Problem. A 34-year-old woman admitted for control of diabetes develops acute abdominal pain that increases in severity over several hours.

Immediate Questions

- A. What are the patient's vital signs?
- B. Where is the pain located?
- C. Does the pain radiate?
- D. When did the pain begin?
- E. What is the quality of the pain?
- F. What relieves the pain or makes it worse?
- G. Are there any associated symptoms?
- H. For women, what is the patient's menstrual history?
- I. What is the patient's medical history?
- J. What medications is the patient taking?

A. What are the patient's vital signs?

- Tachycardia and hypotension → circulatory or septic shock from perforation, hemorrhage, or fluid loss into the intestinal lumen or peritoneal cavity.
- Orthostatic blood pressure and pulse changes → volume loss.
- Fever → inflammatory conditions such as cholecystitis and appendicitis.
- Fever > 39 C → gangrene or perforation of a viscus should be suspected.
- Fever may not be present in elderly patients, patients on corticosteroids, or those who are immunocompromised.

B. Where is the pain located?

- Generally, pain arising from the GI tract is perceived in the midline because of the symmetric and bilateral innervation of these organs.
- Unilateral pain should prompt consideration of a disorder of organs with unilateral innervation such as the kidney, ureter, or ovary, although unilateral pain can also be seen in disorders arising from the gut.

B. Where is the pain located?

- midepigastric pain ← disorders of the stomach, duodenum, pancreas, liver, and biliary tract.
- Periumbilical pain ← disease of the small intestine, appendix, upper ureters, testes, and ovaries
- Lower abdominal pain ← processes in the colon, bladder, lower ureters, and uterus.
- Inflammation of the parietal peritoneum results in more severe pain that is well localized to the area of inflammation.

B. Where is the pain located?

- Referred pain (pain originating from a site more central than where it is perceived) occurs because the cutaneous dermatomes and visceral organs share the same spinal cord level.
- In addition, perceived abdominal pain may arise outside of the abdomen. For example, zoster involving the thoracic dermatomes may present as severe right upper quadrant pain.

DIFFERENTIAL DIAGNOSIS OF ACUTE **ABDOMINAL PAIN** BY LOCATION

- Right upper quadrant
  - Cholecystitis
  - Choledocholithiasis
  - Duodenal ulcer
  - Fitz-Hugh-Curtis syndrome
    - perihepatitis as a complication of gonorrhea or chlamydial infection in women
  - Hepatic adenoma rupture
  - Right lower lobe pneumonia
  - Pulmonary embolus

DIFFERENTIAL DIAGNOSIS OF ACUTE **ABDOMINAL PAIN** BY LOCATION

- Epigastric
  - Gastric ulcer
  - Gastritis
  - Pancreatitis
  - Esophagitis
  - Myocardial infarction
  - Cholecystitis
  - Choledocholithiasis

DIFFERENTIAL DIAGNOSIS OF ACUTE **ABDOMINAL PAIN** BY LOCATION

- Left upper quadrant
  - Gastritis
  - Peptic ulcer disease
  - Splenic infarct
  - Splenic hematoma
  - Colonic ischemia
  - Left lower lobe pneumonia
  - Pulmonary embolus

DIFFERENTIAL DIAGNOSIS OF ACUTE **ABDOMINAL PAIN** BY LOCATION

- Right lower quadrant
  - Appendicitis
  - Cecal diverticulitis
  - Crohn's disease
  - Ileitis
  - Ovarian cyst
  - Tubal pregnancy
  - Tubo-ovarian abscess

DIFFERENTIAL DIAGNOSIS OF ACUTE **ABDOMINAL PAIN** BY LOCATION

- Left lower quadrant
  - Diverticulitis
  - Inflammatory bowel disease
  - Colonic ischemia
  - Ovarian cyst
  - Tubal pregnancy
  - Tubo-ovarian abscess

DIFFERENTIAL DIAGNOSIS OF ACUTE **ABDOMINAL PAIN** BY LOCATION

- Periumbilical
  - Early appendicitis
  - Small bowel obstruction
  - Pancreatitis
  - Gastroenteritis
  - Abdominal aortic aneurysm

C. Does the pain radiate?

- Pain that becomes rapidly generalized implies perforation and leakage of fluid into the peritoneal cavity.
- Biliary pain can radiate from the right upper quadrant to the right inferior scapula.
- Pancreatic and abdominal aneurysmal pain may radiate to the back.
- Ureteral colic classically is referred to the groin and thigh.

D. When did the pain begin?

- Sudden onset suggests perforated ulcer, mesenteric occlusion, ruptured aneurysm, or ruptured ectopic pregnancy.
- A more gradual onset (> 1 hour) implies an inflammatory condition such as appendicitis, cholecystitis, diverticulitis, or an obstructed viscus such as bowel obstruction.

E. What is the quality of the pain?

- Intestinal colic occurs as cramping abdominal pain interspersed with pain-free intervals.
- Biliary colic is not a true colicky pain in that it usually presents as sustained persistent pain.
- The terms sharp, dull, burning, and tearing, although used by patients to describe pain, seldom assist in determining the cause.

F. What relieves the pain or makes it worse?

- Pain with deep inspiration is associated with diaphragmatic irritation, such as with pleurisy or upper abdominal inflammation.
- Patients with intestinal or ureteral colic tend to be restless and active, whereas patients with peritonitis attempt to avoid all motion. Coughing frequently exacerbates abdominal pain from peritonitis.

G. Are there any associated symptoms?

- Vomiting → intestinal obstruction or a visceral reflex caused by pain.
  In acute surgical abdomen, the vomiting usually follows rather than precedes the onset of pain.
- Hematemesis → gastritis or peptic ulcer disease.
- Diarrhea → gastroenteritis, also from ischemic colitis or inflammatory bowel disease.
- Obstipation (absence of passage of stool or flatus) → mechanical bowel obstruction.
- Hematuria → GU disease such as nephrolithiasis.
- Cough and sputum → lower lobe pneumonia

H. For women, what is the patient's menstrual history?

- A missed period in a sexually active woman suggests ectopic pregnancy.
- A foul vaginal discharge may indicate pelvic inflammatory disease.

I. What is the patient's medical history?

- Is there a history of peptic ulcer disease, gallstones, diverticulosis, alcohol abuse, abdominal operations suggesting adhesions, or an abdominal aortic aneurysm?
- Is there any known history of cardiac arrhythmias or other cardiac disease that could result in embolization to a mesenteric artery?
- Is there a history of a hypercoagulable state?

J. What medications is the patient taking?

- Is the patient already on chronic pain medications or steroids that mask the clinical picture?
- Does the patient use nonsteroidal anti-inflammatory agents or other medications that might lead to abdominal pain?
- Is the patient taking a medication associated with acute pancreatitis? (immunosuppressants, AIDS drugs, furosemide, thiazides, etc.)

Differential Diagnosis

- A. Intra-abdominal disease
- B. Extra-abdominal disease

A. Intra-abdominal disease

1. Hollow viscera.
   Perforation of a hollow viscus represents a surgical emergency.
   a. Upper abdomen. Esophagitis, gastritis, peptic ulcer disease, cholecystitis, cholelithiasis, and biliary colic.
   b. Midgut. Small bowel obstruction or infarction.
   c. Lower abdomen. Inflammatory bowel disease, appendicitis, large bowel obstruction, diverticulitis.

A. Intra-abdominal disease

2. Solid organ
   a. Hepatitis
   b. Budd-Chiari syndrome (hepatic vein thrombosis)
   c. Pancreatitis
   d. Splenic infarction or abscess
   e. Pyelonephritis / urolithiasis / renal infarction

3. Pelvis
   a. Pelvic inflammatory disease
   b. Ruptured ectopic pregnancy

A. Intra-abdominal disease

4. Vascular system
   a. Ruptured aneurysm
   b. Dissecting aneurysm
   c. Mesenteric thrombosis or embolism

5. Spontaneous bacterial peritonitis

B. Extra-abdominal disease

- 1. Diabetic ketoacidosis
- 2. Acute adrenal insufficiency
- 3. Acute porphyria
- 4. Pneumonia involving lower lobes
- 5. Pulmonary embolism involving lower lobes
- 6. Pneumothorax
- 7. Herpes zoster of thoracoabdominal dermatomes
- 8. Myocardial infarction
- 9. Lead toxicity

C. Special populations

1. Elderly patients. Pain is often present without signs and symptoms commonly seen in younger patients.
2. Patients with HIV.
3. Patients with coagulopathies including hemophilia and patients taking warfarin.
   - Hematoma of bowel wall.

PHYSICAL FINDINGS

WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Perforated viscus
  Scaphoid, tense abdomen; diminished bowel sounds (late); loss of liver dullness; guarding or rigidity

PHYSICAL FINDINGS

WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Peritonitis
  Motionless, absent bowel sounds (late); cough and rebound tenderness; guarding or rigidity

PHYSICAL FINDINGS

WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Inflamed mass or abscess
  Tender mass (abdominal, rectal, or pelvic); punch tenderness; special signs (Murphy's, psoas, or obturator)

PHYSICAL FINDINGS

WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Intestinal obstruction
  Distention; visible peristalsis (late); hyperperistalsis (early) or quiet abdomen (late); diffuse pain without rebound tenderness; hernia or rectal mass (some)

PHYSICAL FINDINGS
WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Paralytic ileus
  - Distention; minimal bowel sounds; no localized tenderness

PHYSICAL FINDINGS
WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Ischemic or strangulated bowel
  - Not distended (until late); bowel sounds variable; severe pain but little tenderness; rectal bleeding (some)

PHYSICAL FINDINGS
WITH VARIOUS CAUSES OF ACUTE ABDOMEN.

- Bleeding
  - Pallor, shock; distention; pulsatile (aneurysm) or tender (eg, ectopic pregnancy) mass; rectal bleeding (some)

A. Physical examination key points

1. Vital signs and general appearance
   - Does the patient appear uncomfortable?
   - Is the patient jaundiced?
   - Is there a position that provides some relief of the pain?
   - Patients with peritonitis resist movement, whereas patients with colic writhe in pain.

A. Physical examination key points

2. Lungs
   - Percuss for dullness at the bases, which suggests a pleural effusion or consolidation.
   - In addition to dullness, crackles or bronchial breath sounds suggest a pneumonia, infarction, or atelectasis associated with decreased inspiratory effort because of pain.
   - A friction rub suggests pleuritis as a cause of upper abdominal pain.

A. Physical examination key points

3. Heart
   - Look for jugular venous distention, S3 gallop, or a displaced apical impulse indicative of congestive heart failure that might predispose to passive congestion of the liver or mesenteric ischemia.
   - An irregular pulse could indicate atrial fibrillation, which might result in mesenteric artery embolism.
   - Pericarditis is suggested by a friction rub and could be associated with upper abdominal discomfort.

A. Physical examination key points

4. Abdomen

- a. Inspection.
  Examine for distention (obstruction, ileus, ascites), ecchymoses (hemorrhagic pancreatitis), caput medusae (portal hypertension), and surgical scars (adhesions).
- b. Auscultation.
  Listen for bowel sounds (absent or an occasional tinkle with ileus, hyperperistaltic with gastroenteritis, high-pitched rushes with small bowel obstruction).

A. Physical examination key points

4. Abdomen

- c. Percussion.
  Tympany is associated with distended loops of bowel. Shifting dullness and a fluid wave suggest ascites with peritonitis.
- d. Other signs.
  Pain with active hip flexion or with extension of the patient's right thigh while lying on the left side (psoas sign) could result from an inflamed appendix. Obturator sign (pain on internal rotation of the flexed thigh) can occur with appendicitis.

A. Physical examination key points

5. Rectum

Evaluation of acute abdominal pain is not complete until a rectal exam has been performed. A mass suggests the presence of rectal carcinoma. Lateral rectal tenderness occurs with appendicitis, a condition in which examination of the abdomen may not reveal localized findings. If stool is present, evaluate for occult blood.

A. Physical examination key points

6. Female genitalia

Examine for pain with cervical motion and cervical discharge that may suggest pelvic inflammatory disease.

Palpate for adnexal masses that would indicate an ectopic pregnancy, ovarian abscess, cyst, or neoplasm.

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- Murphy's sign

  Cessation of inspiration during right upper quadrant examination

  → Acute cholecystitis

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- McBurney's sign

  Tenderness located midway between the anterior superior iliac spine and umbilicus

  → Acute appendicitis

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- Cullen's sign
  Periumbilical bluish discoloration
  → Retroperitoneal hemorrhage,
  Pancreatic hemorrhage,
  AAA rupture

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- Grey Turner's sign
  Bluish discoloration of the flanks
  → Retroperitoneal hemorrhage,
  Pancreatic hemorrhage
  AAA rupture

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- Kehr's sign
  Severe left shoulder pain
  → Splenic rupture
  Ectopic pregnancy rupture

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- Obturator sign
  Pain with flexed right hip internal rotation
  → Appendicitis

PHYSICAL SIGNS IN PATIENTS WITH ACUTE **ABDOMINAL PAIN**

- Psoas sign
  Pain when raising a straight leg against resistance
  → Appendicitis (right side)

B. Laboratory data

1. Hematology

An increased hematocrit suggests hemoconcentration from volume loss (pancreatitis).

A low hematocrit may suggest a process that has resulted in chronic blood loss or possibly acute intra-abdominal hemorrhage or an acute gastrointestinal (GI) hemorrhage. With acute blood loss, however, the hematocrit may not decrease for several hours.

An elevated white blood cell count suggests an inflammatory process such as appendicitis or cholecystitis.

B. Laboratory data

2. **Electrolytes, BUN, creatinine**.
   Bowel obstruction with vomiting can result in hypokalemia, azotemia, and volume contraction alkalosis.
   A strangulated bowel or sepsis may result in a metabolic gap acidosis. An elevated BUN/creatinine ratio is seen with volume depletion and GI bleeding.

B. Laboratory data

3. **Liver function tests** including bilirubin, transaminases, and alkaline phosphatase. Results are elevated in acute hepatitis, cholecystitis, and other biliary tract disease.

B. Laboratory data

4. **Amylase/lipase**
   Markedly elevated levels are associated with pancreatitis. However, in up to 30% of patients with acute pancreatitis, amylase may be initially normal, especially in patients with lipemic serum.
   Conversely, amylase can also be elevated in conditions other than pancreatitis, such as acute cholecystitis, perforated ulcer, small bowel obstruction with strangulation, and ruptured ectopic pregnancy.
   Serum lipase helps to differentiate pancreatitis from other causes of hyperamylasemia.

B. Laboratory data

5. Arterial blood gases.
   Hypoxemia is often an early sign of sepsis and may occur with pancreatitis. As mentioned, metabolic acidosis may result from ischemic bowel or sepsis.
6. Pregnancy test.
   All premenopausal women with acute right or left lower abdominal pain should be tested for human chorionic gonadotropin levels to rule out ectopic pregnancy, regardless of whether or not they missed their last period.

B. Laboratory data

7. Urinalysis.
   Hematuria may indicate nephrolithiasis; pyuria and hematuria can be present in urinary tract infections. In addition, pyuria is occasionally present with appendicitis.
8. Cervical culture.
   Obtain a cervical culture for chlamydia and gonorrhea when pelvic inflammatory disease is suspected.

C. Radiology and other studies

1. **Flat and upright abdominal films**.
   These films can be readily obtained and may provide important information.
   Watch for the following indicators: gas pattern; evidence of bowel dilation; air fluid levels; presence or absence of air in the rectum; pancreatic calcifications; biliary and renal calcifications; aortic calcifications; loss of psoas margin (suggesting retroperitoneal bleeding); and presence or absence of air in the biliary tract.

C. Radiology and other studies

2. Chest film.

A chest x-ray may reveal lower lobe pneumonia, pleural effusion, or elevation of a hemidiaphragm indicating a subdiaphragmatic inflammatory process.

Free air under the diaphragm suggests a perforated viscus and is most often seen on the upright chest film. The sensitivity of this test has been reported as low as 38%.

C. Radiology and other studies

3. Ultrasound (US).

This readily obtainable and noninvasive test is the preferred modality for right upper quadrant pain or gynecologic disease. US may reveal the presence or absence of gallstones, biliary tract dilation, or ectopic pregnancy.

C. Radiology and other studies

4. Computed tomography (CT).

The most sensitive test when considering many possible diagnoses. CT has a sensitivity of 96% and a specificity of 83-89% for appendicitis compared with 75- 90% and 86-100%, respectively, for ultrasound.

The American College of Radiology, Expert Panel on Gastrointestinal Imaging, states that if the patient has fever or is HIV-positive, CT imaging is the preferred modality.

C. Radiology and other studies

5. Electrocardiogram (ECG).

An ECG is needed to rule out an acute myocardial infarction or pericarditis, which may present with acute upper abdominal pain.

6. Arteriography.

This may be necessary in patients in whom mesenteric artery ischemia is suspected

C. Radiology and other studies

7. Paracentesis.

With known ascites and acute abdominal pain, this test is required to rule out the possibility of spontaneous bacterial peritonitis. If ascites is suspected but has not been documented, an ultrasound should be performed before an attempted paracentesis.

C. Radiology and other studies

8. Other studies:

- a. Intravenous pyelogram
- b. Hepato-iminodiacetic acid (HIDA) scan, to rule out acute cholecystitis
- c. Contrast bowel studies, such as an upper GI and small bowel series, to look for evidence of occult perforation or mechanical obstruction. A barium enema may be helpful in evaluation for sigmoid or cecal volvulus.
- d. Endoscopic studies, such as panendoscopy, colonoscopy, or endoscopic retrograde cholangiopancreatography (ERCP).

Plan

A. Observation.

1. Surgery consultation.
   Any patient developing acute abdominal pain should be evaluated by a general surgeon.
2. Gastric decompression.
   When mechanical obstruction is suspected or vomiting is present, a nasogastric tube should be placed for decompression.
3. Intravenous fluids.
   Septic or circulatory shock should be treated with vigorous intravenous volume replacement. If hypotension persists, vasopressors such as dopamine may be needed

Plan

A. Observation.

4. Serial physical examinations.
   Periodic examinations by the same clinician are helpful in determining a change in the patient's condition and establishing a diagnosis or need for surgery.

Plan

B. Surgery.

Indications for an urgent operation without a period of observation or establishment of a specific preoperative diagnosis are:

Indication for Urgent Surgical Operation

Physical findings

- Involuntary guarding or rigidity, especially if spreading
- Increasing or severe localized tenderness
- Tense or progressive distention
- Tender abdominal or rectal mass with high fever or hypotension
- Rectal bleeding with shock or acidosis

Indication for Urgent Surgical Operation

Physical findings

- Equivocal abdominal findings along with
  - Septicemia (high fever, marked or rising leukocytosis, mental changes, or increasing glucose intolerance in a diabetic patient)
  - Bleeding (unexplained shock or acidosis, falling hematocrit)
  - Suspected ischemia (acidosis, fever, tachycardia)
  - Deterioration on conservative treatment

Indication for Urgent Surgical Operation

- **Radiologic findings**
  - Pneumoperitoneum
  - Gross or progressive bowel distension
  - Free extravasation of contrast material
  - Space-occupying lesion on CT scan with fever
  - Mesenteric occlusion on angiography .

Indication for Urgent Surgical Operation

- **Endoscopic findings**
  Perforated or uncontrollably bleeding lesion
- **Paracentesis findings**
  Blood, bile, pus, bowel contents, or urine

Table 4-1 -- Comparison of Common Causes of Acute Abdominal Pain

Condition	Onset	Location	Character	Descriptor	Radiation	Intensity
Appendicitis	Gradual	Periumbilical early; RLQ late	Diffuse early; localized late	Ache	RLQ	++
Cholecystitis	Rapid	RUQ	Localized	Constricting	Scapula	++
Pancreatitis	Rapid	Epigastric, back	Localized	Boring	Mid-back	++++
Diverticulitis	Gradual	LLQ	Localized	Ache	None	+++
Perforated peptic ulcer	Sudden	Epigastric	Localized early, diffuse late	Burning	None	+++
Small bowel obstruction	Gradual	Periumbilical	Diffuse	Cramping	None	++
Mesenteric ischemia/infarction	Sudden	Periumbilical	Diffuse	Agonizing	None	+++
Ruptured abdominal aortic aneurysm	Sudden	Abdominal, back, flank	Diffuse	Tearing	Back, flank	+++
Gastroenteritis	Gradual	Periumbilical	Diffuse	Spasmodic	None	+++
Pelvic inflammatory disease	Gradual	Either LQ, pelvic	Localized	Ache	Upper thigh	++
Ruptured ectopic pregnancy	Sudden	Either LQ, pelvic	Localized	Lightheaded	None	++

+ = mild, ++ = moderate, +++ = severe; LLQ = left lower quadrant; LQ = lower quadrant; RLQ = right lower quadrant; RUQ = right upper quadrant.

Feldman: Sleisenger & Fordtran's Gastrointestinal and Liver Disease, 8th ed ,2006

Differential Diagnosis of Chronic or Recurrent Abdominal Pain

- Structural (or Organic) Disorders
  - Peptic ulcer disease
  - Gallstones
  - Chronic pancreatitis
  - Abdominal neoplasms
  - Inflammatory bowel diseases
  - Mesenteric ischemia
  - Pelvic inflammatory diseases
  - Endometriosis
  - Abdominal adhesions
  - Intestinal obstruction
- Functional Gastrointestinal Disorders
  - Irritable bowel syndrome
  - Functional (nonulcer) dyspepsia
  - Functional abdominal pain syndrome
  - Levator ani syndrome
  - Biliary pain (gallbladder or sphincter of Oddi dysfunction