

## Mini-Review

# Non-Gynecologic Causes of Unexplained Lower Abdominal Pain in Adolescent Girls: Two Clinical Cases and Review of the Literature

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**Key Words.** Adolescents—Abdominal Pain

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### Introduction

Unexplained lower abdominal pain in adolescent girls is a common complaint that can pose a challenge for even the most experienced physicians.<sup>1–3</sup> It is also one of the most frequent conditions prompting a referral to a specialist. The differential diagnosis is lengthy, and the cost of an extensive laboratory evaluation is high.<sup>2</sup> In many cases the pain resolves spontaneously and no cause is found.<sup>4</sup> However, this fact should be coupled with an awareness that occasionally a serious underlying medical or psychiatric disorder exists. The purpose of this paper is to offer guidelines to the clinician caring for adolescent girls with unexplained lower abdominal pain and to stress the value of a thorough history and physical. Clues to the diagnosis and suggestions for management of non-gynecologic conditions will be presented.

### Illustrative Cases

#### Case 1

A 19-year-old young woman was evaluated for a several-year history of pain in the right lower quadrant. The pain was constantly present and described as a dull ache. Intermittently it would become more severe and stabbing in character. The physical examination was entirely unremarkable other than localized tenderness to superficial palpation in the right lower quadrant. The following studies were performed and found to be normal: complete blood count with differential and platelet count, erythrocyte sedimentation rate, serum electrolyte determination, liver enzymes, serum albumin and total protein, serum human chorionic gonadotropin, urinalysis, and urine culture. An upper GI

series, barium enema, CAT scan and sonogram of the abdomen/pelvis, and exploratory laparoscopy with appendectomy were also all negative.

The patient was followed sequentially over a period of several months. She had persistent, pinpoint pain to fingertip palpation in the superficial muscle layers of the right lower quadrant and was referred to a general surgeon. He injected the involved area with lidocaine and the pain disappeared. The patient was then taken to surgery and found to have entrapment of a superficial nerve that was constricted by herniated fibers of the rectus abdominis muscle. This was repaired and the pain resolved.

#### Case 2

A 12-year-old girl was seen in consultation for evaluation of abdominal pain of two weeks duration. The pain was initially intermittent, but then became continuous shortly before she was evaluated at our center. The patient noted a decrease in appetite and she was afraid that the pain would recur whenever she ate. There was mild nausea with one episode of vomiting. There was no history of change in bowel habits or urinary tract symptoms. The patient was premenarchal and had not noted any vaginal discharge. On exam, she was afebrile and the vital signs were normal. The general physical was entirely unremarkable other than mild tenderness in the right lower quadrant. The rectal was also normal. A pelvic examination was not performed.

The following studies were performed at the outlying hospital and found to be normal: complete blood count, serum chemistries, pregnancy test, urinalysis, urine culture, and stool culture. A stool sample was slightly positive for occult blood. A plain film of the abdomen showed distended small bowel loops. Markedly thickened loops of small bowel in the right lower abdomen were seen on a CAT scan of the abdomen. The patient was felt to have a ruptured appendix and then transferred to our facility. At surgery, she was

found to have torsion of a Meckel diverticulum with adhesive bands to the mesentery and an internal hernia with 20 cm of twisted, necrotic small bowel. The involved segment was then resected and the patient had an uneventful recovery.

### Key Elements of the History

While taking the history, the clinician should demonstrate a willingness to listen and should be particularly alert for any clues to a “hidden agenda” or an underlying illness. The onset, nature, duration, location, and severity of the pain as well as any aggravating or relieving factors should be explored. Particular attention should be paid to any significant changes in the patient’s physical activity level, exercise tolerance, and ability to keep up with peers. Pain that awakens the patient at night or that always occurs in the same localized area is highly suggestive of an underlying organic etiology. A nutritional history should be taken, and correlation with the type, amount, or timing of meals noted. Associated gastrointestinal symptoms such as nausea, vomiting, eructation, flatulence, hematemesis, melena, or hematochezia should be sought. The pattern of bowel movements including frequency, consistency, and any changes since the onset of pain should also be described.

A careful review of systems is also essential with close attention to any constitutional symptoms such as fatigue, malaise, unexplained fevers, chills, excessive sweating, anorexia, weight loss, or lymphadenopathy, which may suggest the presence of an underlying infection, malignancy or other inflammatory process. The genitourinary tract is also an important source of abdominal pain; therefore, questions about this system should be asked. Dysuria, frequency, urgency, dribbling, enuresis, hematuria, a history of a urinary tract infection, or any change in urinary volume may signify an organic problem.

The menstrual history should include age of menarche, frequency, duration, regularity, dates of last period, and any associated symptoms, including pain. A history of sexual activity, vaginal discharge, or malodorous secretions should also be taken.

The past medical and surgical history may prove to be important in identifying the correct diagnosis. Particular attention should be given to the possibility of complications from previous abdominal surgery, such as adhesions, as a cause of the abdominal pain. A history of trauma to the abdomen, including blunt force, is another important subject to explore. Inquires should also be made into medications that are being taken, such as ibuprofen or tetracycline, which may cause gastric irritation.<sup>5</sup>

The family history should search for close relatives with abdominal pain as well as inheritable disorders such as inflammatory bowel disease, irritable bowel syndrome, endometriosis, angioneurotic edema, hyperperlipidemias, hemoglobinopathies, and porphyria.<sup>6-9</sup> If the history is positive, the patient may be susceptible to an organic disorder and/or develop sympathetic pains.

After exploring the present illness and background medical history, more sensitive issues should then be discussed with the patient alone. Every effort must be made to assure privacy and confidentiality when obtaining such personal information from adolescents. In many instances, the information obtained during the psychosocial interview is key to elucidating the etiology of unexplained lower abdominal pain in teenagers. The issues outlined in [Table 1](#) can be addressed with the traditional verbal approach using the cue words illustrated or by having the patient complete a self-administered personal questionnaire. With either method, the questions should be answered privately and reviewed confidentially with the examiner, unless the patient specifically requests otherwise. Under these circumstances, patients will probably give reliable answers to more sensitive questions relating to abdominal pain, including those on problems with family or friends, history of abuse, concerns about pregnancy, and sexual activity.<sup>10</sup> The latter should include specific questions about anal intercourse, consensual or otherwise.

It is important to note that stress, anxiety and depression may be associated with abdominal pain in adolescents.<sup>11</sup> The three most common sources of conflict are problems at home, strained peer relationships, and school-related difficulties. Having a job or lack of a job for those in financial need may be an added source of pressure. The practitioner should also look for feelings of sadness, poor self-esteem, changes in behavior, difficulty concentrating, declining school performance, and other symptoms of depression. Alterations in sleep

**Table 1.** The “HEADS FIRST” Approach to Psychosocial-Medical Issues of Adolescence

Home:	Separation, support, “space to grow”
Education:	Expectations, study habits, achievement
Abuse:	Emotional, verbal, physical, sexual
Drugs:	Tobacco, alcohol, marijuana, cocaine, others
Safety:	Hazardous activities, seatbelts, helmets
Friends:	Confidant, peer pressure, interaction
Image:	Self-esteem, looks, appearance
Recreation:	Exercise, relaxation, TV, video or computer games
Sexuality:	Changes, feelings, experiences, identity
Threats:	Running away, harm to self or others

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patterns, and other similar changes in lifestyle may also be significant. Most teens respond very openly when asked if they get upset or depressed easily and if they have ever felt like hurting themselves or someone else. Any positive responses can then be pursued by asking the patient to "tell me about this." It must be stressed that adolescents who are actively suicidal or homicidal require immediate intervention by mental health experts, legal authorities, or both.

### Highlights of the Physical Examination

Many clues to the etiology of unexplained lower abdominal pain in adolescent girls may be found on the physical examination. The vital signs, height, and weight are particularly helpful. Although inflammatory bowel disease may cause abdominal pain in adolescents, it frequently presents with decreased linear growth velocity, poor weight gain, and/or delayed puberty.<sup>12</sup> The general appearance should provide insight to the patient's overall wellbeing. Particular attention should be given to the patient's nutritional status and whether she looks sick or appears depressed.

Cutaneous findings may be seen with a number of underlying conditions associated with lower abdominal pain. Pallor may be seen with bleeding anywhere from the esophagus to the anus. Urticaria suggests the possibility of hepatitis, systemic mastocytosis, or angioedema.<sup>6,13-15</sup> The latter condition may also be accompanied by a brawny edema of the extremities and recurrent attacks of wheezing or swelling of the larynx.<sup>16</sup> Petechiae or ecchymoses may be a clue to liver abnormalities or malabsorptive states. Erythema nodosum is characterized by painful, erythematous, recurrent nodules over the extensor surfaces of the extremities and is associated with inflammatory bowel disease.<sup>17</sup> Multiple epidermal cysts, sebaceous cysts, fibromas, and/or lipomas should raise suspicion for Gardner's Syndrome, which is characterized by multiple intestinal polyps that may bleed or cause intestinal obstruction and also have malignant potential.<sup>18</sup>

The presence of iritis, uveitis, glossitis, gingivitis, or stomatitis should suggest inflammatory bowel disease.<sup>19,20</sup> The Peutz-Jeghers syndrome is characterized by hyperpigmentation of the lips and buccal mucosa associated with hamartomatous intestinal polyps.<sup>21</sup> Recurrent attacks of severe pain, probably related to intermittent intussusception, are common in these patients.<sup>21</sup>

The chest should be palpated, percussed, and auscultated carefully, looking for any signs of direct chest wall tenderness, active pulmonary disease (especially asthma and pneumonia) or source of cough. All of

these may cause referred pain to the abdomen. A pericardial friction rub may be the only clue that pericarditis is the source of the abdominal pain.<sup>22</sup>

A thorough abdominal examination must be performed in an effort to detect any evidence of organomegaly, mass lesion or tenderness. Every effort should be made to relax the patient so that an optimal evaluation can be performed. Techniques such as engaging the patient in conversation, flexion of the hip muscles, and examining suspected painful areas last may be very helpful in this regard. Following superficial palpation, gentle, sustained pressure over tender areas usually allows sufficient relaxation to permit adequate palpation. The location and radiation of any pain on direct palpation or rebound tenderness be noted. Any pain noted on rebound or referred to a distant site is very significant and suggests peritoneal inflammation.

Intra-abdominal tenderness may be distinguished from anterior wall muscle pain by having the patient raise her head and thereby actively contract her abdominal muscles. Tenderness to superficial palpation suggests a problem within the muscle, such as a tear, a strain, or other injury that is usually induced by exercise or physical exertion, especially when associated with repetitive activity. A pinched nerve or hernia within the abdominal wall may also occur.<sup>23</sup> A palpable defect may be noted with a larger hernia; however, in many cases the ring is hidden beneath the external oblique aponeurosis or is too small to be felt on exam.<sup>23</sup> Tumors of the abdominal wall may occur, but they are very rare in this age group.<sup>24</sup> Persistent pinpoint pain, especially when the patient is distracted, is an important clue to diagnosing localized lesions within the abdominal wall.

Passive stretching of the abdominal muscles is another important maneuver. This can be performed with the patient in the prone position and having the examiner raise one leg at a time. Pain produced with this technique may be caused by superficial muscle tenderness, but, more important, it suggests inflammation within the abdomen or retroperitoneal space.<sup>25</sup> This finding may be an important clue to the presence of an abscess or tumor of the psoas muscle as well as an inflamed retrocecal appendix.<sup>25</sup>

The inguinal region should be inspected carefully when there is a history of lower abdominal pain. Swelling caused by a hernia may be accentuated by having the patient cough or bear down, particularly when standing. The inguinal ring and surrounding structures should also be directly palpated for any enlargement or defect as well as swelling. As may be expected with abdominal surgery, pain under a surgical incision is frequently seen and probably represents scar tissue formation. However, nerve entrapment may occur following such surgery, especially in the inguinal area

with involvement of the ilioinguinal or iliohypogastric nerves.<sup>26</sup>

The anus should also be inspected, looking for any evidence of bleeding, lacerations, scarring or similar signs of trauma as may be seen with anal intercourse, sexual assault, or other forms of rectal penetration. Rectal bleeding or discharge may also be seen with proctitis or colitis caused by sexually transmitted diseases such as *N. gonorrhoeae*, *C. trachomatis*, *T. pallidum*, and herpes simplex virus.<sup>27</sup> In addition, these symptoms may be caused by enteric pathogens and inflammatory bowel disease. Of particular note is the fact that perianal disease including tags, fistulae, or anorectal abscesses, is relatively common in patients with Crohn's disease.<sup>28</sup> In addition, digital examination of the rectum should be performed, looking for evidence of tenderness, impacted feces, or mass lesion and to test any stool for the presence of occult blood.

A slipped capital femoral epiphysis, Legg-Calve-Perthes disease, arthritis of the hip, or lesions of the symphysis pubis and other pelvic bones may refer pain to the abdomen.<sup>29</sup> For this reason direct palpation as well as range of motion of these structures should be performed, looking for any evidence of discomfort. Spinal abnormalities, such as diskitis (inflammation of the intervertebral disc space), space occupying lesions, or other forms of nerve compression may also cause pain referred to the abdomen.<sup>30</sup> Thus, a careful neurological examination is indicated in patients with unexplained lower abdominal pain. Although relatively uncommon, referred pain from the liver, gall bladder, or pancreas may sometimes cause discomfort in the lower abdomen. Careful, localized palpation of these structures, independent of the lower quadrants, should be attempted to determine if this reproduces the symptom the patient is experiencing.

Finally, although non-gynecologic conditions are the focus of this article, it must be stressed that any adolescent girl with unexplained lower abdominal pain should be considered for a pelvic examination.

### Differential Diagnosis

The differential diagnosis of unexplained lower abdominal pain in adolescent girls is extensive and includes numerous conditions as outlined in Table 2. Other than the urge to defecate, constipation is probably the most common cause of chronic abdominal pain in adolescents. On careful questioning, there is often a history of hard, painful stools passed at infrequent intervals. A history of intermittent diarrhea, probably caused by overflow around the impaction, is also not unusual. On palpation of the abdomen there is often a firm, cylindrical mass outlining the descending colon in patients with constipation. However, this is not

**Table 2.** Differential Diagnosis of Non-Gynecologic Causes of Lower Abdominal Pain in Adolescent Girls

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Abdominal wall abnormalities
Spigelian hernia
Femoral or inguinal hernia
Pinched nerve
Abdominal muscles
Iliohypogastric, ilioinguinal entrapment
Muscle strain, tear, or other injury
Anorectal
Anal intercourse
Proctitis
Bowel
Appendix
Fecalith
Retrocecal
Constipation
Inflammatory bowel disease
Irritable bowel syndrome
Meckel diverticulum
Mesenteric lymphadenitis
Obstruction
Intussusception
Volvulus
Genitourinary
Calculi
Cystitis
Bacterial, viral
Interstitial
Hydronephrosis
Neurogenic bladder
Spastic component
Pyelonephritis
Infections
Bacterial, parasitic, viral
Mass lesion (benign or malignant)
Medications
Miscellaneous rare causes
Carcinoid tumor
Munchausen syndrome
Munchausen syndrome by proxy
Others
Psychosocial-medical
Abuse
Depression and grief
School phobia
Stress, anxiety, hyperventilation
Substance abuse, withdrawal of drugs
Referred pain from
Back: cord lesion
Chest pathology
Heart: pericarditis
Hip, symphysis pubis, pelvic bone
Liver, gall bladder, pancreas
Psoas muscle: abscess, tumor
Systemic conditions
Angioedema
Connective tissue disease
Familial Mediterrean Fever
Hypercalcemia
Hyperlipidemias
Orthostatic edema
Porphyria
Sickle cell crisis
Systemic mastocytosis, others
Trauma

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always appreciated, especially in obese adolescents who are constipated. In addition, many adolescents with a documented fecal impaction on X-ray believe that they are having normal bowel movements and do not consider themselves constipated. Thus, a plain film of the abdomen may be helpful if constipation is suspected.<sup>31</sup>

Several other conditions also deserve emphasis. As illustrated in Case 1, a Spigelian hernia, muscle tear, pinched nerve, or other anatomic lesion of the abdominal wall must be considered in the differential diagnosis of unexplained abdominal pain in adolescents.<sup>23,32</sup> These patients often have a constant, dull ache that is intermittently more severe, especially after muscular activity. Persistent, reproducible, pinpoint pain by history and to fingertip palpation, especially when the patient is distracted, is an important clue to the presence of such conditions and highly suggests that an underlying anatomic problem exists. This principle applies to hernias in the inguinal and femoral areas as well, whether or not swelling is reported by the patient or found on exam. Failure to recognize such anatomic lesions may result in unnecessary testing, procedures, or referrals with a resultant delay in appropriate intervention. The technique of injection with lidocaine can also be helpful in patients with a pinched nerve, as seen in Case 1.

Case 2 documents that torsion of a Meckel diverticulum and internal herniation with small bowel obstruction may present in adolescent girls with unexplained right lower quadrant pain. Although painless rectal bleeding is the most common manifestation of Meckel diverticulum during the first two decades of life, a number of other complications have also been described in adolescent girls.<sup>33-35</sup> These include inflammation with diverticulitis that may simulate acute appendicitis and lead to perforation with peritonitis.<sup>33</sup> In addition, partial or complete bowel obstruction may occur when the diverticulum serves as the lead point of an intussusception.<sup>33</sup> The intraperitoneal bands that cause obstruction due to internal herniation of small bowel may also result in a volvulus of the bowel around the band. Thus, early recognition and prompt surgical treatment of a Meckel diverticulum are essential to an optimal outcome so that any such serious complications can be avoided.

Other important causes of partial bowel obstruction, such as tumor, adhesions from previous surgery, incarcerated hernia, intussusception, and malrotation of the intestine may present in adolescents with recurrent episodes of vomiting, abdominal pain, or diarrhea, especially in relation to eating.<sup>35</sup> Decreased appetite with associated weight loss may also occur as a result of these symptoms. While most patients with a malrotation are identified in the newborn period or during childhood, occasionally the manifestations are delayed

until the second or third decade of life.<sup>36</sup> Thus, malrotation must always be considered in the differential of unexplained abdominal pain in adolescents. Failure to diagnose this condition in a timely manner may be associated with severe adverse sequelae caused by an intermittent volvulus or duodenal compression by Ladd bands, or other adhesive bands affecting the large and small bowel.<sup>37</sup>

Inflammatory bowel disease may present with classic symptoms of abdominal pain and bloody, mucousy stools in adolescents. However, in this age group, extra-intestinal manifestations often precede these symptoms by months or years.<sup>12</sup> Arthritis, severe stomatitis, erythema nodosum, delayed puberty, anorexia, and poor weight gain or weight loss are relatively common early symptoms.<sup>12,17,19,20</sup> Additional clues to the diagnosis of inflammatory bowel disease may also be present early, including persistent elevation of the erythrocyte sedimentation rate, indicating that an active inflammatory process is occurring. Although this is a nonspecific finding, it is seen in more than 75% of patients with inflammatory bowel disease at the time of diagnosis.<sup>38</sup> A low mean corpuscular volume without evidence of anemia is a subtle hematological finding that may be seen relatively early in patients with inflammatory bowel disease who have mild gastrointestinal blood loss. Depression of hemoglobin levels occurs in only a third of newly diagnosed cases.<sup>38</sup> A low serum albumin is another important diagnostic clue to the presence of inflammatory bowel disease.<sup>39</sup> Of particular note, a negative upper GI series with small bowel follow-through, normal barium enema, and negative sigmoidoscopy do not exclude the diagnosis of inflammatory bowel disease. Colonoscopy with multiple biopsies is a more sensitive and specific test for evaluating patients suspected of having this disorder.<sup>40</sup> Children with Crohn's disease have characteristic microscopic inflammatory changes, even in the presence of a grossly normal colon.<sup>41</sup>

The physical findings of appendicitis vary with the location of the appendix and the time course of the inflammation. Typical signs and symptoms may be absent with a retrocecal appendix, as noted previously in the physical exam section, or when there is chronic underlying pathologic process, such as with a fecalith. An appendiceal fecalith should always be considered in patients who have unexplained lower abdominal pain, particularly if it occurs on the right side.<sup>42</sup> It is important to establish the diagnosis as soon as possible, for 50% of children with a fecalith and abdominal pain develop a perforated appendix.<sup>43</sup> Plain films of the abdomen, looking for opacities within the appendix, may be positive, even before calculi are apparent on ultrasonographic investigation.<sup>42</sup> In many instances, however, fecaliths are not calcified or otherwise detectable prior to surgery. Negative laboratory or radiographic studies do not exclude this diagnosis. Under

these circumstances, the practitioner must have a high index of suspicion, based upon the clinical presentation, so that definitive treatment is not unduly delayed.

Urinary tract infection, obstruction, or calculi are relatively common causes of lower abdominal pain in adolescents. Interstitial cystitis is also in the differential, although it is uncommon in adolescents.<sup>44</sup> This condition should be suspected when there is sensory urgency, frequency, and bladder pain unassociated with infection.<sup>44</sup> In addition, neurogenic bladder dysfunction should be considered, especially when there is exacerbation of the pain with voiding. The pain associated with this condition is believed to be due to spasms of the bladder.<sup>42,45</sup> In more severe cases, there may be significant urinary retention with a palpable bladder that may simulate an enlarged uterus. When the possibility of neurogenic bladder dysfunction is considered, a referral to urology is indicated and urodynamic studies are necessary to establish or exclude the diagnosis.

Hereditary angioedema is a rare cause of recurrent abdominal pain.<sup>6</sup> This condition is caused by a quantitative or qualitative C1 esterase inhibitor defect.<sup>6</sup> The most common presentation of angioedema is intermittent, brawny swelling of the extremities.<sup>46</sup> However, facial and subglottic swelling as well as recurrent, crampy abdominal pain and wheezing may also occur.<sup>6,16</sup> The edema usually lasts one to four days and may be precipitated by minor trauma or stress, but in many cases there is no known trigger factor.<sup>16,47</sup>

Lack of a definable medical etiology must not be equated with a psychiatric diagnosis by default. The appropriate psychodynamics should be present before this possibility is seriously entertained. Therefore, the examiner must look closely for signs and symptoms of stress, anxiety, or depression. In many instances, these symptoms may be secondary to persistence or recurrence of the abdominal pain. However, a pattern may actually emerge that suggests a non-organic basis for the pain itself. As the number of missed school days accumulates, there is an increased chance that a school phobia may develop, especially if parents unwittingly encourage the absences. Decrease of the pain at home and on weekends is an important clue to this diagnosis. Abdominal pain is also a common physical symptom of depression and anxiety.<sup>48</sup> The hyperventilation syndrome should be suspected when the pain is accompanied by light-headedness, difficulty in breathing, numbness and tingling of the extremities, headaches, and chest pain. This constellation of symptoms is relatively unique and strongly suggests that the patient is suffering from anxiety, either primary or secondary to unresolved abdominal pain.

The possibility of sexual abuse must always be considered in adolescent girls with unexplained lower abdominal pain.<sup>49</sup> Physical, verbal, and emotional abuse may also present with this symptom. Bullies at

school, on the bus, or in the neighborhood may be teasing, harassing, or even punching the patient in the abdomen.<sup>50</sup> Suspicion about abuse should be heightened when the patient tries to avoid certain situations, places, or individuals. Even when asked directly about abuse, adolescents are often too shy, embarrassed, or even afraid to disclose this information. It is not unusual for teenagers to reveal their true feelings during a followup visit, especially in patients who may have difficulty verbalizing such concerns to others. Their feelings are often internalized and may be expressed with subtle symptoms, including vague somatic complaints. Close contact with the clinician should be maintained and the "door left open" for further dialogue to explore such sensitive issues. This process is facilitated by assuring privacy and confidentiality for the patients during the evaluation.

Substance abuse is also in the differential diagnosis. For example, use of alcohol and inhalants as well as withdrawal of opioids and central nervous system depressants may cause abdominal pain.<sup>51-53</sup> Any significant behavioral changes should also suggest the possibility of substance abuse.<sup>54</sup> This subject should be discussed privately with the adolescent in an effort to gain a sense of trust and establish rapport.

Adolescents with known sickle cell disease pose a very difficult dilemma for the practitioner.<sup>8,55</sup> There is no specific diagnostic test to distinguish a painful crisis from other conditions in the abdomen. Thus, it is necessary to approach these patients as if they are having a sickle cell crisis with abdominal involvement, while at the same time monitoring their clinical course carefully for the possibility that another underlying condition may also be present. Appropriate investigative studies and additional therapeutic intervention should be pursued as indicated.

## Diagnostic Investigation

### Baseline Screening Studies

In many instances, no diagnostic testing is necessary after a careful history and complete physical examination. The costs of investigative studies are high, and any unnecessary testing should be avoided unless specifically indicated. Practitioners should carefully select the diagnostic studies that seem most appropriate based on the clinical presentation. However, if the diagnosis remains uncertain, the clinician should consider a screening evaluation that includes the baseline studies shown in [Table 3](#).

The following serological studies are easily administered, relatively inexpensive, and will give a rapid assessment of target organ status to screen for an inflammatory process or generalized systemic condition: complete blood count, erythrocyte sedimentation

**Table 3.** Diagnostic Investigation for Non-Gynecologic Causes of Lower Abdominal Pain in Adolescent Girls

<b>Baseline Screening Studies (if necessary)</b>	
1:	Complete blood count with differential and platelet count
2:	Erythrocyte sedimentation rate
3:	Serum electrolyte, calcium, and phosphorus determination
4:	Liver enzymes, bilirubin, protein, and albumin
5:	Urinalysis, urine culture and sensitivity
6:	Serum human chorionic gonadotropin if pregnancy cannot be excluded
7:	Flat plate, upright of abdomen
8:	Sonogram of abdomen, pelvis
<b>Additional Diagnostic Studies (if indicated)</b>	
1:	Consider repeating the simple screening tests outlined earlier, looking for interval change
2:	Antinuclear antibody, rheumatoid factor, C3 and C4 complement, creatine phosphokinase
3:	CEsterase inhibitor level, qualitative and quantitative
4:	Serum for lead
5:	Porphyria screen
6:	Serum thyroxin and thyroid stimulating hormone
7:	Lipoprotein electrophoresis or lipid profile
8:	Computed tomography or magnetic resonance imaging
9:	Upper GI series with small bowel follow-through
10:	Barium enema
11:	Intravenous pyelogram
12:	Technetium scan
13:	Stool for occult blood, ova and parasites
14:	Rectal swab for gonorrhea, chlamydia if history of anal sex
15:	Colonoscopy
16:	Diagnostic laparoscopy
17:	Others as indicated

rate, electrolytes, calcium, phosphorus, amylase, lipase, liver enzymes, bilirubin, albumin, and serum protein. In addition, a urinalysis and urine culture will also screen for pathology in the urinary tract. A serum pregnancy test should be ordered in adolescent girls if the possibility of pregnancy cannot be excluded.

A single flat plate of the abdomen is very useful diagnostic study, looking for evidence of a fecal impaction, appendiceal fecalith, urinary tract stone, dilated loops of bowel that suggest obstruction or other anatomic abnormality.<sup>31,42,56</sup> An upright film of the abdomen showing air-fluid levels also raises the possibility of an intestinal obstruction.<sup>56</sup> It is also reasonable to consider a sonogram of the abdomen and pelvis as part of the initial evaluation. If a Spigelian hernia is suspected, a sonogram of the abdominal wall is sometimes diagnostic.<sup>23</sup>

### Additional Diagnostic Studies

If these studies are negative, but the clinician remains concerned that an organic disorder may be present, a more thorough laboratory investigation should be considered as shown in Table 3. Rheumatologic studies including antinuclear antibodies, rheumatoid factor, C3 and C4 complement, and creatine phosphokinase will help exclude systemic lupus erythematosus

and other connective tissue diseases which may present with abdominal pain. C1 esterase inhibitor levels, both quantitative and qualitative, should also be obtained in an effort to exclude angioedema, especially if the pain is short-lived or episodic and accompanied by wheezing, symptoms of subglottic swelling or edema of the face or extremities.

Patients with abdominal pain associated with refractory constipation of unknown origin should be screened for lead poisoning and porphyria, especially if signs of increased intracranial pressure or psychiatric symptoms are present.<sup>9,57</sup> A serum thyroxin and thyroid stimulating hormone are also indicated for patients with severe constipation, particularly if it is accompanied by fatigue, depression, cold intolerance, weight gain, or other symptoms of hypothyroidism.

Lipemic serum or a family history of elevated lipids should prompt the clinician to order a lipoprotein electrophoresis to investigate for the possibility of hyperlipidemia, a rare cause of abdominal pain in adolescents.<sup>7</sup> Another tipoff to this condition is *apparent* hyponatremia, an artifact, which may be seen when the water content of plasma is reduced by the presence of increased quantities of lipids.<sup>58</sup> This error can be avoided by laboratory methods that use ion-selective electrodes in the measurement of serum electrolytes.<sup>58</sup>

Additional radiographic studies may also be indicated. Computed tomography of the abdomen is considered by some to be a reasonable next step, especially when more detailed visualization of the appendix is desired.<sup>59</sup> However, recent studies argue against unrestrained use of appendiceal CT scanning and reinforce the need for clinical evaluation by the operating surgeon before routine performance of this study.<sup>59,60</sup> Computed tomography may also be used to more clearly define the abdominal wall layers in an effort to diagnose a Spigelian hernia.<sup>23</sup> Unfortunately, smaller defects may not be detected with this technology.

Magnetic resonance imaging of various parts of the abdomen may also be helpful when greater resolution is needed in selected cases. An upper gastrointestinal series with small bowel follow-through and barium enema should be reserved for specific clinical situations to help exclude an anatomic lesion or to more clearly delineate any questionable findings noted on previous studies. An intravenous pyelogram has long been considered by many to be the gold standard for the radiographic detection of urinary tract calculi. Recently, however, some institutions are replacing the intravenous pyelograms with noncontrast helical CT scans for the patient who presents with flank pain and suspicion of a ureteral stone.<sup>61</sup> A technetium scan is indicated to help rule out a Meckel diverticulum, although both false positive and false negative results may occasionally occur with this test.<sup>62,63</sup>

Fresh stool for occult blood, ova, and parasites should also be sent when the diagnosis remains elusive. In addition, patients with a history of anal intercourse should have a rectal swab to screen for gonorrhea and chlamydia or other sexually transmitted diseases as indicated.<sup>27</sup>

The benefits must be weighed against the cost and potential hazards of any additional studies or procedures. Consultation with a gastroenterologist experienced in evaluating adolescents may be advisable in selected cases. If colonoscopy is performed, multiple biopsies should be taken to look for evidence of inflammatory bowel disease. Diagnostic laparoscopy or other exploratory surgery should be reserved for patients with severe, unremitting pain, in whom no cause has been found after a thorough evaluation, such as outlined above.

## Management

Treatment should be directed toward the underlying cause of the pain. If a specific organic or psychiatric disorder is found, appropriate therapy should be initiated. Patients with a fecal impaction should be treated for constipation and seen back in one to two weeks to confirm evacuation. It must be stressed that persistence of a palpable mass in the left lower quadrant following appropriate treatment for constipation should raise suspicion for a tumor or other anatomic lesion and appropriate diagnostic studies should be ordered as indicated.

In some cases the pain may have started with an illness, but it persists longer than would be expected. The lack of a definable medical cause for the pain may be difficult for the patient, parents, and physician to accept. Persistence of the pain also generates an increasing amount of anxiety and frustration for all parties involved. The patient may sense a feeling of control as she becomes the center of attention, but at the same time she may struggle internally with feelings of ambivalence about the need to get better. Under these circumstances, lack of a diagnosis should not be equated with lack of a problem. A helpful approach is to acknowledge that a problem does exist, no matter what the cause. This should be conveyed to the patient, to help alleviate any guilt feelings and stimulate a discussion about any unresolved conflicts, issues or concerns.

When a significant psychogenic component to the illness is identified, it is explained to the family that a broad-based, comprehensive approach is necessary, since emotional difficulties can aggravate physical pain and vice versa. The patient and her parents should be informed that stress, anxiety, and depression may worsen the pain, although it may not be clear as to what degree they are contributing to it. Thus, it

is recommended that clinicians address any psychiatric symptoms that are identified at the same time as the medical evaluation proceeds. As discussed in the section on differential diagnosis, it is important to avoid assigning a psychiatric diagnosis by default. In many instances, jumping to such a conclusion is not only unfounded, it can also be very counterproductive. This may be particularly problematic when an anatomic abnormality is actually present, but goes unrecognized.

Those patients without a clearly definable cause of the pain, based on the evaluation outlined in this article, should be followed sequentially. Consideration should be given to repeating some of the simple screening tests outlined earlier, looking for interval change as indicated. This approach adds credibility to the patient's complaints while at the same time it provides a period of close observation. Such followup is particularly important for patients with intermittent pain as may occur with conditions such as a recurrent intussusception.

Examination during the attacks is another very useful technique. A pale, diaphoretic adolescent who is in obvious pain and distress is more likely to have an underlying organic condition than a patient who does not have these findings. Appropriate investigative studies, ordered on an acute basis, may help to establish a diagnosis. For example, flat plate and upright abdominal films showing evidence of air-fluid levels or dilated loops of bowel strongly suggest the presence of an underlying organic lesion that may be causing an intermittent bowel obstruction.<sup>56</sup>

The entire family should be reassured when there is no objective evidence of a serious underlying abnormality. However, it is important to validate the symptoms and to express an understanding of the patient's discomfort, especially when there are few physical findings. Treatment is supportive, although there is no consensus on the value of prescribing specific medication under these circumstances. Whenever possible, the patient should remain in school during the period of observation and any absences approved only by the treating physician. The lines of communication between the family, school, and practitioner should be kept open to discourage any tendency by the patient to develop school phobia. At the same time this helps defuse the situation at home and gives the clinician the opportunity to analyze the available data.

## Summary

Unexplained lower abdominal pain in young women can present a challenge for even the most experienced clinicians. Although the cause is usually benign and self-limited, occasionally a serious underlying disorder exists. Clinicians should have an organized approach

for diagnosis and management in an effort to avoid any unnecessary tests or referrals. The most important elements of the evaluation are a thorough history, careful physical, and sequential followup as needed. Selective use of the laboratory and radiographic studies should be considered on an individual basis. Invasive procedures should be avoided, unless dictated by specific clinical findings or the overall clinical course.

A careful, methodical approach to chronic abdominal pain does not necessarily guarantee any easy or quick answers. In many instances the etiology defies diagnosis, posing a difficult dilemma for patients, parents, and physicians themselves. When no evidence of a serious underlying condition is found after a thorough investigation, it may be necessary to allow the illness to "play out" or "burn out." In the meantime, adolescents and their parents should be reassured that while there may be no known cure, the pain is not life threatening and can usually be controlled with supportive measures as needed. As one gains more experience with this disorder in adolescents, it becomes evident that when our resources are depleted, time is sometimes our best ally.

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