Abdominal Pain — Pathophysiology, Classification and Causes

Abdominal pain occurs as a result of pain receptors that are present in the abdomen and which respond to mechanical and chemical stimuli. There are numerous causes of abdominal pain which are classified according to the localization of pain on the abdomen. For example, right upper quadrant pain is related to biliary and hepatic etiologies, epigastric pain is related to acute myocardial infarction, pancreatic and gastric etiologies while left upper quadrant pain is related to splenic pathologies, and so on. A thorough history, a physical exam with relevant investigations will lead one to an accurate diagnosis.

Pathophysiology of the Abdominal Pain

The abdominal cavity is that part of the body which is bounded superiorly by the xiphoid process and costal margins, posteriorly by the vertebral column and inferiorly by the upper parts of the pelvic bones.

Abdominal pain occurs when mechanical or chemical stimuli, stimulates pain receptors
present in the abdomen. Stretch is the primary mechanical stimulus involved in visceral pain perception. Other mechanical stimuli like expansion, contraction, compression, pulling on and twisting of the viscera are also perceived. These receptors responsible for the perception of pain are located on serosal surfaces of visceral, within the mesenteries, and within the walls of viscera.

The perception of abdominal pain depends upon its interpretation by the central nervous system. For example, the gastric mucosa is insensitive to mechanical pressure or chemical stimuli, but in the presence of gastric inflammation, the same stimuli cause pain. The threshold for perceiving pain (intensity of pain) varies among individuals and in certain diseases.

Classification of Abdominal Pain

There have been different types of abdominal pain depending on the organs involved:

Visceral pain

Visceral pain is considered vague and dull pain because the majority of organs do not
have an abundance of nerve fibers. Instead, the nerve fibers respond to the stretched organs (for example when the intestine is stretched by gas) or when the surrounding muscles of a hollow organ contract causing the dull aching visceral pain.

The patient will experience mild or less severe pain that is poorly localized and it is difficult to pinpoint the exact location.

**Parietal pain**

Parietal pain or somatic pain occurs when there is an irritation of the parietal peritoneum that lines the abdominal cavity (peritoneal cavity). Unlike visceral organs, nerves fibers are abundant in the peritoneum and respond to irritation. Somatic pain is sharp, constant and on one side or the other and quite easy to pinpoint the location.

**Referred pain**

This type of pain is perceived distant from its source; occurs when organs share a common nerve pathway. It is poorly localized but normally constant in nature.

**Most common examples of referred pain in the human body are:**

- Referred pain of renal stone into the groin
- The shoulder pain that occurs due to irritation of phrenic nerve by blood or infection
- A pain of cholecystitis radiates from the right hypochondrium along right costal margin to the back
- A pain of acute myocardial infarction radiates to the left arm and jaw

**Methodological Assessment of Abdominal Pain**

A stepwise approach to abdominal pain is required to identify the high-risk population, which may need urgent intervention and low-risk population for differential diagnosis.

**Taking History**

Assessment of the complete history of the patient is the basis of an accurate diagnosis. When the location of the pain is identified, general information should be obtained about time/ mode of onset, duration of the pain, severity, and quality of pain and about aggravating and remitting factors which may provide critical additional information.

**Medical history**

The medical history of the patient should be taken into account like previous surgery, Sexual activity, travel exposure risk/occupation, psychiatric issues like a stress and type of medications (can alleviate symptoms).

For example, a history of abdominal surgery can rule out a condition or can raise the doubt over complications such as obstruction from adhesions.

**Drug History**

Gastrointestinal and hepatobiliary symptoms are among the most frequent complaints in patients with [HIV infection](#) and are on ART.
The patient on steroids or NSAIDs is more likely to suffer abdominal pain because these medications negatively affect the integrity of the gastric mucosa.

**Menstrual History**

Menstrual history is important in women in the childbearing period and should include the time, regularity of menstruation and any abnormal vaginal bleeding to rule out ectopic pregnancy which is considered a very common cause of abdominal pain in women.

**Examination**

Besides history, a physical examination is considered an important key in evaluation a patient with abdominal pain.

**Inspection**

Inspection of the abdomen for the shape of the abdomen, any visible masses or scars, and the movement of the abdomen with respiration provide clues to the diagnosis of abdominal pain.

Generalized distensions suspect intestinal obstruction, while specific distention in upper quadrant may suspect acute gastric dilatation or pancreatic cyst.

**Palpation**

Palpation of the abdomen for assessment of:

1. **Masses**: The epigastric mass may suggest gastric or pancreatic carcinoma.
2. **Tenderness**: Right lower quadrant pain may suggest appendicitis, cecal diverticulitis or perforated viscous as colon cancer.
3. **Pulsations as epigastric pulsation**: Epigastric pulsations can originate either from the aorta, pulsating liver or dilated RV of the heart.
4. **Spasm or abdominal guarding** which occurs in perforated viscous due to peritoneal irritation. Acute perforated ulcer presents a characteristic “boardlike” rigidity of the abdominal wall.
5. **Internal organs** for their size, borders, and surface.

Rectal examination for presence of the occult or frank blood, pain, or mass (faecal impaction, tumour, prostate, pelvic abscess) Pelvic examination indicated for most women if pain is in the lower abdomen; it may assist in the diagnosis of ovarian torsion, an ectopic pregnancy, or PID, or may exclude these conditions.

**Investigations**

**Laboratory investigations**

Diagnostic tests are used to confirm or to exclude a specific diagnosis. However, these laboratory tests are often non-specific and are used to support clinical findings and medical expertise.

All patients with abdominal pain should always have:

1. Complete peripheral blood count
2. Determination of serum electrolyte, serum, creatinine, blood glucose and urinalysis
3. Stools can be analyzed for blood, pus or fat (evidence of impaired digestion and absorption of food)
4. Urine pregnancy test must be done for all women in the child-bearing period with abdominal pain
5. Liver function tests and serum amylase level should be done in all patients with right upper quadrant abdominal pain, either with or without jaundice

**Imaging investigations**

1. **Plain abdominal x-ray**
   
   It’s an initial and inexpensive test that can be used to confirm or to rule out certain diagnoses such as:
   
   - Perforated viscous which appears as air under diaphragm in chest X-ray
   - Intestinal obstruction which appears as air-fluid level in erect abdominal x-ray
   - Renal and gall bladder stones may appear as radio-opaque opacities on x-ray

2. **Abdominal Ultrasound**
   
   Abdominal U/S is one of the most commonly used diagnostic tests that used in the diagnosis of hepatobiliary system diseases, urinary tract as well as the acute appendicitis. Pelvic U/S in women with suspected ectopic pregnancy may show blood or pseudo sac in utero or a complex mass in the adnexa.

3. **Abdominal Computed Tomography (CT)**
   
   Abdominal CT provides better visualization to the abdominal viscera. For example, abdominal CT is considered the investigation of choice in the diagnosis of acute appendicitis.

**Causes of Abdominal Pain According to Regions**
Causes of upper abdominal pain

Upper abdominal pain can be divided into right upper quadrant pain, pain in epigastrium and left upper quadrant pain.
Causes of lower abdominal pain

Lower abdominal pain can be divided into **lower abdominal pain localized to one side**, **lower abdominal pain localized to either right or left side** and its pain can be anywhere on the lower abdomen.

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Causes of diffuse abdominal pain

Conditions that cause **diffuse abdominal pain** include the following:

- **Obstruction**
- Perforation of gastrointestinal tract
- **Mesenteric ischemia**
- **Inflammatory bowel disease** ([ulcerative colitis](https://en.wikipedia.org/wiki/Ulcerative_colitis) and [Crohn’s disease](https://en.wikipedia.org/wiki/Crohn%27s_disease))
- Viral gastroenteritis
- Peritonitis ([spontaneous bacterial peritonitis](https://en.wikipedia.org/wiki/Serous_membrane_infection) and peritonitis in peritoneal dialysis patient)
- Malignancy (colorectal, gastric and pancreatic)
- **Celiac disease**

Causes of lower abdominal pain or pelvic pain, specifically seen in women

**Lower abdominal pain or pelvic pain, specifically seen in women** include the following:

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Differential Diagnosis of Different Causes of Epigastric Abdominal Pain

There is no definite way to determine the cause of epigastric pain simply by examining the history and physical exam in the majority of cases. However, history and physical exam do give some clue to etiology. For example, pancreatitis is the most common reason for epigastric tenderness and pain while pancreatic ulcer disease is associated

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<th>Right upper quadrant</th>
<th>Epigastrium</th>
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<td>Biliary etiologies:</td>
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with epigastric tenderness in only < 20% of patients. Below, is a systemic organization of the differential diagnosis of epigastric pain:

**Gastitis**

**Definition**

Gastitis is the term applied to describe inflammation, erosion (breach in the mucosa) or damage of the gastric lining that has not developed into an ulcer. Gastitis can be caused by alcohol, NSAIDS, Helicobacter, head trauma, burns and mechanical ventilation. The type of gastitis from these factors is referred to as type B, which is associated increased gastric acid production and is more common than type A. Type A gastitis is from atrophy of the gastric mucosa and is due to autoimmune processes such as pernicious anemia.

**Clinical features**

- Asymptomatic bleeding presents as hematemesis or melena
- Epigastric pain when gastritis becomes erosive
- Nausea and vomiting may also occur

**Diagnosis**

For diagnosis of *H. pylori*, serology, urea breath testing, stool antigen testing or biopsy with histology. The last one is most sensitive and specific and can exclude cancer.

Pernicious anemia is initially diagnosed with a low vitamin B12 level and an increased methylmalonic acid level. The diagnosis of pernicious anemia is confirmed by the presence of anti-parietal cell antibodies and anti-intrinsic factor antibodies.

**Treatment**

Proton pump inhibitors (e.g omeprazole) with clarithromycin and amoxicillin. This regimen is aimed at the eradication of *H. pylori* and is effective in > 90% patients. Pernicious anemia is treated with vitamin B12 replacement.
Gastroparesis

Definition

Decreased stomach motility due to diabetes, electrolyte imbalance or previous vagotomy.

Clinical features

Early satiety, postprandial nausea and feeling of ‘increased abdominal fullness’.

It generally occurs in those presenting with epigastric pain and abdominal bloating and who have a long history of diabetes, along with retinopathy, neuropathy, nephropathy, and history of poor glycemic control.

Diagnosis

The diagnosis of diabetic gastroparesis is made clinically. Gastroparesis can be the only cause of ‘increased abdominal fullness’, vomiting and nausea in a long-term diabetic after other diseases have been excluded by endoscopy.

Treatment

Erythromycin and metoclopramide. Erythromycin increases motilin levels.

Peptic ulcer disease

Definition

Ulcers (breach in the mucosa with extension in the submucosa or deeper) form in the duodenum (> 90 % cases) or stomach (form in the lesser curvature near the incisura angularis).

Risk factors include H. pylori colonization, stress, alcohol, smoking, male sex, Zollinger-Ellison syndrome (parietal cell tumor), high dose steroids combined with NSAIDs.

Clinical features
Epigastric pain
- Only 20% patients have epigastric tenderness and nausea, vomiting is also rare

The epigastric pain in gastric ulcers aggravates on eating while the epigastric pain in duodenal ulcers in relieved by eating. The epigastric pain may radiate to the back if the ulcer is in the posterior duodenum.

**Diagnosis**
- < 45 years, a trial of proton pump inhibitors or H2 blockers should be performed and if symptoms persist, do an endoscopy
- > 45 years or those with alarm symptoms (weight loss, anemia, melena or dysphagia), endoscopy should be done

For diagnosis of H.pylori, serology, urea breath testing, stool antigen testing or biopsy with histology. The last one is most sensitive and specific and can exclude cancer.

**Treatment**
Proton pump inhibitors (omeprazole, lansoprazole, pantoprazole, rabeprazole or esomeprazole) with clarithromycin and amoxicillin. This regimen is aimed at the eradication of H.pylori. Surgery may also be effective.

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**Acute pancreatitis**

**Definition**

**Inflammation of the pancreas** most commonly due to alcoholism and gallstones. Other causes include medications such as pentamidine, didanosine, azathioprine and sulpha derivatives like sulfamethoxazole-trimethoprim and thiazide diuretics. Hypercalcemia and hypertriglyceridemia can also cause pancreatitis for unclear reasons.

Pancreatitis can also be caused by endoscopic retrograde cholangiopancreatography (such patients just have an asymptomatic increase in amylase), trauma, mumps and premature activation of trypsinogen into trypsin while it is still in the pancreas.

**Clinical features**
- Epigastric pain with tenderness, nausea, and vomiting
- Epigastric pain radiates to the back

When pancreatitis is severe, it may present as fever, hypotension, respiratory distress, a tense abdomen and increased white blood cell count.

**Diagnosis**

The best initial tests are amylase and lipase. The most specific test is CT scan. Needle biopsy is a must in determining the presence of infection in those who have extensive necrosis.

**Treatment**

Treatment is nothing per oral, intravenous hydration, analgesia and proton pump inhibitors. If there is more than 30 % necrosis on CT, adding antibiotics like imipenem decrease mortality.

**Pseudocysts** may need to be drained. ERCP is used to remove stones or place stents.

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**Functional dyspepsia**

**Definition**

Functional dyspepsia is epigastric pain that has no identified etiology. This disorder can only be diagnosed after endoscopy. It presents as epigastric pain with a normal endoscopy.

**Clinical features**

Epigastric pain, bloating, belching, early satiety.

**Diagnosis**

Endoscopy to rule out other causes.

**Treatment**

Antacids of various types from H2 blockers to liquid antacids to PPIs are tried until something is found to relieve the discomfort.

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**GERD**

**Definition**
Gastroesophageal reflux disease is caused by the abnormal flow of the acidic gastric contents from the stomach up into the esophagus due to an unknown cause or due to a loosening of the lower esophageal sphincter. Decreased tone or loosening of the sphincter can be due to nicotine, alcohol, caffeine, peppermint, chocolate, anticholinergics, calcium channel blockers and nitrates.

Clinical features

- Pain in the substernal area
- Presence of a sore throat, a bad metal like taste in the mouth, hoarseness
- Presence of a sore throat, a bad metal like taste in the mouth, hoarseness, cough, and wheezing

Diagnosis

Diagnosis is usually clinical. However, the most accurate diagnostic test is a 24 hour pH monitor.

Treatment

Proton pump inhibitors (omeprazole, lansoprazole, pantoprazole, rabeprazole or esomeprazole). Surgery may also be effective.

Acute Myocardial Infarction

Definition

Acute myocardial infarction is most commonly formed by the following mechanisms. Firstly a rupture of atheromatous plaque in the coronary artery damages the endothelium leading to the formation of an occlusive platelet thrombus. This decreases blood flow to the heart. Secondly, thromboxane A2 released by activated platelets during endothelial injury is a potent vasoconstrictor and further causes vasospasm of coronary artery.

Clinical features

- Sudden onset of severe, dull and squeezing chest pain or epigastric pain
- Usually, lasts > 30 minutes
- Not relieved by nitroglycerin
- Usually radiates to the inner left (most common) or right arm (less common),
  into the shoulders or into the jaw or epigastrium
- Associated with sweating, anxiety, and hypotension

**Diagnosis**

- Serial testing for creatinine kinase isoenzyme MB (CK-MB)
- Serial testing for cardiac troponins
- Electrocardiogram (ECG)

**Treatment**

Non-pharmacologic therapy includes limiting patient activity, cessation of smoking and
placing the patient on a diet that is low in cholesterol and salt.

Pharmacologic therapy includes antiplatelet therapy (aspirin or clopidogrel if allergic to
aspirin), nitrates, nasal oxygen, calcium channel blockers, angiotensin-converting enzyme
inhibitors or angiotensin receptor blockers and percutaneous coronary intervention.

**References**

Kumar, P. J., & Clark, M. L. (2012). Kumar & Clark clinical medicine (8th ed.). Edinburgh:
W.B. Saunders.


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