4 ACUTE ABDOMINAL PAIN

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Assessment of Acute Abdominal Pain

The term acute abdominal pain generally refers to previously undiagnosed pain that arises suddenly and is of less than 7 days’ (usually less than 48 hours’) duration.1 It may be caused by a great variety of intraperitoneal disorders, many of which call for surgical treatment, as well as many extraperitoneal disorders,2 which typically do not call for surgical treatment [see Tentative Differential Diagnosis, below]. Abdominal pain that persists for 6 hours or longer is usually caused by disorders of surgical significance.3 The primary goal in the management of patients with acute abdominal pain is to determine whether operative intervention is necessary and, if so, when the operation should be performed. Often, this determination is easy to make; on occasion, however, the evaluation of patients with acute abdominal pain can be one of the most difficult challenges in clinical surgery. It is essential to keep in mind that most (at least two thirds) of the patients who present with acute abdominal pain have disorders for which surgical intervention is not required.2,4,5

Making the correct decision regarding whether to operate on a patient with acute abdominal pain requires sound surgical judgment. The decision must be based on a detailed medical and surgical clinical history as well as a meticulous physical examination. These, in turn, must be based on experience, a thorough knowledge of the anatomy and physiology of the peritoneal cavity, and a clear understanding of the pathologic processes that occur within the abdomen. Much has been written about the diagnosis of acute abdominal pain since 1921, when Sir Zachary Cope first published his now classic paper.3 Although the basic approach to assessment of acute abdominal pain remains much the same today, the introduction of new diagnostic technologies and better resuscitation methods, coupled with an aging population (in the United States and other developed countries) and new disease processes, necessitates periodic revision of the traditional approach as well as constant broadening of the differential diagnosis. For example, with the proliferation of less invasive surgery, the use of laparoscopy has expanded far beyond its initial application to cholecystectomy. Emergency laparoscopy has become more widely accepted in the management of patients with acute abdominal pain since 1921, when Sir Zachary Cope first published his now classic paper.3 Although the basic approach to assessment of acute abdominal pain remains much the same today, the introduction of new diagnostic technologies and better resuscitation methods, coupled with an aging population (in the United States and other developed countries) and new disease processes, necessitates periodic revision of the traditional approach as well as constant broadening of the differential diagnosis. For example, with the proliferation of less invasive surgery, the use of laparoscopy has expanded far beyond its initial application to cholecystectomy. Emergency laparoscopy has become more widely accepted in the treatment of acute surgical diseases (e.g., acute appendicitis and perforated peptic ulcer) as general surgeons gain competence in its use. Diagnostic laparoscopy has also proved valuable in the assessment of acute abdominal pain (see below).

Historically, diagnosis of the causes of acute abdominal pain has been based largely on pattern recognition, in which clinicians attempt to match new cases to preexisting stereotypes (so-called classic presentations) of various diseases. Certainly, knowledge of these classic presentations is basic to successful diagnosis, but it is crucial to remember that at least one third of patients with acute abdominal pain exhibit atypical features that render pattern recognition unreliable.4,6,7

Clinical History

A careful and methodical clinical history should be obtained that includes the mode of onset, duration, frequency, character, location, chronology, radiation, and intensity of the pain, as well as the presence or absence of any aggravating or alleviating factors and associated symptoms. Often, such a history is more valuable than any single laboratory or x-ray finding and determines the course of subsequent evaluation and management. Unfortunately, when the ability of clinicians to take an organized and accurate history has been studied, the results have been disappointing.7 For this reason, the use of standardized history and physical forms, with or without the aid of diagnostic computer programs, has been recommended.

Computer-aided diagnosis has been extensively studied in England.8-11 In these studies, physicians collected clinical data on structured data sheets and entered the information into a computer running a diagnostic program; the computer, which contained a large clinical database, then generated diagnostic probabilities. One such study demonstrated that integration of computer-aided diagnosis into the management of 16,737 patients with acute abdominal pain yielded a 20% improvement in diagnostic accuracy.8 This improvement resulted in statistically significant reductions in inappropriate admissions, negative laparotomies, serious management errors (e.g., failure to operate on patients who require surgery), and length of hospital stay, as well as statistically significant increases in the number of patients who were immediately discharged home without adverse effects and the promptness with which those requiring surgery underwent operation. Although these impressive results are undoubtedly attributable to more than one cause, it is certain that the required use of a structured data sheet to record the patient’s history for computer analysis played a crucial role. In fact, when the data sheets were used without the computer, diagnostic accuracy and overall decision making were still significantly improved.

There now appears to be more than sufficient evidence to support the routine use of structured data sheets in the initial stages of obtaining a history from a patient with acute abdominal pain.9-11 An example of such a data sheet is the pain chart developed by the World Organization of Gastroenterology (OMGE) [see Figure 1]. The components of this data sheet represent the consensus of the more than 2,000 surgeons worldwide who contributed to its development and have used it to collect
# ABDOMINAL PAIN CHART

<table>
<thead>
<tr>
<th>Name</th>
<th>Reg. Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Mode of Arrival</td>
<td>Date</td>
</tr>
</tbody>
</table>

## Site of Pain
- **At Onset**
- **At Present**
- **Radiation**

## Aggravating Factors
- Movement
- Coughing
- Respiration
- Food
- Other
- None

## Relieving Factors
- Lying still
- Vomiting
- Antacids
- Food
- Other
- None

## Progression of Pain
- Better
- Same
- Worse

## Duration
- Intermitent
- Steady
- Colicky

## Severity
- Moderate
- Severe

## Nausea
- Yes  No

## Vomiting
- Yes  No

## Anorexia
- Yes  No

## Indigestion
- Yes  No

## Jaundice
- Yes  No

## Bowels
- Normal
- Constipation
- Diarrhea
- Blood
- Mucus

## Micturition
- Normal
- Frequency
- Dysuria
- Dark
- Hemituria

## Previous Similar Pain
- Yes  No

## Previous Abdominal Surgery
- Yes  No

## Drugs for Abdominal Pain
- Yes  No

## Female-LMP
- Pregnant
- Vaginal discharge
- Dizzy/faint

## Temperature
- Normal
- Upset
- Anxious

## Color
- Normal
- Pale
- Flushed
- Jaundiced
- Cyanotic

## Intestinal Movement
- Normal
- Poor/nil
- Peristalsis

## Scars
- Yes  No

## Distention
- Yes  No

## Location of Tenderness
- Rebound
- Yes  No

## Guarding
- Yes  No

## Rigidity
- Yes  No

## Mass
- Yes  No

## Murphy's Sign Present
- Yes  No

## Bowel Sounds
- Normal
- Absent
- Increased

## Rectal-Vaginal Tenderness
- Left
- Right
- General
- Mass
- None

## Initial Diagnosis & Plan

## Results
- Amylase
- Blood count (WBC)
- Urine
- X-ray

## Diagnosis & Plan after Investigation

## Discharge Diagnosis

History and examination of other systems on separate case notes.

*Figure 1* Shown is a data sheet modified from the abdominal pain chart developed by the OMGE.13
**Assessment of Acute Abdominal Pain**

**Generate working diagnosis**
Proceed with subsequent management on the basis of the working diagnosis. Reevaluate patient repeatedly. If patient does not respond to treatment as expected, reassess working diagnosis and return to differential diagnosis.

**Patient presents with acute abdominal pain**

**Obtain clinical history**
Assess mode of onset, duration, frequency, character, location, chronology, radiation, and intensity of pain. Look for aggravating or alleviating factors and associated symptoms. Use structured data sheets if possible.

**Perform basic investigative studies**
Laboratory: complete blood count, hematocrit, electrolytes, creatinine, blood urea nitrogen, glucose, liver function tests, amylase, lipase, urinalysis, pregnancy test, ECG (if patient is elderly or has atherosclerosis).
Radiologic: Plain abdominal films (upright and supine) and chest radiographs. (Note: These studies are rarely diagnostic by themselves; their purpose is primarily confirmatory.)

**Patient requires immediate laparotomy**
Conditions necessitating immediate laparotomy include ruptured abdominal aortic or visceral aneurysm, ruptured ectopic pregnancy, spontaneous hepatic or splenic rupture, major blunt or penetrating abdominal trauma, and hemoperitoneum from various causes. Severe hemodynamic instability is the essential indication.

**Patient has suspected surgical abdomen**
Determine whether urgent laparotomy is necessary.

**Patient requires urgent laparotomy or laparoscopy**
Conditions necessitating urgent laparotomy include perforated hollow viscus, appendicitis, Meckel diverticulitis, strangulated hernia, mesenteric ischemia, and ectopic pregnancy (unruptured). Laparoscopy is recommended for acute appendicitis and perforated ulcers (provided that surgeon has sufficient experience and competence with the technique).

**Patient requires early laparotomy or laparoscopy**
Early laparotomy or laparoscopy is reserved for patients whose conditions are unlikely to become life threatening if operation is delayed for 24–48 hr (e.g., those with uncomplicated intestinal obstruction, uncomplicated acute cholecystitis, uncomplicated acute diverticulitis, or nonstrangulated incarcerated hernia).

**Patient is candidate for elective laparotomy or laparoscopy**
Elective laparotomy or laparoscopy is reserved for patients who are highly likely to respond to conservative medical management or whose conditions are highly unlikely to become life threatening during prolonged evaluation (e.g., those with IBD, peptic ulcer disease, pancreatitis, or endometriosis).

**Patient should be hospitalized and observed**
Observe patient carefully, and reevaluate condition periodically. Consider additional investigative studies (e.g., CT, ultrasonography, diagnostic peritoneal lavage, radionuclide imaging, angiography, MRI, and GI endoscopy). Diagnostic laparoscopy is recommended if pain persists after a period of observation.

**Patient is candidate for elective laparotomy or laparoscopy**

**Diagnosis is uncertain, or patient has suspected nonsurgical abdomen**
Reevaluate patient as appropriate (see facing page).
II COMMON PRESENTING PROBLEMS

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Generate tentative differential diagnosis

Remember that the majority of patients will turn out to have nonsurgical diagnoses.
Take into account effects of age and gender on diagnostic possibilities.

Perform physical examination

Evaluate general appearance and ability to answer questions; estimate degree of obvious pain; note position in bed; identify area of maximal pain; look for extra-abdominal causes of pain and signs of systemic illness.
Perform systematic abdominal examination: (1) inspection, (2) auscultation, (3) percussion, (4) palpation.
Perform rectal, genital, and pelvic examinations.

Patient has suspected surgical abdomen

Reevaluate patient as appropriate (see facing page).

Patient should be hospitalized and observed

Provide narcotic analgesia as appropriate.
Observe patient carefully, and reevaluate condition periodically.
Consider additional investigative studies. CT and ultrasonography may be especially useful.

Diagnosis is uncertain

Determine whether patient should be hospitalized or can be managed as an outpatient.

Patient has suspected nonsurgical abdomen

Nonsurgical conditions causing acute abdominal pain include both extraperitoneal [see Table 2] and intraperitoneal disorders.

Patient can be evaluated in outpatient setting

Provide narcotic analgesia as appropriate.
Observe patient carefully, and reevaluate condition periodically.
Consider additional investigative studies.

Patient should be hospitalized and observed

Provide narcotic analgesia as appropriate.
Observe patient carefully, and reevaluate condition periodically.
Consider additional investigative studies.

Patient has suspected surgical abdomen

Reevaluate patient as appropriate (see facing page).

Diagnosis is uncertain, or patient has suspected nonsurgical abdomen

Reevaluate patient as appropriate (see above, right, and facing page).

Diagnosis is uncertain

Determine whether patient should be hospitalized or can be managed as an outpatient.

Patient can be evaluated in outpatient setting

Provide narcotic analgesia as appropriate.
Observe patient carefully, and reevaluate condition periodically.
Consider additional investigative studies.

Patient should be hospitalized and observed

Provide narcotic analgesia as appropriate.
Observe patient carefully, and reevaluate condition periodically.
Consider additional investigative studies.

Diagnosis is nonsurgical

Refer patient for medical management.
information for the Research Committee of the OMGE and other groups studying acute abdominal pain.\textsuperscript{12,13} Given that the data sheet is by no means exhaustive, individual surgeons may want to add to it; however, they would be well advised not to omit any of the symptoms and signs on the data sheet from their routine examination of patients with acute abdominal pain.\textsuperscript{14}

When the surgeon obtains a complete clinical history with an open mind, the patient often provides important clues to the correct diagnosis. Patients should be allowed to relate the history in their own words, and examiners should refrain from suggesting specific symptoms, except as a last resort. Any questions that must be asked should be open-ended—for example, “What happens when you eat?” rather than “Does eating make the pain worse?” Leading questions should be avoided. When a leading question must be asked, it should be posed first as a negative question (i.e., one that calls for an answer in the negative), since a negative answer to a question is more likely to be honest and accurate. For example, if peritoneal inflammation is suspected, the question asked should be “Does coughing make the pain better?” rather than “Does coughing make the pain worse?”

The mode of onset of abdominal pain may help the examiner determine the severity of the underlying disease. Pain that has a sudden onset suggests an intra-abdominal catastrophe, such as a ruptured abdominal aortic aneurysm, a perforated viscus, or a ruptured ectopic pregnancy. Rapidly progressive pain that becomes intensely centered in a well-defined area within a period of a few minutes to an hour or two suggests a condition such as acute cholecystitis or pancreatitis. Pain that has a gradual onset over several hours, usually beginning as slight or vague discomfort and slowly progressing to steady and more localized pain, suggests a subacute process and is characteristic of peritoneal inflammation. Numerous disorders may be associated with this mode of onset, including acute appendicitis, diverticulitis, pelvic inflammatory disease (PID), and intestinal obstruction.

Pain can be either intermittent or continuous. Intermittent or cramping pain (colic) is pain that occurs for a short period (a few minutes), followed by longer periods (a few minutes to one-half hour) of complete remission during which there is no pain at all. Intermittent pain is characteristic of obstruction of a hollow viscus and results from vigorous peristalsis in the wall of the viscus proximal to the site of obstruction. This pain is perceived as deep in the abdomen and is poorly localized. The patient is restless, may writhe about incessantly in an effort to find a comfortable position, and often presses on the abdominal wall in an attempt to alleviate the pain. Whereas the intermittent pain associated with intestinal obstruction (typically described as gripping and mounting) is usually severe but bearable, the pain associated with obstruction of small conduits (e.g., the biliary tract, the ureters, and the uterine tubes) often becomes unbearable. Obstruction of the gallbladder or bile ducts gives rise to a type of pain often referred to as biliary colic; however, this term is a misnomer, in that biliary pain is usually constant because of the lack of a strong muscular coat in the biliary tree and the absence of regular peristalsis.

Continuous or constant pain is pain that is present for hours or days without any period of complete relief; it is more common than intermittent pain. Continuous pain is usually indicative of peritoneal inflammation or ischemia. It may be of steady intensity throughout, or it may be associated with intermittent pain. For example, the typical colicky pain associated with simple intestinal obstruction changes when strangulation occurs, becoming continuous pain that persists between episodes or waves of cramping pain.

Certain types of pain are generally held to be typical of certain pathologic states—for example, the general burning pain of a perforated gastric ulcer, the tearing pain of a dissecting aneurysm, and the gripping pain of intestinal obstruction. However, the character of the pain is not always a reliable clue to its cause.

For several reasons—apart from patterns, dual innervation by visceral and somatic afferents, normal variations in organ position, and widely diverse underlying pathologic states—the location of abdominal pain is only a rough guide to diagnosis. It is nevertheless true that in most disorders, the pain tends to occur in characteristic locations, such as the right upper quadrant (cholecystitis), the right lower quadrant (appendicitis), the epigastrium (pancreatitis), or the left lower quadrant (sigmoid diverticulitis) [see Figure 2]. It is important to determine the location of the pain at onset because this may differ from the location at the time of presentation (so-called shifting pain). In fact, the chronological sequence of events in the patient’s history is often more important for diagnosis than the location of the pain alone. For example, the classic pain of appendicitis begins in the periumbilical region and settles in the right lower quadrant. A similar shift in location can occur when escaping gastro-duodenal contents from a perforated ulcer pool in the right lower quadrant.

It is also important to take into account radiation or referral of the pain, which tends to occur in characteristic patterns [see Figure 3]. For example, biliary pain is referred to the right sub- scapular area, and the boring pain of pancreatitis typically radiates straight through to the back. The more severe the pain is, the more likely it is to be referred.

The intensity or severity of the pain is related to the magnitude of the underlying insult. It is important to distinguish between the intensity of the pain and the patient’s reaction to it because there appear to be significant individual differences with respect to tolerance of and reaction to pain. Pain that is intense enough to awaken the patient from sleep usually indicates a significant underlying organic cause. Past episodes of pain and factors that aggravate or relieve the pain often provide useful diagnostic clues. For example, pain caused by peritonitis tends to be exacerbated by motion, deep breathing, coughing, or sneezing, and patients with peritonitis tend to lie quietly in bed and avoid any movement. The typical pain of acute pancreatitis is exacerbated by lying down and relieved by sitting up. Pain that is relieved by eating or taking antacids suggests duodenal ulcer disease, whereas diffuse abdominal pain that appears 30 minutes to 1 hour after meals suggests intestinal angina.

Associated gastrointestinal symptoms, such as nausea, vomiting, anorexia, diarrhea, and constipation, often accompany abdominal pain; however, these symptoms are nonspecific and therefore may not be of great value in the differential diagnosis. Vomiting in particular is common: when sufficiently stimulated by pain impulses traveling via secondary visceral afferent fibers, the medullary vomiting centers activate efferent fibers and cause reflex vomiting. Once again, the chronology of events is important, in that pain often precedes vomiting in patients with conditions necessitating operation, whereas the opposite is usually the case in patients with medical (i.e., nonsurgical) conditions.\textsuperscript{4,4} This is particularly true for patients with acute appendicitis, in whom pain almost always precedes vomiting by several hours. Similarly, constipation may result from a reflex paralytic ileus when sufficiently stimulated visceral afferent fibers activate efferent sympathetic fibers (splanchnic nerves) to
Figure 2 In most disorders that give rise to acute abdominal pain, the pain tends to occur in specific locations.
reduce intestinal peristalsis. Diarrhea is characteristic of gastroenteritis but may also accompany incomplete intestinal obstruction. More significant is a history of obstipation, because if it can be definitely established that a patient with acute abdominal pain has not passed gas or stool for 24 to 48 hours, it is certain that some degree of intestinal obstruction is present. Other associated symptoms that should be noted include jaundice, melena, hematochecia, hematemesis, and hematuria. These symptoms are much more specific than the ones just discussed and can be extremely valuable in the differential diagnosis. Most conditions that cause acute abdominal pain of surgical significance are associated with some degree of fever. Fever suggests an inflammatory process; however, it is usually low grade and often absent altogether, particularly in elderly and immunocompromised patients. The combination of a high fever with chills and rigors indicates bacteremia, and concomitant changes in mental status (e.g., agitation, disorientation, and lethargy) suggest impending septic shock.

A history of trauma (even if the patient considers the traumatic event trivial) should be actively sought in all cases of unexplained acute abdominal pain; such a history may not be readily volunteered (as is often the case with trauma resulting from domestic violence). With female patients, it is essential to obtain a detailed gynecologic history that includes the timing of symptoms within the menstrual cycle, the date of the last menses, previous and current use of contraception, any abnormal vaginal bleeding or discharge, an obstetric history, and any risk factors for ectopic pregnancy (e.g., PID, use of an intrauterine device, or previous ectopic or tubal surgery).

A complete history of previous medical conditions must be obtained because associated diseases of the cardiac, pulmonary, and renal systems may give rise to acute abdominal symptoms and may also significantly affect the morbidity and mortality associated with surgical intervention. Weight changes, past illnesses, recent travel, environmental exposure to toxins or infectious agents, and medications used should also be investigated. A history of previous abdominal operations should be obtained but should not be relied on too heavily in the absence of operative reports. A careful family history is important for detection of hereditary disorders that may cause acute abdominal pain. A detailed social history should also be obtained that includes tobacco, alcohol, or illicit drug use as well as a sexual history.

### Tentative Differential Diagnosis

Once the patient’s history has been obtained, the examiner should generate a tentative differential diagnosis and carry out the physical examination in search of specific signs or findings that either rule out or confirm the diagnostic possibilities. Given that the list of conditions that can cause acute abdominal pain is almost endless [see Tables 1 and 2], there is no substitute for some general knowledge of what the most common causes of acute abdominal pain are and how age, gender, and geography may affect the likelihood that any of these potential causes is present.

Ambulatory patients with acute abdominal pain as a chief complaint constitute 2% to 3% of all patients in an office practice and 5% to 10% of all patients seen in the emergency department. At least two thirds of these patients have disorders that do not call for surgical intervention. Although acute abdominal pain is the most common surgical emergency and most non–trauma-related surgical admissions (and 1% of all hospital admissions) are accounted for by patients complaining of abdominal pain, little information is available regarding the clinical spectrum of disease in these patients. Nevertheless, detailed epidemiologic information can be an invaluable asset in the diagnosis and treatment of acute abdominal pain.

The most extensive information available comes from the ongoing survey begun in 1977 by the Research Committee of the OMGE. As of the last progress report on this survey, which was published in 1988, more than 200 physicians at 26 centers in 17 countries had accumulated data on 10,320 patients with acute abdominal pain.
abdominal pain [see Table 3]. The most common diagnosis in these patients was nonspecific abdominal pain (NSAP)—that is, the retrospective diagnosis of exclusion in which no cause for the pain can be identified.17,18 Nonspecific abdominal pain accounted for 34% of all patients seen; the four most common diagnoses accounted for more than 75%. The most common surgical diagnosis was acute appendicitis, followed by acute cholecystitis, small bowel obstruction, and gynecologic disorders. Relatively few patients had perforated peptic ulcer, a finding that confirms the recent downward trend in the incidence of this condition. Cancer was found to be a rated peptic ulcer, a finding that confirms the recent downward

Further analysis of the data from the OMGE survey also makes it clear that the disease spectrum in children is different from that in adults: well over 90% of cases of acute abdominal pain in children are diagnosed as either acute appendicitis (32%) or nonspecific abdominal pain (62%).23 Similar age-related differences in the spectrum of disease have been confirmed by other studies,16 as have various gender-related differences.

Knowledge of the most common causes of acute abdominal pain and familiarity with the special circumstances that make particular
causes more likely than others allow the surgeon to play the odds.\footnote{14}
As has often been said, common things are common—or, to put it another way, most people get what most people get.

**Physical Examination**

In physical examination, as in history taking, there is no substitute for organization and patience; the amount of information that can be obtained is directly proportional to the gentleness and thoroughness of the examiner. The physical examination begins with a brief but thorough evaluation of the patient’s general appearance and ability to answer questions. The degree of obvious pain should be estimated. The patient’s position in bed should be noted: as an example, a patient who lies motionless with flexed hips and knees is more likely to have generalized peritonitis, whereas a restless patient who writhes about in bed is more likely to have colicky pain, which suggests different diagnoses. The area of maximal pain should be identified before the physical examination is begun.

The examiner can easily do this by simply asking the patient to cough and then to point with one finger to the area of maximal pain. This allows the examiner to avoid the area in the early stages of the examination and to confirm it at a later stage without causing the patient unnecessary discomfort in the meantime.

A complete physical examination should be performed and extra-abdominal causes of pain and signs of systemic illness should be sought before attention is directed to the patient’s abdomen. Systemic signs of shock, such as diaphoresis, pallor, hypothermia, tachypnea, tachycardia with orthostasis, and frank hypotension, usually accompany a rapidly progressive or advanced intra-abdominal condition and, in the absence of extra-abdominal causes, are an indication for immediate laparotomy. The absence of any alteration in vital signs, however, does not necessarily exclude a serious intra-abdominal process.

The surgeon then begins the abdominal examination. This is done with the patient resting in a comfortable supine position. The examination should include inspection, auscultation, percussion, and palpation of all areas of the abdomen, the flanks, and the groin (including all hernia orifices) in addition to rectal and genital examinations (and, in female patients, a full gynecologic examination). A systematic approach is crucial: an examiner who methodically follows a set pattern of abdominal examination every time will be rewarded more frequently than one who improvises haphazardly with each patient.

### Table 2  Extraperitoneal Causes of Acute Abdominal Pain

<table>
<thead>
<tr>
<th>Genitourinary</th>
<th>Endocrine</th>
<th>Hematologic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyelonephritis</td>
<td>Diabetic ketoacidosis</td>
<td>Sickle cell crisis</td>
</tr>
<tr>
<td>Perinephric abscess</td>
<td>Hyperparathyroidism (hypercalcemia)</td>
<td>Acute leukemia</td>
</tr>
<tr>
<td>Renal infarct</td>
<td>Acute adrenal insufficiency (Addisonian crisis)</td>
<td>Acute hemolytic states</td>
</tr>
<tr>
<td>Nephrolithiasis</td>
<td>Hyperthyroidism or hypothyroidism</td>
<td>Coagulopathies</td>
</tr>
<tr>
<td>Ureteral obstruction (lithiasis, tumor)</td>
<td></td>
<td>Pernicious anemia</td>
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<tr>
<td>Acute cystitis</td>
<td>Rectus sheath hematoma</td>
<td>Other dyscrasias</td>
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<tr>
<td>Prostatitis</td>
<td>Arthritis/diskitis of thoracolumbar spine</td>
<td></td>
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<tr>
<td>Seminal vesiculitis</td>
<td>Neurogenic</td>
<td></td>
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<tr>
<td>Epididymitis</td>
<td>Herpes zoster</td>
<td></td>
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<tr>
<td>Orchitis</td>
<td>Tabes dorsalis</td>
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<tr>
<td>Testicular torsion</td>
<td>Nerve root compression</td>
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<tr>
<td>Dysmenorrhea</td>
<td>Spinal cord tumors</td>
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<tr>
<td>Threatened abortion</td>
<td>Osteomyelitis of the spine</td>
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<tr>
<td>Pulmonary</td>
<td>Abdominal epilepsy</td>
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<td>Pneumonia</td>
<td>Abdominal migraine</td>
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<tr>
<td>Empyema</td>
<td>Multiple sclerosis</td>
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<tr>
<td>Pulmonary embolus</td>
<td>Inflammatory</td>
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<td>Pulmonary infarction</td>
<td>Schöönlein-Henoch purpura</td>
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<td>Pneumothorax</td>
<td>Systemic lupus erythematosus</td>
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<td>Cardiac</td>
<td>Polyarteritis nodosa</td>
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<td>Myocardial ischemia</td>
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<td>Myocardial infarction</td>
<td>Scleroderma</td>
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<td>Acute pericarditis</td>
<td>Infectious</td>
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<td>Metabolic</td>
<td>Bacterial</td>
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<tr>
<td>Acute intermittent porphyria</td>
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<tr>
<td>Familial Mediterranean fever</td>
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<td>Hypolipoproteinemia</td>
<td>Parasitic (malaria)</td>
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<tr>
<td>Hemochromatosis</td>
<td>Viral (measles, mumps, infectious mononucleosis)</td>
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<tr>
<td>Hereditary angioneurotic edema</td>
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<td>Retroperitoneal</td>
<td>Rickettsial (Rocky Mountain spotted fever)</td>
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<td>Periarteritis</td>
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<tr>
<td>Toxins</td>
<td>Bacterial toxins (tetanus, staphylococcus)</td>
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<td>Insect venom (black widow spider)</td>
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<tr>
<td>Animal venom</td>
<td>Heavy metals (lead, arsenic, mercury)</td>
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<tr>
<td>Poisonous mushroom</td>
<td>Drugs</td>
<td></td>
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<tr>
<td>Drugs</td>
<td>Withdrawal from narcotics</td>
<td></td>
</tr>
<tr>
<td>Retroperitoneal</td>
<td>Retroperitoneal hemorrhage (spontaneous adrenal hemorrhage)</td>
<td></td>
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<tr>
<td>Hematologic</td>
<td></td>
<td></td>
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<tr>
<td>Sickle cell crisis</td>
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<tr>
<td>Acute leukemia</td>
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<tr>
<td>Acute hemolytic states</td>
<td></td>
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<tr>
<td>Coagulopathies</td>
<td></td>
<td></td>
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<tr>
<td>Pernicious anemia</td>
<td></td>
<td></td>
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<tr>
<td>Other dyscrasias</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychogenic</td>
<td>Hypochondriasis</td>
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<tr>
<td>Somatization disorders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factitious</td>
<td>Munchausen syndrome</td>
<td></td>
</tr>
<tr>
<td>Malingerence</td>
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</tbody>
</table>
The first step in the abdominal examination is careful inspection of the anterior and posterior abdominal walls, the flanks, the perineum, and the genitalia for previous surgical scars (possible adhesions), hernias (incarceration or strangulation), distention (intestinal obstruction), obvious masses (distended gallbladder, abscesses, or tumors), ecchymosis or abrasions (trauma), striae (pregnancy or ascites), everted umbilicus (increased intra-abdominal pressure), visible pulsations (aneurysm), visible peristalsis (obstruction), limitation of movement of the abdominal wall with ventilatory movements (peritonitis), or engorged veins (portal hypertension).

The next step in the abdominal examination is auscultation. Although it is important to note the presence (or absence) of bowel sounds and their quality, auscultation is probably the least rewarding aspect of the physical examination. Severe intra-abdominal conditions, even intra-abdominal catastrophes, may occur in patients with normal bowel sounds, and patients with silent abdomens may have no significant intra-abdominal pathology at all. In general, however, the absence of bowel sounds indicates a paralytic ileus; hyperactive or hypoactive bowel sounds often are variations of normal activity; and high-pitched bowel sounds with splashes, tinkles (echoing as in a large cavern), or rushes (prolonged, loud gurgles) indicate mechanical bowel obstruction.

The third step is percussion to search for any areas of dullness, fluid collections, sections of gas-filled bowel, or pockets of free air under the abdominal wall. Tympany may be present in patients with bowel obstruction or hollow viscus perforation. Percussion can be useful as a way of estimating organ size and of determining the presence of ascites (signaled by a fluid wave or shifting dullness). It is most useful, however, as a means of demonstrating peritoneal irritation (rebound tenderness). The customary technique is to dig the fingers deep into the patient's abdomen and then let go abruptly. This technique is a time-honored one, but it is painful and often misleads the examiner into assuming that an acute process is present when none exists. Gentle percussion over the four quadrants of the abdomen is much better tolerated by the patient; in addition, it is much more accurate in demonstrating rebound tenderness.

The last step, palpation, is the most informative aspect of the physical examination. Palpation of the abdomen must be done very gently to avoid causing additional pain early in the examination. It should begin as far as possible from the area of maximal pain and then should gradually advance toward this area, which should be the last to be palpated. The examiner should place the entire hand on the patient's abdomen with the fingers together and extended, applying pressure with the palms (not the tips) of the fingers by flexing the wrists and the metacarpophalangeal joints. It is essential to determine whether true involuntary muscle guarding (muscle spasm) is present. This determination is made by means of gentle palpation over the abdominal wall while the patient takes a long, deep breath. If guarding is voluntary, the underlying muscle immediately
relaxes under the gentle pressure of the palpating hand. If, however, the patient has true involuntary guarding, the muscle remains in spasm (i.e., taut and rigid) throughout the respiratory cycle (so-called boardlike abdomen). True involuntary guarding is indicative of localized or generalized peritonitis. It must be remembered that muscle rigidity is relative: for example, muscle guarding may be less pronounced or absent in debilitated and elderly patients who have poor abdominal musculature. In addition, the evaluation of muscle guarding is dependent on the patient’s cooperation.

Palpation is also useful for determining the extent and severity of the patient’s tenderness. Diffuse tenderness indicates generalized peritoneal inflammation. Mild diffuse tenderness without guarding usually indicates gastroenteritis or some other inflammatory intestinal process without peritoneal inflammation. Localized tenderness suggests an early stage of disease with limited peritoneal inflammation.

Careful palpation can elicit several specific signs [see Table 4]—such as the Rovsing sign (associated with acute appendicitis) and the Murphy sign (acute cholecystitis)—that are indicative of localized peritoneal inflammation. Similarly, specific maneuvers can elicit signs of localized peritoneal irritation, such as the psoas sign (associated with retrocecal appendicitis), the obturator sign (pelvic appendicitis), and the Kehr sign (diaphragmatic irritation). One very important maneuver is the Carnett test, in which the patient elevates his or her head off the bed, thus tensing the abdominal muscles. Tenderness to palpation persists when the pain is caused by abdominal wall conditions (e.g., rectal sheath hematoma) but decreases or disappears when the pain is caused by intraperitoneal conditions (the Carnett sign).

Rectal, genital, and (in women) pelvic examinations are an essential part of the evaluation in all patients with acute abdominal pain. The rectal examination should include evaluation of sphincter tone, tenderness (localized versus diffuse), and prostate size and tenderness, as well as a search for the presence of hemorrhoids, masses, fecal impaction, foreign bodies, and gross or occult blood. The genital examination should search for adenopathy, masses, discoloration, edema, and crepitus. The pelvic examination in women should check for vaginal discharge or bleeding, cervical discharge or bleeding, cervical mobility and tenderness, uterine tenderness, uterine size, and adnexal tenderness or masses. Although a carefully performed pelvic examination can be invaluable in differentiating nonsurgical conditions (e.g., PID) from conditions necessitating prompt operation (e.g., acute appendicitis), the possibility that a surgical condition is present should not be prematurely dismissed solely on the basis of a finding of tenderness on pelvic or rectal examination.

### Table 4 Frequency of Specific Diagnoses in Younger and Older Patients with Acute Abdominal Pain in the OMGE Study

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Frequency (% of Patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age &lt; 50 Yr (N = 6,317)</td>
</tr>
<tr>
<td>Nonspecific abdominal pain</td>
<td>39.5</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>32.0</td>
</tr>
<tr>
<td>Cholecystitis</td>
<td>6.3</td>
</tr>
<tr>
<td>Obstruction</td>
<td>2.5</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>1.6</td>
</tr>
<tr>
<td>Diverticular disease</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Cancer</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Hernia</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Vascular disease</td>
<td>&lt; 0.1</td>
</tr>
</tbody>
</table>

Although laboratory and radiologic studies rarely, if ever, establish a definitive diagnosis by themselves, they are often useful for confirming the diagnosis suggested by the history and the physical examination.

### LABORATORY STUDIES

In all except extremely hemodynamically unstable patients, a complete blood count, blood chemistries, and a urinalysis are routinely obtained. The hematocrit is important in that it allows the surgeon to detect significant changes in plasma volume (e.g., dehydration caused by vomiting, diarrhea, or fluid loss into the peritoneum or the intestinal lumen), preexisting anemia, or bleeding. An elevated white blood cell count is indicative of an inflammatory process and is a particularly helpful finding if associated with a marked left shift; however, the presence or absence of leukocytosis should never be the single deciding factor as to whether the patient should undergo an operation. A low white blood cell count may be a feature of viral infections, gastroenteritis, or NSAP.

Serum electrolyte, blood urea nitrogen, and creatinine concentrations are useful in determining the nature and extent of fluid losses. Blood glucose and other blood chemistries may also be helpful. Liver function tests (serum bilirubin, alkaline phosphatase, and transaminase levels) are mandatory when abdominal pain is suspected to be hepatobiliary in origin. Similarly, amylase and lipase determinations are mandatory when pancreatitis is suspected, although it must be remembered that amylase levels may be low or normal in patients with pancreatitis and may be markedly elevated in patients with other conditions (e.g., intestinal obstruction, mesenteric thrombosis, and perforated ulcer).

Urinalysis may reveal red blood cells (suggestive of renal or ureteral calculi), white blood cells (urinary tract infection or inflammatory processes adjacent to the ureters, such as retrocecal appendicitis), increased specific gravity (dehydration), glucose, ketones (diabetes), or bilirubin (hepatitis). A pregnancy test should be considered in any woman of childbearing age with acute abdominal pain.

An electrocardiogram is mandatory in elderly patients and in patients with a history of atherosclerotic heart disease. Abdominal pain may be a manifestation of myocardial disease, and the physiologic stress of acute abdominal pain can increase myocardial oxygen demands and induce ischemia in patients with coronary artery disease.

### RADIOLOGIC STUDIES

In most patients with acute abdominal pain, initial radiologic evaluation should include plain films of the abdomen in the
supine and standing positions and chest radiographs. If the patient is unable to stand, a left lateral decubitus radiograph should be obtained. Like the basic laboratory studies (see above), these plain radiographs may help confirm diagnoses suggested by the history and the physical examination, such as pneumonia (signaled by pulmonary infiltrates); intestinal obstruction (air-fluid levels and dilated loops of bowel); intestinal perforation (pneumoperitoneum); biliary, renal, or ureteral calculi (abnormal calcifications); appendicitis (fecalith); incarcerated hernia (bowel protruding beyond the confines of the peritoneal cavity); mesenteric infarction (air in the portal vein); chronic pancreatitis (pancreatic calcifications); acute pancreatitis (the so-called colon cutoff sign); visceral aneurysms (calcified rim); retroperitoneal hematoma or abscess (obliteration of the psoas shadow); and ischemic colitis (so-called thumbprinting on the colonic wall).

A prospective study published in 1999 evaluated the utility of routine plain abdominal radiographs in the management of adult patients with acute right lower quadrant abdominal pain. The results seem to demonstrate that indiscriminate use of such radiographs in this patient subset is not helpful but that discriminating use in selected patients with clinically suspected small bowel obstruction or urinary symptoms may be worthwhile. Admittedly, plain abdominal radiographs cost relatively little; still, refraining from routinely obtaining them in all patients with suspected acute appendicitis would help reduce the cost of medical care appreciably.

### Working Diagnosis

Ideally, the tentative differential diagnosis list generated after the clinical history was obtained should be narrowed down to a working diagnosis by the physical examination and the information provided by the basic laboratory and radiologic studies. Once this working diagnosis has been established, subsequent management depends on the accepted treatment for the particular condition believed to be present. In general, the course of management follows four basic pathways (see below), depending on whether the patient (1) is in need of immediate laparotomy, (2) is believed to have an underlying surgical condition, (3) has an uncertain diagnosis, or (4) is believed to have an underlying nonsurgical condition.

It must be emphasized that the patient must be constantly reevaluated (preferably by the same examiner) even after the working diagnosis has been established. If the patient does not

<table>
<thead>
<tr>
<th>Sign or Finding</th>
<th>Description</th>
<th>Associated Clinical Condition(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaron sign</td>
<td>Referred pain or feeling of distress in epigastrium or precordial region on continued firm pressure over the McBurney point</td>
<td>Acute appendicitis</td>
</tr>
<tr>
<td>Ballance sign</td>
<td>Presence of dull percussion note in both flanks, constant on left side but shifting with change of position on right side</td>
<td>Ruptured spleen</td>
</tr>
<tr>
<td>Bassler sign</td>
<td>Sharp pain elicited by pinching appendix between thumb of examiner and iliacus muscle</td>
<td>Chronic appendicitis</td>
</tr>
<tr>
<td>Beevor sign</td>
<td>Upward movement of umbilicus</td>
<td>Paralysis of lower portions of rectus abdominis muscles</td>
</tr>
<tr>
<td>Blumberg sign</td>
<td>Transient abdominal wall rebound tenderness</td>
<td>Peritonitis</td>
</tr>
<tr>
<td>Carnett sign</td>
<td>Disappearance of abdominal tenderness when anterior abdominal muscles are contracted</td>
<td>Abdominal pain of intra-abdominal origin</td>
</tr>
<tr>
<td>Chandelier sign</td>
<td>Intense lower abdominal and pelvic pain on manipulation of cervix</td>
<td>Pelvic inflammatory disease</td>
</tr>
<tr>
<td>Charcot sign</td>
<td>Intermittent right upper quadrant abdominal pain, jaundice, and fever</td>
<td>Choledocholithiasis</td>
</tr>
<tr>
<td>Chaussier sign</td>
<td>Severe epigastric pain in gravid female</td>
<td>Prodrome of eclampsia</td>
</tr>
<tr>
<td>Claybrook sign</td>
<td>Transmission of breath and heart sounds through abdominal wall</td>
<td>Ruptured abdominal vissus</td>
</tr>
<tr>
<td>Courvoisier sign</td>
<td>Palpable, nontender gallbladder in presence of clinical jaundice</td>
<td>Periampullary neoplasm</td>
</tr>
<tr>
<td>Cruveilhier sign</td>
<td>Varicose veins radiating from umbilicus (caput medusae)</td>
<td>Portal hypertension</td>
</tr>
<tr>
<td>Cullen sign</td>
<td>Periumbilical darkening of skin from blood</td>
<td>Hemoperitoneum (especially in ruptured ectopic pregnancy)</td>
</tr>
<tr>
<td>Cutaneous hyperesthesia</td>
<td>Increased abdominal wall sensation to light touch</td>
<td>Parietal peritoneal inflammation secondary to inflammatory intra-abdominal pathology</td>
</tr>
<tr>
<td>Dance sign</td>
<td>Slight retraction in area of right iliac fossa</td>
<td>Intussusception</td>
</tr>
<tr>
<td>Danforth sign</td>
<td>Shoulder pain on inspiration</td>
<td>Hemoperitoneum (especially in ruptured ectopic pregnancy)</td>
</tr>
<tr>
<td>Direct abdominal wall tenderness</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Fothergill sign</td>
<td>Abdominal wall mass that does not cross midline and remains palpable when rectus muscle is tense</td>
<td>Rectus muscle hematoma</td>
</tr>
</tbody>
</table>

(continued)
respond to treatment as expected, the working diagnosis must be reassessed and the possibility that another condition exists must be immediately entertained and investigated by returning to the differential diagnosis list.

**Indications for Immediate Laparotomy**

A systematic approach to patients with acute abdominal pain is essential because in some patients, action must be taken immediately and there is not enough time for an exhaustive evaluation. As outlined (see above), such an approach should include a brief initial assessment, a complete clinical history, a thorough physical examination, and basic laboratory and radiologic studies. These steps can usually be completed in less than 1 hour and should be insisted on in the evaluation of most patients.

There are, in fact, very few abdominal crises that mandate immediate operation, and even with these conditions, it is still necessary to spend a few minutes on assessing the seriousness of the problem and establishing a probable diagnosis. Among the most common of the abdominal catastrophes that necessitate immediate operation are ruptured abdominal aortic or visceral aneurysms, ruptured ectopic pregnancies, and spontaneous hepatic or splenic ruptures. The relative rarity of such conditions notwithstanding, it must always be remembered that patients with acute abdominal pain may have a progressive underlying intra-abdominal disorder causing the acute pain and that unnecessary delays in diagnosis and treatment can adversely affect outcome, often with catastrophic consequences.

When immediate operation is not called for, the physician must decide whether urgent or nonurgent but early operation is necessary, whether additional tests are required before a decision can be made, whether the patient should be admitted to the hospital for careful observation, or whether nonsurgical treatment is indicated [see Suspected Surgical Abdomen, Uncertain Diagnosis, and Suspected Nonsurgical Abdomen, below].

### Suspected Surgical Abdomen

**INDICATIONS FOR URGENT LAPAROTOMY OR LAPAROSCOPY**

Once a definitive diagnosis has been made, it is easy to decide whether a

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**Table 5 (continued)**

<table>
<thead>
<tr>
<th>Sign or Finding</th>
<th>Description</th>
<th>Associated Clinical Condition(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey Turner sign</td>
<td>Local areas of discoloration around umbilicus and flanks</td>
<td>Acute hemorrhagic pancreatitis</td>
</tr>
<tr>
<td>Iliopsoas sign</td>
<td>Elevation and extension of leg against pressure of examiner’s hand causes pain</td>
<td>Appendicitis (retrocecal) or an inflammatory mass in contact with psoas</td>
</tr>
<tr>
<td>Kehr sign</td>
<td>Left shoulder pain when patient is supine or in the Trendelenburg position (pain may occur spontaneously or after application of pressure to left subcostal region)</td>
<td>Hemoperitoneum (especially ruptured spleen)</td>
</tr>
<tr>
<td>Kustner sign</td>
<td>Palpable mass anterior to uterus</td>
<td>Dermoid cyst of ovary</td>
</tr>
<tr>
<td>Mannkopf sign</td>
<td>Acceleration of pulse when a painful point is pressed on by examiner</td>
<td>Absent in factitious abdominal pain</td>
</tr>
<tr>
<td>McClintock sign</td>
<td>Heart rate &gt; 100 beats/min 1 hr post partum</td>
<td>Postpartum hemorrhage</td>
</tr>
<tr>
<td>Murphy sign</td>
<td>Palpation of right upper abdominal quadrant during deep inspiration results in right upper quadrant abdominal pain</td>
<td>Acute cholecystitis</td>
</tr>
<tr>
<td>Obturator sign</td>
<td>Flexion of right thigh at right angles to trunk and external rotation of same leg in supine position result in hypogastric pain</td>
<td>Appendicitis (pelvic appendix); pelvic abscess; an inflammatory mass in contact with muscle</td>
</tr>
<tr>
<td>Puddle sign</td>
<td>Alteration in intensity of transmitted sound in intra-abdominal cavity secondary to percussion when patient is positioned on all fours and stethoscope is gradually moved toward flank opposite percussion</td>
<td>Free peritoneal fluid</td>
</tr>
<tr>
<td>Ransohoff sign</td>
<td>Yellow pigmentation in umbilical region</td>
<td>Ruptured common bile duct</td>
</tr>
<tr>
<td>Revising sign</td>
<td>Pain referred to the McBurney point on application of pressure to descending colon</td>
<td>Acute appendicitis</td>
</tr>
<tr>
<td>Subcutaneous crepitance</td>
<td>Palpable crepitus in abdominal wall</td>
<td>Subcutaneous emphysema or gas gangrene</td>
</tr>
<tr>
<td>Summer sign</td>
<td>Increased abdominal muscle tone on exceedingly gentle palpation of right or left iliac fossa</td>
<td>Early appendicitis; nephrolithiasis; ureterolithiasis; ovarian torsion</td>
</tr>
<tr>
<td>Ten Horn sign</td>
<td>Pain caused by gentle traction on right spermatic cord</td>
<td>Acute appendicitis</td>
</tr>
<tr>
<td>Toma sign</td>
<td>Right-sided tympany and left-sided dullness in supine position as a result of peritoneal inflammation and subsequent mesenteric contraction of intestine to right side of abdominal cavity</td>
<td>Inflammatory ascites</td>
</tr>
</tbody>
</table>
patient should undergo operation. On occasion, however, a patient must be operated on before a precise diagnosis is reached. In contemporary clinical practice, the misuse or abuse of available technology frequently underlines the importance of sound surgical judgment at the bedside: in particular, too many patients with obvious surgical abdomens are subjected to time-consuming imaging studies before surgical consultation is obtained. It cannot be emphasized too strongly that although diagnostic accuracy is intellectually satisfying and undoubtedly important, the primary goal in the management of patients with acute abdominal pain is not to arrive at an exact clinicopathologic diagnosis but rather to determine which patients require immediate or urgent surgical intervention. Indications for immediate laparotomy (see above) are essentially limited to severe hemodynamic instability. Indications for urgent laparotomy are somewhat more numerous.

Urgent laparotomy implies operation within 1 to 2 hours of the patient’s arrival; thus, there is usually sufficient time for adequate resuscitation, with proper rehydration and restoration of vital organ function, before the procedure. Indications for urgent laparotomy may be encountered during the physical examination, may be revealed by the basic laboratory and radiologic studies, or may not become apparent until other investigative studies are performed. Involuntary guarding or rigidity during the physical examination, particularly if spreading, is a strong indication for urgent laparotomy. Other indications include increasing severe localized tenderness, progressive tense distention, physical signs of sepsis (e.g., high fever, tachycardia, hypotension, and mental status changes), and physical signs of ischemia (e.g., fever and tachycardia). Basic laboratory and radiologic indications for urgent laparotomy include pneumoperitoneum, massive or progressive intestinal distention, signs of sepsis (e.g., marked or rising leukocytosis, increasing glucose intolerance, and acidosis), and signs of continued hemorrhage (e.g., a falling hematocrit). Additional findings that constitute indications for urgent laparotomy include free extravasation of radiologic contrast material, mesenteric occlusion on angiography, endoscopically uncontrollable bleeding, and positive results from peritoneal lavage (i.e., the presence of blood, pus, bile, urine, or gastrointestinal contents). Acute appendicitis, perforated hollow viscera, and strangulated hernias are examples of common conditions that necessitate urgent laparotomy.

Several studies from the 1990s suggest that laparoscopy is the procedure of choice when the primary clinical diagnosis is acute appendicitis or perforated peptic ulcer. In a prospective, randomized trial, Hansen and associates reported that laparoscopic appendectomy is as safe as open appendectomy. Although laparoscopic appendectomy requires a longer operating time (63 minutes versus 40 minutes), it has two advantages: the surgical site infection rate is lower, and patients return to normal activities earlier. Accordingly, we recommend laparoscopic appendectomy as a worthwhile alternative for patients with a clinical diagnosis of acute appendicitis. It has also been shown that diagnostic laparoscopy through the right lower abdominal incision is very helpful in establishing the correct diagnosis in patients who are operated on for suspected acute appendicitis but in whom the appendix is grossly normal.

Laparoscopic treatment of perforated peptic ulcers—either with an omental patch or with sutures—is becoming more popular as surgeons gain experience and competence with the technique. Compared with open approaches, laparoscopic repair results in reduced wound pain and respiratory complications as well as earlier return to normal activities.

HOSPITALIZATION AND ACTIVE OBSERVATION

Numerous studies have shown that of all patients admitted for acute abdominal pain, only a minority require immediate or urgent operation. It is therefore cost-effective as well as prudent to adopt a system of evaluation that allows for thought and investigation before definitive treatment in all patients with acute abdominal pain except those identified early on as needing immediate or urgent laparotomy. The traditional wisdom is that spending time on observation opens the door for complications (e.g., perforating appendicitis, intestinal perforation associated with bowel obstruction, or strangulation of an incarcerated hernia); however, careful clinical trials evaluating active in-hospital observation of patients with acute abdominal pain of uncertain origin have demonstrated that such observation is safe, is not accompanied by an increased incidence of complications, and results in fewer negative laparotomies.

After the initial assessment has been completed, narcotic analgesia for pain relief should not be withheld. In appropriately titrated doses, analgesics neither obscure important physical findings nor mask their subsequent development. In fact, some physical signs may be more easily identified after adequate pain relief. Severe pain that persists in spite of adequate doses of narcotics suggests a serious condition that is likely to call for operative intervention.

Active observation allows the surgeon to identify most of the patients whose acute abdominal pain is caused by NSAP or various specific nonsurgical conditions. It must be emphasized that active observation means something more than simply admitting the patient to the hospital: it implies an active process of thoughtful, discriminating, and meticulous reevaluation of the patient (preferably by the same examiner) at intervals ranging from minutes to a few hours, to be complemented by appropriately timed additional investigative studies.

Additional investigative studies beyond the basic ones already mentioned should be obtained only if the results are likely to alter or improve patient management significantly. Furthermore, the invasiveness, morbidity, and cost-effectiveness of each additional test must be carefully weighed. More liberal use of supplemental studies is justified in those patients in whom the history and physical findings tend to be less reliable (e.g., the very young, the elderly, the critically ill, or the immunocompromised).

Supplemental studies that may be considered include computed tomography, ultrasonography, diagnostic peritoneal lavage, radionuclide imaging, angiography, magnetic resonance imaging, gastrointestinal endoscopy, and diagnostic laparoscopy. Diagnostic laparoscopy has been recommended when surgical disease is suspected but its probability is not high enough to warrant open laparotomy. It is particularly valuable in young women of child-bearing age, in whom gynecologic disorders frequently mimic acute appendicitis. A report by Chung and coworkers showed that diagnostic laparoscopy had the same diagnostic yield as open laparotomy in 55 patients with acute abdomen; 34 (62%) of these patients were safely managed with laparoscopy alone, with no increase in morbidity and with a shorter average hospital stay. Diagnostic laparoscopy has also been shown to be useful in the assessment of acute abdominal pain in ICU patients and patients with AIDS.
ACTIVE OBSERVATION

HOSPITALIZATION AND Uncertain Diagnosis

Early laparotomy or laparoscopy (within 24 to 48 hours of the initial evaluation) is reserved for patients whose conditions are not likely to become life threatening if operation is delayed to permit further resuscitation or additional investigative studies. It is often possible to perform early laparotomy or laparoscopy in patients with uncomplicated acute cholecystitis or diverticulitis and those with nonstrangulated incarcerated hernias, thereby preventing the increased patient risk that always accompanies unplanned emergency operations as well as avoiding the logistical impediments to unscheduled surgical procedures in the middle of the night or on weekends or holidays. Similarly, patients with simple uncomplicated intestinal obstructions often benefit from several hours of nasogastric tube decompression and fluid and electrolyte resuscitation.

Elective laparotomy or laparoscopy is reserved for patients whose condition is highly likely to respond to conservative medical management or highly unlikely to become life threatening during prolonged periods (several days or even weeks) of diagnostic evaluation.

OUTPATIENT EVALUATION

The epidemiology of acute abdominal pain is such that for every patient who requires hospitalization, there are at least two or three others who have self-limiting conditions for which neither operation nor hospitalization is necessary. Much or all of the evaluation of such patients, as well as any treatment that may be needed, can now be completed in the outpatient department. To treat acute abdominal pain cost-effectively and efficiently, the surgeon must be able not only to identify patients who need immediate or urgent laparotomy or laparoscopy but also to reliably identify those whose condition does not present a serious risk and who therefore can be managed without hospitalization. The reliability and intelligence of the patient, the proximity and availability of medical facilities, and the availability of responsible adults to observe and assist the patient at home are factors that should be carefully considered before the decision is made to evaluate or treat individuals with acute abdominal pain as outpatients.

Uncertain Diagnosis

If the diagnosis is unclear, the surgeon’s task is to determine whether hospitalization and active observation are necessary or whether outpatient evaluation is an option. All patients with acute abdominal pain and evidence of extracellular fluid deficits, electrolyte imbalances, or sepsis must be hospitalized. Furthermore, any patient with unexplained abdominal symptoms whose condition has not improved within 24 hours of the initial evaluation should be hospitalized.

Supplemental studies are often required for further evaluation and complete workup of patients with uncertain diagnoses and for the exclusion of many medical conditions that do not call for operation. When the diagnosis is not obvious from the history and the physical examination, apparent on the plain radiographs, or suggested by the basic laboratory studies, ultrasonography and CT, both of which are now widely available, should be considered. CT is more useful in the early evaluation of patients with acute abdominal pain because it is not operator dependent, is not hampered by the presence of overlying gas (which transmits sound waves poorly and interferes with ultrasonography), and can be performed rapidly (a complete scan of the abdomen and pelvis takes less than 15 minutes). Although watchful observation with ongoing reexamination is a time-honored approach to the patient with acute abdominal pain of uncertain origin, excessive reliance on this practice or on esoteric physical diagnosis maneuvers (which most medical students have witnessed in awe at one time or another) suggests that the surgeon is unaware of how valuable, rapid, and accurate a CT scan can be in the early diagnosis of these patients.

Diagnostic peritoneal lavage, although most useful in the evaluation of blunt abdominal trauma, may be particularly helpful in obtunded or critically ill patients, whose condition is difficult to assess by means of history taking and physical examination.

Suspected Nonsurgical Abdomen

There are numerous disorders that cause acute abdominal pain but do not call for surgical intervention. These nonsurgical conditions are often extremely difficult to differentiate from surgical conditions that present with almost indistinguishable characteristics. For example, the acute abdominal pain of lead poisoning or acute porphyria is difficult to differentiate from the intermittent pain of intestinal obstruction, in that marked hyperperistalsis is the hallmark of both. The pain of acute hypolipoproteinemia may be accompanied by pancreatitis, which, if not recognized, can lead to unnecessary laparotomy. Similarly, acute and prostrating abdominal pain accompanied by rigidity of the abdominal wall and a low hematocrit may lead to unnecessary urgent laparotomy in patients with sickle cell anemia crises. To further complicate the clinical picture, cholelithiasis is also often found in patients with sickle cell anemia.

In addition to numerous extraperitoneal disorders, nonsurgical causes of acute abdominal pain include a wide variety of intraperitoneal disorders, such as acute gastroenteritis (from enteric bacterial, viral, parasitic, or fungal infection), acute gastritis, acute duodenitis, hepatitis, mesenteric adenitis, salpingitis, Fitz-Hugh–Curtis syndrome, mellitschmerz, ovarian cyst, endometritis, endometriosis, threatened abortion, spontaneous bacterial peritonitis, and tuberculous peritonitis. Acute abdominal pain in immunosuppressed patients or patients with AIDS is now encountered with increasing frequency and can be caused by a number of unusual conditions (e.g., cytomegalovirus enterocolitis, opportunistic infections, lymphoma, and Kaposi sarcoma) as well as by the more usual ones.
As noted [see Tentative Differential Diagnosis, above], most patients with acute abdominal pain presenting to the office or the emergency department have an underlying nonsurgical condition and do not require operation. Again, the single most common diagnosis in these patients is NSAP. Although the natural history of NSAP has been well documented (harmless abdominal pain that is relieved in a few days without any treatment), there have been no prospective studies detailing the symptomatology and physical findings associated with this disorder. Furthermore, it remains unclear whether NSAP is in fact a single disease entity or is simply the presenting symptom complex for many different minor and self-limiting conditions. A complete clinical history and physical examination, coupled with careful in-hospital observation and a high index of suspicion, will in most cases prevent unnecessary laparotomy in patients with nonsurgical causes of acute abdominal pain. On rare occasions, diagnostic laparoscopy may be employed to prevent unnecessary laparotomy.

Conclusion

In the management of patients with acute abdominal pain, it occasionally happens that even with the aid of considerable clinical acumen and liberal use of diagnostic tests, the surgeon cannot readily determine whether a patient requires operation. In such cases, laparotomy or diagnostic laparoscopy may constitute the definitive, as well as the safest, approach to the evaluation of acute abdominal pain.

References


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