

## Abdominal Pain

(See also *Harrison's Principles of Internal Medicine*, 17<sup>th</sup> Edition, Chapter 14)

### Definition

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- Pain in the abdomen ranging from acute, life-threatening emergencies to chronic functional disease and disorders of several organ systems
- Evaluation of acute pain requires rapid assessment of likely causes and early initiation of appropriate therapy.
- A more detailed and time-consuming approach to diagnosis may be followed in less-acute situations.

### Epidemiology

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- Incidence
  - One of the most common presenting problems in emergency medicine
  - Accounts for ~10% of all emergency department visits
  - Half of healthy adults have abdominal pain on questioning.
- Age and sex
  - Dependent on cause of abdominal pain

### Mechanism

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- Pain originating in the abdomen
  - Inflammation of the parietal peritoneum
  - Obstruction of hollow viscus
  - Vascular disturbances
  - Abdominal wall
  - Distension of visceral surfaces
- Pain referred from extra-abdominal sources
- Metabolic causes
- Neurogenic causes
- Functional causes

### Symptoms & Signs

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#### Abdominal origin

- Inflammation of parietal peritoneum: pain characteristics
  - Quality: steady and aching
  - Location: directly over inflamed area with exact reference possible
  - Intensity: dependent on type and amount of material to which peritoneal surfaces are exposed in a given time period
    - Sudden release into peritoneal cavity of small quantity of sterile acid gastric juice causes much more pain than same amount of grossly contaminated neutral feces.

- Enzymatically active pancreatic juice causes more pain and inflammation than same amount of sterile bile containing no potent enzymes.
    - Blood and urine are often so bland they are detected only if contact with peritoneum is sudden or massive.
    - In bacterial contamination (e.g., pelvic inflammatory disease), pain is frequently of low intensity until bacterial multiplication has caused elaboration of irritating substances.
  - Rate at which irritating material is applied to peritoneum is important.
    - Perforated peptic ulcer: clinical picture dependent only on rapidity with which gastric juice enters peritoneal cavity
  - Pain is accentuated by pressure or changes in tension of peritoneum.
    - Produced by palpation or movement (e.g., coughing, sneezing)
    - Patient with peritonitis lies quietly in bed to avoid painful motion.
    - Patient with colic may writhe incessantly.
  - Tonic reflex spasm of abdominal musculature
    - Localized to involved body segment
    - Intensity of spasm is dependent on location and rate of development of inflammatory process and integrity of nervous system.
    - Spasm over perforated retrocecal appendix or perforated ulcer into lesser peritoneal sac may be minimal or absent because of protective effect of overlying viscera.
    - Slowly developing process often greatly attenuates degree of spasm.
  - Possibly minimal or no detectable pain or spasm in obtunded, seriously ill, debilitated elderly, or psychotic patients; even in catastrophic abdominal emergencies (e.g., perforated ulcer).
- Obstruction of hollow viscera: pain characteristics
  - Classically described as intermittent or colicky
    - Produces steady pain with occasional exacerbations
    - Not nearly as well localized as pain of parietal peritoneal inflammation
  - Obstruction of small intestine
    - Colicky pain
    - Usually periumbilical or supraumbilical
    - Poorly localized
    - As intestine becomes progressively dilated with loss of muscular tone, colicky nature may diminish.
    - With superimposed strangulating obstruction, pain may spread to lower lumbar region if there is traction on root of mesentery.
  - Colonic obstruction
    - Colicky pain of lesser intensity than that of small intestine
    - Often located in infraumbilical area
    - Lumbar radiation common
  - Acute distention of gallbladder
    - Steady rather than colicky pain; term *biliary colic* misleading
    - Usually pain in right upper quadrant with radiation to right posterior region of thorax or to tip of right scapula
  - Acute distention of common bile duct
    - Often pain in epigastrium radiating to upper part of lumbar region
    - Considerable variation is common; differentiation between this and acute distention of gallbladder may be impossible; typical subscapular pain or lumbar radiation is frequently absent.
  - Gradual dilatation of biliary tree (e.g., carcinoma of head of pancreas)
    - May cause no pain or only mild aching sensation in epigastrium or right upper quadrant
  - Distention of pancreatic ducts
    - Pain similar to distention of common bile duct

- Very frequently accentuated by recumbency and relieved by upright position
  - Obstruction of urinary bladder
    - Dull suprapubic pain, usually low in intensity
    - Restlessness without specific complaint of pain may be only sign of distended bladder in obtunded patient.
  - Acute obstruction of intravesicular portion of ureter
    - Severe suprapubic and flank pain that radiates to penis, scrotum, or inner aspect of upper thigh
  - Obstruction of ureteropelvic junction
    - Pain in costovertebral angle
  - Obstruction of remainder of ureter
    - Flank pain that often extends into same side of abdomen
- Vascular disturbances
  - Pain not always sudden or catastrophic
  - Embolism or thrombosis of superior mesenteric artery or impending rupture of abdominal aortic aneurysm
    - Pain may be severe and diffuse.
  - Occlusion of superior mesenteric artery
    - Pain may be mild, continuous, and diffuse for 2 or 3 days before vascular collapse or findings of peritoneal inflammation appear or may be severe and diffuse.
    - Early, insignificant discomfort is caused by hyperperistalsis rather than peritoneal inflammation.
    - Absence of tenderness and rigidity in presence of continuous, diffuse pain are characteristic of vascular disease.
  - Rupturing abdominal aortic aneurysm
    - Abdominal pain with radiation to sacral region, flank, or genitalia
    - Pain may persist over several days before rupture and collapse occur.
- Abdominal wall
  - Usually constant and aching
  - Movement, prolonged standing, and pressure accentuate discomfort and muscle spasm.
  - Hematoma of rectus sheath
    - Most frequently with anticoagulant therapy
    - Mass may be present in lower quadrants of abdomen.
    - Simultaneous involvement of muscles in other parts of body usually differentiates myositis of abdominal wall from intra-abdominal process that might cause pain in same region.

### Referred pain in abdominal diseases

- Diaphragmatic pleuritis from pneumonia or pulmonary infarction
  - Pain in right upper quadrant or supraclavicular area
- Referred pain of thoracic origin
  - Often accompanied by splinting of involved hemithorax with respiratory lag and decrease in excursion more marked than seen in intra-abdominal disease
  - Diaphragmatic pleuritis from pneumonia or pulmonary infarction
    - May cause pain in right upper quadrant or supraclavicular area
    - Apparent abdominal muscle spasm caused by referred pain
    - Will diminish during inspiratory phase of respiration
  - Palpation over area of referred pain in abdomen
    - Does not usually accentuate pain
    - In many instances, actually seems to relieve it

- Referred pain from spine
  - Usually involves compression or irritation of nerve roots
  - Characteristically intensified by certain motions (e.g., cough, sneeze, strain)
  - Associated with hyperesthesia over involved dermatomes
- Referred pain from testicles or seminal vesicles
  - Dull aching pain
  - Poorly localized
  - Generally accentuated by slightest pressure on testicles or seminal vesicles

### Metabolic abdominal crises

- May simulate almost any other type of intra-abdominal disease
- In certain instances (e.g., hyperlipidemia), metabolic disease may be accompanied by intra-abdominal process such as pancreatitis
  - Can lead to unnecessary laparotomy unless recognized
- C'1 esterase deficiency associated with angioneurotic edema
  - Often associated with episodes of severe abdominal pain
- Familial Mediterranean fever
  - Abdominal pain is hallmark.
- Pain of porphyria and lead colic
  - Severe hyperperistalsis prominent feature
  - Pain usually difficult to distinguish from that of intestinal obstruction
- Uremia or diabetes
  - Nonspecific pain
  - Pain and tenderness frequently shift in location and intensity.
- Diabetic acidosis
  - May be precipitated by acute appendicitis or intestinal obstruction
- Black widow spider bites
  - Intense pain and rigidity of abdominal muscles and back (an area infrequently involved in intra-abdominal disease)

### Neurogenic causes

- May occur in diseases that injure sensory nerves
  - Pain
    - Burning character
    - Usually limited to distribution of given peripheral nerve
    - Normal stimuli such as touch or change in temperature may be transformed into this type of pain.
    - May be precipitated by gentle palpation
    - Frequently present in patient at rest
  - Rigidity of abdominal muscles absent
  - Respirations not disturbed
  - Distension of abdomen not common
  - Demonstration of irregularly spaced cutaneous pain spots may be only indication of old nerve lesion underlying causalgic pain
- Pain arising from spinal nerves or roots
  - Comes and goes suddenly
  - Lancinating type
  - Not related to intake of food, distention of abdomen, or changes in respirations
  - May be caused by:
    - Herpes zoster
    - Impingement by arthritis
    - Tumors

- Herniated nucleus pulposus
- Diabetes
- Syphilis
- Severe muscle spasm (e.g., gastric crises of tabes dorsalis)
  - Common but is either relieved or not accentuated by abdominal palpation
- Pain is made worse by movement of spine and is usually confined to a few dermatomes.
- Hyperesthesia is very common.

### Functional causes

- Conforms to none of above patterns
- Irritable bowel syndrome (IBS)
  - Characterized by abdominal pain and altered bowel habits
  - Episodes of pain often brought on by stress.
  - Pain varies considerably in type and location.
  - Nausea and vomiting are rare.
  - Localized tenderness and muscle spasm are inconsistent or absent.

### Differential Diagnosis

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- Pain originating in abdomen
  - Parietal peritoneal inflammation
    - Bacterial contamination (e.g., perforated appendix, pelvic inflammatory disease)
    - Chemical irritation (e.g., perforated ulcer, pancreatitis, mittelschmerz)
  - Mechanical obstruction of hollow viscera (e.g., small or large intestine, biliary tree, ureter)
- Vascular disturbances
  - Embolism or thrombosis
  - Vascular rupture
  - Pressure or torsional occlusion
  - Sickle cell anemia
- Abdominal wall
  - Distortion or traction of mesentery
  - Trauma or infection of muscles
- Distention of visceral surfaces (e.g., hepatic or renal capsules)
- Pain referred from extra-abdominal source
  - Thorax (e.g., myocardial or pulmonary infarction, pneumonia, pericarditis, esophageal disease)
  - Spine (e.g., radiculitis from arthritis, herpes zoster)
  - Genitalia (e.g., torsion of the testicle)
- Metabolic causes
  - Exogenous
    - Black widow spider bite
    - Lead poisoning and others
  - Endogenous
    - Uremia
    - Diabetic ketoacidosis
    - Porphyrria
    - Allergic factors (C'1 esterase inhibitor deficiency)

- Neurogenic causes
  - Organic
    - Tabes dorsalis
    - Herpes zoster
    - Causalgia and others
  - Functional
    - IBS: one of the most common causes of abdominal pain

## Diagnostic Approach

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### General considerations

- Definitive diagnosis cannot always be established at initial examination.
  - Watchful waiting with repeated questioning and examination will often elucidate true nature of illness and indicate proper course of action.
- Few abdominal conditions require such urgent operative intervention that an orderly approach need be abandoned, no matter how ill the patient.
  - Only patients with exsanguinating intra-abdominal hemorrhage (e.g., ruptured aneurysm) must be rushed to the operating room immediately.
    - This is relatively rare.
    - Only a few minutes are required to assess critical nature of problem.
    - All obstacles must be swept aside, adequate venous access for fluid replacement obtained, and operation begun.
    - Many have died while awaiting unnecessary examinations (e.g., electrocardiograms, abdominal films).
    - There are no contraindications to operation when massive intra-abdominal hemorrhage is present.
  - GI hemorrhage can often be managed by other means.
- IBS
  - One of the most common causes of abdominal pain
  - Must always be kept in mind
  - Diagnosis based on clinical criteria after exclusion of demonstrable structural abnormalities
- Diseases of upper abdominal cavity, such as acute cholecystitis or perforated ulcer, are frequently associated with intrathoracic complications.
- Possibility of intrathoracic disease must be considered in every patient with abdominal pain, especially if pain is in upper part of abdomen.
- Thoracic and abdominal diseases frequently coexist and may be difficult or impossible to differentiate.
  - Patient with known biliary tract disease often has epigastric pain during myocardial infarction.
  - Biliary colic may be referred to precordium or left shoulder in patient who has suffered previously from angina pectoris.
- Consider metabolic origin whenever cause of abdominal pain is obscure.
  - If prompt resolution of pain does not result from correction of metabolic abnormalities, suspect underlying organic problem.

### Diagnostic approach

- Orderly, detailed history
  - Far more valuable than any laboratory or radiographic examination
    - Reasonably accurate diagnosis can be made on basis of history alone in majority of cases.
  - Computer-aided diagnosis provides no advantage over clinical assessment alone.

- Diagnosis is readily established in most instances of acute abdominal pain.
  - Success is not so frequent in patients with chronic pain.
- Chronological sequence of events is often more important than location of pain.
- Particular information obtained should include:
  - Location of pain
  - Radiation of pain
  - Exacerbating and ameliorating factors
  - Associated symptoms (fevers, chills, weight loss or gain, nausea, diarrhea, constipation, blood in the stool, jaundice, change in color of urine or stool, change in diameter of stool)
  - Family history of bowel disorders
  - Alcohol intake
  - Medication history (particularly NSAIDs)
  - Accurate menstrual history in females
  - Sexual history, contacts, risky behaviors, past sexually transmitted diseases
- Careful attention to extra-abdominal regions that may be responsible for abdominal pain
- Physical examination
  - There is no substitute for sufficient time spent in examination.
  - Simple critical inspection of patient (e.g., facies, position in bed, and respiratory activity) may provide valuable clues.
  - Measurement of vital signs; checking for orthostatic changes
  - Examination of skin and eyes for jaundice
  - Auscultation and percussion of the chest
  - Auscultation of the abdomen for bowel sounds
  - Palpation of the abdomen for masses, tenderness, and peritoneal irritation
  - Rectal examination and stool testing for occult blood
  - Pelvic examination
  - Amount of information gleaned is directly proportional to gentleness and thoroughness of examiner.
    - Once a patient with peritoneal inflammation has been examined brusquely, accurate assessment by next examiner becomes almost impossible.
    - Eliciting rebound tenderness by sudden release of deeply palpating hand in patient with suspected peritonitis is cruel and unnecessary.
    - Gentle percussion of abdomen (rebound tenderness on miniature scale) can be far more precise and localizing.
    - Asking patient to cough will elicit true rebound tenderness without need for placing hand on abdomen.
    - Forceful demonstration of rebound tenderness will startle and induce protective spasm in nervous or worried patient in whom true rebound tenderness is not present.
    - Palpable gallbladder will be missed if palpation is so brusque that voluntary muscle spasm becomes superimposed on involuntary muscular rigidity.
  - Abdominal signs
    - May be minimal; exceptionally meaningful if accompanied by consistent symptoms
    - May be virtually or totally absent in cases of pelvic peritonitis
  - Tenderness on pelvic or rectal examination in absence of other abdominal signs can be caused by operative indications such as:
    - Perforated appendicitis
    - Diverticulitis
    - Twisted ovarian cyst

- Auscultation
  - Bowel sounds may be misleading.
  - Strangulating small intestinal obstruction or perforated appendicitis may occur in presence of normal peristaltic sounds.
  - When proximal part of intestine above an obstruction becomes markedly distended and edematous, peristaltic sounds may lose characteristics of borborygmi and become weak or absent, even when peritonitis is not present.
  - Severe chemical peritonitis of sudden onset is usually associated with truly silent abdomen.
- Assessment of patient's state of hydration is important.
- Laboratory examinations (as indicated)
  - May be of value, yet rarely establish diagnosis
  - Complete blood count
  - Blood chemistries including blood urea nitrogen, glucose, bilirubin, amylase, and lipase
  - Urinalysis
- Radiologic studies (as indicated)
  - Plain and upright or lateral decubitus radiographs
  - Contrast enema
  - Ultrasonography
  - CT
  - Radioisotopic scans (HIDA)
  - Barium or water-soluble contrast study of upper GI tract
    - Useful in rare instances when diagnosis elusive
    - Avoid oral administration of barium sulfate if any question of obstruction of the colon
- Laparoscopy

### **Laboratory Tests**

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- Urinalysis
  - May reveal state of hydration
  - Rule out severe renal disease, diabetes, or urinary infection
- Complete blood count
  - Leukocytosis
    - Never single deciding factor for surgical intervention
    - Count >20,000/ $\mu$ L may be seen in perforation of viscus, pancreatitis, acute cholecystitis, pelvic inflammatory disease, and intestinal infarction.
    - Normal white blood cell count is not rare in perforation of abdominal viscera.
  - Diagnosis of anemia may be more helpful than white blood cell count especially when combined with history.
- Blood chemistries
  - Blood urea nitrogen, glucose, and serum bilirubin may be helpful.
  - Serum amylase: may be elevated in pancreatitis, perforated ulcer, strangulating intestinal obstruction, and acute cholecystitis.
    - Elevations do not rule out need for operation.
  - Serum lipase
    - May have greater accuracy than serum amylase
  - $\beta$ -human chorionic gonadotrophin levels in pre- or perimenopausal women
- Blood and urine cultures in patients with fever or unstable vital signs
- HIV testing, if relevant



## Imaging

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- Plain and upright or lateral decubitus radiographs
  - May be of value in cases of:
    - Intestinal obstruction
    - Perforated ulcer
    - Other conditions
  - Usually unnecessary in:
    - Acute appendicitis
    - Strangulated external hernias
- Barium or water-soluble contrast study of upper part of GI tract
  - May demonstrate partial intestinal obstruction that may elude diagnosis by other means
  - If there is any question of obstruction of colon, oral administration of barium sulfate should be avoided.
- Contrast enema may be diagnostic in suspected colonic obstruction (without perforation).
- Ultrasonography
  - Useful in detecting
    - Enlarged gallbladder or pancreas
    - Gallstones
    - Enlarged ovary
    - Tubal pregnancy
- Hepatobiliary iminodiacetic acid (HIDA )
  - May help differentiate acute cholecystitis from acute pancreatitis
- CT
  - May demonstrate
    - Enlarged pancreas
    - Ruptured spleen
    - Thickened colonic or appendiceal wall and streaking of mesocolon or mesoappendix characteristic of diverticulitis or appendicitis

## Diagnostic Procedures

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- Laparoscopy
  - Especially helpful in diagnosing pelvic conditions, such as:
    - Ovarian cysts
    - Tubal pregnancies
    - Salpingitis
    - Acute appendicitis
- Peritoneal lavage used only in cases of trauma
  - Has been replaced as diagnostic tool by ultrasound, CT, and laparoscopy

## Treatment Approach

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- Stabilize patient.
- Ascertain if urgent surgical intervention is required.
  - If so, establish venous access for fluid replacement and begin surgery immediately.
- Provide pain relief.
  - Narcotics or analgesics should not be withheld until definitive diagnosis or definitive plan is formulated.
  - Obfuscation of diagnosis by adequate analgesia is unlikely.
- Prescribe empiric antibiotic therapy if intra-abdominal infection suspected.

- Provide other symptomatic relief (e.g., antiemetics, antispasmodics).
- Definitive treatment is dependent on etiology of pain.

## Specific Treatments

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### Symptom relief

- Pain control
  - Opioid analgesics commonly used (e.g., hydromorphone: 1–2 mg SC or IM; meperidine: 75–100 mg IM)
  - Antacids or H<sub>2</sub>receptor antagonists for burning pain caused by gastric acid (famotidine: 20 mg/50 mL IV; ranitidine: 50 mg)
  - Intravenous ketorolac (15–30 mg) may be used for renal or biliary colic.
- Control of intractable emesis
  - Droperidol (2.5 mg IM)
  - Prochlorperazine (5–10 mg IM)
  - Promethazine (12.5–25 mg IM)
  - Trimethobenzamide (200 mg IM)
  - Above agents may cause mental status changes.
- Nasogastric tube with suction for suspected small-bowel obstruction

### Empiric antibiotics

- Second-generation cephalosporins combined with metronidazole (unless local antibiotic resistance)
  - Cefamandole (500 mg –1 g IV q4–8h)
  - Cefotetan (1–3 g IV q12h)
  - Cefoxitin (2 g q4–8h or 3 g q6h IV)
  - Metronidazole (loading dose: 15 mg/kg IV infusion over 1h; maintenance dose: 7.5 mg/kg IV infusion over 1h, q6h)
- Alternatives:  $\beta$ -lactam agents with  $\beta$ -lactamase antagonists
  - Ampicillin sulbactam (1.5–3 g q6h IV)
  - Piperacillin/tazobactam (3.375 g q6h IV)
  - Ticarcillin/clavulanate (200–300 mg/kg per d IV)
- Alternatives if patient recently took other antibiotics: carbapenem or cefepime
  - Imipenem (500 mg q6h to 1 g q8h IV)
  - Meropenem (1 g q8h IV)
- Antifungal agents may be necessary for immunocompromised patients.

### Definitive treatment

- Dependent on etiology of pain

### Monitoring

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- Careful follow-up with frequent reexamination (by the same examiner, when possible)

### Complications

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- Complications are dependent on etiology of abdominal pain but can include:
  - Sepsis
  - Peritonitis
  - Ruptured viscus

- Ischemic bowel
- Intra-abdominal hemorrhage
- Intestinal obstruction
- Urinary obstruction
- Splenic infarction
- Death

### Prognosis

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- Prognosis depends on the etiology, timely diagnosis, and appropriate treatment.

### Prevention

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- Possible preventive measures depend on underlying cause.

### ICD-9-CM

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- 789.00 Abdominal pain, unspecified site
- 789.0\_ Abdominal pain, (anatomic site specified by fifth digit)

### See Also

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- Abdominal Abscesses
- Abdominal Aortic Aneurysm
- Acute Appendicitis
- Acute Cholecystitis
- Acute Intestinal Obstruction
- Acute Pancreatitis
- Chronic Pancreatitis
- Gallstones
- Gastritis
- Irritable Bowel Syndrome
- Pelvic Inflammatory Disease
- Peptic Ulcer Disease
- Peritonitis

### Internet Sites

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- Professionals
  - Homepage-Physicians  
American College of Gastroenterology
- Patients
  - Abdominal pain  
MedlinePlus
  - Abdominal Pain  
American College of Gastroenterology

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## PEARLS

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- The workup of the patient with acute abdominal pain can be viewed as a 3-step process:
  - Patients who are hemodynamically unstable are at risk for having had a vascular catastrophe such as ruptured aortic aneurysm and go immediately to surgery.
  - The three conditions that next need to be evaluated are intestinal obstruction, peritonitis, and ruptured ectopic pregnancy. Outcome is influenced by delaying surgical intervention.
  - In a hemodynamically stable patient without obstruction, peritonitis, or ruptured ectopic pregnancy, evaluation can be more deliberative and is based on the location of the pain.
- Severe pathology may be masked in immunosuppressed and elderly subjects because of a compromised inflammatory response. Signs and symptoms of peritonitis may be muted.
- Referred abdominal pain is often perceived to be near the surface of the body.
- Left upper quadrant pain in a patient with atrial fibrillation (or otherwise at risk of thromboembolism) may indicate splenic infarct.