, 14-year-old William began experiencing abdominal pain. His pediatrician initially saw the patient and then referred him to Dr. Knight, a pediatric surgeon. It was the defendant physician's opinion that the patient had appendicitis based on an elevated white blood cell count and a medical history consistent with that diagnosis. The defendant, however, decided not to perform an appendectomy, as the patient had not reached a "certain diagnostic threshold." The patient was discharged four days later after the resolution of clinical signs. Apparently, the patient's white blood cell count had decreased, and he was able to take oral fluids.

The pain did not resolve, and on Sept. 9, the defendant again saw the patient and performed an appendectomy. In spite of persistent pain and weakness, the patient was discharged six days later. On Sept. 20, the patient went to see a colon and rectal surgeon, who diagnosed a pelvic abscess. The abscess was drained at least twice, and subsequently it was discovered that the patient had developed a recto-vesicular fistula requiring a catheter and a colostomy.

The plaintiff's expert testified that the defendant had deviated from the standard of care in not immediately diagnosing the patient with appendicitis and

performing an appendectomy. In addition, it was stated that the patient would not have developed subsequent complications had he undergone an appendectomy during his initial hospitalization. Another expert testified that the immediate performance of an appendectomy would have prevented subsequent postoperative complications. A jury verdict awarded the plaintiff \$100,000 in damages for the alleged malpractice.

Discussion

The standard of care for the management of non-perforated appendicitis remains appendectomy. Because prompt treatment of appendicitis is important in preventing further morbidity and mortality, a margin of error in overdiagnosis is acceptable.² It is estimated that there is a national rate of negative appendectomies of approximately 20%.²⁴ There have been investigations regarding nonoperative management in patients with appendicitis; however, 40% of these patients eventually required appendectomy.²⁵

In an era of utilization review and limitations placed on physicians by both hospitals and insurers, it is difficult to fault physicians for observational treatment of patients. However, accepting that there are significant complications to a perforated appendix, it is critical that EPs quickly obtain surgical consultation when there is suspicion of appendicitis. In addition, surgeons must provide rapid surgical exploration and accept the need for a certain number of false-negative operations.

Case #2: *Pearson v. Parsons, et al.*²⁶ On Dec. 21, 1984, Emily Pearson, age 2½, complained to her parents that she had a stomachache. She was ill for approximately three days before being brought to the Blackford Medical Clinic to see the defendant, a board-certified pediatrician. Besides having a stomachache, it also was reported that Emily ran a fever. After an examination, the defendant felt that the patient had a viral illness.

A CBC showed a high white count, and a surgical consult was requested. The surgeon did not believe that Emily had acute appendicitis and discharged the child with the request to return if she was "getting any worse." This was described as the continuation of a high fever and any pain.

The patient's condition intermittently waxed and waned for the next several days, culminating in a respiratory and cardiac arrest and death. A medical malpractice claim was brought against the physicians in State Court in Idaho. Initially, the case was decided in favor

of the defendants for summary judgment based on allegations that the expert was not board-certified in the same specialty as the defendants. However, the Supreme Court of Idaho reversed this, since the expert had stated that he was familiar with the standards of care regarding suspected appendicitis. He stated that it was the standard of care in the community not to rely on the observational powers of the parents in the diagnosis of appendicitis but either to hospitalize and observe or re-examine the patient within a specific time span.

Discussion

It hardly is necessary to tell EPs and nurses about the need for communication with parents in taking care of children. It also is critical that the physician be able to identify the relative skills of the parents in the continued observation of the child. In situations in which the care or follow-up by the parents may be limited, or if there are transportation difficulties, it often is necessary either to admit a patient to the hospital or to consider keeping the patient for a prolonged period of time for serial observation in an observation unit within the ED.

Cases #3 and #4: *Traina v. Grelow Pediatrics*, and *Lavista v. Huntington Hospital*. Two New York cases have been brought by plaintiffs who demanded compensation for the speculative injuries associated with infertility after a rupture of the appendix.^{27,28} In *Traina*, the Supreme Court, Appellate Division, of New York reversed the trial court decision that the allegations regarding infertility was too speculative to be compensable. In *Lavista*, the Court upheld the denial of the defendants' motion to strike these types of claims.

Discussion

Although perforation of the appendix is considered a risk factor for female tubal infertility, the epidemiologic evidence supporting this relation is inconsistent.²⁹ Studies have shown that distribution of age of birth among women with perforated and nonperforated appendices and women who underwent appendectomy and were found to have a normal appendix were similar.³⁰

Though using these medical criteria may liberalize the observation patterns of female patients with abdominal pain, it does not preclude that plaintiffs may be given significant rewards for fairly speculative damages. These speculative damages include the possibility of infertility due to adhesions blocking the oviducts. These damages presume that the patient 1) will be infertile; and 2) would have been

fertile had the appendix not ruptured secondary to a timely performed appendectomy. This again demonstrates the reliance of plaintiffs' lawyers on the anger and sympathy of a relatively unsophisticated jury regarding the infertility of an individual patient.

Abdominal Pain in the Adolescent Female

The differential diagnosis of abdominal pain in the adolescent female is extensive and the identification of the specific etiology frequently requires multiple examinations. Diagnosis is complicated further by the difficulty of getting adequate historical information.³¹ The adolescent female may be reticent to provide sexual history and social history to the EP or nurse in a busy ED setting. This requires sensitivity on the part of the examining clinician.

Beyond the causes that are characteristic of all ages, gynecologic and obstetric issues have to be considered. It often is difficult for a clinician to acquire an adequate sexual history. In addition, the possibility of sexual abuse always must be considered.

Consequently, a social history must be obtained from the teen and her parent. The history is best taken with and without the parents present. It is critical to consider such gynecologic conditions as ectopic pregnancies, ovarian torsions, and threatened abortions. Less emergent, but still urgent, conditions include pelvic inflammatory disease, tubal ovarian abscesses, fibroids, endometriosis, and ovarian cysts. Other conditions such as mittelschmerz also must be considered.

It often is difficult to determine gynecologic causes of abdominal pain without appropriate rectal or pelvic examinations. If necessary, consultation with a pediatrician specializing in adolescent care or a gynecologist may be necessary in the ED.

Pregnancy rates, although decreasing, still remain high among U.S. female adolescents.³² Adolescent patients with abdominal pain must be considered pregnant until proven otherwise. Pregnancy testing is warranted in all such teens presenting with abdominal pain.

Ectopic pregnancy is a condition that can be fatal without intervention.³³ It is difficult to diagnose ectopic pregnancy through examination alone. It has been reported that the initial clinical impression for ectopic pregnancy is correct in only 55% of patients.³⁴

The most common presenting complaint is abdominal pain associated with amenorrhea. Serial and quantitative serum human chorionic gonadotrophins (HCGs)

often are helpful in that the progression of beta HCG doubling is impaired in ectopic pregnancies.³⁵

A high level of suspicion will lead to an appropriate use of ultrasound to diagnose ectopic pregnancy. There is a strong need for follow-up of these patients and coincident need to determine the social situation to allow this follow-up. Early diagnosis may allow for conservative, nonsurgical management and prevention of potentially fatal hemorrhage and shock.

Another potential emergency condition for adolescent females is ovarian torsion. When the ovary rotates on its pedicle, the blood supply is compromised and tissue necrosis can result. Because of the subsequent loss of fertility, infection, sepsis, and death, it also should be considered a surgical emergency. The most common early symptom of ovarian torsion is abdominal pain, but it often is associated with nausea and vomiting.³⁶ A high index of suspicion as well as radiologic evaluation using ultrasound and CT may be helpful when the diagnosis of torsion is suspected.

Ovarian cysts generally are asymptomatic but can lead to severe abdominal pain. Rupture of a follicular cyst in mid cycle may cause sharp unilateral pain called *Mittelschmerz*. This is experienced by approximately 25% of ovulating females.³⁷ The diagnosis of ovarian cysts may be made clinically. It is unnecessary to require emergent ultrasound of patients in whom this diagnosis clinically is suspected. However, rupture of cysts often can lead to pedicle rotation and subsequent abdominal pain. If torsion or ectopic clinically is suspected, ultrasonography is required. Patients who are hemodynamically unstable require emergent surgical consultation.

Pelvic inflammatory disease (PID) generally occurs in sexually active females, often in those younger than 19.³⁸ The most common sign generally is lower abdominal pain that often is bilateral and diffuse. Fever, nausea, and vomiting are somewhat variable. A tubal ovarian abscess often can complicate PID. In addition, Fitz-Hugh-Curtis syndrome or inflammation of the liver capsule can occur in up to 30% of these patients.³⁹ Other complications of PID include chronic pelvic pain and subsequent infertility. This often is associated with an increase in the incidence of ectopic pregnancies.⁴⁰

Case #5: *Adams v. Via Christie Regional Medical Center, et al.*⁴¹ The plaintiffs were the parents of the decedent who filed a wrongful death action after their daughter died as a result of a ruptured ectopic

pregnancy. Upon returning home from work, the mother found that daughter Nichelle had been complaining about abdominal pain and had gone to bed. Nichelle's mother called the family doctor at 9 p.m. and explained that her daughter was 5-8 weeks pregnant and was experiencing abdominal pain.

The physician testified that the mother did not express any urgency or serious concern when he initially was called. The physician informed the mother that abdominal pain is not abnormal during pregnancy but recommended that the patient be taken to the ED if she got any worse. He also recommended seeing a physician the following day.

As the condition worsened, the mother drove Nichelle to the hospital early in the morning the following day. Quickly thereafter, the patient vomited and went into cardiac arrest. Initial efforts at resuscitation were successful, although the patient remained on life support systems until care was discontinued later that evening. The jury awarded total damages of more than \$2 million.

Discussion

Again, the critical issue is to have a high index of suspicion that any female adolescent presenting with abdominal pain may, in fact, have an ectopic pregnancy. Although abdominal pain can be a common sequela of a normal pregnancy, it is critical that it be evaluated. Ectopic pregnancy is the most common cause of death during the first trimester of pregnancy and needs to be evaluated and eliminated as a possibility. Also, it is important to be aware that, similar to adhesions secondary to appendicitis, the courts in the past have been liberal in awarding speculative damages associated with loss of fertility secondary to either PID or ruptured ectopic pregnancy.

Intestinal Obstruction in Infants and Children

Acute intestinal obstruction is the most common cause of emergency surgical exploration of infants.⁴² Intestinal obstruction may be caused by such divergent conditions as pyloric stenosis, intussusception, incarcerated hernia, post-surgical obstruction caused by adhesions, large bowel volvulus, Meckel's diverticulum, and chronic intestinal pseudo-obstruction. Intestinal obstruction usually presents with a triad of colicky abdominal pain, vomiting, and/or abdominal distension.

Intussusception

Intussusception is defined as an invagination or

telescoping of a segment of intestine into an adjacent portion of bowel. It is the most common cause of obstruction in children between 3 months and 6 years of age.⁴³ Besides abdominal pain, it is common for parents to complain of red currant jelly stools, seen in up to 95% of all patients.⁴⁴ In addition, it often is possible to palpate a sausage-shaped abdominal mass, most common in the region of the hepatic flexure. This obviously is much more difficult to palpate in crying infants with abdominal pain. It is not uncommon for these patients also to present with an altered mental status.⁴⁵ Physical examination and abdominal films often are not reliable to diagnose this condition. Ultrasound has had varying degrees of specificity and sensitivity. In one report, ultrasonography had a sensitivity of 98.5% and a specificity of 100% in the diagnosis of intussusception.⁴⁶

The key to treatment is the availability of surgical consultation. Nonoperative reduction should not be attempted in facilities where surgical backup is not available since complications of chemical peritonitis can occur with enema reduction.⁴⁷ Adequate volume resuscitation also is an essential element in treating these patients. Patients with signs of peritonitis or failed nonsurgical reduction will require operative reduction emergently.

Meckel's Diverticulum

Meckel's diverticulum is a congenital anomaly resulting from failure of the vitelline duct to involute between the fifth and seventh week of gestation. It is the most common gastrointestinal congenital anomaly and is present to in 1-3% of all infants.⁴⁸

Although most often this condition does not present with abdominal pain or obstruction, it is a disease that can mimic acute appendicitis with right lower quadrant pain, vomiting, and fever. The most common clinical symptomatology is the presence of rectal bleeding. This typically is diagnosed with a Meckel's scan to evaluate ectopic gastric tissue.⁴⁹ Management of Meckel's diverticulum generally is by surgical excision via laparoscopy.⁵⁰ Patients with asymptomatic disease often may be observed.

Incarcerated Hernias

Hernias often are found in infants from failure of the process vaginalis to close after birth. The instance is 1-5% in infants, with a male predominance.⁵¹ By far the most common clinical symptom is irritability and swelling in the groin. Vomiting also commonly is present. Manual reduction generally is attempted in most cases. Analgesia and sedation are recommended

if the reduction is difficult. Surgical consultation should be sought for failed reduction, pain on examination following reduction, or to arrange close follow-up after discharge.

Large Bowel Volvulus

Volvulus results from the rotation of redundant loops of bowel around the mesentery, causing strangulation of the arterial and venous supply.⁵² The mean age of recurrence is 7 years, with a predominantly male presentation.⁵³ Delayed recognition of this disease can be devastating. Sixty-seven percent of these patients present with abdominal pain. Patients can present with recurrent symptoms and may have intermittent bouts of pain. Barium enemas are diagnostic and often can be therapeutic. The definitive treatment is controversial, although it is important to have the availability of operative intervention. Both operative and nonoperative management have been used successfully. Nonoperative management often helps stabilize and prepare the patient for surgery.

Post-Surgical Obstruction

Children with prior abdominal surgery may develop adhesions that may cause post-surgical obstruction.⁵⁴ The site of obstruction often will determine the constellation of signs. In a high obstruction, vomiting often will be present without abdominal pain. Abdominal distension may be more evident in patients with a low obstruction. Pain is "crampy" secondary to peristalsis.

Obstruction in the Neonatal Period

Obstruction is more common in the neonatal period and may represent a true surgical emergency. Common neonatal surgical conditions in the gastrointestinal tract include intestinal atresia, malrotation in midgut volvulus, Hirschsprung's disease, meconium ileus, abdominal wall defects, and hypertrophic pyloric stenosis.⁵⁵ Vomiting is a more common clinical sign than abdominal pain in these patients. Potentially, the most serious condition is malrotation.⁵³

This typically presents in the first month of life with vomiting and a sudden onset of abdominal pain. Physical examination may exhibit a normal abdominal exam in approximately half of the patients. In the newborn, volvulus rapidly can result in significant bowel compromise, shock, peritonitis, and death. The most serious complication of malrotation is necrosis of the entire midgut. In this case, mortality ranges from 2.5% to 24%. Survival is directly relative to the rapidity with which the diagnosis is made and the condition is treated.⁵⁶

Necrotizing Enterocolitis

Necrotizing enterocolitis is predominantly a disease of premature low birth weight infants and also presents in the immediate newborn period. It is the most common gastrointestinal emergency seen in the neonatal intensive care unit and occurs in 3-5% of all admitted infants.⁵⁷ Feeding intolerance, abdominal distension, and tenderness are not uncommon, although more ominous signs include bilious emesis and grossly bloody stools. Pneumatosis intestinalis is a particularly ominous radiographic sign.⁵⁸ Pneumatosis intestinalis generally is defined as evidence of air within the gastrointestinal walls, indicating the possibility of bowel ischemia or pneumoperitoneum.⁵⁹

Necrotizing enterocolitis may lead to long-term complications such as intestinal strictures and adhesions. These subsequently can lead to bowel obstruction. In addition, short bowel syndrome is a potential complication.

Intestinal Duplications

A rare congenital abnormality that can develop along the intestinal tract includes the intestinal duplications. Generally, abdominal pain and melena are the most common presenting symptoms.⁶⁰

Case #6: *Donnelly v. Phoenixville Hospital, Court of Common Pleas, Philadelphia County.*⁶¹ A doctor and hospital admitted liability in a \$6.6 million settlement. The physician admitted his failure in July 1996 to visit the newborn baby in the hospital despite evidence of bilious vomiting and abdominal distress. Two pediatricians examined the child during the day, and no serious complications were found during that period. At midnight, nurses at the hospital discovered the child with abdominal distention and bilious emesis. Although the pediatrician was alerted, he neglected to examine the patient until the following morning. Subsequently, it was discovered that the child had a midgut volvulus and required resection of ischemic bowel leading to "short-gut syndrome." Following emergency surgery, the child required parenteral nutrition until his death 18 months later.

Discussion

This unfortunate case demonstrates the fragility of neonates and the need for attention to what may be subtle signs of serious disease. The clinical signs displayed were consistent with mild feeding intolerance, but unfortunately were associated with a catastrophic surgical emergency. The need for the availability of pediatric or neonatal consultation likewise is demonstrated. There is a famous pediatric axiom

that states, "Never let the sun set on bilious vomiting." This case illustrates that point.

The case also unfortunately demonstrates the potential of windfall settlements based on the fear of runaway verdicts from angry juries.

Case #7: *Thomas, et al. v. Newnan Hospital.*⁶² The infant daughter of Ronald and Sangelynn Thomas presented to the ED of Newnan Hospital on the morning on Sept. 12, 1982. A nurse noted that the chief complaint was abdominal cramps and took the infant's vital signs and history. At the time, her vital signs were stable and her skin was warm. She was not felt to be critically ill by the triage nurse or the pediatrician on call. The pediatrician evaluated the patient's abdomen and documented normal bowel sounds, normal palpation of the abdomen, normal urine analysis, and no evidence of rectal abnormalities. The child was given an enema and sent home.

By 11 p.m., Mr. Thomas called the physician and said the child had begun vomiting. The emesis was not described as being unusual or bilious. It was the doctor's impression that the child was developing a viral gastroenteritis. He did not believe her signs and symptoms were consistent with abdominal obstruction. The child was seen a second time in the ED, was given antiemetics, and again sent home.

The child did not improve overnight and was taken to her family doctor the following morning. At the time, she was not noted to be in severe pain or to be vomiting. The family doctor ordered some blood work because he felt the child looked anemic. Subsequently, the child became very weak and was taken again to the ED. Soon after arrival, the child went into cardiac arrest and was resuscitated and transferred into intensive care. A surgical consult was ordered with a suspicion of appendicitis. Before the consultation, the child again went into respiratory arrest and was unable to be resuscitated. Her death was determined to have been caused by volvulus resulting from a rare congenital anomaly. At trial, an expert who presented on behalf of the physician stated that the initial diagnosis of gastroenteritis probably was correct in that respect. It was stated that the doctors in the hospital had delivered appropriate care well within the proper standards, and was suggested that the child initially did have gastroenteritis, which at some point precipitated the volvulus. The defendant's expert further opined that the diagnosis of appendicitis at the time of her presentation was a reasonable conclusion based on the clinical signs. The

jury ultimately found on behalf of the defendant physicians and the hospital in this matter.

Discussion

Although ultimately this case was decided on behalf of the hospital, the facts in this case again demonstrate the subtle signs of a catastrophic surgical abdomen. It was reasonable for the physicians not to have a high index of suspicion for a major illness based on the presentation of the patient. Given the number of patients who present with nonspecific signs of illness, it is a physician's nightmare to think of the possibility of missing such a diagnosis based on such presentations.

Case #8: *Estate of Sarah M. Hegarty v. Angela Beauchaine, MD, et al.*⁶³ A 15-year-old girl began developing abdominal pain. At the time, her pediatrician referred the child to a pediatric gastroenterologist at a local children's hospital.

On March 20, 1996, the patient developed severe abdominal pain, nausea, and vomiting and was rushed to the ED. The child initially was treated by an EP and later by a first-year medical resident. The patient's condition rapidly deteriorated. Of notable interest, only a resident saw the patient during the evening of her admission.

Approximately 10 hours after admission, it was noted that the child's abdomen was distended, rigid, and tender. Within several hours, the patient became critical and required resuscitation. She was taken to surgery and ultimately diagnosed with a small bowel volvulus and complete bowel infarction. Secondary to these complications, the child required more than 50 surgical procedures subsequent to her death two years later. The cost of medical care during this period was nearly \$3 million.

The trial court granted summary judgment to one of the physicians based on the Statute of Limitations. This judgment partially was reversed by the appellate court and remanded.

Case #9: *Higgins v. United States of America.*⁶⁴ A patient brought a claim under the Federal Torts Claim Act for medical malpractice alleging that a U.S. Public Health Service physician negligently failed to diagnose a surgical abdomen. Upon presentation, the 19-year-old girl began to feel ill while on vacation with her family. She complained of abdominal pain, nausea, cramps, and stiffness.

The following day, it was noted that her menstrual period had started. She developed a fever and remained at home in bed with gastrointestinal symptoms for

several days. Approximately a week after her initial illness, she was taken to the clinic. In the clinic, her temperature was reported to be normal and she was thought not to look ill.

A U.S. Public Health Service physician was on call for that day. The physician examined the patient but did not record the results of examination. The patient said that her abdomen hurt everywhere on his abdominal evaluation. No x-rays, blood, or urine were submitted. No pelvic or rectal exam was performed. The physician diagnosed viral gastroenteritis and prescribed Compazine.

The child did not improve and went back home to be seen by her regular physician. At the time, she had an obviously distended abdomen and severe abdominal pain. Her abdomen was noted as being distended and tense. In addition, she had a temperature of 101.2° and grossly abnormal x-rays with evidence of peritonitis and an abscess. A white count was in excess of 16,000, and the prognosis was guarded. She was admitted to George Washington University Hospital in the service of a gastroenterologist and underwent an exploratory laparotomy. During the procedure, an abscess was noted and pus was everywhere within her abdomen. Multiple adhesions also were evident. She ultimately developed an incisional hernia that required surgical repair. In addition, keloid scars were evident. She was considered to be at increased risk of sterility due to these problems. A verdict was entered for the plaintiff against the defendant for \$875,000.

Discussion

This case strongly supports the importance of careful and complete physical examinations. Upon the initial presentation, extensive laboratory and radiographic evaluation may not have been indicated. However, at a minimum, a urinalysis (or urine dipstick) and pregnancy test should have been performed. This patient may have been diagnosed accurately and litigation avoided through an initial rectal and pelvic examination and more adequate communication with the patient. If nothing else, close follow-up should have been arranged and careful documentation to return to the ED for increasing pain, fever, or new symptoms should have been stressed to the patient and family and documented in the discharge instructions.

Testicular Torsion

Another pediatric surgical emergency is testicular torsion. It also is not an uncommon cause of litigation

in the pediatric ED.⁶⁵ The most common clinical symptomology is a painful scrotum and swelling; however, abdominal pain can be an isolated characteristic of this condition.⁶⁶⁻⁶⁸

The most common causes of a painful pediatric scrotum are testicular torsion and torsion of the appendage testes, epididymitis, or trauma. Of these causes, testicular torsion is an emergency requiring rapid treatment. Testicular torsion is the most common cause of testicular loss and occurs most commonly in the prepubal age group.⁶⁹ Secondary to torsion, the spermatic cord becomes twisted, causing venous engorgement and arterial ischemia. Pain is most severe in the location of the testes but may refer to the abdomen, thigh, flank, or hip. In addition, nausea and vomiting may occur in 30-40% of such patients. Urinalysis and CBC generally are not helpful in making this diagnosis.

Ultrasound of the testes tends to be a useful adjunct in making the diagnosis with a high degree of sensitivity and specificity.⁷⁰ The test is not 100% sensitive or specific, and there are cases in the literature of testicular torsion with patients having normal or equivocal ultrasound evaluations.⁷¹ Generally, it is important to operate within six hours of the torsion to save the testes. It is unlikely that a patient operated on more than 12 hours after onset of pain will have a good result.⁷²

Case #10: *Dorfman v. Schwable*.⁷³ On Oct. 21, 1996, 14-year-old Christopher Schwable developed abdominal pain that worsened during the evening. He was brought to a Florida hospital ED, and it was determined that he likely had testicular torsion in his right testicle. The staff urologist was called at home to examine the patient. By the time the urologist came into the ED, the patient's pain apparently had subsided. It was the urologist's contention that the patient had spontaneously detorsed and, thus, was no longer in danger of losing his testicle.

The urologist reached this conclusion despite Doppler evaluations that suggested that blood was not flowing to the patient's testicle. The patient was sent home without surgery. The patient returned that night experiencing no pain, but the following day woke up with a recurrence of the pain and was taken back to the urologist's office. The urologist performed surgery, but by that time there was total ischemia of the right testicle. A four-day trial took place in September 1999, and a verdict was rendered for the plaintiff for \$675,000 in past and future noneconomic damages.

Discussion

Testicular examination and examination for possible hernias are critical adjuncts to the evaluation of a male child with abdominal pain. It also is critical that an ultrasound be performed in any case of testicular swelling, as epididymitis cannot always easily be distinguished from torsion on physical examination alone.

Conclusion

Abdominal pain in children poses a common diagnostic challenge to the ED physician. Although the vast majority of cases are relatively minor and nonspecific, complications of catastrophic illness may lead to disastrous consequences, specifically if not detected early. ED personnel must be proficient in the examination of the child with abdominal pain and in using the appropriate consultations in this examination. In addition, it is important to know what laboratory and diagnostic tests are important in pursuing the more serious illness that can be manifested by abdominal pain.

As in all pediatric illness, it is important to be sensitive to the needs of the child and cognizant of the limitations in acquiring an adequate history and performing an appropriate physical exam. For this reason, it very often is necessary to admit a patient for serial examinations or observation prior to deciding the appropriate course of action. If doubt exists as to the severity of the etiology of abdominal pain, overtreatment and overconsultation are, in fact, the best approach. Delays in diagnosis can lead to poor outcomes, patient complications, and litigation.

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CE/CME Questions

1. Which of the following is correct regarding the pediatric patient with abdominal pain?
 - A. A comprehensive history should be taken from the parent but it is unnecessary to question the child.
 - B. Physical exam should be performed with special attention to palpation and auscultation of the abdomen.
 - C. An ultrasound of the abdomen always should be performed.
 - D. CT scans are done in all patients.

2. ED personnel incur a serious risk of liability for which of the following conditions?
 - A. Infertility associated with adhesions for missed appendicitis
 - B. Infertility due to adhesions secondary to pelvic inflammatory disease
 - C. Liability secondary to intestinal necrosis secondary to large bowel volvulus
 - D. Bleeding secondary to Meckel's diverticulum
 - E. All of the above
3. Which of the following best describes the current standard of care regarding the pediatric patient with abdominal pain?
 - A. All patients who manifest abdominal pain should be hospitalized for observation.
 - B. All patients who demonstrate right lower quadrant pain should be explored surgically for possible appendicitis.
 - C. A pediatric gynecologist should be consulted for any teenage girl with abdominal pain.
 - D. A pregnancy test should be performed in sexually active adolescent girls.
4. Before discharging a pediatric patient with abdominal pain, the ED practitioner should do which of the following?
 - A. Determine the transportation status as well as the level of understanding of the parent or guardian
 - B. Order an ultrasound of the abdomen to rule out the possibility of appendicitis
 - C. Ask the parent to remain with the patient in the ED for at least 24 hours
 - D. Consult a pediatric surgeon for a second opinion

Answers: 1. B; 2. E; 3. D; 4. A.

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