

Chapter 26

Abdominal Pain

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Key Points

- Wide range of pathologies may present with abdominal pain.
- Key to reach proper diagnosis is adequate history and physical examination along with laboratory tests and imaging.
- Disposition of patients with abdominal pain is as difficult as its diagnosis.
- Low threshold should be kept for high-risk patients.
- Life-threatening diseases should not be missed in emergency.

Introduction

- Abdominal pain is one of the most common reasons for emergency department visits. Incidence is around 10–12 % globally. Demographic factors like age, gender, ethnicity and family history affect its presentation.
- It is paramount for emergency physicians to have methodical approach in history, physical examination, investigation and treatment. Clinical suspicion of life-threatening diseases in high-risk patients is utmost important.

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Pathophysiology

- Many intra-abdominal and extra-abdominal diseases are responsible for abdominal pain.
- Nature of abdominal pain can be divided into three categories based on neurological pathways:
 - Somatic (parietal) pain:

It results from irritation of parietal peritoneum caused by inflammation, infection or chemical reaction. It is supplied by myelinated nerve fibres. It is localised and constant. As the disease process evolves and irritates parietal peritoneum, we can elicit tenderness, guarding and rigidity. The patient prefers to lie immobile.
 - Visceral pain:

It is caused by stretching of walls of hollow viscera, innervated by unmyelinated fibres. It is diffuse and intermittent, dull aching and colicky in nature. Patients keep tossing on the bed. It is felt in the abdominal region which correlates to the somatic segment of embryonic region. Foregut, midgut and hindgut structures (Table 26.1) relate to upper, middle and lower abdomen, respectively. Visceral pain can be perceived away from actual disease process, i.e. pain of acute appendicitis is felt around umbilicus initially as it corresponds to T10 somatic distribution.
 - Referred pain:

It is defined as a pain that is felt away from the site of origin. Common anatomical origin or same nerve root innervations are primary reasons for such pain (Fig. 26.1).

Clinical Features

- History:
 - Age and gender are important history points. Elderly patients with nonspecific complaints may have serious pathology. In females, obstetrics and gynaecological causes should be considered.

Table 26.1 Abdominal structures and its origin

Foregut	Stomach, liver, gall bladder, pancreas, first/second part of duodenum
Midgut	Third/forth part of duodenum, jejunum, ileum, appendix, caecum, ascending colon, transverse colon (proximal two thirds)
Hindgut	Transverse colon (distal one third), descending colon, sigmoid, rectum, genitourinary organs

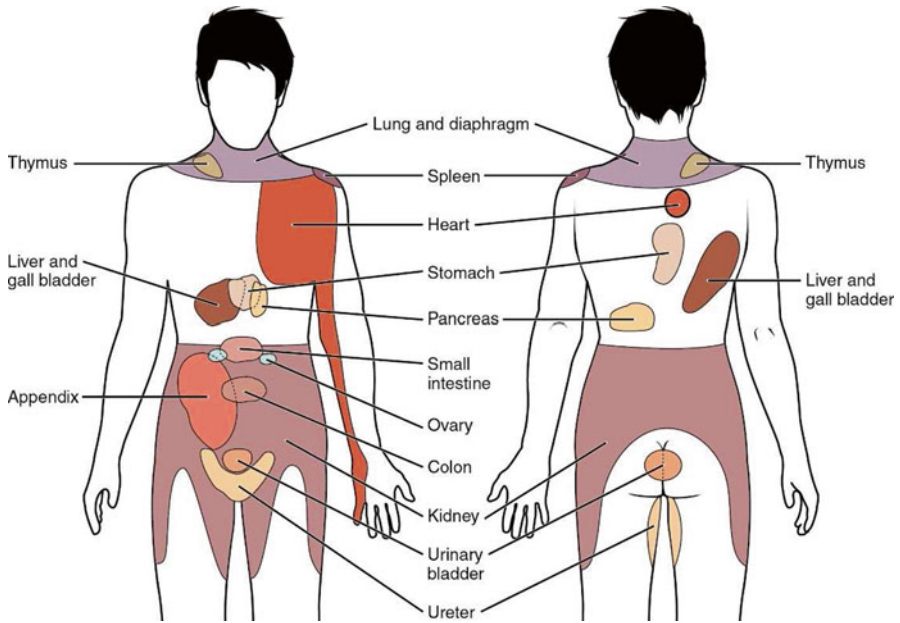


Fig. 26.1 Common locations for referred pain

- Pain can be described as (SCRIPT FADO):

Site

Character

Radiation

Intensity

Precipitating/relieving factors

Time duration

Frequency

Associated features

Diurnal variation

Onset

- *Gastrointestinal* complaints (anorexia, nausea, vomiting, altered bowel habits, haematemesis, haematochezia, abdominal distension, back pain), *genitourinary* problems (urinary complaints, foul discharge), *thoracic* complaints (chest pain, breathlessness, palpitation) and *constitutional* symptoms (fever, weight loss)
- *Past history*: Regarding previous similar episodes, admissions, investigations and treatment
- *Pre-existing medical illness*: Diabetes, hypertension, heart diseases, liver/renal diseases, HIV, STD and tuberculosis
- *Medication history*: Antibiotics, antiplatelets/anticoagulants, steroids, beta-blockers/calcium channel blockers, NSAIDs, chemotherapeutic agents, etc.
- *Surgical history*: Laparotomy, caesarean sections, etc.

Table 26.2 Physical examination correlation

<i>Respiratory</i>	
Restriction	Pleural effusion
Crackles	Pneumonia
<i>Cardiovascular</i>	
Gallop rhythm, arrhythmia	Myocardial infarction
<i>Abdomen</i>	
Caput medusa	Portal hypertension
Bulging flanks	Ascites
Visible hernia	Strangulated hernia
Tenderness, guarding, rigidity	Peritonitis
Shifting dullness	Ascites
Absent bowel sounds	Ileus, late sign of bowel obstruction
Psoas sign	Retrocaecal appendicitis
Obturator sign	Retrocaecal appendicitis, local abscess
Rovsing's sign	Appendicitis
Murphy's sign	Cholecystitis
Kehr's sign	Cholecystitis, perforation
Cullen's sign	Pancreatitis, retroperitoneal bleed
Renal angle tenderness	Renal stones
Grey Turner sign	Pancreatitis, ruptured abdominal aortic aneurysm
<i>Rectal</i>	
Tenderness	Prostatitis, anal fissure
Mass	Anorectal carcinoma, haemorrhoids
Empty PR examination	Intestinal obstruction
<i>Pelvic</i>	
Tenderness	Ectopic pregnancy, PID, ovarian cyst
Mass	Ovarian cyst, tumour, abscess

PID pelvic inflammatory disease, *PR* per rectal

- *Obstetric history*: Last menstrual period, previous pregnancies/deliveries, abortions, ectopic, IVF, IUCDs and other contraceptive measures
- Allergies, social history (alcohol/drug addiction), history of last meal and history of trauma
- *Physical examination*:
 - Despite the development of newer imaging modalities, i.e. ultrasound, CT scan and MRI, physical examination holds a key role in patient evaluation. Some specific signs are summarised in Table 26.2.
 - *General examination and vital signs*: Appearance, temperature, pulse, blood pressure, respiratory rate, oxygen saturation, GCS, blood glucose measurement and pain score.

- *Inspection*: With consent, inspect abdominal skin for scars (adhesions), dilated tortuous vein (spider angiomas, caput medusae), skin eruptions (herpes zoster), haemorrhage or signs of trauma (ecchymosis), foreign body and entry/exit wounds. Distension of abdomen (ascites, intestinal obstruction, ileus) and obvious masses (tumour, hernia, pregnancy, distended bladder, aneurysm) should be examined. Hernia orifices and external genitalia should not be forgotten.
- *Palpation*: Focus on locating the site of tenderness, signs of peritonism and palpation of masses. Abdomen is divided into right upper, right lower, left upper and left lower quadrants. Localisation of tenderness guides physician to generate differential diagnosis pertaining to that area. However, one can have diffuse abdominal pain spreading to more than one quadrant, i.e. pain of renal calculus extends from lumbar region to the iliac fossa and groin.

Patients with peritoneal irritation show tenderness, guarding/rigidity and pain with coughing. Guarding could be voluntary or involuntary. Due to lax abdominal wall musculature, guarding and rigidity may be absent in the elderly. Typical rebound tenderness is no longer considered an important examination tool due to painful procedure [1].

Abdominal aorta, liver and spleen sizes can be evaluated by palpation. Elderly patients with history of recent abdominal/flank/low back pain, known hypertension, pulsatile abdominal mass and feeble/absent distal pulses are suggestive of abdominal aortic aneurysm/dissection. Bedside ultrasound facilitates visualisation of increased abdominal aortic diameter and determines further surgical/medical management.

- *Percussion*: Helpful to assess free air intraperitoneum, degree of ascites, gas-filled bowel loops and peritonitis. It is not very useful in noisy ED.
- *Auscultation*: It gives information regarding bowel and vascular status. Absent or diminished bowel sound indicates ileus, mesenteric ischaemia, narcotic use or peritonitis. Hyperactive bowel sounds suggest small bowel obstruction, enteritis or early ischaemic intestine. High pitched tinkling sound reflects mechanical obstruction.
- *Digital rectal examination*: Useful for detection of perianal and rectal pathologies (haemorrhoids, fissure and fistula), intraluminal intestinal haemorrhage (dark maroon/red stool), proctitis and constipation (faecal impaction and intestinal obstruction). It is no more useful in diagnosing acute appendicitis [2].
- Emergency physicians should be vigilant and think of serious pathology in presence of any of the following clinical features:

Abdominal pain prior to vomiting
 Haematemesis/haematochezia
 Confusion

Toxic appearance
 Signs of shock/dehydration
 Localised/generalised tenderness
 Guarding/rigidity
 Absent bowel sound

Differential Diagnosis

Extensive differential considerations ranging from simple nonspecific abdominal pain to severe life-threatening conditions are mentioned in Table 26.3.

It is essential to suspect life-threatening conditions (Box 26.1) in haemodynamically unstable. Early resuscitation and stabilisation should be followed by investigations and hospitalisation of such patients.

Box 26.1 Life-Threatening Conditions

Acute intestinal obstruction
Viscus perforation
Traumatic rupture of the spleen/liver/bowel
Acute pancreatitis
Mesenteric ischaemia
Ruptured abdominal aortic aneurysm
Ruptured ectopic pregnancy
Myocardial infarction

Women of reproductive age group with abdominal pain should undergo pregnancy test and seek gynaecological consult and bedside ultrasonography if necessary. Consider ectopic pregnancy in such patients unless proven otherwise.

It is not necessary to reach proper diagnosis despite availability of various tests. It is incumbent to consider extra-abdominal causes (Table 26.4) in such patients before considering it as nonspecific.

Investigations

Laboratory evaluation in addition to history and clinical findings aid in diagnosis (Box 26.2).

Table 26.3 Important differential diagnosis

Condition	Epidemiology	Clinical features	Laboratory tests	Imaging	Complications
Acute gastritis	Any age	Epigastric burning pain, associated with food, increases on supine position Epigastric tenderness, no rebound tenderness	–	Upper GI endoscopy, biopsy for <i>H. pylori</i>	Gastro-oesophageal reflux disease, perforation
Peptic ulcer disease	Age >50 years, M>F, RF: <i>H. pylori</i> , NSAIDS use, smoking, alcohol	Severe epigastric pain 2–5 h after meals or at night, nausea, vomiting, early satiety Epigastric tenderness	Stool for occult blood (bleeding ulcer)	Upper GI endoscopy	Perforation, bleeding
Biliary tract disease	Age: 40–60 years, F>M, RF: childbearing age, obese, alcohol, OC pills	Epigastric/RUQ pain, radiating to right shoulder/subscapular, postprandial pain, nausea, fever Jaundice, RUQ tenderness, rebound tenderness, Murphy's sign	CBC, liver function test	Ultrasonography – most sensitive, CT scan in extrahepatic biliary obstruction, hepatobiliary scintigraphy	Septicaemia, pancreatitis
Acute pancreatitis	Age: 45–60 years, varies with aetiology; M>F, aetiology: gallstones, alcohol	Severe epigastric pain following meal, radiating to back, nausea, vomiting, fever, tachycardia, tachypnoea, hypotension, hyperthermia, epigastric tenderness, guarding, Cullen's sign, Grey Turner's sign	CBC, S. lipase, S. amylase, liver function test	Helical CT with contrast, ultrasonography for biliary tract pathology	Local complications: acute local fluid collection, pseudocyst, necrosis, abscess Systemic: septicaemia, ARDS

(continued)

Table 26.3 (continued)

Condition	Epidemiology	Clinical features	Laboratory tests	Imaging	Complications
Bowel obstruction	Any age, RF: h/o previous abdominal surgery	Crampy abdominal pain, nausea, vomiting, constipation, abdominal distension	CBC, S. electrolytes	X-ray abdomen standing, CT abdomen	Strangulation, incarceration
		Tachycardia, diffuse tenderness, tympanic note, hyperactive bowel sound, PR examination – empty			
Viscus perforation	Elderly age, RF: peptic ulcer, intestinal ulcers, carcinoma	Severe abdominal pain, lies still in bed, abdominal distension, vomiting, fever	CBC, S. electrolytes	X-ray chest, abdomen standing	Septicaemia
		Signs of shock, generalized abdominal tenderness, rigidity, signs of peritonitis			
Mesenteric ischaemia	Elderly population, M>F, RF: atherosclerosis, arrhythmia, CHF, recent MI, valvular diseases	Diffuse abdominal pain out of proportion, vomiting, diarrhoea	CBC, S. lactate, blood pH, S. amylase, S. creatinine kinase	CT abdominal angiography	Intestinal necrosis, metabolic acidosis
		Tachycardia, tachypnoea, hypotension, silent abdomen initially, signs of peritonitis			
Diverticulitis	Mean age: 60 years, M=F, sigmoid colon – most common site	Left lower quadrant pain, fever, change in bowel habits	CBC, stool for occult blood	CT abdomen	Perforation, fistula, obstruction, haemorrhage
		Abdominal tenderness, guarding, signs of peritonitis			

Appendicitis	Young adulthood, M>F	Periumbilical pain migrates to RLQ, nausea, vomiting, fever RLQ tenderness, guarding, rebound tenderness, psoas sign, obturator sign	CBC, S, electrolytes, urine examination	CT in adult and non-pregnant patients	Perforation, peritonitis, septicaemia, abscess
Ureteric colic	Age: 30–40 years, M>F	Severe colicky flank pain radiating to groin, nausea, vomiting, haematuria, tossing up in bed Flank tenderness	Urine examination, CBC	Spiral CT, ultrasonography in pregnancy	UTI
Ruptured abdominal aortic aneurysm	Age >50 years, M>F, RF: hypertension, atherosclerotic disease, DM, smoking family history	Severe sudden onset abdominal pain radiating to back, syncope, GI bleeding, shock Tachycardia, hypotension, palpable abdominal mass, unequal femoral pulses	–	Bedside ultrasonography, CT aortogram	Shock, limb ischaemia
Traumatic organ rupture	Age: 15–35 years; M>F	Abdominal pain, vomiting Signs of shock, injury marks	CBC	EEAST, abdominal sonography, CT abdomen	Shock, peritonitis, DIC
Ruptured ectopic pregnancy	Female of childbearing age, RF: IUCD, previous ectopic, PID	Sudden, severe pain, spotting, amenorrhoea Tachycardia, hypotension, peritoneal signs, adnexal mass and tenderness, cervical motion tenderness, blood in vaginal vault	UPT, S.HCG, CBC	FAST, transvaginal and transabdominal ultrasonography	Shock, septicaemia, DIC

(continued)

Table 26.3 (continued)

Condition	Epidemiology	Clinical features	Laboratory tests	Imaging	Complications
PID	Age: 15–49 years; RF: multiple partners, previous PID	Lower abdominal pain, fever, nausea, vomiting, vaginal discharge Cervical motion/uterine/adnexal tenderness, rebound tenderness	UPT, CBC, vaginal swab test for gonorrhoea/chlamydia	Transvaginal ultrasonography	Tubo-ovarian abscess, ectopic pregnancy
<i>C. difficile</i> colitis	Elderly population, RF: antibiotics (fluoroquinolones, penicillin, clindamycin)	Crampy abdominal pain, watery diarrhoea, fever Signs of dehydration, abdominal tenderness, distension, rebound tenderness, marked rigidity, decreased bowel sound	CBC, Stool culture	CT scan	Pseudomembranous colitis, toxic megacolon, perforation

> – more, = – equal, ARDS acute respiratory distress syndrome, CBC complete blood count CHF congestive heart failure, CT computed tomography, DIC disseminated intravascular coagulation, EFAST extended focused abdominal sonography in trauma, F female, HCG human chorionic gonadotropin, HIV human immunodeficiency virus, IUCD intrauterine copper device, M male, MI myocardial infarction, NSAIDs non-steroidal anti-inflammatory drugs, PID pelvic inflammatory disease, PR per rectum, RF risk factors, RLQ right lower quadrant, RUQ right upper quadrant, UPT urinary pregnancy test, UTI urinary tract infection

Table 26.4 Extra abdominal causes [3]

Abdominal wall	Muscle spasm/haematoma Herpes zoster
Systemic	Alcoholic/diabetic ketoacidosis Sickle cell disease Porphyria Systemic lupus erythematosus Uraemia
Thoracic	Myocardial infarction myocarditis/pericarditis Pulmonary embolism Pneumonia
Toxicology	Lead/iron poisoning Snake/scorpion bite Black widow spider bite
Genitourinary	Testicular torsion
Infections	Mononucleosis Rocky mountain spotted fever Streptococcal pharyngitis

Box 26.2 Routine Laboratory Workup

Haematocrit: GI bleed

WBC count: infection/inflammation, though of limited value [4, 5]

Platelet count: bleeding disorders

Liver profile: hepatitis, cholecystitis, post hepatic biliary tract obstruction

Coagulation profile: status of coagulopathy, bleeding disorders, trauma

Renal profile: prerenal, renal or post renal failure, degree of dehydration, renal insufficiency, electrolyte imbalance

Pancreatic enzymes: pancreatitis, other pancreatic pathologies. Lipase is more sensitive when it is 3 times higher than normal value [6]

Serum lactate level: mesenteric ischaemia, bowel infarction. May be normal in 25 % of patients with intestinal ischaemia [7]

Serum glucose: pancreatitis, diabetic/alcoholic ketoacidosis

Urine analysis: UTI, nephrolithiasis, pyelonephritis, cystitis, renal parenchymal disorders

Urine sugar/ketone dipstick: diabetic ketoacidosis

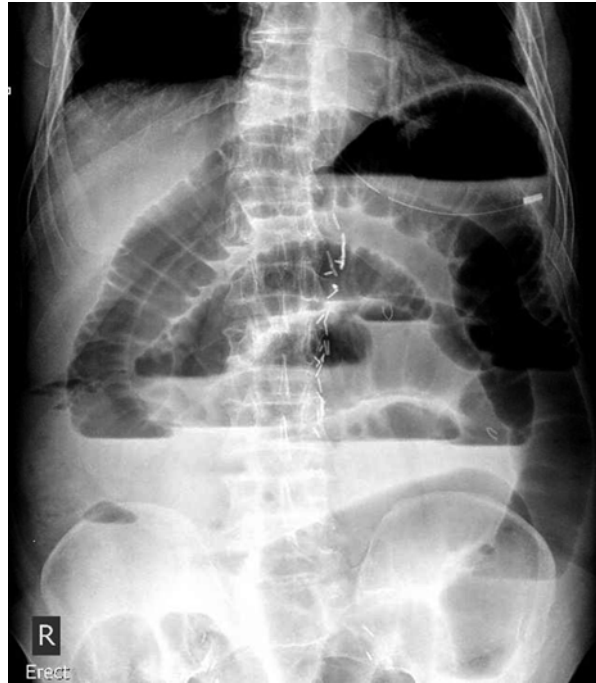
Urine culture: UTI

Urine pregnancy test: females in reproductive age group

Stool for occult blood: upper GI bleed

Stool culture, stool for ova and hanging drop test: diarrhoea

Fig. 26.2 Step-ladder pattern in cases of bowel obstruction



- Diagnostic imaging: Traditional x-rays, ultrasonography, computed tomography (CT) scan and magnetic resonance imaging (MRI) are available modalities. Upright chest and abdomen x-rays: An upright chest x-ray detects 1 ml of air in peritoneal cavity [8]. Lateral decubitus x-ray shows 5–10 ml of intraperitoneal air (pneumoperitoneum) in bedridden patients. Indications (Fig. 26.2):

Small/large bowel obstruction
Hollow viscus perforation
Sigmoid/caecal volvulus
Foreign body
Ingested metal (e.g. mercury)

Ultrasonography: Ultrasound probe is emergency physician's stethoscope in recent times. It has 94 % sensitivity and 78 % specificity for detecting acute cholecystitis [9]. It is efficient in detecting gallstones and intrahepatic and extrahepatic biliary tract diameter. Abdominal/transvaginal sonography is useful in detecting ovarian, uterine and adnexal abnormalities.

Intraperitoneal free fluid can be visualised on US scan in trauma (FAST) and nontrauma patients.

Bedside sonography is useful in following conditions:

- Intraperitoneal free fluid
- Hydronephrosis/hydroureter

Fig. 26.3 Intraperitoneal free fluid (FF) in cases of ascites or trauma

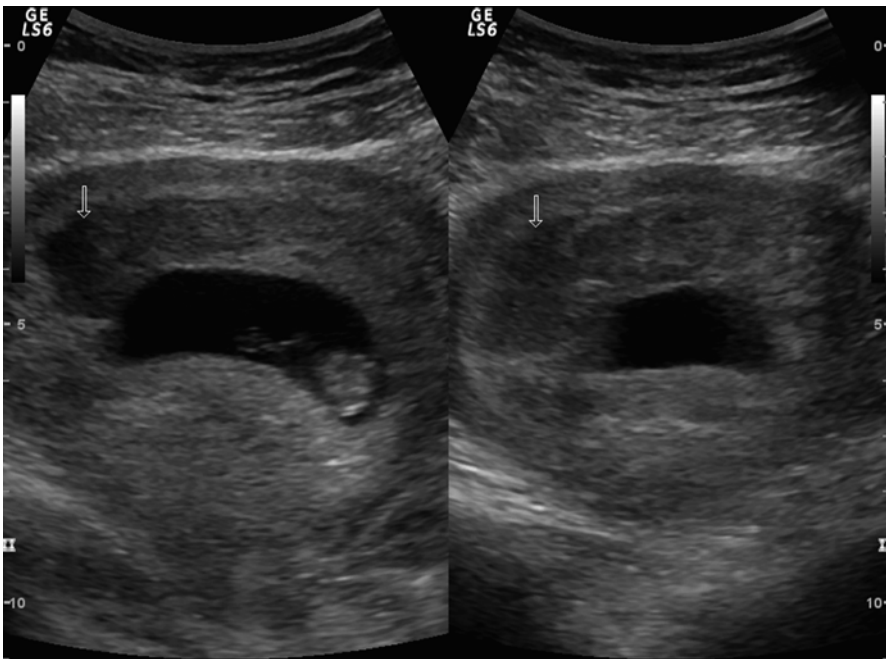
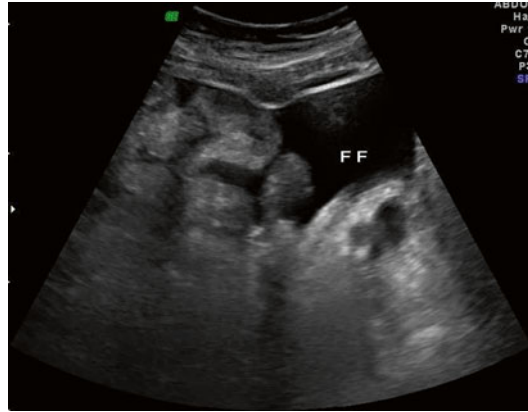


Fig. 26.4 Intrauterine gestational sac with sub-chorionic haemorrhage (marked as *arrow*)

- Intrauterine pregnancy
- Abdominal aorta diameter (aneurysm)
- Volume status with IVC diameter (RUSH protocol)
- Bladder volume (urinary retention)

Disadvantages: Operator dependent

- Distortion of anatomy gives false results.
- Requires proper training (Figs. 26.3 and 26.4).

Fig. 26.5 CT abdomen with contrast film showing multiple air fluid levels suggestive of intestinal obstruction

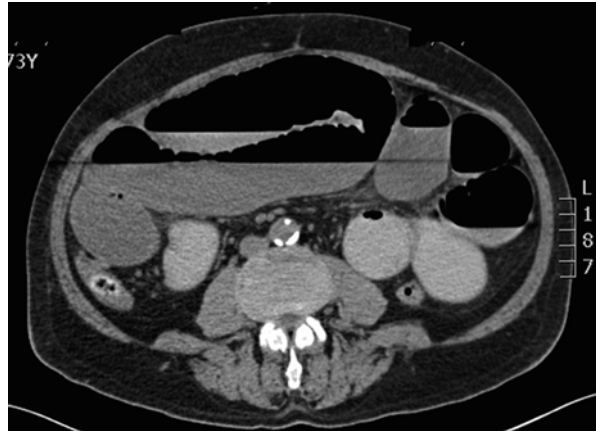


Table 26.5 Recommended imaging test depending on the site of abdominal pain

Right upper quadrant [12]	Ultrasonography
Left upper quadrant	CT scan
Right lower quadrant [13]	CT scan with contrast
Left lower quadrant [14]	CT scan with contrast
Suprapubic	Ultrasonography

CT computed tomography

Computed tomography: It is sensitive and accurate in diagnosing acute appendicitis, bowel wall diseases, solid organs, urinary tract calculi, mesenteric ischaemia and retroperitoneal structures. It is useful in differentiating mechanical vs. paralytic bowel obstruction.

CT scan of abdomen has become an imaging modality of choice. Intraperitoneal and extraperitoneal structures can be visualised through CT scan. It helps to reduce morbidity and mortality. Elderly people are more prone to undergo surgery and have higher mortality than young patients. Moreover, history, vital signs and physical examination are not reliable in elderly due to comorbid conditions and medication use [10].

CT scan is associated with radiation risk. Improved technology and better image resolution have made oral contrast obsolete, and pathologies of solid organ and bowel wall are detected with intravenous contrast only [11] (Fig. 26.5).

Recommended imaging studies based on location of abdominal pain is shown in Table 26.5.

Electrocardiogram is essential especially in elderly people with risk factors.

Treatment

Therapeutic goals for acute abdominal pain patients are primary stabilisation, mitigation from symptoms, diagnosis and treatment of cause.

Primary Stabilisation

Haemodynamic instability may be present in patients with following features:

- Extremes of age
- Immunocompromised state
- Abnormal vital signs
- Signs of dehydration

Early resuscitation and identification of primary cause are the mainstay of treatment. This includes (OMIV): *O*, oxygen; *M*, cardiac monitor; *IV*, large bore IV lines; and *V*, vitals. Blood samples should be collected for routine investigations. Blood transfusion should be anticipated in haemorrhagic conditions (ruptured abdominal aortic aneurysm, massive GI haemorrhage, ruptured ectopic pregnancy, traumatic spleen rupture). Bedside ultrasound helps in identification of undifferentiated shock. These patients require prompt surgical consultation.

Analgesics

Early pain management doesn't mask physical findings, delay diagnosis or increase morbidity and mortality. Analgesics in the form of paracetamol, NSAIDs and opioids like fentanyl or morphine are used depending on pain score. Cope's early diagnosis of acute abdomen [15] favours opioid analgesia in abdominal pain patients.

Antacids and Antiemetics

Antacids relieve burning pain due to gastric acid production [16]. Antiemetics like ondansetron and metoclopramide are useful in remitting nausea and vomiting. NG tube is essential in patients with small bowel obstruction to decompress stomach and provide symptomatic relief. Metoclopramide has extrapyramidal side effects.

Antibiotics

Administration of antibiotics is useful in cessation of disease process and early recovery. Antibiotics should cover gram-negative anaerobic and aerobics and extended to gram-positive pathogens too. Table 26.6 shows some commonly used regimens.

Table 26.6 Useful antibiotic regimen

Uncomplicated infective conditions	Second generation cephalosporins Cefotaxime 1 g IV 12 hourly
Immunocompromised, elderly, hypotensive	Aminoglycosides (Gentamicin/tobramycin 1.5 mg/kg IV 8 hourly) + Metronidazole 400 mg IV 8 hourly
Suspected biliary sepsis	Piperacillin tazobactam 4.5 g IV 12 hourly
Suspected bacterial peritonitis	Ceftriaxone 1 g IV 12 hourly
PID	Doxycycline 100 mg PO 12 hourly for 14 days Metronidazole 400 mg PO 12 hourly for 14 days
<i>Clostridium difficile</i> colitis	Metronidazole 400 mg PO 8 hourly for 14 days Vancomycin 500 mg/day PO for 4 days
<i>H. pylori</i> gastritis [17]	Amoxicillin 1,000 mg PO 12 hourly + Clarithromycin 500 mg PO 12 hourly + Omeprazole 20 mg PO 12 hourly for 14 days

IV intravenous, PO per oral

Disposition and Follow-Up

Decision to discharge is as difficult as diagnosis of acute abdominal pain. Various available options are:

- Admission and surgical/nonsurgical consultation
- Admission for observation
- Discharge with follow-up advice

Indications for hospitalisation:

- Elderly and immunocompromised
- Intractable nausea, vomiting and abdominal pain
- Appears ill with unclear diagnosis
- Intolerable oral intake
- Abnormal physical examination (signs of peritonitis)
- Poor social support

Patients with less severe symptoms without specific diagnosis need laboratory/radiological evaluation and observation for 8–10 h in ED. Follow-up with primary care physician in 12 h is another valid option.

Stable asymptomatic patients can be discharged from emergency. Discharge criteria may include:

- Asymptomatic
- No abnormal clinical features
- Normal vital signs
- Tolerate oral intake
- Adequate social support at home

Patients should be given proper diet advice and safety instructions.

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