

# Abdominal Pain in the Female Adolescent

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At all ages, abdominal pain is a difficult and anxiety-provoking symptom for children, parents, and physicians. In the acute form (eg, appendicitis), it carries the threat of serious and potentially life-threatening physical disease; in the recurrent form (eg, recurrent abdominal pain syndrome), it carries the probability of living with a symptom of disease without knowing the cause; and in the chronic form with a physical disease (eg, inflammatory bowel disease), it carries the likelihood of significant functional disability only partially responsive to therapy. For the pediatric diagnostician, the complaint of abdominal pain in the adolescent female is marked by two important features: an increasing reliance on the history given by the patient herself and inclusion in the differential diagnosis of entities referable to the genitourinary tract. If the pediatrician is unaccustomed to "adult" presentations of the symptoms, these changes may increase the physician's discomfort in dealing with this complaint.

## CLASSIFICATION

### Problems with Organic/Functional Classification

It is traditional to approach abdominal pain as a problem of distinguishing "functional" from "organic" abdominal pain. This distinction is not helpful. In some classifications, functional simply covers all of those entities that are not organic, whereas in others the term connotes some form of psychological cause or relationship to stress. This implies a degree of understanding of etiology that has not been demonstrated. A more serious problem is the assumption that the presence of a *symptom* of disease implies the

presence of disease (something wrong or abnormal) accounting for the symptom. For example, lactose intolerance results from the interaction between a normal developmental phenomenon (decreased small intestinal lactase activity) and a normal environmental phenomenon (ingestion of lactose-containing products). The low lactase levels are not the result of a disease (and therefore not "organic"), nor does the absence of organic disease imply that it is functional, psychogenic, or in any other way abnormal. In this case, abdominal pain is only a symptom of disease in a physically and mentally well child. To overcome these problems, an alternative tripartite classification is proposed which is relevant both for our understanding of the symptom and for the clinical diagnostic process (Table 1).

### Alternative Clinical Classification

Three major categories are recognized: organic, psychogenic, and dysfunctional. Organic pain refers to pain sensations assumed to originate intra-abdominally from a specific disease process in an organ system(s) in which treatment of the disease results in amelioration of the symptoms. Subcategories include diseases referable primarily to the gastrointestinal tract, the genitourinary tract, and others. Apley has reported organic causes in school-aged children to be approximately half gastrointestinal and half genitourinary. In adolescents, one might expect more genitourinary causes, but specific data in unselected series are not available at present.

The phrase psychogenic pain is reserved for those situations in which the subject experiences pain in the absence of disordered patterns originating in intra-abdominal sensory nerve endings. Recognition by the patient of the relationship between the pain and relevant psychological events strengthens the diagnosis and aids in therapy. Subcategories include exacerbations of pain in response to acute or chronic

## EDUCATIONAL OBJECTIVE

36. Appropriate evaluation of the adolescent girl with abdominal pain with the ability to differentiate between organic and functional causes (Topics 82/83).

stress (eg, loss of a relative), behavioral pain complaints (eg, complaint modeling, maintenance of the pain complaint for secondary gain), pain occurring as part of a psychiatric syndrome (eg, depression, conversion hysteria), and other behavioral syndromes (eg, school phobia). In all categories, positive evidence for the relevant disordered intrapersonal or interpersonal behavior is required.

In dysfunctional pain syndromes, the pain sensations are assumed to originate intra-abdominally from normal rather than disordered physiologic processes. The term "dysfunctional" recognizes the fact that, even in the absence of disease, the symptom of pain itself is a problem for peer, parent, or school relationships. Dysfunctional pain includes two subcategories. Specific syndromes are those in which the mechanism of pain production is recognizable, such as lactose intolerance and Mittelschmerz. In non-specific abdominal pain syndromes,

## Abbreviations

AIP	Acute intermittent porphyria
IBS	Irritable bowel syndrome
PID	Pelvic inflammatory disease
RAP	Recurrent abdominal pain
UTI	Urinary tract infection

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**TABLE 1.** Proposed Classification of Abdominal Pain

Dysfunctional	Example
Nonspecific	Spontaneous resolution, early Spontaneous resolution, late Persistent
Specific	Dysmenorrhea (primary) Lactose intolerance Irritable bowel syndrome Pregnancy
Organic	
Gastrointestinal	Inflammatory bowel disease Peptic ulcer Appendicitis
Genitourinary	Pelvic inflammatory disease Urinary tract infection Ovarian cyst
Other	Acute intermittent porphyria
Psychogenic	
Stress-related	Reaction anxiety
Behavioral	Complaint modeling Secondary gain
Psychiatric	Depression Conversion hysteria
Other	School phobia

no apparent mechanism is recognizable. Patients in whom the symptom subsides within three visits without specific therapy (spontaneous resolution, early) are distinguished from those whose symptoms do not subside (nonspecific abdominal pain, persistent). In our clinical experience, adolescents have persistent pain more commonly than younger school-aged children. In most practices, these dysfunctional, nonspecific categories will probably account for more than half of the cases.

## PRESENTATION

### Acute vs Recurrent

The diagnostic priorities will be determined by the clinical presentation and the situation in which the patient is first seen (Figure). Abdominal pain usually presents either as an acute episode or as recurrent abdominal pain (RAP) syndrome. Truly chronic abdominal pain, which is continuously present, is rare as a first presentation, although it may occur in children with underlying chronic disease. In general, recognizable organic entities are more common in acute abdominal pain, whereas dysfunctional entities are

more common with the RAP syndrome. However, this apparently simple distinction is blurred by the fact that an acute presentation may only be the first episode of a subsequent RAP syndrome, any particular episode with RAP syndrome may present as acute pain, and patients with RAP may be equally likely to have an intercurrent disease process (such as appendicitis) in addition to their recurrent pain. In the acute presentation, determination of the necessity for and timing of surgical intervention (a "surgical" abdomen) or specific medical therapy are predominant. In the recurrent pain presentation, definition of the syndrome, identification of the source(s) of secondary anxiety (eg, fear of cancer) and dysfunction (eg, accusations of malingering), and staged evaluation of potential etiologies are predominant. In the acute presentation, the main concern of management is prevention of tissue damage. In the recurrent presentation, this concern coexists along with measures designed to prevent secondary consequences. For the adolescent with persistent nonspecific recurrent pain, prevention of secondary dysfunction constitutes an appropriate, and often achievable, therapeutic goal.

## Pain Perception and Behavior

Although we commonly assume that we know what pain means, it is an extremely complex experience. Both its perception and expression are subject to a variety of neurologic, psychological, and social influences constrained by the developmental evolution of the child. In the clinical setting, physicians must assess the pain complaint by relying only on verbal and behavioral expressions. An important clinical principle is the recognition that verbal and behavioral reactions may be dissociated. The severity of the pain may be down-played when the patient is asked to describe it verbally while the pain behavior suggests it is severe, or the opposite may be true. As a result, assessment of the sensation and experience of pain underlying the complaint is difficult.

Nevertheless, some general themes relevant to abdominal pain are becoming apparent. Adolescents are more likely than school-aged children to be able to localize their abdominal pain complaint. In addition, adolescents are more likely than younger children to identify their pain as nonperiumbilical. Whether this is the result of a different mechanism of pain production or increasing facility with pain language is unclear. Other authors have demonstrated an age-related increasing "pain threshold" to experimentally induced anterior tibial pressure in children. In general, adolescents seem more capable of specifying location and less quick to label a stimulus as painful than are younger children.

There is a common assumption that subjects with abdominal pain react differently from pain-free subjects to the same stimulus, but there is little evidence to support this. Apley stated that there was no difference in pain threshold to anterior tibial pressure in children with RAP compared to control subjects. Similarly, we found no differences in verbal report of pain severity, behavior (facial reactions), or physiologic response (heart rate, vasoconstriction, muscle activity) to cold pressor pain. Adults with irritable bowel syndrome rate pain severity caused by sigmoid balloon distension the same as normal and neurotic control subjects.

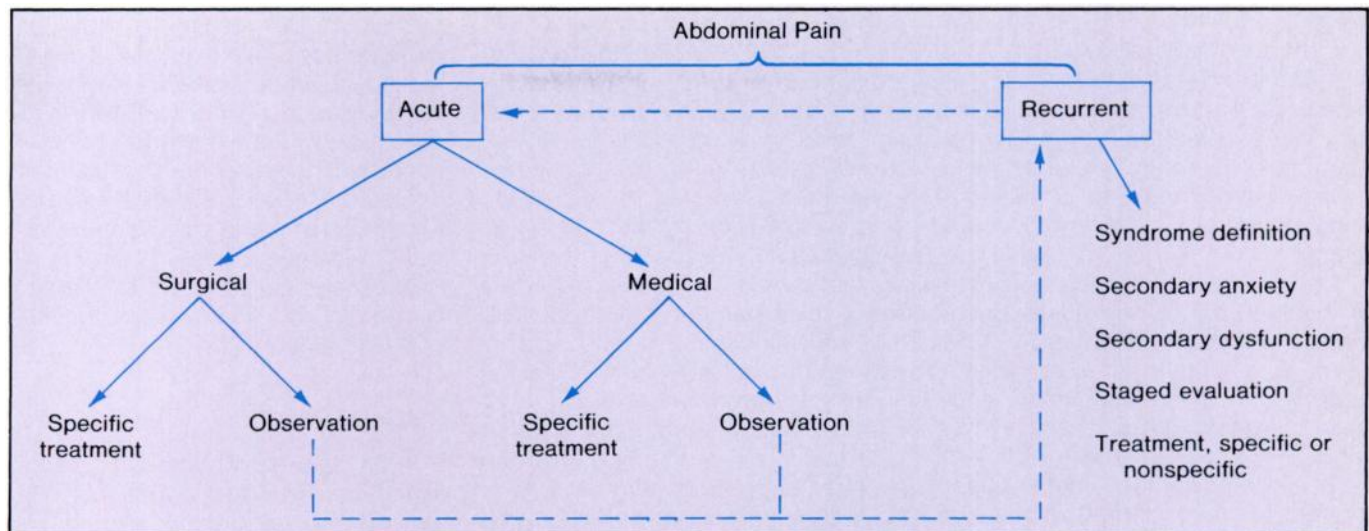


Figure. Clinical presentation and clinical priorities of abdominal pain.

Consequently, the concept that children, and especially adolescents, with abdominal pain are simply "more sensitive" to abdominal or other pain stimuli is unlikely.

**Pain Complaint and Stress**

There is an almost universal assumption that stress plays an important role in the etiology of abdominal pain complaints. This appears justified because of the frequency with which evidence of stressful life events are reported in the clinical setting. In addition, changes in gastrointestinal physiology associated with various forms of stress have been repeatedly documented in adults. The stresses experienced by adolescents would seem to make them particularly vulnerable to stress-related abdominal complaints. Despite the attractiveness of this hypothesis, the role of stress is far from clear. First, the complaint of abdominal pain is more common in younger schoolchildren than in adolescents. Second, some children with abdominal pain have the pain complaint reappear as adults after a symptomless hiatus in adolescence. Third, series reporting a high prevalence of stress events are seldom controlled, do not describe the temporal sequence of stress and pain complaints, and have not demonstrated the effectiveness of therapeutic modalities aimed at stress reduction.

The assumption that stress is an adequate explanation of the symp-

tom in the absence of organic pathology is unwarranted. Not only may evaluation for other causes be delayed, but also it may compromise the physician's credibility in the eyes of a perceptive patient. The important question is not whether stress exists, but how it is related to the pain in a particular patient.

**SPECIFIC ENTITIES IN DIFFERENTIAL DIAGNOSIS**

**Nonspecific Dysfunctional Pain**

This typically is first seen as a recurrent abdominal pain syndrome although the first presentation may be acute. The main feature is that the pain is usually relatively short (less than three hours) and the patient is well between attacks. Episodes may be frequent and regular, may be infrequent, may come in clusters, or (most commonly) may have no particular pattern. Typically, the pain is periumbilical in children, but adolescents more commonly describe nonperiumbilical pain despite lack of evidence of organicity. This is also true of adults with irritable bowel syndrome. In children, nonperiumbilical pain is more likely than umbilical pain to be organic in etiology, but this diagnostic point is less helpful in adolescents. Autonomic symptoms of nausea, vomiting, pallor, perspiration, headache and limb pains are frequently associated. In contrast, "organic" symptoms of fever, weight loss, jaundice, bloody stools, pain on urination, and ur-

gency are uncommon. Physical examination is unremarkable except for colonic tenderness on palpation, especially in the left lower quadrant. As specific therapy directed at a recognized underlying etiology will not be possible, appropriate evaluation includes identification of sources of secondary anxiety about the symptom and the potential for secondary dysfunction. Although each case must be individualized, it is generally useful to raise possible areas of concern (such as fear of cancer) if not raised by the adolescent herself.

**Irritable Bowel Syndrome (IBS)**

Irritable bowel syndrome is the most frequent diagnosis in adults complaining of abdominal pain. It is defined as a disturbed and irregular bowel habit in the absence of demonstrable organic disease. The disorder is thought to be associated with changes in colonic motility, but whether these changes are quantitatively or qualitatively different from normal is still disputed. Some clinicians consider nonspecific RAP syndrome in children to be the analogue of adult IBS, but there is no clinical advantage to making this assumption. However, recognition of the better defined subgroups of IBS may help in confidently preventing unnecessary procedures searching for organic diseases.

IBS is considered to include three subgroups: (1) spastic colon defined as irregular or infrequent bowel movements with abdominal pain, (2)

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painless diarrhea, and (3) alternating diarrhea and constipation. The first category accounts for approximately 80% of the cases and is the only one that enters the differential diagnosis for pain. Patients who have just abdominal pain or just constipation are not considered to have IBS.

The spastic IBS usually presents in the recurrent form but the onset occurs abruptly approximately 25% of the time. Compared to symptoms experienced by adults with diagnosed organic disease, the symptoms of visible distension, relief of pain with a bowel movement, looser and more frequent stools at onset of pain, passage of mucus, and a feeling of incomplete evacuation are significantly more common in IBS. More than two of these symptoms are present in 80% of IBS patients compared with 25% of patients with organic disease. Positive findings on the physical examination are usually limited to colonic tenderness. Continuous pressure over the area of tenderness is more likely to produce partial relief when due to IBS than when due to inflammatory conditions. The lack of an effective specific therapeutic modality for altering the course of the syndrome implies that attention to secondary consequences is relevant in the evaluation and management of these cases.

### Dysmenorrhea

Dysmenorrhea is one of the most frequent pain complaints referable to the genitourinary tract in adolescent girls, and approximately 30% will have consulted a physician for this problem by 20 years of age. It appears to be related to cyclic increases in myometrial activity, secretion of prostaglandins E and F, and increased sensitivity of pain receptors to prostaglandins and/or uterine ischemia. Typically, the pain begins with, or some hours before, the onset of menstruation, lasts from three hours to three days, and is suprapubic in location. It may be confused by radiation to the back or thighs and by vomiting, nausea, or (rarely) diarrhea. In the classic case, recognition of the pattern should not be difficult if menstrual periods are well established. Because dysmen-

orrhea is associated with ovulation, the first episode may not occur during the early anovulatory periods following menarche. A crucial diagnostic decision is the distinction between primary and secondary dysmenorrhea (painful menstruation without and with pelvic pathology, respectively). Secondary dysmenorrhea should be suspected when fever, use of an intrauterine device, abnormal findings on pelvic examination, and failure of therapeutic response to appropriate oral contraceptives or prostaglandin synthetase inhibitors is detected. The associated periodicity makes it easy to confuse with endometriosis, pelvic inflammatory disease, noninflammatory dysmenorrhea associated with intrauterine devices, or obstruction and fusion defects. If the pain is unilateral, organic pathology is suggested. Initial evaluation should include a thorough pelvic examination and rectal palpation for the detection of masses. Ultrasonography and laparoscopy may be indicated in selected patients in whom secondary dysmenorrhea is suspected.

### Lactose Intolerance

Abdominal pain due to lactose intolerance is usually recurrent in presentation. Contrary to expectation, it does not always follow milk ingestion, is usually not associated with diarrhea, and may first appear with frequent or infrequent pain complaints. This variability probably relates to the large number of factors that can affect absorption and metabolism of lactose in the colon, as well as individual differences in pain reporting. Identification of patients with the necessary *predisposition* to lactose intolerance (ie, low lactase levels) can be accomplished by the noninvasive lactose breath hydrogen test. Symptoms following the test are not nearly so important as a trial of lactose elimination with a rechallenge period. It is difficult to perform diet trials properly, and calendar monitoring of pain frequency, severity, timing, and lactose ingestion are crucial to making an appropriate clinical decision as to its significance. Inasmuch as lactase deficiency may rarely be secondary to a disease process, appropriate in-

vestigation for those possibilities must be considered. Lactase insufficiency is more common in most black, Jewish, Asian, Native American, and Mediterranean populations, and the likelihood of lactose intolerance accounting for the symptom may depend in part on the composition of the practice. Careful clinical judgment is required to prevent overdiagnosis and underdiagnosis of this condition.

### Pregnancy

In an adolescent with well-established cyclic menstruation, the diagnosis of pregnancy should be straightforward. However, if the pregnant patient is seen because of abdominal pain, the chance of not even considering pregnancy considerably increases the likelihood of a missed diagnosis. This may be further complicated if the adolescent denies the possibility of pregnancy altogether. Associated symptoms that help raise suspicion typically include amenorrhea, increased breast fullness or tenderness, fatigue, and nausea and vomiting. However, the crucial question is not so much when the last period occurred, but how normal it was, since episodes of bloody discharge (usually short and light) in early pregnancy are not uncommon (about 8%). The complaint of fatigue is less likely to be mentioned, and the classic "morning" vomiting is not nearly so consistent in adolescents. The cramps are sometimes described as being the same as those with periods.

Diagnosis is usually confirmed by a laboratory test for human chorionic gonadotropin (HCG). Various tests have different levels of sensitivity and specificity, and thus it is important to be aware of the limitations of the tests available. In particular, a false-negative test in the atypical presentation of pregnancy as abdominal pain could result in considerable mismanagement. Assay for the  $\beta$ -subunit of HCG has the advantages of early detection (three weeks after prior menstrual period) and no crossover reaction with luteinizing hormone. Pregnancy testing is indicated in the absence of a recent and normal period and a normal pelvic examination. Suspicion of

pregnancy may be investigated by sonographic demonstration of the small white gestational ring at five to six weeks postamenorrhea. Portable Doppler techniques for detection of the fetal heart sound separate from the mother's confirms a pregnancy by 12 to 14 weeks.

A much less frequent but crucial diagnosis is that of ectopic pregnancy presenting as an acute emergency. The classic presentation is menstruation that has become "spotty," sudden sharp severe lower abdominal pain, vasomotor reactions, pain in the neck or shoulder from peritoneal blood, exquisite pain with movement of the cervix, and hypotension. Pain may be unilateral, bilateral, or generalized, and a history of amenorrhea may not be elicited in one quarter of the cases. Urine tests may be negative (as often as 50% of the time) because less chorionic gonadotropin is secreted from the placenta of an ectopic pregnancy. In such instances, assay for  $\beta$ -subunits is helpful, if available. A history of previous pelvic inflammatory disease in the presence of symptoms and signs of pregnancy increases the risk of ectopic pregnancy tenfold. The leukocyte count may be elevated, leading to confusion with acute pelvic inflammatory disease or appendicitis. Sonographic demonstration of a conception in the uterus helps rule out an ectopic pregnancy. However, laparoscopy or laparotomy may well be indicated for definitive diagnosis and treatment.

### Inflammatory Bowel Disease

The presentation of both ulcerative colitis and Crohn's disease includes abdominal pain which is often associated with evidence of organ disease. Approximately 20% of patients with ulcerative colitis or Crohn's disease will be seen before the age of 21 years. In ulcerative colitis, diarrhea with rectal bleeding is the most common form of presentation, but a more acute onset of bloody diarrhea with cramps and urgency occurs approximately 30% of the time. By contrast, abdominal pain is the most prominent presenting symptom in Crohn's disease.

Presence of perianal disease makes Crohn's disease more likely. Typically, pain in Crohn's disease is accentuated by eating. In both conditions, the primary symptoms are often accompanied by weight loss, malaise, low grade fever, and anemia. A positive family history in first degree relatives is also relevant. Growth failure and extraintestinal manifestations, both of which may precede the onset of intestinal symptoms, are particularly important in adolescents. Weight and particularly height change and delayed puberty occur in 15% to 30% of children. Extraintestinal manifestations include arthritis (usually of large peripheral joints or spine), skin lesions (erythema nodosum, pyoderma gangrenosum, papulonecrosis), and, rarely, inflammation of the eyes. Crohn's disease may include renal involvement (ureteral obstruction, renal calculi), cholelithiasis, and hepatic involvement. The main difficulties in differential diagnosis are the variety of possible presentations and the slow, insidious onset of disease. If there is good reason to suspect it, sigmoidoscopy, rectal biopsy, and contrast radiography are indicated.

### Peptic Ulcer

Ulcer disease in adolescents is usually primary and duodenal; gastric and secondary ulcers are more common in younger children and infants. Primary duodenal ulcers commonly are seen as recurrent pain syndromes, whereas secondary ulcers have acute presentations. Time from symptom onset to diagnosis is usually one to two years in the adolescent group, probably because of a low index of suspicion and a clinical expression that is atypical compared with that seen in adults.

The cardinal complaint is upper abdominal pain, but only approximately 30% show the typical pattern of pain related to meals, relieved by food, and waking the patient during the night or early morning. In more than 50% of these patients, the presentation is atypical, including shorter exacerbations and shorter remissions than seen in adults. In nearly half, pain episodes last for less than 30 minutes and may occur only one to three or four times a

day. One third of these patients will report no effect of eating; another one third will have their pain exacerbated with food ingestion. Vomiting is the most common ulcer presentation in younger patients, but is present in less than half of older patients. Gastrointestinal bleeding is reported in approximately half of patients, with melena being more common than hematemesis. Heartburn is seldom the primary complaint, but is associated nearly 80% of the time. Changed bowel habit is very rare, which helps distinguish ulcer from irritable bowel syndrome. A positive family history can help raise suspicion of primary duodenal ulcer; this is reported approximately 30% of the time. The most common diagnostic study is contrast radiography of the upper gastrointestinal tract, but it may have to be performed twice to establish the presence of a definite ulcer crater in as many as 25% of cases. Deformity of the duodenal cap or signs of spasm or duodenitis may be associated with ulcer-like symptoms, but are less satisfactory as diagnostic criteria. Direct visualization by endoscopy is helpful, if available and if there is a high index of suspicion, but it should not be used to "screen" for ulcer. Unfortunately, the prognosis is guarded, since more than half of patients whose ulcer is diagnosed in a hospital setting will continue to have recurrence of symptoms.

### Appendicitis

The differential diagnosis of appendicitis is complicated considerably in the adolescent female by the addition of genitourinary conditions that have similar presentations. Although appendicitis is a possibility at any age, it is most prevalent during adolescence within the pediatric age group. Appropriate treatment must be provided within 36 hours after pain begins if the complications of perforation are to be avoided.

The typical pattern of anorexia, periumbilical pain, vomiting following the pain, and pain shift to the right lower quadrant is well known. Following pain localization, the physical signs progress from "wincing tenderness" to guarding, spasm, and rebound tenderness.

However, there is little that is pathognomonic about this presentation. As many as half of the patients may say they are hungry, and vomiting may be absent even in patients who progress to perforation. When the appendix is displaced (eg, retrocecal), the pain may never shift to the right lower quadrant. In systematic studies, rebound tenderness has not been shown to be a highly reliable sign of peritoneal irritation. Following perforation, the patient usually lies still, vomiting becomes more frequent, and pain and muscle spasm may become generalized. Occasionally, a low volume "diarrhea" may occur due to irritation of the rectosigmoid by inflammatory fluid.

Differentiation from pelvic inflammatory disease may be possible by the lower abdominal location of the pain, and an abnormal sedimentation rate in pelvic inflammatory disease compared with the usually normal ESR in appendicitis. In acute urinary tract infection, the abdominal signs are less specific, and urinalysis is an important differentiating test. Appendiceal abscess in the region of the right ureter may produce inflammatory cells in the urine. A discrete mass on vaginal examination makes twisted ovarian cyst more likely. Ruptured ectopic pregnancy produces more pain than appendicitis with motion of the cervix, and the pain from appendicitis is usually localized higher.

Despite these apparent differences of symptoms and signs, the diagnosis is essentially an exercise in careful clinical judgment. Some help can be obtained by urinalysis, microscopic examination of urine and cervical smear, and plain films. Blood tests are seldom specific enough to be differentially helpful. Presence of a fecalith with pain increases the chances of a perforated appendix. Cultures of the urine and vagina are essential, but a clinical decision will be required before the results are known. When looking for filling defects *with* associated cecal or ileal signs, properly performed barium enemas may be helpful in selected cases. In adults with acute abdominal pain, diagnostic accuracy of clinicians is approximately 65%—a reminder of the degree of

overlap and atypicality that characterizes diagnosis of acute abdominal pain.

### Pelvic Inflammatory Disease (PID)

PID is the most common serious complication of sexually transmitted diseases. In the ten years prior to 1975, the incidence of reported gonorrhea in female adolescents more than 15 years old increased fivefold. Risk of PID is increased in females with multiple sexual partners, using intrauterine devices for contraception, and who have had previous gonococcal salpingitis. The clinical presentation is highly variable, and results in significant overdiagnosis and underdiagnosis (see review by Shafer et al, 1982). The "classic" presentation includes lower abdominal pain and tenderness, cervical motion and adnexal tenderness, fever, leukocytosis, and elevated sedimentation rate. However, when compared with direct visualization by laparoscopy, only 20% of females have the classic presentation, and only 65% whose condition is diagnosed clinically have it confirmed when laparoscopy is performed. Patients whose salpingitis is confirmed by laparoscopy have the same incidence of lower abdominal pain, increased vaginal discharge, irregular bleeding, urinary symptoms, or gastrointestinal symptoms as those found to have normal pelvices. Clinical signs or laboratory findings that were more frequently associated (adnexal tenderness, elevated ESR, fever, and vaginal discharge) were not sufficiently sensitive or specific to be reliable clinically. Data such as these have focused attention on the value of direct laparoscopic evaluation as the only accurate way to confirm the diagnosis. In the absence of this procedure, Shafer et al recommend the following criteria be fulfilled. The patient should have all of the following: (1) lower abdominal pain; (2) lower abdominal tenderness; (3) cervical motion tenderness; (4) adnexal tenderness; and (5) at least one of these signs: (a) fever, (b) leukocytosis, (c) elevated ESR, (d) inflammatory adnexal mass on sonography, or (e) culdocentesis demon-

strating bacteria and WBCs in peritoneal fluid.

PID may also be seen in a subacute recurrent form characterized by lower abdominal pain, dyspareunia, dysmenorrhea, menstrual irregularity, and occasionally fever and elevated ESR. The Fitz-Hugh-Curtis syndrome is a complication of salpingitis due to perihepatitis and adjacent peritonitis associated with right upper quadrant pain and tenderness. Secondary symptoms and signs include shoulder pain, pleuritic pain, perihepatic friction rub, and liver function abnormalities. It is increasingly common in adolescents.

Appropriate evaluation includes cultures (cervix, urethra, throat, rectum), blood tests for inflammation and to monitor therapy, and reevaluation within 48 hours, by which time a therapeutic response should be evident. Gynecologic consultation is appropriate. Laparoscopy is helpful when available for definitive diagnosis, obtaining tubal cultures (for gonorrhea, anaerobes, aerobes, and *Chlamydia*, when available), detecting Fitz-Hugh-Curtis syndrome, and ruling out other acute surgical conditions. It is even more important in the patient who is acutely ill, or does not respond in two days, or in whom there is a high suspicion in the face of negative cultures.

### Urinary Tract Infection (UTI)

Symptomatic urinary tract infection is seen as abdominal pain in acute or recurrent forms. Indeed, abdominal pain and fever are more frequent presenting symptoms than urgency, frequency, and dysuria in older age groups. The mainstay of diagnosis remains appropriately collected urine culture. Although pyuria indicates inflammation, only 75% with this finding will have confirmed UTIs, or it may be absent altogether. Contamination of urine cultures remains a difficult problem. Thorough cleansing of the perineum and a specimen that is "midstream" are crucial. A negative clean-catch culture (<10,000 colonies/milliliter) rules out UTI in 98% of symptomatic patients. One positive culture (>100,000 colonies/milliliter) makes UTI probable (80%), whereas

two positive cultures with the same organism makes it 95% certain. An evaluation to determine "level" of infection is preferable. As the kidney is involved in 25% to 50% of UTIs, the long-term consequences of kidney infection are greater than infection limited to the bladder, and determination of the site of infection cannot be defined on the basis of symptomatology alone. Methods for establishing a level of diagnosis have been reviewed by Carvajal (1978). The choice between tests (eg, antibody-coated bacteria test, lactic dehydrogenase isoenzymes, ureteral catheterization) will depend on the availability of laboratory facilities. If the infection implicates the kidney and is recurrent, radiologic and urologic evaluations are warranted by the third week of therapy.

### Ovarian Cyst

Ovarian cysts enter the diagnosis of abdominal pain either because they may be associated with torsion or bleeding from a ruptured cyst and present as acute abdominal pain, or because they may be found on pelvic examination during evaluation of recurrent abdominal pain. In the former case, the diagnosis is usually made at operation when the pelvis is explored and evidence of appendicitis is not found. In the latter case, the question of their significance is difficult. The possibility that recurrent pain may sometimes be due to recurrent torsion and detorsion seems feasible, but cysts seldom produce symptoms themselves. Ultrasound is useful in confirming the presence and size of cysts. If found, reexamination at monthly intervals to detect changes in character, size, and persistence is recommended. The patient should be asked to report any acute symptoms quickly so that surgical intervention may be initiated if necessary.

### Acute Intermittent Porphyria (AIP)

AIP is an autosomal dominant inborn error of metabolism which is expressed clinically by recurrent episodes of neurologic dysfunction. Although the neurologic lesions may occur anywhere in the nervous system, the disease is most commonly

manifest as an autonomic neuropathy. An acute attack of abdominal pain is the initial symptom in 85% of cases and usually precedes other evidence of peripheral neuropathy, or may occur without any neuropathy at all. The pain may be localized or general, involve the back and extremities, be severe enough to require narcotics, and be accompanied by vomiting and constipation or diarrhea. Other autonomic manifestations include tachycardia, postural hypotension, sweating, pallor, and incontinence. In the extreme case, the neuropathy progresses to complete flaccid paralysis within a few days. Inclusion of this disease in the differential diagnosis of abdominal pain is particularly relevant, not simply because of its ability to mimic other forms of acute abdomen, but also because its clinical manifestations are usually precipitated by four groups of factors all of which are more prevalent in adolescence. These are (1) exposure to certain drugs (including barbiturates, sulfonamides, chlorthalidone, and alcohol excess), (2) hormones and related steroids, (3) infections (bacterial and viral), and (4) starvation or dieting. The implication of female sex hormones in disease activation is particularly interesting because of its clinical association with menstruation, pregnancy, and oral contraceptive use. This relationship may explain the fact that this autosomal dominant disease is expressed predominantly in females. The diagnosis ultimately requires confirmation of the underlying chemical defect, a deficiency of uroporphyrinogen I synthetase, measured simply and reliably in erythrocytes. Measurement of the excess porphobilinogen precursor in the urine, either by the qualitative "windowsill" test or by quantitative methods, is inadequate because some patients will excrete normal amounts of this metabolite when they are symptom-free. Although rare as a cause of acute abdominal pain, AIP must be identified to prevent significant neurologic damage and unnecessary surgical interventions in adolescents with recurrent severe acute attacks.

### Psychogenic Causes

Evaluation of adolescents with

"primary" psychogenic conditions is no less difficult than identification of organic disease entities. Although specific categories of psychological disturbance will not be discussed, certain general principles are relevant. Assessments of adolescent patients must be highly individualized, but have in common the search for an understanding of the *meaning* of the pain experience for the patient. The pain complaint acts as a signal of disordered intrapersonal or interpersonal relationships which go well beyond the pain symptom itself. In some cases, it may be an integral component of the syndrome complex (eg, conversion hysteria), whereas in others it is peripheral to the syndrome (eg, secondary gain) and soon becomes unimportant when attention is focused on the patient's more important concerns.

The search for the meaning of the pain complaint may be facilitated by attending to the patient's description of how the pain is experienced and how it is dealt with, both by the patient and those around her. Consideration of the "emotional coloring" or affective qualities of the pain experience may be more salient for the patient with a psychogenic etiology of her pain complaint. The pain complaint may be the result of punishment, separation, neglect, or increased need for attention or reward. It may provide a starting point for a broader discussion of more central problems. Questions directed at past, apparently unrelated, pain experiences may throw light on the complaint's possible role in defining the adolescent's relationships.

Clear evidence of psychogenic pain is seldom elicited at the first interview. On the other hand, abdominal pain is seldom the only manifestation of truly disturbed personal relationships, and complaints of pain in the absence of other evidence of problematic relationships makes a psychogenic origin unlikely. To reduce reluctance or denial, this author encourages patients to explicate the meaning of the pain experience and how it is handled on subsequent visits. It is usually easier to "discover" emotionally significant feelings than to describe them in response to direct questioning. Even when a good case for "psycho-

TABLE 2. Principles in Approach to Adolescent with Abdominal Pain

Principle	Examples
1. Conditions present differently in adolescents than in younger children.	RAP: periumbilical in children; non-periumbilical in adolescents. UTI: vomiting in children; abdominal pain in adolescents.
2. Conditions present differently in adolescents than in adults	Peptic ulcer: pain improved with food intake in adults; pain unchanged or worse in adolescents.
3. Conditions presenting at all ages become more prevalent in adolescents.	Inflammatory bowel disease; appendicitis.
4. Conditions relating to the genitourinary tract enter the differential diagnosis.	Pelvic inflammatory disease; dysmenorrhea.
5. Conditions may be related to life-style changes and environmental exposure.	Acute intermittent porphyria precipitated by barbiturates; lactose intolerance precipitated by "lactose binges"; dysmenorrhea secondary to intrauterine device (IUD) use.
6. Problem of abdominal pain includes symptom, secondary anxiety, and secondary dysfunction.	RAP: symptom: recurrent; anxiety: underlying cancer; dysfunction: accusations of malingering.
7. In the history, beware of missing information due to shyness concerning sexual function or denial of symptom's significance.	Shyness: inaccurate description of periods ("They're OK."); denial: of missed period and possible pregnancy.
8. Importance of sensitive and accurate gynecologic examination.	Maintenance of patient-physician trust; detection of masses, anomalies; obtaining of cultures.
9. In acute pain, consider surgical/gynecologic consultation.	Treatment of appendicitis, ectopic pregnancy, torsion of cyst and adnexae.
10. In recurrent pain, evaluation should be "staged" rather than "shotgun."	In <i>absence of specific typical pattern</i> : Early: lactose breath hydrogen test, pregnancy test, stool culture; ova and parasites. Later: sonography for masses, contrast studies: selectively; intravenous pyelogram (IVP) before upper gastrointestinal tract series, barium enema. Latest: laparoscopy.

genicity" has been demonstrated, the adolescent may have both a psychological disturbance and abdominal pain without the two being related.

## SUMMARY

The diagnosis of abdominal pain is difficult. It requires additional skills and care when the patient is an adolescent. Although the approach required to diagnose a specific disease entity *known* to be causing the pain symptom is easy, the decisions to take when the patient has the complaint without specific signposts pointing to one entity or another is

difficult. In the acute presentation, the decision as to which tests to order or which therapies to initiate must be made almost totally on presenting symptoms and signs. Often the definitive test necessary for the differential (eg, urine culture, cervical culture for gonococcus) will not be reported by the time a clinical decision must be made. In the recurrent presentation, more time is available, but the yield from invasive and expensive tests is lower and more difficult to justify. There are no data prospectively collected in a representative sample of adolescents presenting *with abdominal pain* in whom a systematic approach

to diagnosis was utilized. Thus the *relative* likelihood of finding urinary tract infection or pelvic inflammatory disease accounting for the symptom, or the *relative* usefulness of a barium enema examination vs laparoscopy for evaluation of right lower quadrant pain is unknown.

As a result, emphasis in this description has been placed on presenting symptoms and signs. Recognizing that diagnostic clinical judgment often involves "pattern recognition," typical presentations have been stressed. However, it should be apparent that this will be insufficient to guarantee diagnostic accuracy. Two of the main reasons for this are the similarity of presentation of so many entities, and the prevalence of atypical presentations. However, a number of principles can be recommended (Table 2): (1) adolescents have different presentations than do younger children; (2) contrary to common belief, adolescents have different presentations than do adults; (3) be aware of increasing prevalence in adolescents of entities that cause abdominal pain at all ages; (4) be aware of entities relating to the genitourinary tract entering into the differential diagnosis; (5) be aware of entities related to life-style changes and exposure to environmental precipitants; (6) appropriate evaluation of the *problem* of abdominal pain includes assessment of the symptom, the anxiety secondary to the symptom, and the dysfunction secondary to the symptom; (7) history taking requires excellent communication to overcome shyness relating to patient's self-awareness of sexuality or outright denial of the symptom's significance; (8) appropriate evaluation most often includes a sensitive, expertly performed pelvic examination by an experienced examiner (Cowell); (9) in acute pain presentations, clinical judgment requires consideration of the potential negative consequences of missed "surgical" abdomen, and surgical/gynecologic consultation is often indicated; (10) in recurrent pain presentations, evaluations other than base line tests (history, physical, and pelvic examinations, blood count, ESR, urinalysis, and culture) should not be "shotgun," but used selectively and



staged according to relative likelihood of the entity being sought, and usefulness of the procedure in detecting it. Enrollment of the patient as a "coinvestigator" and use of a diary has been found to be helpful in detecting patterns and focusing secondary anxiety about the symptom.

It has been estimated that well over 100 entities may present as abdominal pain. Many common (eg, stool retention, gastroenteritis, Mittelschmerz) and less common (eg, abdominal tumors, endometriosis) entities that enter the differential diagnosis have not been discussed. In the face of these possibilities, I usually adopt the following strategy: (1) with acute pain presentations, to consider first entities with potentially severe consequences requiring early definitive treatment (eg, appendicitis, ectopic pregnancy, ovarian torsion, pelvic inflammatory disease) and to move "down" the differential only when there is good evidence that these first entities are not implicated; and (2) with recurrent presentations, to consider first entities that are most common (eg, nonspecific recurrent abdominal pain, irritable bowel syndrome) and to move "up" the differential to further investigation only when there is

good evidence implicating other specific entities. However, no strategy will be appropriate for all situations, and we are far from having a successful recipe for diagnostic success with abdominal pain in adolescents.

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**EDUCATIONAL OBJECTIVE**

36. Appropriate evaluation of the adolescent girl with abdominal pain with the ability to differentiate between organic and functional causes (including the irritable bowel syndrome, urinary tract infection, and pelvic inflammatory disease) (82/83 Topics).

**Abdominal Pain**

**Differential Diagnosis of Acute Pelvic Inflammatory Disease.** Jacobson L. *Am J Obstet Gynecol* 138:1006, 1980.

The author presented 814 patients with the classic clinical criteria of acute pelvic inflammatory disease (PID). Within 24 hours and prior to treatment, the pelvis was examined by laparoscopic visualization. The overall accuracy rate for diagnosing acute PID on the basis of clinical criteria did not exceed 65%: 12% of the patients had other pelvic disorders; 15% of the patients had undiagnosed PID; 23% did not have any pelvic pathology. The main differential diagnostic errors involved acute appendicitis, pelvic endometriosis, and intrapelvic bleeding. The author compared the presenting signs and symptoms of the 623 true-positive cases with those of the 184 false-positive cases. The classic clinical criteria for PID (lower abdominal pain, increased vaginal discharge, fever >38 C, irregular bleeding, urinary symptoms, adnexal tenderness, adnexal mass, or ESR 15 mm Hg) were present as frequently in both groups.

**Comment:** The author makes two important clinical points. The diagnosis of acute PID based solely on clinical symptoms is about 65% accurate. The routine use of laparoscopy is the most reliable procedure in the diagnosis and differential diagnosis of acute salpingitis. It has been our experience that PID is an overdiagnosed disorder, particularly in patients with recurrent lower abdominal pain. The more frequent use of diagnostic laparoscopy in these cases should be considered. The main obstacles to the increased use of diagnostic laparoscopy are organizational and economical but there is also personal reluctance to use the method at many institutions. The determination of specific genital isoamylases in peritoneal fluid has potential as a diagnostic aid. Inflammation of the pelvic structures causes the specific amylases to disappear from the peritoneal fluid. (*J. Russo, NJ Medical School*)

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