EMERGENCY MEDICINE PRACTICE

AN EVIDENCE-BASED APPROACH TO EMERGENCY MEDICINE

Assessing Abdominal Pain In Adults: A Rational, Cost-Effective, And Evidence-Based Strategy

Premier Issue

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CME Objectives

Upon completing this article, you should be able to:

1. describe the life-threatening etiologies of abdominal pain and how they present;
2. identify the most commonly missed diagnoses;
3. identify the "high-risk" patient with abdominal pain; and
4. discuss the controversies related to using narcotics in patients with abdominal pain.

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See "Physician CME Information" on back page.

AN experienced emergency physician might compare the painful abdomen to the dark side of the moon—a terrain both indistinct and enigmatic. The patient's history is frequently mutable, the physical examination misleading. And to further complicate the issue, "textbook" presentations of serious disease seem to occur only in print. Patients with severe pain may prove to have gastroenteritis after an expensive work-up, while those with a seemingly benign belly are hiding a surgical catastrophe.

This issue of *Emergency Medicine Practice* will address the dilemma of abdominal pain and provide a structured approach to this complaint. The central principles include recognizing the high-risk patient, selecting appropriate tests, and using flexible clinical pathways.

This article emphasizes disposition over diagnosis. It's not so important to identify a cause of abdominal pain as to recognize a surgical abdomen. In patients with pain of uncertain significance, the diagnosis may be clarified by a re-examination in 6-8 hours.

Epidemiology, Etiology, Differential Diagnosis

Abdominal pain is one of the most frequent ED complaints, accounting for approximately 4-8% of all adult ED visits.[1,2] In most adults, admission to the hospital ranges from 18-42%, but the incidence soars in the elderly. Nearly two-thirds of older patients with abdominal pain require hospitalization, and many undergo surgery.[3-6]

Abdominal pain may arise from many organ systems, including pulmonary, cardiac, and endocrine. While the gastrointestinal (GI) and genitourinary (GU) tracts are the most frequent offenders, it's perilous to ignore extra-abdominal and systemic etiologies, which are outlined in detail in **Table 1**.

The etiology of abdominal pain remains obscure at the end of many ED encounters. In up to 40% of patients, the origin of abdominal pain is never

determined.[1] Resist "forcing" a diagnosis on an inscrutable belly. Some irresolute emergency physicians succumb to impulse and write "gastroenteritis" in the diagnosis section of the chart, when the correct diagnosis should be "abdominal pain of undetermined etiology," "undifferentiated abdominal pain," or "nonspecific abdominal pain." "Gastroenteritis" is often used as a wastebasket diagnosis, which leads to premature closure in evaluation. True gastroenteritis is an acute, self-limited illness caused by a multitude of agents (infectious or toxic), and vomiting and diarrhea are *always* required to establish this diagnosis.

Special Considerations

Because they're often misdiagnosed, there are three subgroups of patients with abdominal pain who deserve particular focus: the elderly, the immunocompromised (especially those with HIV), and women of childbearing age. Changes in the immune system, abdominal musculature, or peritoneal responsiveness may leave the elderly and immunosuppressed without peritoneal signs until late in the disease. The huge overlap in clinical findings between pelvic inflammatory disease (PID) and appendicitis makes misdiagnosis frequent in women of childbearing age. In addition, the frequently subtle presentations of ectopic pregnancy may lead to missed diagnosis and poor outcome.

The Elderly

Abdominal pain is associated with significant morbidity and mortality in the elderly (variously defined as greater than 50 years old or greater than 65 years old). The diagnosis of an acute abdomen in mature adults is complicated by the relative lack of physical findings despite serious disease. In addition, the surgical problems in the elderly are more rapidly life-threatening than in younger patients.[7] Older patients are at risk for vascular catastrophes (e.g., mesenteric ischemia, leaking or ruptured abdominal aortic aneurysm, or myocardial infarction). These conditions comprise fully 10% of all cases of abdominal pain in patients greater than 70 years old presenting to a hospital.[3-6,8,9] Some physicians who routinely admit every 75-year-old with chest pain regularly discharge the elderly with abdominal pain. This "logic" seems absurd when one considers that the morbidity and mortality of abdominal pain in this age group rivals that of chest pain.[10-12]

With each decade of life in adults, mortality increases and diagnostic accuracy decreases, until, in octogenarians, the mortality for all patients presenting to the ED with abdominal pain is 7% (70 times that in adolescents). By the time a patient reaches age 80, the physician's ability to make an accurate initial diagnosis drops below 30%.[5] These numbers suggest the need to consider surgical consultation for most geriatric patients with abdominal pain.

Not surprisingly, this fall in diagnostic precision is paralleled by a significant rise in mortality. The problem is somewhat attributable to age-related differences in disease prevalence. (**Table 2** outlines the variation in confirmed diagnoses by age.) In the aged, biliary tract disease is the single most common cause of abdominal pain.[5,13] In one study of elderly patients, temperature and laboratory screening could not differentiate surgical from nonsurgical disease.[14] Clinical impression was more important than laboratory tests in the decision to request special studies or surgical consultation. Indeed, the rest of this article stresses many other important considerations and caveats for assessing abdominal pain in the elderly.

Patients With HIV

The patient with HIV may have unusual conditions such as bacterial enterocolitis, drug-induced pancreatitis, or AIDS-related cholangiopathy. Drug-induced pancreatitis may be fulminant, and mortality can reach 10%.[15-18]

Opportunistic infections can result in obstruction and perforation. In one study of abdominal pain in AIDS patients, pain was attributable to the immunocompromised state in 65%. Causes included gastrointestinal non-

Table 1. Important Extra-abdominal Causes Of Abdominal Pain.

Systemic
- Diabetic ketoacidosis
- Alcoholic ketoacidosis
- Uremia
- Sickle cell disease
- Porphyria
- Systemic lupus erythematosus
- Vasculitis
- Glaucoma
- Hyperthyroidism

Toxic
- Methanol poisoning
- Heavy metal toxicity
- Scorpion bite
- Black widow spider bite

Thoracic
- Myocardial infarction/ Unstable angina
- Pneumonia
- Pulmonary embolism
- Herniated thoracic disc (neuralgia)

Genitourinary
- Testicular torsion
- Renal colic

Infectious
- Strep pharyngitis (more often in children)
- Rocky Mountain Spotted Fever
- Mononucleosis

Abdominal wall
- Muscle spasm
- Muscle hematoma
- Herpes zoster

Adapted from: Purcell TB. Nonsurgical and extraperitoneal causes of abdominal pain. *Emerg Med Clin North Am* 1989;7:721-740.

Table 2. Disease Spectrum In Abdominal Pain By Age.

Confirmed Cause of Acute Abdominal Pain	Acute Abdominal Pain Patients < 50 (N=6,317)	Acute Abdominal Pain Patients ≥ 50 (N=2,406)
Cholecystitis	6%	21%
Nonspecific abdominal pain	40%	16%
Appendicitis	32%	15%
Bowel obstruction	2%	12%
Pancreatitis	2%	7%
Diverticular disease	< 0.1%	6%
Cancer	< 0.1%	4%
Hernia	< 0.1%	3%
Vascular	< 0.1%	2%

Adapted from: de Dombal FT. Acute abdominal pain in the elderly. *J Clin Gastroenterol* 1994;19:331-335.

Hodgkin's lymphoma, cytomegalovirus (CMV) or *M. avium intracellulare* enteritis or colitis, sclerosing cholangitis, cryptosporidial infection, and CMV gastritis or esophagitis.[17] Patients with HIV also fall victim to ordinary afflictions such as appendicitis or renal colic.

Women Of Childbearing Age

The woman of childbearing age who presents with lower abdominal pain poses a unique conundrum, as pregnancy-related conditions and gynecologic disorders complicate diagnosis. Because as many as 13% of such patients are gravid,[19] the fundamental step is to diagnose pregnancy. The physician must not rely on the patient's menstrual history, supposed birth control use, or tubal ligation to exclude pregnancy. Even patients who report no history of sexual activity may be pregnant.[20]

Once pregnancy-related disease such as ectopic pregnancy is excluded, the physician is left to ponder the question of urinary (UTI or pyelonephritis), gastrointestinal (gastroenteritis, enteritis, or appendicitis), or pelvic (PID or ovarian disease) pathology. Errors are common, and one-third of women of childbearing age ultimately found to have appendicitis are initially misdiagnosed.[21] The menstrual history and presence or absence of GI symptoms cannot reliably distinguish between appendicitis and pelvic disease.[22,23] This puzzle is not clarified by laboratory testing, and the CBC is more likely to deceive than illuminate.[24]

Not only first-trimester gestations demonstrate puzzling complaints. By the second half of pregnancy, the appendix has moved out of the right lower quadrant, to the extreme right upper quadrant. Such patients may be most tender just under the ribs or even in the flank.

Emergency Department Evaluation

The ancient Greeks believed that hubris, the crime of excessive pride, invariably leads to tragedy. The wise and humble practitioner recognizes the limitations of clinical diagnosis. There is a great deal of error in the diagnosis of abdominal pain. When initial and final diagnoses are compared, accuracy is no better than 50% and 65%, respectively.[25-27] Accuracy may be improved by a structured chart (**Tool 1** on page 8 presents a model) and computer-aided diagnosis.[28-30] The advantage of computer-aided diagnosis may not rest in the decision algorithm per se but rather in the more complete data collection.[31,32] A targeted history and physical examination should be paired with an organized method to interpret the findings. Place serious ailments foremost in the differential diagnosis.

Specific diagnoses cannot be finalized or excluded with a single historical or physical finding. In a study of cases of misdiagnosed appendicitis brought to litigation, several themes recur. Patients with misdiagnosed disease had less right lower quadrant (RLQ) pain and tenderness as well as diminished anorexia, nausea, and vomiting.[33] It seems intuitive that early ED follow-up for patients discharged with abdominal pain of uncertain etiology would decrease errors, although the value of early follow-up has yet to be proven in an evidence-based fashion.

History

The patient's history is key to uncover the etiology of abdominal pain. In malpractice cases for failure to diagnose abdominal conditions, deficiencies in data gathering and charting were more responsible for the misdiagnosis than misinterpretation of the data.[33-35] The use of a standardized history form increases both patient satisfaction and diagnostic accuracy.[30] Additionally, **Table 3** outlines some excellent questions to assist the ED physician in pinpointing possible causes. However, while these questions may help target the high-risk patient, no single inquiry can confirm or refute a surgical emergency. Indeed, a patient can have all "good" answers to historical questions and still have a perilous diagnosis. In addition to the high-yield questions in Table 3, ask about the drive to the hospital—was the drive itself painful? The experience of pain on going over a bump in the road is about 80% sensitive (but only 52% specific) for appendicitis.[36] Despite the possible phenomenon of recurrent appendicitis, a history of previous RLQ pain makes the diagnosis of appendicitis less likely.[37]

Physical Examination

The physical examination begins with the patient's vital signs. But apart from gross hypotension or significant tachycardia, just what do these signs actually mean?

Table 3. High-Yield Historical Questions.

1. **How old are you?** (Advanced age means increased risk)
2. **Which came first—pain or vomiting?** (Pain first is worse [i.e., more likely to be caused by surgical disease])
3. **How long have you had the pain?** (Pain for less than 48 hours is worse)
4. **Have you ever had abdominal surgery?** (Consider obstruction in patients who report previous abdominal surgery)
5. **Is the pain constant or intermittent?** (Constant pain is worse)
6. **Have you ever had this before?** (A report of no prior episodes is worse)
7. **Do you have a history of cancer, diverticulosis, pancreatitis, kidney failure, gallstones, or inflammatory bowel disease?** (All are bad)
8. **Do you have HIV?** (Consider occult infection or drug-related pancreatitis)
9. **How much alcohol do you drink per day?** (Consider pancreatitis, hepatitis, or cirrhosis)
10. **Are you pregnant?** (Test for pregnancy—consider ectopic pregnancy)
11. **Are you taking antibiotics or steroids?** (These may mask infection)
12. **Did the pain start centrally and migrate to the right lower quadrant?** (High specificity for appendicitis)
13. **Do you have a history of vascular or heart disease, hypertension, or atrial fibrillation?** (Consider mesenteric ischemia and abdominal aneurysm)

Vital Signs

Temperature. An elevated temperature is frequently associated with intraabdominal infections, but its sensitivity and specificity vary greatly. Consider obtaining a rectal temperature with patients at risk for intraabdominal infections. Do not rely on tympanic temperatures to rule out fever.[38,39] Oral temperatures are falsely low in patients with rapid breathing—a frequent occurrence in patients who are suffering.[40,41] Rectal temperatures are generally more reliable. While the significance of a fever in a patient with abdominal pain is not always clear, it certainly attracts the attention of a surgical consultant.

Temperature is less useful in the elderly compared to younger patients. The majority of elderly patients with acute cholecystitis and appendicitis are afebrile despite higher rates of perforation and sepsis.[12,42-44]

Respiratory Rate. An elevated respiratory rate can be the result of pain and sub-diaphragmatic irritation. Tachypnea may also arise from hypoxia (due to pneumonia or acute respiratory distress syndrome [ARDS]), early sepsis, anemia, or metabolic acidosis. Sustained tachypnea may warrant evaluation for these conditions.

Abdominal Examination

Palpation. It is rare that a serious abdominal condition presents without any abdominal tenderness. At times, it is difficult to distinguish tenderness of abdominal organs vs. tenderness of the abdominal musculature. Carnett's sign is increased tenderness to palpation when the abdominal muscles are contracted (as when the patient lifts his or her head and / or legs off the bed). Tenderness that is greatest when the abdomen muscles are contracted is likely due to abdominal wall pain.[45] This sign was 95% accurate at distinguishing abdominal wall from visceral abdominal pain in one small study.[46]

Location Of Tenderness. While the area of tenderness supposedly corresponds to the anatomic location of diseased organs, it's important to recognize that this may be misleading in patients with abdominal pain.[47] Patients with appendicitis are often most tender at McBurney's point, a spot located several inches medial to the anterior superior spine of the ileum on an imaginary line that connects the spine to the umbilicus. However, the original study that analyzed McBurney's point only included a handful of cases (<10).[48] Moreover, barium enema studies have found that most appendices lie inferior and medial to this point, and the base of the appendix lies more than 5 cm from this point in more than two-thirds of cases.[49] Importantly, while most appendices lie within the right lower quadrant, the tip of the appendix can actually extend to any quadrant within the abdomen. A patient with retrocecal appendicitis is usually tender in the right flank or right upper quadrant. Thus, while 80% of patients with appendicitis have tenderness in the right lower quadrant, the disturbing corollary is that 20% of patients with surgically proven appendicitis have no RLQ pain or tenderness.[37]

Guarding. Voluntary guarding is sometimes a response to fear, anxiety, or even a reaction to a physician's cold hands. Reassurance and gentle palpation may overcome voluntary guarding. Involuntary guarding (rigidity) on palpation is more likely to occur with surgical disease and is not relieved by physician encouragement.[50] The presence of rigidity nearly quadruples the likelihood of appendicitis, whereas simple guarding is less predictive.[37]

Peritoneal Signs. These signs are considered hallmarks of surgical disease. Peritoneal signs include "rebound" pain, and pain with cough, with shaking the gurney, or hitting the supine patient's heel (heel tap). Grimacing may be a more accurate finding than a report of pain by the patient.[50]

The classic rebound test is performed when the examiner presses on the abdomen then suddenly releases the pressure. While most emergency physicians believe that a positive rebound test is pathognomonic for surgical disease, this blind faith is not supported by the literature. In one meta-analysis on appendicitis, rebound pain was only 63% sensitive and 69% specific.[37] However, another study showed a sensitivity of 82% and a specificity of nearly 90%.[36] In a fit of icon smashing, other researchers prospectively assessed the usefulness of rebound tenderness in unselected patients with abdominal pain. In this study, rebound pain had no predictive value.[51] Rebound is even less useful in elderly patients with appendicitis despite the frequency of perforation.[12,44]

An alternative to assessment of rebound pain is the "cough test," where the examiner has the patient cough and looks for evidence of post-tussive abdominal pain (grimacing, flinching, or grabbing the belly). Studies find the cough sign to be between 80% and 95% sensitive for surgically proven peritonitis.[52,53] Another series showed the "heel drop" sign (RLQ pain upon dropping the heels to ground after standing on toes) was 93% sensitive for appendicitis.[54] This test can also be performed by forcefully banging on the patient's heel with the examiner's hand.

Signs And Eponyms: Murphy's, Psoas, Obturator, Rovsing's. Some authors argue that Murphy's sign, where a patient will stop a deep inspiration during palpation of the right upper quadrant (RUQ), is very sensitive for acute cholecystitis and biliary colic. When assessed in 65 patients, Murphy's sign had a sensitivity and negative predictive value of 97% and 93%, respectively, for acute cholecystitis, but the specificity was slightly lower than 50%.[55] In elderly patients, a positive Murphy's sign is useful when present but is less sensitive than in younger patients.[56] In one study, the psoas sign proved specific (95%) but not sensitive (16%) for appendicitis.[37] Neither the obturator sign (pain with internal rotation of the flexed hip) nor Rovsing's sign (pain in the RLQ precipitated by palpation of the LLQ) has been rigorously studied.

Auscultation. The character of bowel sounds is most useful in the diagnosis of obstruction and perforation. High-pitched, tinkling, or absent bowel sounds are strongly associated with acute small bowel obstruction, especially in the presence of distention.[29] Abnormal bowel sounds are associated with adverse outcomes in the elderly.[3]

Pelvic Examination

While a pelvic examination is mandatory in young women with lower abdominal pain, it is also valuable in those with

upper abdominal pain. A woman with severe PID and perihepatic inflammation (Fitz-Hugh-Curtis syndrome) may demonstrate minimal lower abdominal tenderness and a predominance of findings in the right upper quadrant. Only pelvic examination and the resultant cervical motion tenderness may reveal the true etiology. Pus that leaks from the fallopian tubes into the abdominal gutters may cause LUQ tenderness as well. The pelvic exam also helps differentiate PID from appendicitis. While women with appendicitis may have cervical motion and adnexal tenderness, the presence (or absence) of mucopurulent discharge from the cervix is key. Ninety-five percent of women with PID have pus leaking from their cervical os. If pus is absent, beware the diagnosis of PID and reconsider appendicitis.

Rectal Examination

The sweeping generalization that all patients with abdominal pain require a rectal exam remains unsupported by the literature. Two studies have questioned the value of the rectal examination in the evaluation of appendicitis. While the exam may be positive in appendicitis, both studies found it provided no additional information that was not available on the abdominal examination.[57,58] However, these limited studies do not signal the demise of the rectal exam. Certainly, the diagnoses of prostatitis, perirectal disease, stool impactions, rectal foreign bodies, and GI bleeds all depend upon the digital exam. The most useful aspect of the rectal exam is detection of heme-positive stools.

Serial Exams

In a group of patients with intermediate initial probability of appendicitis, Graff et al found that a 10-hour observation period improved the ability to distinguish between patients with and those without appendicitis.[59] While the value of scheduled return visits has not been specifically evaluated, a mandatory recheck in eight or 10 hours should yield similar results. The value of telephone follow-up has not been studied in the management of abdominal pain but remains a cost-effective alternative in low-risk patients.

Diagnostic Studies

The emergency physician must not depend on laboratory tests or x-rays to provide the diagnosis. Laboratory assays or imaging studies rarely approach 100% accuracy. Diagnostic adjuncts are most useful when placed in the context of the patient's history and physical examination. While some diagnostic adjuncts (such as the abdominal x-ray, complete blood count, and liver function tests) are overutilized, others (such as pregnancy tests, urinalysis, and electrocardiograms) are probably underused. **Table 4** (see page 6) demonstrates the pros and cons of several types of diagnostic studies with respect to various conditions.

Laboratory Tests

Complete Blood Count (CBC). Question: What is the most frequently requested study in patients with abdominal pain? Answer: The most misleading study in abdominal pain—the CBC. While the CBC is de rigeur in the evaluation of appendicitis, numerous studies emphasize its flaws. Anywhere from 10-60% of patients with surgically proven appendicitis have an initially normal white count.[60-63]

Neither the absolute neutrophil count nor the differential reliably exclude or identify appendicitis. In children, the CBC is even less helpful, and it may be normal in the majority of children with appendicitis whose pain is less than 24 hours in duration.[64,65] Reluctance of the emergency physician to consult a surgeon for a patient with a normal white count (and the surgeon's similar unwillingness to operate on such a patient) results in missed diagnosis. Two studies have found that following WBC counts over time cannot distinguish appendicitis from other causes of abdominal pain.[66] In addition, an elevated white count detects a mere 53% of severe abdominal pathology.[67]

While a normal white count gives false comfort, an elevated white count does imply serious disease. An elevated white count often results in further testing and increased costs, but it does not necessarily add to knowledge obtained by the history and physical exam.[68] In patients with gastroenteritis, there is no significant correlation between an abnormal CBC and the administration of IV fluids, antibiotics, or hospital admission.[69] Furthermore, one study showed that the CBC, which is often routine for women of childbearing age with lower abdominal pain, changed management in only 2% of such patients. In each case, it led to the *wrong* diagnosis.[24]

C-Reactive Protein (CRP). In one meta-analysis, CRP proved approximately 62% sensitive and 66% specific for the diagnosis of appendicitis.[70] It's particularly insensitive in patients with symptoms for less than 12 hours. Serial measurements may be more reliable; one study showed that appendicitis is rare in patients who have two normal CRPs drawn 12 hours apart.[71]

Amylase And Lipase. A serum lipase is the best test for suspected pancreatitis. Amylase is neither sensitive nor specific for pancreatitis.[72] It is routinely elevated in alcoholics without pancreatitis.[73,74] Serum lipase, especially at a level three times greater than normal, is a more accurate test.[75,76] Both amylase and lipase may be normal in some patients with CT-proven pancreatitis, especially if the disease is recurrent. These limitations notwithstanding, a lipase is the most useful test in patients suspected of pancreatitis. Patients with significant epigastric tenderness and vomiting are most likely to benefit from the assay.

Urinalysis. The urinalysis can be particularly misleading in patients with abdominal pain. Abnormal urine may be associated with non-urinary conditions. It's tempting to diagnosis cystitis in a patient with abdominal pain and pyuria, but in reality, 20-30% of patients with appendicitis present with blood, leukocytes, or even bacteria in their urine.[77,78] Similarly, while hematuria plus flank pain equals renal colic to the ingenuous practitioner, at least one report shows an 87% incidence of hematuria in ruptured abdominal aortic aneurysm (AAA),[79] although most other reports are around 30%.[80-83] Furthermore, the presence of gross hematuria causes a significant delay in the diagnosis because the physician pursues a urinary work-up.[79]

Continued on page 13

Table 4. Weighing The Pros And Cons Of Diagnostic Tools For Various Disease Entities.

Appendicitis

Plain films
Pros: Don't get. Rarely, a plain film may demonstrate an appendicolith.
Cons: *Most* cases of appendicitis require no imaging study. In cases of significant diagnostic uncertainty, triple-contrast CT may be helpful.

CT
Pros: The high sensitivities (approaching 100%) are reported from institutions using latest generation machines and rectal as well as oral and IV contrast.
Cons: There can be considerable variability in performance of CT in different institutions. Accuracy depends on the machine used, triple contrast, and experience of the reader.

Ultrasound
Pros: Occasionally valuable in women with RLQ pain where the differential diagnosis is broad. Less accurate than CT for appendicitis.
Cons: Operator experience and body habitus influence accuracy.

Radionuclide-labeled WBCs
Pros: Accurate in some institutions.
Cons: Institutional variation and length of test remain problematic.

White blood count
Pros: *Everybody* orders it. Nearly all surgical consultants want this test.
Cons: As likely to deceive as to inform. The CBC is often normal in patients with appendicitis and is often elevated in patients with gastroenteritis and non-specific abdominal pain. In women of childbearing age, it is more likely to lead to an incorrect diagnosis than a proper one.

C-reactive protein
Pros: High sensitivity in a few studies, especially with serial levels.
Cons: Wide range in accuracy.

Biliary Tract Disease

Ultrasound
Pros: Best for gall bladder *anatomy*. Associated criteria: gall-bladder wall thickening, edema, pericholic fluid, sonographic Murphy's sign specific for diagnosis of cholecystitis. Overall, greater than 95% sensitive for cholelithiasis and about 85% sensitive for cholecystitis.
Cons: The presence of gallstones alone does not imply pain is stone-related. A 5-10% false-negative rate.

Radionuclide scanning
Pros: Best for gall bladder *functioning*.
Cons: Not as immediately available as ultrasound.

CT
Pros: Good for common duct stones.
Cons: Not sensitive for cholecystitis and not well-studied for this indication.

Diverticulitis

Ultrasound
Pros: Accurate in selected patients.
Cons: Operator/reader dependent.

CT with PO contrast
Pros: Accurate in selected patients. Can detect abscess formation.
Cons: Expensive.

Barium enema
Pros: Accurate in selected patients.
Cons: Less accurate in ED due to no prior bowel prep. May increase risk of perforation if performed acutely.

Bowel Obstruction

Plain films
Pros: Most cost-effective and readily available ED test for obstruction.
Cons: May occasionally miss an early or proximal obstruction.

CT
Pros: Accurate.
Cons: Rarely needed to make the diagnosis. Expensive.

Ultrasound
Pros: Fairly accurate.
Cons: Less accurate than CT and rarely needed to make the diagnosis.

Pancreatitis

CT
Pros: Useful if suspicion of gallstone pancreatitis (especially if female and/or nondrinker), pseudocyst, or pancreatic phlegmon/abscess (fever, mass, severe toxicity). Also, CT grade can predict risk of abscess formation and mortality.
Cons: Imaging rarely necessary in ED; clinical suspicion of severe pancreatitis warrants consultation.

Ultrasound
Pros: See above.
Cons: See above. Less sensitive than CT. Poor image if ileus or increased bowel gas.

Amylase
Pros: A cut-off of greater than three times the normal value is more specific for pancreatitis.
Cons: Amylase is routinely elevated in alcoholics even in absence of pancreatitis.

Lipase
Pros: Lipase is more specific for pancreatitis than amylase.
Cons: May be normal early in pancreatitis as well as in chronic pancreatitis.

Urinary Stone Disease

***Helical* CT un-enhanced (non-contrast)**
Pros: Very accurate for stone disease. Can evaluate other pathology, such as AAA, appendicitis, and perinephric abscess.
Cons: Expensive. Interpreter dependent—limited experience in some centers.

IVP
Pros: Traditional gold standard.
Cons: Cannot evaluate other organ systems. Will miss AAA.

Ultrasound+KUB
Pros: Rapid ED test to detect stone. 500cc IV fluid bolus may increase diagnostic yield. US alone useful in pregnancy to detect obstruction.
Cons: Cannot always localize stone. Less sensitive if no obstruction.

KUB
Pros: Readily available but not recommended.
Cons: Poor sensitivity/specificity.

Abdominal Aortic Aneurysm

CT
Pros: Readily available. Accurate in many studies.
Cons: If patient is clinically unstable, imaging may be a death sentence. Notify surgeon of unstable patients with suspicion of AAA. *Immediate* bedside US is helpful in cases of unclear diagnosis. CT misses 50% or more with aortoenteric fistula, inflammatory aneurysm, and aorto-venous fistula. In one study, CT was only 79% sensitive and 76% specific in diagnosis of ruptured AAA.[103]

Continued on page 7

Table 4. Weighing The Pros And Cons Of Diagnostic Tools For Various Disease Entities. (continued)

Angiography
Pros: Traditional standard. Fairly accurate in the stable patient.
Cons: If patient is clinically unstable, imaging may be a death sentence. Notify surgeon of unstable patients with suspicion of AAA. *Immediate* bedside US is helpful in cases of unclear diagnosis. Angiography can give false negative due to intraluminal clot.

MRI
Pros: Accurate in the stable patient. MRI identifies most complications although is less well-studied than CT or angiography.
Cons: If patient is clinically unstable, imaging may be a death sentence. Notify surgeon of unstable patients with suspicion of AAA. *Immediate* bedside US is helpful in cases of unclear diagnosis.

Ultrasound
Pros: Accurate bedside test. Sensitive for aneurysm.
Cons: Insensitive to retroperitoneal blood. May also miss small amounts of intraperitoneal blood—one study found that leakage of AAA was detected by US in only 4%.[104] Poor at identifying complications of AAA and branch vessel involvement.

Intestinal Infarction/ Ischemia

Plain films
Pros: Can obtain immediately at bedside and may reveal thumb-printing if lucky.
Cons: Most films are normal or reveal ileus or bowel obstruction, falsely reassuring the emergency physician and surgeon.

Angiography, CT, MR
Pros: Accurate; available in most institutions.
Cons: None are completely accurate in establishing the diagnosis and have equivalent reported sensitivities.

Ectopic Pregnancy

Ultrasound (transabdominal; ß-HCG >6000)
Pros: An IUP is best evidence against ectopic pregnancy. Rapid, inexpensive, readily available.
Cons: 1 out of 35,000 chance of a heterotopic pregnancy—IUP plus an ectopic pregnancy. Transabdominal US less able to visualize early IUP.

Ultrasound (endovaginal; ß-hCG >2000)
Pros: More sensitive than transabdominal US for early IUP. Skill easily learned by the emergency physician.
Cons: See above regarding heterotopic pregnancy. Many studies are non-diagnostic (i.e., no IUP and no adnexal mass). May need repeat exam in several days.

Serum progesterone
Pros: Serum progesterone 25ng/mL or higher has 98% negative predictive value to rule out ectopic pregnancy.
Cons: Stat progesterones not universally available.

ß-hCG
Pros: Bedside urine test is rapid and accurate. Negative test essentially rules out the diagnosis of ectopic pregnancy.
Cons: Rare false-negatives with very early pregnancy (days after conception). Ectopic pregnancy is not excluded by low (or high) ß-hCG. Doubling of ß-hCG in 48 hours does not rule out ectopic pregnancy—about 10% of ectopics may double ß-hCG.

Testicular Torsion

Color Doppler, radionuclide scanning
Pros: Both have comparable sensitivities and specificities and are accurate in making the diagnosis.
Cons: Clinical examination is the best initial screen for testicular torsion. If testicular torsion is strongly suspected, immediately consult a urologist or perform manual detorsion. Delay in operation to obtain an imaging study may result in loss of an otherwise viable teste.

Urinary Tract Infection

CT, IVP, US
Pros: CT and IVP are sensitive to stone disease; US is sensitive for obstruction. CT is excellent for perinephric abscess.
Cons: The emergency physician does not need to order advanced imaging studies for simple pyelonephritis. Clinical suspicion combined with a urinalysis compatible with pyelonephritis warrants treatment. Suspicion of an infected stone or perinephric abscess prompts consultation and CT or IVP.

Urine WBC (>10/HPF)
Pros: Fairly sensitive to UTI in adults.
Cons: False-positives and -negatives occur with all of the routine tests.

Bacteriuria
Pros: Fairly sensitive to UTI in adults.
Cons: False-positives and -negatives occur.

Leukocyte esterase
Pros: Inexpensive, easily available, more sensitive than nitrates.
Cons: Not specific for UTI.

Nitrate test
Pros: More specific than leukocyte esterase.
Cons: Not sensitive for UTI.

Gastroenteritis—Bacterial

Fecal leukocytes
Pros: Rapid, inexpensive.
Cons: Wide variation in interpretation of test.

Fecal leukocytes + fecal blood
Pros: Most accurate when taken together.
Cons: Clinical picture of fever and visible blood or mucus is as accurate as lab testing.

PID (Salpingitis)

WBC, ESR, CRP
Pros: Inexpensive, widely available.
Cons: Generally unnecessary; clinical diagnosis is key. WBC is more likely to mislead than illuminate in the distinction between PID and appendicitis.

Cervical WBC
Pros: Found in >90% of patients with PID.
Cons: Visual exam of the cervical os alone is adequate to detect mucopurulent cervicitis.

Ultrasound
Pros: Helpful to rule out TOA in high-risk patients—mass on pelvic exam, HIV patient with PID, toxicity. Useful in patients with unclear diagnosis, especially appendicitis vs. PID.
Cons: Not necessary for routine ED diagnosis of PID. Many patients ill enough to need US need consultation.

Ovarian Torsion

Color-flow Doppler
Pros: Excellent test.
Cons: Not widely available; operator-dependent.

Tool 1. **Sample Patient Chart For The Patient With Abdominal Pain.**

NAME: _____ **REG NUMBER:** _____

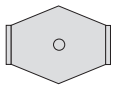
MALE: _____ **FEMALE:** _____ **AGE:** _____ **FORM FILLED BY:** _____

MODE OF ARRIVAL: _____ **DATE:** _____ **TIME:** _____

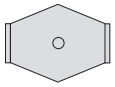
HISTORY

Circle: Yes or No

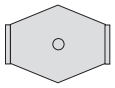
Site of pain at onset?
Mark



Site of pain at present?
Mark



Radiation of pain?
Mark



Nausea?
Yes No

Vomiting?
Yes No

Anorexia?
Yes No

Indigestion?
Yes No

Jaundice?
Yes No

Bowels:
Normal
Constipation
Diarrhea
Blood
Mucus

Aggravating factors:
Movement
Coughing
Respiration
Food
Other
None

Progression of pain:
Better
Same
Worse

Prev. similar pain?
Yes No

Pain?
Constant
Intermittent

Micturition:
Normal
Frequency
Dysuria
Dark
Hematuria

Relieving factors:
Lying still
Vomiting
Antacids
Food
Other
None

Duration of pain:
_____

Drugs for abd. pain?
Yes No

On medications?
Antibiotics
Steroids
Other

CAD?
Yes No

Prev. abd. surgery?
Yes No

Severity:
Moderate
Severe

Female—LMP
Pregnant?
Yes No
Vag. discharge?
Yes No
Dizzy/faint?
Yes No

PMH of:
Cancer
Diverticulosis
Pancreatitis
Kidney failure
Gallstones

Other signficant PMH?
Yes No

PHYSICAL

Degree of pain

1	2	3	4	5	6	7	8	9	10

Low ←——————————————→ **High**

Mark **I** for initial exam; Mark **R** for repeat exam

Temp? _____ **Pulse?** _____ **BP?** _____

Mood?
Normal
Upset
Anxious

Color?
Normal
Pale
Flushed
Jaundice
Cyanosis

Scars?
Yes No

Rebound?
Yes No

Guarding?
Yes No

Rigidity?
Yes No

Mass?
Yes No

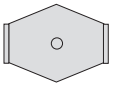
Murphy's sign present?
Yes No

Bowel sounds?
Normal
Absent
Increased

Intestinal movement?
Normal
Poor/nil
Peristalsis

Rectal-vaginal tenderness?
Left
Right
General
Mass
None

Location of tenderness



Initial diagnosis and plan:

Results:
Amylase ____
Blood count _____ (WBC) _____
Urine _____ X-ray _____
Other _____

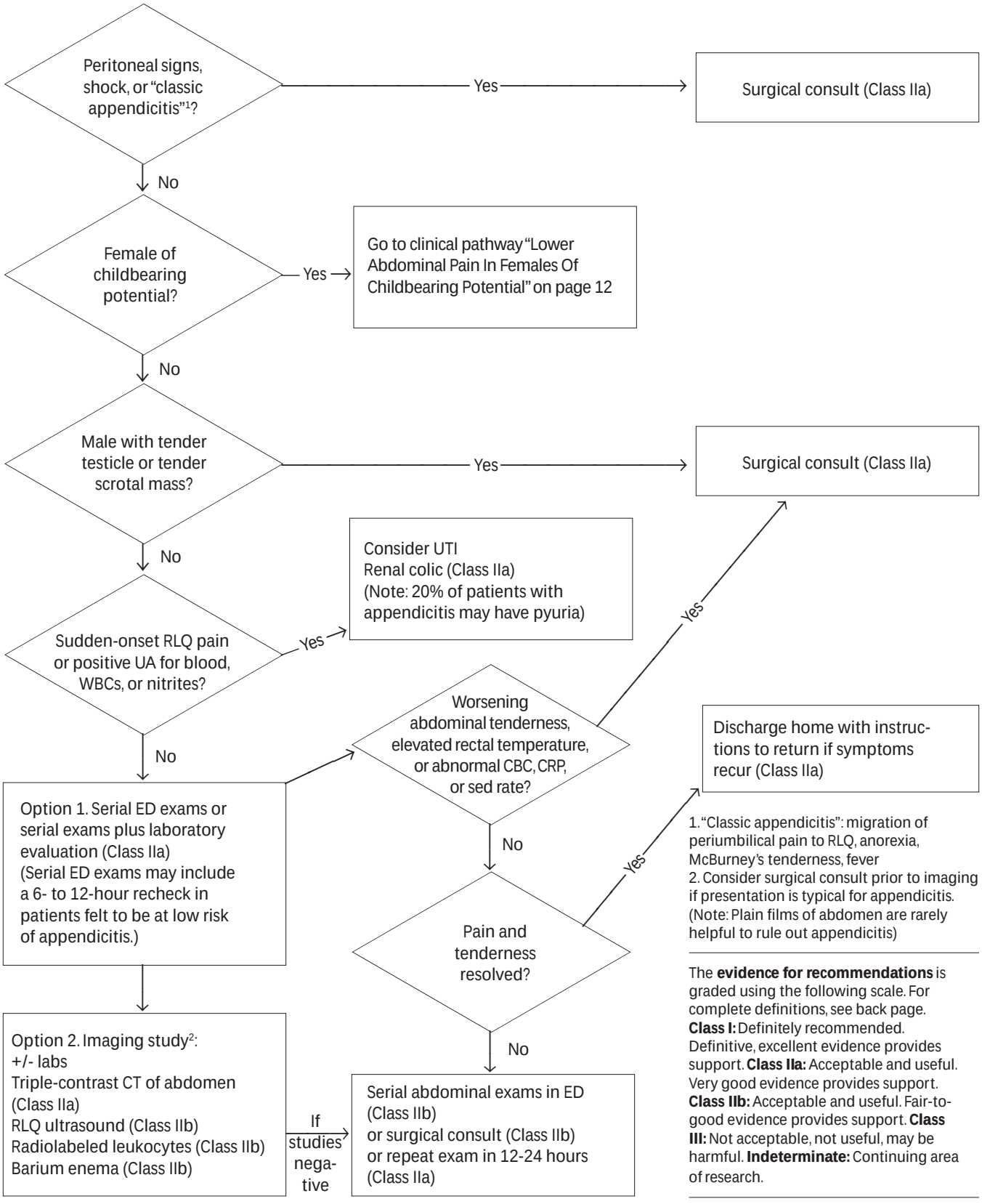
Diagnosis and plan after investigation:

Time: _____

Discharge diagnosis:

Adapted from the World Organization of Gastroenterology's Abdominal Pain Chart and the ACEP Clinical Policy for the Initial Approach to Patients Presenting with a Chief Complaint of Non-traumatic Acute Abdominal Pain.

Clinical Pathway: Patients With Right Lower Quadrant Pain (Under Age 50)

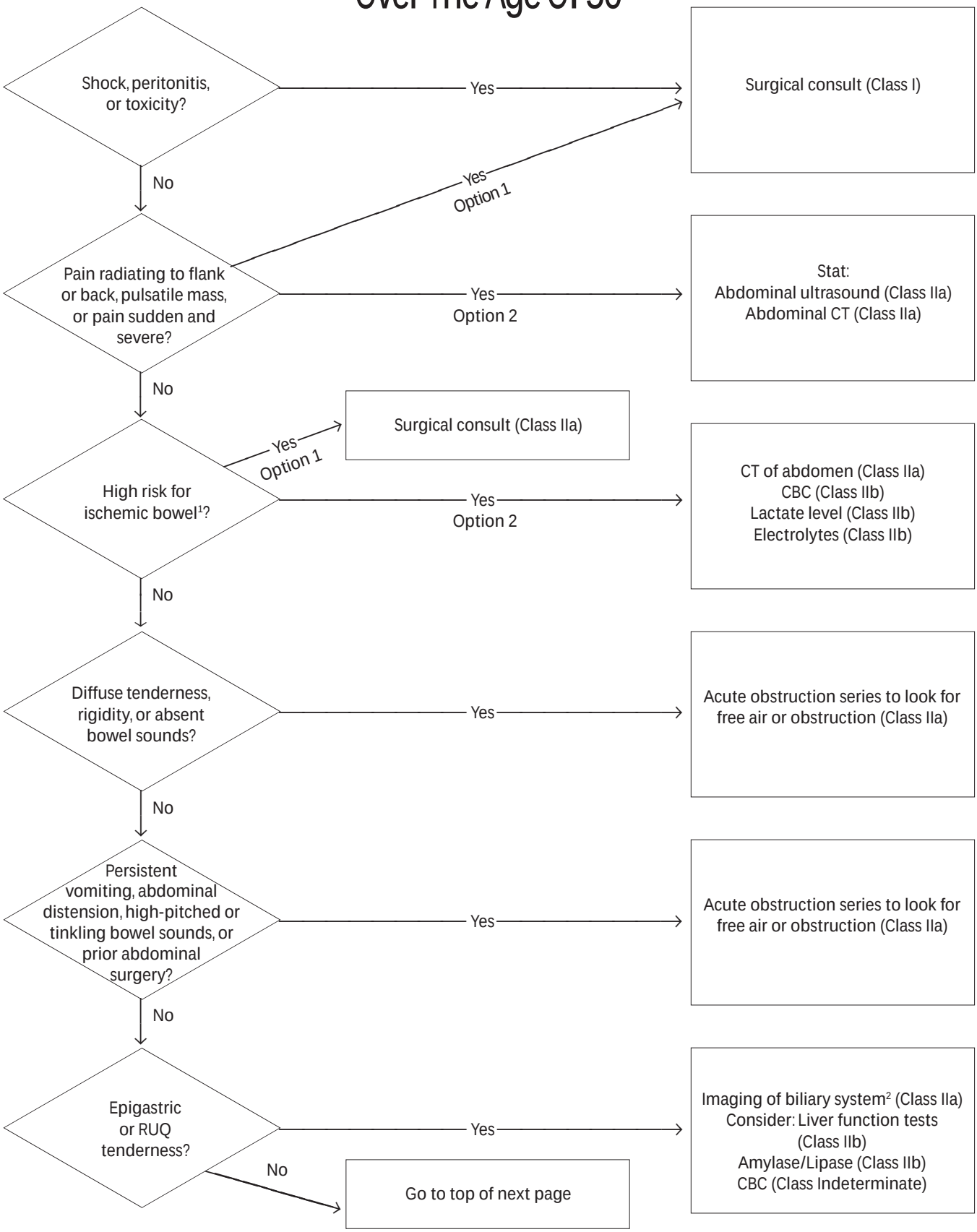


1. "Classic appendicitis": migration of periumbilical pain to RLQ, anorexia, McBurney's tenderness, fever
2. Consider surgical consult prior to imaging if presentation is typical for appendicitis. (Note: Plain films of abdomen are rarely helpful to rule out appendicitis)

The **evidence for recommendations** is graded using the following scale. For complete definitions, see back page. **Class I:** Definitely recommended. Definitive, excellent evidence provides support. **Class IIa:** Acceptable and useful. Very good evidence provides support. **Class IIb:** Acceptable and useful. Fair-to-good evidence provides support. **Class III:** Not acceptable, not useful, may be harmful. **Indeterminate:** Continuing area of research.

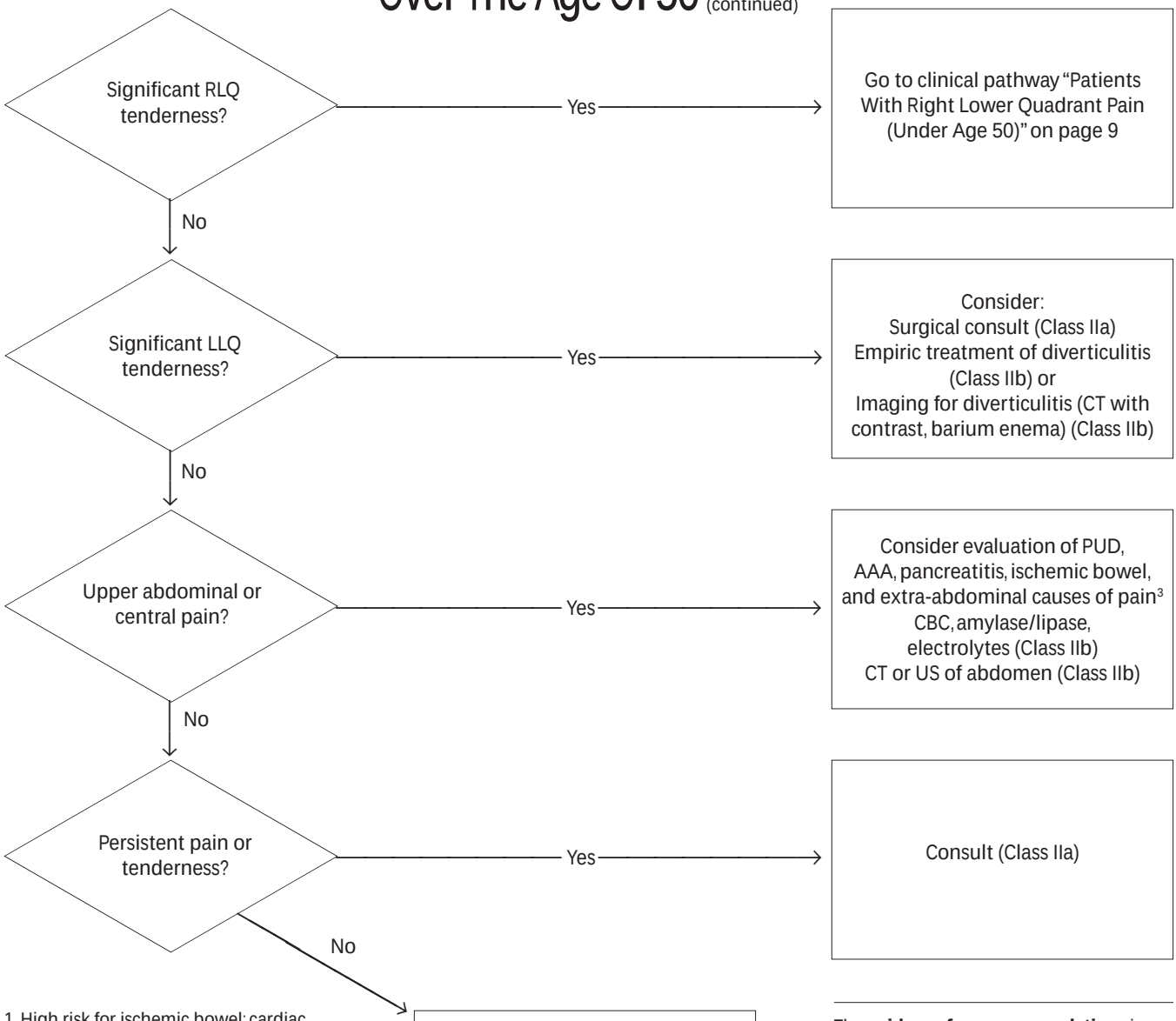
This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Clinical Pathway: Abdominal Pain In Patients Over The Age Of 50



This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Clinical Pathway: Abdominal Pain In Patients Over The Age Of 50 (continued)



1. High risk for ischemic bowel: cardiac disease (especially CHF), peripheral vascular disease, dysrhythmias (especially atrial fibrillation), bloody diarrhea, pain out of proportion to tenderness
2. Biliary imaging may include ultrasound, nuclear medicine scintigraphy, high-resolution CT
3. Extra-abdominal etiologies include myocardial ischemia, pneumonia, and metabolic disease

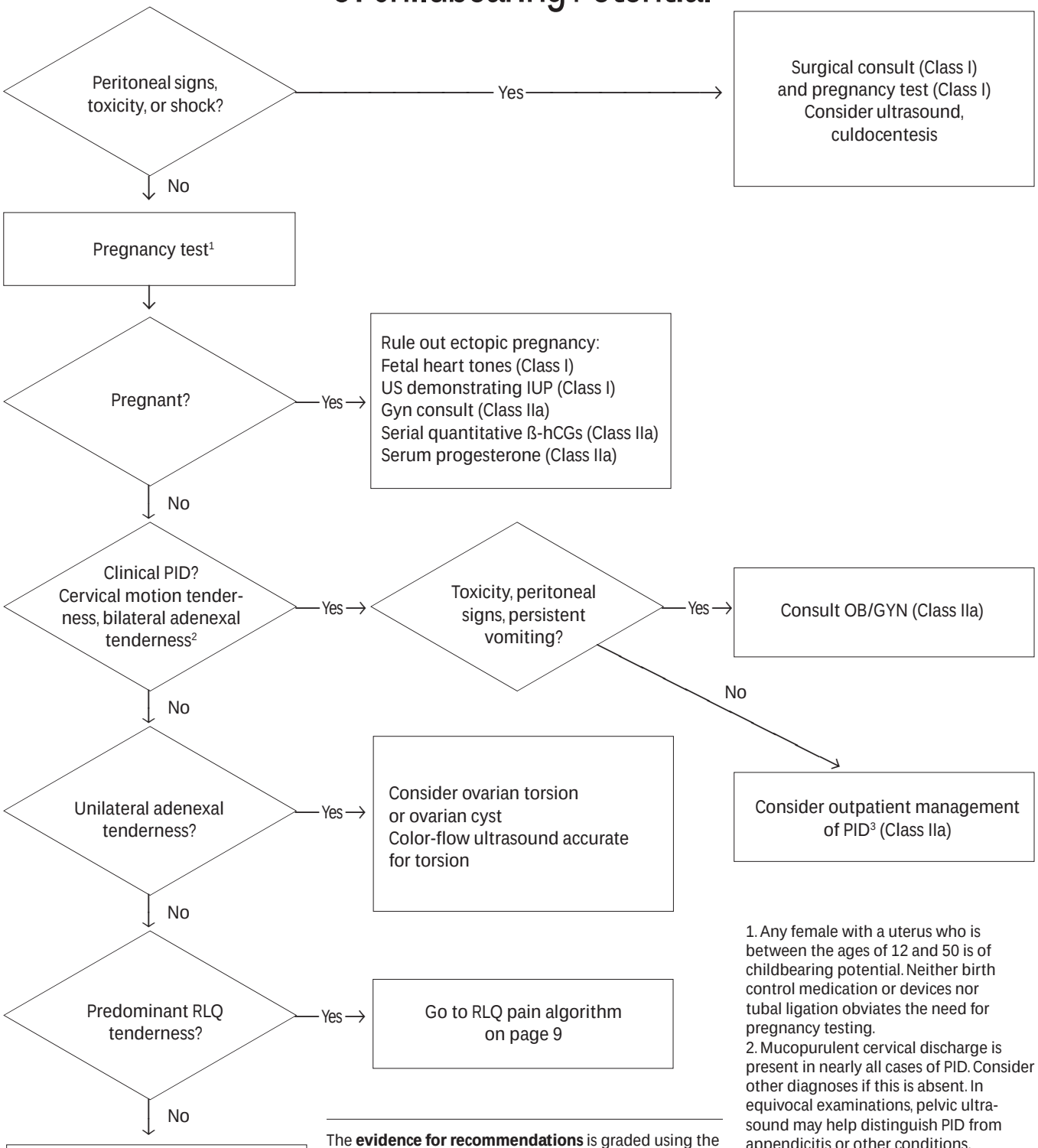
The **evidence for recommendations** is graded using the following scale. For complete definitions, see back page. **Class I:** Definitely recommended. Definitive, excellent evidence provides support. **Class IIa:** Acceptable and useful. Very good evidence provides support. **Class IIb:** Acceptable and useful. Fair-to-good evidence provides support. **Class III:** Not acceptable, not useful, may be harmful. **Indeterminate:** Continuing area of research.

Note: Abdominal pain in the elderly is often associated with significant surgical disease.

Extensive laboratory testing may be indicated if the diagnosis is in doubt and may include CBC with differential, lipase and/or amylase, electrolytes, and liver function tests. Helpful imaging studies include upright chest x-ray, flat and upright abdominal films, and abdominal ultrasound. High-resolution CT of the abdomen may be a valuable study if pain persists or the diagnosis remains in doubt. Obtain surgical consultation for patients with persistent pain or tenderness.

This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Clinical Pathway: Lower Abdominal Pain In Females Of Childbearing Potential



1. Any female with a uterus who is between the ages of 12 and 50 is of childbearing potential. Neither birth control medication or devices nor tubal ligation obviates the need for pregnancy testing.
2. Mucopurulent cervical discharge is present in nearly all cases of PID. Consider other diagnoses if this is absent. In equivocal examinations, pelvic ultrasound may help distinguish PID from appendicitis or other conditions.
3. Appendicitis in females of childbearing age is frequently misdiagnosed as PID or UTI. Neither CMT nor pyuria excludes the diagnosis of appendicitis. Instruct the patient to return to the ED or see her PMD if not better in 24 hours or if her condition worsens.

The **evidence for recommendations** is graded using the following scale. For complete definitions, see back page. **Class I:** Definitely recommended. Definitive, excellent evidence provides support. **Class IIa:** Acceptable and useful. Very good evidence provides support. **Class IIb:** Acceptable and useful. Fair-to-good evidence provides support. **Class III:** Not acceptable, not useful, may be harmful. **Indeterminate:** Continuing area of research.

This clinical pathway is intended to supplement, rather than substitute, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Continued from page 5

Radiology

Plain Films. The rate of positive findings on abdominal films is low in unselected patients, and, as a rule, abdominal radiographs do not suggest unsuspected diagnoses. Importantly, never rely on plain films to exclude surgical disease. Only a few serious abdominal conditions have specific radiologic findings. These include perforated viscus, bowel obstruction, and, occasionally, bowel ischemia. **Table 5** expands on the indications for abdominal plain films.

In most patients, such as those with suspected appendicitis or undifferentiated abdominal pain, plain films are likely to be normal or misleading. In one large series of such patients, nearly 40% of positive findings were inconsistent with the final diagnosis.[84] Plain films are not indicated in suspected appendicitis or cholecystitis, and they have limited utility in renal colic.[85] One retrospective study of plain abdominal radiography in patients 65 years and older found that 43% of patients with major surgical disorders had plain films that were either normal or misleading.[86] However, the combination of KUB and ultrasound is helpful in evaluating urinary stone disease. The finding of either hydronephrosis and / or calcification over the ureters provides a sensitivity nearly equal to that of IVP.[87]

Views. A single flat plate of the abdomen provides little information. Minimum views include an upright chest and supine abdomen. Some authorities believe that these two views will detect all major pathology, such as free air or obstruction.[88,89] Others suggest that an upright abdomen adds further information and should be included in the series.[90] Several studies have shown that free air may be absent on plain films in one-third to one-half of all patients with visceral perforation.[84,91-93]

Ultrasound

This technology is very operator dependent, and performance at one institution might not be replicated at another. However, ready availability in many EDs and relatively low cost make it attractive for evaluation of certain conditions. (See **Table 4**.)

Ultrasound images most solid intraabdominal organs, including the liver, spleen, gall bladder, pancreas, and kidneys. While frequently ordered for RUQ pain, physicians must not over-interpret the findings. The presence of stones does not mean that the patient's pain is biliary in nature, as the stones are often an incidental finding. Sonographic signs of cholecystitis, such as gall bladder wall thickening, pericholecystic fluid, ductal dilatation, and a sonographic Murphy's sign are more precise.

Ultrasonography is the diagnostic test of choice for many presumed gynecologic complaints. ED use of transvaginal sonography to rule out ectopic pregnancy represents a dramatic improvement in patient care.[94,95]

Table 5. Indications For Abdominal Plain Films.

Suspected Diagnosis	Clinical Findings
Perforated viscus*	Sudden-onset pain Rigid abdomen Decreased bowel sounds
Bowel obstruction*	Prior abdominal surgery Abdominal distention Abnormal bowel sounds High risk for obstruction or volvulus
Foreign body	Mental retardation Psychosis Suspicion of rectal foreign body

* Most important indications for plain films

Adapted from: Flak B, Rowley VA. Acute abdomen: Plain film utilization and analysis. *Can Assoc Radiol J* 1993;44:423-428; Eisenberg RL, Heineken P, Hedgcock MW, et al. Evaluation of plain abdominal radiographs in the diagnosis of abdominal pain. *Ann Intern Med* 1982;97(2):257-261.

CT Scan

Computed tomography (CT) has become the imaging modality of choice in many abdominal conditions. Helical CT is accurate for renal colic, appendicitis, diverticulitis, intraabdominal abscesses, and can rule out the diagnosis of AAA. (See **Table 4**.) Recent data regarding the use of helical CT with triple contrast (oral, rectal, and IV) is impressive. In patients with suspected appendicitis, the CT was 98% sensitive, specific, and accurate.[96] In the case of suspected appendicitis, triple-contrast helical CT can prevent unnecessary surgery and can prevent needless observation when an operation is indicated.[97] This strategy saves significant costs compared to traditional management based on serial clinical examinations and laboratory testing. These impressive results, however, may be related to the special expertise available in research institutions. Before this approach is widely adopted, studies in other hospitals are needed.

Of all of the caveats associated with the use of CT, the most important remains: "CT is a dark and lonely place where emergency patients go to die." Unstable patients do not belong in a radiology suite. They must first be resuscitated or managed in some other appropriate fashion. Hypotensive patients suspected of ruptured AAA need immediate surgery or, in the case of diagnostic uncertainty, an immediate bedside ultrasound.

Electrocardiogram

While all physicians recognize that angina or myocardial infarction can cause epigastric pain, the cardiac etiology is often missed in patients presenting with a chief complaint of abdominal pain. Indigestion is a high-risk complaint in the emergency department. Relief of pain with the so-called GI cocktail *does not* preclude myocardial ischemia. In fact, many such patients "cured" with the cocktail ultimately prove to have acute cardiac disease.[98] Patients over 40 years of age with unexplained epigastric pain and a non-tender abdomen benefit from electrocardiography. Obviously, the ECG may be normal in a patient with an acute MI. However, a normal ECG in a patient with atypical chest pain (epigastric pain) is at least reassuring.

Treatment

The treatment of the myriad *causes* of abdominal pain is beyond the scope of this article. However, the treatment of *pain* is a manageable topic. While proponents battle, the tide is shifting to more active pain management.

Analgesia In Acute Abdominal Pain

Traditionally, physicians withhold analgesia from patients with acute abdominal pain. This practice may derive from an unsupported remark in an early edition of Zachary Cope's *Diagnosis of the Acute Abdomen*. Conventional wisdom argued that narcotics would obscure the etiology of abdominal pain and mask the need for laparotomy. However, there is a growing body of evidence suggesting that administration of opioids to patients with abdominal pain is not only safe, but may in fact *aid* diagnosis.[99-102] Analgesics may facilitate the history and physical exam by reducing patient anxiety and relaxing the abdominal musculature. Small doses of intravenous narcotics titrated to pain control are unlikely to conceal a surgical emergency. However, patients given narcotics for abdominal pain should not be discharged simply because their pain is gone. In such a patient, serial ED exams, laboratory and radiologic studies, and possibly a 10-hour recheck in the ED may be prudent.

Controversies/Cutting Edge

CT Scanning

Recent reports highlight the value of CT in the diagnosis of appendicitis, renal colic, mesenteric ischemia, and evaluation of abdominal pain in the elderly. However, most studies are performed at major research centers using the finest equipment and subspecialty radiologists. Whether this experience will translate to the community hospital is a source of controversy.

Clinical Policies

Clinical policies have become the darling of hospital administrators and managed care organizations. They have the potential to decrease practice variability and reduce costs. Yet, despite the far-ranging interest in clinical policies, few data demonstrate that they perform any better than individual physician judgment. Regarding abdominal pain, reaching an evidence-based conclusion would require a multi-center, randomized trial to compare outcomes of patients managed with and without use of a clinical policy.

ED Ultrasound

Many physicians are concerned about the role of ED ultrasound in patients with abdominal pain. Some believe ultrasound performed by emergency physicians expedites patient care, while others (usually radiologists) argue that only radiologists possess the expertise to interpret these studies. Emergency physicians, unlike radiologists, perform a *focused* examination. They should not perform an ultrasound to "look around." Emergency medicine ultrasound should be directed to answer a specific question, such as, "Does this patient have an abdominal aortic aneurysm?" Important questions include: What is the utility of routine abdominal ultrasound in patients with abdom-inal pain? What is the sensitivity and specificity in the diagnosis of appendicitis, pancreatitis, and biliary and renal colic? Does ED ultrasound lead to premature closure in diagnosis? In other words, incidental gallstones may prompt an inappropriate diagnosis of biliary colic in a patient with a more serious disease, such as mesenteric ischemia. Researchers must evaluate the cost, patient length of stay, and accuracy of ED US studies.

Observation Units

The role of observation and serial examinations in the diagnosis of abdominal pain remains in evolution. ED chest pain centers have proven cost-effective in the evaluation of chest pain. Can the application of observational medicine to abdominal pain yield similar results? Again, multi-center prospective studies are lacking. Some patients clearly require consultation, while others have an obviously benign condition. Both of these groups are easy to manage. It's the borderline or "watershed" patients who may benefit from admission to an ED observation unit. But how do we identify this borderline patient? What are the costs, diagnostic accuracy, and outcomes of ED observation compared to consultation or discharge? The relative value of laboratory studies, serial examinations, and diagnostic imaging must be appraised.

Common Pitfalls/Medicolegal Issues

Patients with abdominal pain pose significant medicolegal risk to the emergency physician. The sidebar on page 16 lists the "Ten Excuses That Don't Work In Court"—some of the most common medicolegal pitfalls associated with abdominal pain cases.

Patients assigned an ED diagnosis of gastroenteritis, gastritis, urinary tract infection, PID, or constipation are more likely than others to be misdiagnosed.[5,8] **Table 6** (on page 16) lists the dangerous mimics every emergency medicine physician should be aware of.

Disposition

Despite patient expectations, the final diagnosis is less important than the proper disposition of surgical consult, admission, imaging test, prolonged ED observation, or discharge home. The emergency physician must recognize the patient who needs surgical consultation based on high-risk demographics, physical examination, or worrisome diagnostic studies. Timing of consultation is also important. Clearly, patients with suspected ruptured AAA or mesenteric ischemia require immediate surgical consultation. In many patients, the definitive diagnosis is best determined by laparotomy. Those who are clinically stable (e.g., presumed uncomplicated cholecystitis) can undergo definitive studies before consultation.

The ED remains the ultimate safety net. If timely follow-up in a physician's office is impractical, patients can return to the ED in 8-10 hours for reexamination—sooner if their pain worsens. While the value of the CBC or C-reactive

protein is debatable, a higher level drawn hours later may prove useful. Tenderness that was benign or vague on the initial examination may localize to the right lower quadrant on repeat examination. Other patients develop peritoneal signs in the intervening hours. Serial examinations improve the diagnostic accuracy at little expense. The choice of a repeat visit in 6-8 hours vs. placement in a clinical decision unit (observation unit) is a judgment based on both the likelihood of serious pathology and an estimate of whether the patient will return.

For those patients without a clear diagnosis who appear well enough for discharge, the emergency physician must stress that sometimes the diagnosis is not clear and emphasize the importance of follow-up and under what circumstances they should return immediately to the ED. Standard discharge instructions modified by the physician are a valuable way to underscore these points. (See **Tool 2** on page 17.)

Cost-Effective Strategies In Patients With Abdominal Pain

The cost of evaluating abdominal pain can increase rapidly during the course of ED evaluation. Reflexive testing is ingrained in medical training. Like automatons, we are programmed to believe that fever necessitates a CBC; belly pain, an x-ray. Before ordering a test, though, consider the likelihood that the results will change management. If the test is unlikely to have an impact on subsequent care, do not get the test. The following strategies help constrain runaway costs.

1. Limit abdominal x-rays.
X-rays have limited value in the diagnosis of abdominal pain. They are *rarely* helpful in suspected appendicitis, nonspecific abdominal pain, or gallbladder disease. Restricting films to patients with suspected obstruction or perforation is rational and cost-effective.

Risk Management Caveat: Criteria for abdominal films may be liberalized in the elderly. Abnormalities are more likely in this population and are associated with poor outcome.[96]

2. Limit CBCs.
The CBC is frequently misleading in patients with abdominal pain. It is often normal in patients with appendicitis and cannot distinguish between serious and benign abdominal conditions. It is unnecessary in patients with clinical presentation of gastroenteritis. Bedside hemoglobin adequately screens for anemia when necessary.

Risk Management Caveat: Liberalize criteria in the elderly, as leukocytosis in this population is associated with poor outcome. Order a CBC in patients consulted to surgery. Surgeons would rather gargle radioactive waste than operate without a CBC.

3. Limit electrolytes.
Most patients with nausea, vomiting, and diarrhea do not need electrolytes. Electrolytes double ED costs and quadruple ED length of stay.[105] Clinically significant electrolyte abnormalities (CSEA) occur in only 1% of adults 18-60 years old with gastroenteritis. These abnormalities are predicted by history of diuretic use, liver or kidney disease, and symptoms lasting more than 24 hours. CSEAs are not related to orthostatic vital signs.

Risk Management Caveat: Patients with altered mental status, serious underlying medical disease, or inability to communicate may require less restrictive criteria.

4. Urinalysis and urine cultures.
In most patients, obtain a dipstick urinalysis instead of microscopic UA. It is less expensive and generally as accurate. Do not order urine cultures for uncomplicated cystitis in women of childbearing age.[106]

Risk Management Caveat: The urinalysis is frequently abnormal in many conditions, including appendicitis and pelvic inflammatory disease. Urinary tract infection becomes a convenient explanation for abdominal pain that is actually due to a more serious etiology.

5. Limit testing in the *non-toxic* alcoholic with abdominal pain.
A serum amylase is a frequent, "knee-jerk" reaction to abdominal pain in the alcoholic. This test rarely provides valuable information, as amylase is usually elevated in alcoholics in the absence of abdominal pathology. While lipase is more specific for alcoholic pancreatitis, clinical criteria, not a number, should determine the need for admission. In non-toxic patients, skip the lab tests. Instead, look for improvement on serial abdominal examinations (possibly with the aid of a GI cocktail) and the ability to tolerate clear liquids.

Risk Management Caveat: Alcoholics have many reasons for abdominal pain, from the benign to the catastrophic—including gastritis, pancreatitis, alcoholic ketoacidosis, perforated viscus, or other intraabdominal calamities. Maintain eternal vigilance for serious conditions in alcoholics. However, a soft abdomen, normal mental status, and a healthy appetite usually indicate a favorable outcome.

6. Selectively use the IVP for renal colic.
Not all patients with a clinical presentation of renal colic need an IVP in the ED, particularly if the patient has a known history of stone disease. One cost-effective alternative is the combination of a flat plate of the abdomen and an ultrasound performed by the emergency physician. This strategy is sensitive and specific for obstructing ureteral stones.[107] Another strategy is selective IVP for patients who have persistent pain or vomiting after pain medication.[108] Patients who are sent home may have outpatient studies ordered by the consultant, should they fail to improve.

Risk Management Caveat: Two classes of patients with presumed renal colic are at high risk. The first is the elderly patient with flank pain and hematuria. Such patients may have an abdominal aortic aneurysm and require emergent abdominal CT or ultrasound. The second high-risk patient is one with a presumed ureteral stone and fever. Such a patient requires IV antibiotics, renal imaging (usually a helical CT), and emergent urology consultation.

7. Limit use of stool cultures.
Stool cultures rarely change emergency management. The patient is often better by the time the cultures return. Treat presumed bacterial enteritis based on clinical criteria such as travel history, high fever, blood or mucus in the stool, or fecal leukocytes.

Risk Management Caveat: Grossly bloody stools may occur with *E. coli 0157:H7*. Antibiotics may increase the risk of hemolytic-uremic syndrome.

Summary

The painful abdomen can humble the most arrogant physician. A seemingly benign abdomen can obscure serious disease. It is the elderly, immunosuppressed patients, and young women who are especially likely to suffer misdiagnosis. A structured history and physical examination using a pre-formatted chart may improve accuracy. Contrary to outdated teachings, judicious use of pain medication may actually assist in evaluation. Pitfalls in management include over-reliance on a single study (particularly the deceitful CBC and the treacherous plain film) and making an unsupported diagnosis. No managed care gnome can force a physician to document a specific disease on the chart. (Not yet, anyway!) Abdominal pain of undetermined etiology is preferable to a "forced" diagnosis of gastroenteritis or constipation. Serial examinations either using prolonged ED evaluation or a 10-hour recheck may prevent missed pathology. Correct disposition (transfer, hospital admission, or immediate surgery) is more important than a precise diagnosis in the ED. These precepts will ensure that you never rely on the "Ten Excuses That Don't Work In Court." ▲

Table 6. Dangerous Mimics.

True Diagnosis	Initial Misdiagnosis
Appendicitis	Gastroenteritis, PID, UTI
Ruptured abdominal aortic aneurysm	Renal colic, diverticulitis, lumbar strain
Ectopic pregnancy	PID, UTI, corpus luteum cyst
Diverticulitis	Constipation, gastroenteritis, pyelonephritis
Perforated viscus	Peptic ulcer disease, pancreatitis, nonspecific abdominal pain
Bowel obstruction	Constipation, gastroenteritis, nonspecific abdominal pain
Mesenteric ischemia	Gastroenteritis, constipation, ileus, small bowel obstruction
Incarcerated or strangulated hernia	Ileus or small bowel obstruction
Shock or sepsis from perforation, bleed, abdominal infection (in elderly)	Urosepsis or pneumonia (in elderly)

Ten Excuses That Don't Work In Court

In The Elderly:

1. "They were just constipated."
"Constipation" is a deadly diagnosis in the elderly. The elderly may go to their private MD for constipation, but not to the ED—at least not very often. "Constipated" patients may have bowel ischemia, volvulus, or intraabdominal or perirectal infection.

2. "I wish I'd thought of it."
Consider the diagnosis of mesenteric ischemia in older patients. The presence of cardiac or peripheral vascular disease, bloody diarrhea, or pain out of proportion to tenderness increases the chance of mesenteric ischemia.

3. "It sounded like a kidney stone."
Always consider the diagnosis of AAA ahead of the diagnosis of renal colic in geriatric patients. Thirty percent of patients with AAA may have hematuria. If a strong suspicion exists for AAA, consider an immediate surgical consult before sending the patient out of the ED for an imaging study.

4. "I should have called a surgeon."
Assume that the elderly patient with abdominal pain has surgical disease. Forty percent of geriatric patients who present to the ED with abdominal pain require surgery. The clinical exam is often deceptive. Geriatric patients may have a normal CBC and lack peritoneal signs despite an abdominal catastrophe.

In Women Of Childbearing Age:

5. "She said she couldn't be pregnant."
In the mind of a prudent emergency physician, women of childbearing age with abdominal pain are always pregnant—in their tubes. Perform a pregnancy test on *all* females between menarche and menopause if they have a uterus (unless they have fetal heart tones). Do not omit pregnancy testing based on reported sexual abstinence, tubal ligation, or contraceptive use.

6. "It looked like just another case of PID."
Consider appendicitis in women of childbearing potential despite a tender pelvic exam and/or pyuria. One-third of all such women who have appendicitis are initially misdiagnosed as having either PID or UTI.

In General:

7. "I thought it was just gastroenteritis."
It's preferable to give a diagnosis of "nonspecific abdominal pain," "undifferentiated abdominal pain," or "abdominal pain of unknown etiology" than to assign a specific but unsupported diagnosis. Gastroenteritis is a "wastebasket" diagnosis that may result in premature closure. A true diagnosis of gastroenteritis requires nausea, vomiting, and diarrhea.

8. "But the CBC was normal."
Do not rule out the diagnosis of surgical disease because a patient has a normal white blood cell count. Twenty percent of patients with appendicitis have a completely normal CBC. Plus, never whine in court.

9. "The pain was in the wrong spot!"
Consider the diagnosis of appendicitis in patients with right flank and right upper quadrant pain. Patients with retrocecal appendicitis present with minimal or no right lower quadrant tenderness.

10. "If only I had read the *Emergency Medicine Practice* article on abdominal pain..."

References

Evidence-based medicine requires a critical appraisal of the literature based upon study methodology and number of subjects. Not all references are equally robust. The findings of a large, prospective, randomized, and blinded trial should carry more weight than a case report.

To help the reader judge the strength of each reference, each reference will note (in bold type following the reference) pertinent information about the study, such as the type of study and the number of patients in the study. In addition, the most informative references cited in the paper, as determined by the author, will be noted by an asterisk (*) by the number of the reference.

1. Brewer R, Golden F, Hitch D, et al. Abdominal pain: An analysis of 1,000 consecutive cases in a university hospital emergency room. *Am J Surg* 1976;131:219-223. **Retrospective; 1,000 patients.**
2.* Powers RD, Guertler AT. Abdominal pain in the ED: Stability and change over 20 years. *Am J Emerg Med* 1995;13(3):301-303. **Retrospective; 1,000 patients.**
3.* Marco CA, Schoenfeld CN, Keyl PM. Abdominal pain in geriatric emergency patients: Variables associated with adverse outcomes. *Acad Emerg Med* 1998;5:1163-1168. **Retrospective.**
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Tool 2. **Sample Discharge Instructions For The Patient With Abdominal Pain.**

There are many causes of abdominal pain. Most pain is not serious and goes away, but some pain gets worse, changes, or will not go away. Please return to the emergency department or see your doctor right away if you (or your family member) experience any of the following:

1. Pain that gets worse or moves to just one spot.
2. Pain that gets worse if you cough or sneeze.
3. Pain that does not get better in 24 hours.
4. Inability to keep down liquids—especially if you are making less urine.
5. Fainting.
6. Blood in the vomit or stool.
7. High fever or shaking chills.
8. Swelling of the abdomen.
9. Any new or worsening problem.

Follow-up Instructions

1. Return to the emergency department in _____ hours for recheck.
2. See your doctor if not completely better in _____ days.
3. See your doctor in _____ days.

Medications

Take the following medications:

Additional Instructions

1. No alcohol.
2. No caffeine, aspirin, or cigarettes.

Remember that the emergency department is open 24 hours a day, every day, and we are always glad to see you.

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appendicitis management in children. *Arch Surg* 1981;116(7):885-887. **Review.**
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96.* Rao PM, Rhea JT, Novelline RA, et al. Helical CT technique for the diagnosis of appendicitis: Prospective evaluation of a focused appendix CT examination. *Radiology* 1997;202:139-144. **Prospective; 100 patients.**
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Physician CME Questions

1. A final diagnosis is possible in approximately what percent of ED patients with abdominal pain?
   a. 95%
   b. 90%
   c. 80%
   d. 60%

2. The most common cause of abdominal pain in the elderly is:
   a. biliary disease.
   b. appendicitis.
   c. peptic ulcer disease.
   d. cancer.

3. The best test for appendicitis is:
   a. the CBC.
   b. a plain film of the abdomen.
   c. serial physical examinations.
   d. a CRP.

4. The CBC:
   a. is always elevated in cases of appendicitis.
   b. can distinguish between surgical and nonsurgical disease.
   c. can distinguish between PID and appendicitis.
   d. is often misleading.

5. Narcotics given to patients with abdominal pain:
   a. are contraindicated, because they obscure surgical disease.
   b. may assist in diagnosis if given in small doses.
   c. allow the patient to be discharged if pain is relieved.
   d. produce tachypnea.

Class Of Evidence Definitions

Each action in the clinical pathways section (see pages 9-12) of *Emergency Medicine Practice* receives an alpha-numerical score based on the following definitions.

Class I
- Always acceptable, safe
- Definitely useful
- Proven in both efficacy and effectiveness
- Must be used in the intended manner for proper clinical indications

Level of Evidence:
- One or more large prospective studies are present (with rare exceptions)
- Study results consistently positive and compelling

Class IIa
- Safe, acceptable
- Clinically useful
- Considered treatments of choice

Level of Evidence:
- Generally higher levels of evidence
- Results are consistently positive

Class IIb
- Safe, acceptable
- Clinically useful
- Considered optional or alternative treatments

Level of Evidence:
- Generally lower or intermediate levels of evidence
- Generally, but not consistently, positive results

Class III:
- Unacceptable
- Not useful clinically
- May be harmful

Level of Evidence:
- No positive high-level data
- Some studies suggest or confirm harm

Indeterminate
- Continuing area of research
- No recommendations until further research

Level of Evidence:
- Evidence not available
- Higher studies in progress
- Results inconsistent, contradictory
- Results not compelling

Adapted from: The Emergency Cardiovascular Care Committees of the American Heart Association and representatives from the resuscitation councils of ILCOR: How to Develop Evidence-Based Guidelines for Emergency Cardiac Care: Quality of Evidence and Classes of Recommendations; also: Anonymous. Guidelines for cardiopulmonary resuscitation and emergency cardiac care. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Part IX. Ensuring effectiveness of community-wide emergency cardiac care. *JAMA* 1992;268(16):2289-2295.

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Needs Assessment: The need for this educational activity was determined by a survey of medical staff, including the editorial board of this publication; review of morbidity and mortality data from the CDC, AHA, NCHS, and ACEP; and evaluation of prior activities for emergency physicians.

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