

**Three Phase CEUs
and
SCS Continuing Education
presents:**

Radiographic Pathology of the GI Tract ©

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Introduction:

Hello and welcome to this program from SCS Continuing Education! Knowledge is the key to success for ourselves and our patients. This easy-to-use point and click program allows you to navigate through text and visual aides designed to provide a comprehensive view of the material covered. Please feel free to contact Shane Smith at ceuarmy@yahoo.com if you have any questions.

Course Abstract and Objectives:

The objective of this home study course is to provide the learner with a computer based tutorial that will give them with the means to learn the common radiographic pathologies of the GI Tract. A 30 question mastery test will be administered at the end of this home study course in order to ensure that competency of the material has been achieved.

Chapters:

- **Introduction to Pathology..... pg 4**
- **Gastrointestinal System.....pg 34**
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Introduction to Pathology Menu

1. Disease
2. Pathology
3. Pathogenesis
4. Inflammation
5. Inflammatory Reactions
6. Edema
7. Abnormal Fluids
8. Ischemia
9. Infarct
10. Hemorrhage
11. Aplasia
12. Atrophy
13. Hypertrophy
14. Neoplasm

Disease:

- Simply put, pathology is the study of disease.
- Disease is a term that literally refers to a lack of “ease.”
- It is a condition that is marked by an abnormal disturbance in the function and or structure of the human body as a result of some type of injury or trauma.

Pathology:

- The study of disease and how it impacts the human body.
- The following is a partial list of sources for pathology:

Hereditary or Congenital

Tumors

Iatrogenic

- Any adverse conditions that results from medical treatment.
- An example would be a pneumothorax that occurs as the result of a thoracentesis.

Infections

- A nosocomial infection is acquired from a health care environment.

Pathogenesis:

- The study of the origin and development of a disease.
- Pathogenesis will lead to observable changes that are known as manifestations.

Sign

- This is a manifestation that is observable by the health care worker.
- Examples would be swelling or a skin rash.

Symptom

- This pertains to the patient's perception of what is wrong and is subjective.
- An example would be a headache.

Pathogenesis:

- Syndrome

This is a group of signs and symptoms that characterize an abnormal disturbance.

An example would be Marfan's Syndrome.

- This is a genetic disorder of connective tissue
- It is characterized by a predisposition to cardiac disorders, long limbs, long fingers, and a tall stature.
- Abraham Lincoln had Marfan's Syndrome.

- Etiology

This is the study of the cause and origin of a disease.

Pathogenesis:

- Idiopathic

This refers to the fact that there may be no real cause for the disease.

Examples would be hypertension and a spontaneous pneumothorax.

Inflammation:

- Inflammation refers to the body's ability to wall-off and sequester an injurious agent.
- The ultimate goal of this process is the safe removal of said injurious agents.
- Hyperemia is the process of dilating capillaries to allow fluids and leucocytes to infiltrate the infected area.
- The leucocytes will act to remove cellular debris through a process known as phagocytosis.
- The cardinal signs of inflammation include heat (results from hyperemia), redness, pain, and often a decrease in function.

Inflammatory Reactions:

- Abscess

This type of inflammatory reaction causes the injurious agent to become a walled-off ball of pus.

Antibiotics cannot penetrate an abscess since they do not contain a blood supply like a neoplasm.

As a result, an abscess must be aspirated with a needle and drained.

- Ulcers

This is another type of inflammatory reaction that is the result of a healing wound that is located on the skin or a mucous membrane

Inflammatory Reactions:

- Cellulitis

This is an acute bacterial infection of the skin and is a third example of an inflammatory reaction.

It can be found anywhere in the body but it is more often seen in areas where the skin can be damaged and thus allow a portal of entry for bacteria.

A byproduct of bacterial reproduction within the tissue is the excretion of methane.

This can sometimes be demonstrated on a radiograph as depicted on the next slide.

Inflammatory Reaction: Cellulitis



The arrows on this image are pointing to an area where the excrement of a bacterial infection has resulted in the formation of air within the tissue of this patient's foot. This is an indication of **cellulitis**.

Edema:

- This is an abnormal accumulation of fluid in body cavities or intercellular spaces.
- The increase in fluid can be localized within a structure or dispersed throughout the body.

An example of a localized edema would be ascites which is essentially edema of the peritoneal cavity.

Generalized edema can be caused by congestive heart failure

- This is characterized by peripheral edema, pulmonary edema, pleural effusions, and ascites.

Abnormal Fluids:

- Transudates

This abnormal, extracellular fluid essentially consists of water that contains a low cell count.

As a result, they are usually clear.

A good example would be a pleural effusion.

- Exudates

This fluid filters from the circulatory system into lesions and generally contains water, pus, and/or blood.

Since exudates contain infected fluid (pus/bacteria), they are therefore not clear.

Ischemia:

- This term refers to an obstruction of the normal blood flow to an organ or structure.
- It usually results from either a narrowing of blood vessels from plaque formation (fatty cholesterol deposits) or as the result of a thrombotic occlusion.
- As humans age, primary blood vessels into an organ may become stenotic due to plaque formation within their lumen.

As a response to this gradual change, secondary blood vessels may enlarge and play an increasingly important role in that organ's blood supply.

This process is called collateral circulation and it is the body's natural defense against ischemia.

Infarct:

- Loss of blood supply to an organ or structure will cause the surrounding tissue to become necrotic.
- This process is referred to as an infarct.
- The following is a list of diseases that are either caused by an infarct or may result in an infarct:

Myocardial Infarction (Heart Attack)

Pulmonary Embolus

Cerebrovascular Accident (Stroke)

Hernia (Mechanical Obstruction)

Volvulus (Mechanical Obstruction)

Hemorrhage:

- Hemorrhage or bleeding is simply the loss of blood from the circulatory system.
- The following is a list of a few examples of a hemorrhage:

Hematoma

- This occurs as the result of a break in a blood vessel that causes a pooling of blood below the surface of the skin, organ, or structure.

Ecchymosis

- This is a type of hematoma that is commonly referred to as a bruise or contusion.
- Capillaries below the skin are damaged usually as the result of some type of trauma.

Hemorrhage:

Purpura

- These are red or purple spots on the body that are caused by a hemorrhage.
- They are often the result of some type of platelet or coagulation disorder.

Petechia

- This is a type of purpura that consists of very small red or purple spot on the body.

Aplasia:

- This is the inability of an organ or structure to form properly.
- The defective development of an organ can result in the partial or complete loss of an organ.

Atrophy:

- Atrophy is the decrease in size of the cells within an organ or structure.
- The following is a list of some of the common causes of atrophy:

Lack of Physical Activity

Poor Nourishment

Nerve Damage

Poor Circulation

Hypertrophy:

- This is the opposite of atrophy in that there is an abnormal increase in cell size.
- This condition is also sometimes referred to as hyperplasia or hypergenesis.
- The following is a list of some of the common causes of hypertrophy:

An Increase in Physical Activity

Hormonal Changes

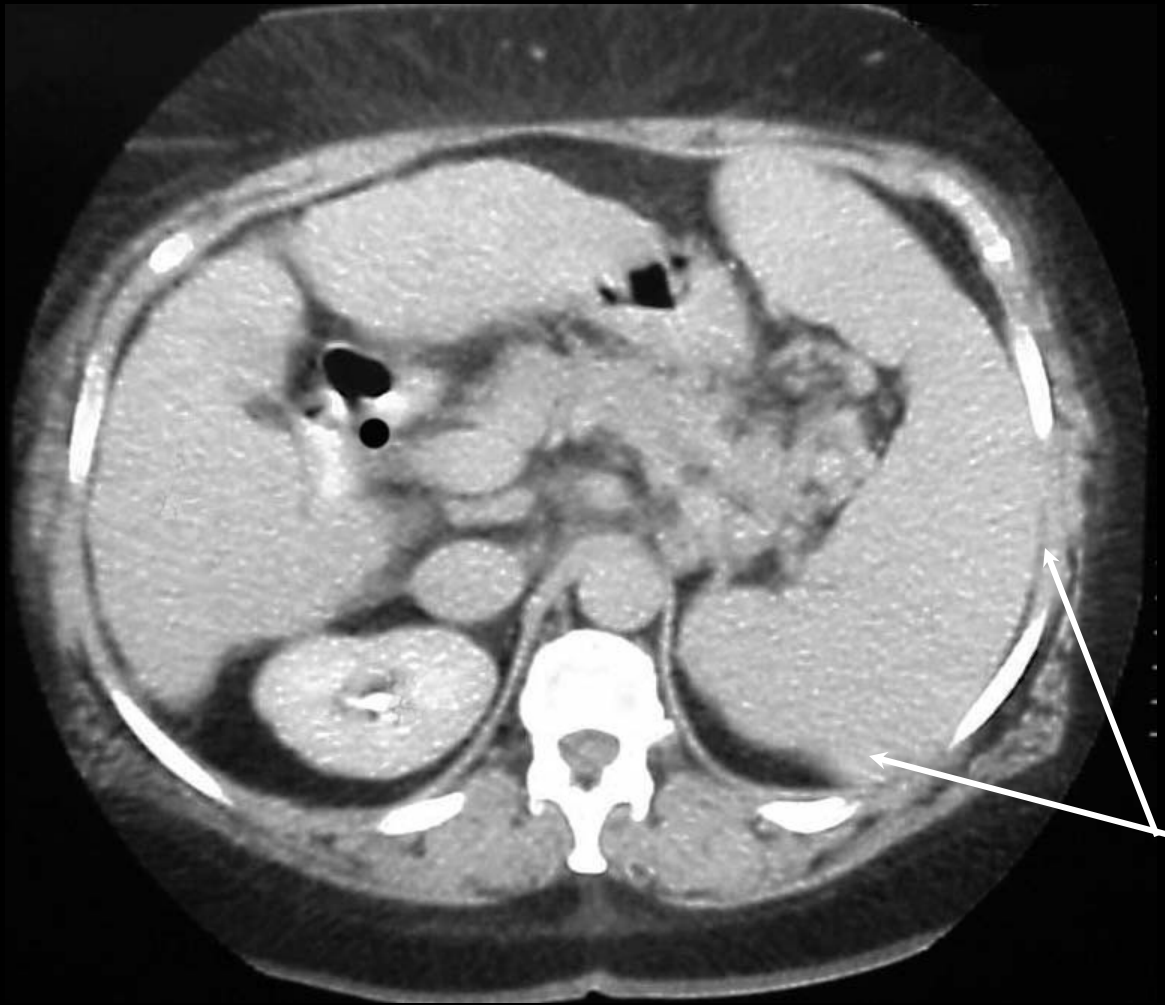
Chronic Inflammation

Hypertrophy: Splenomegaly



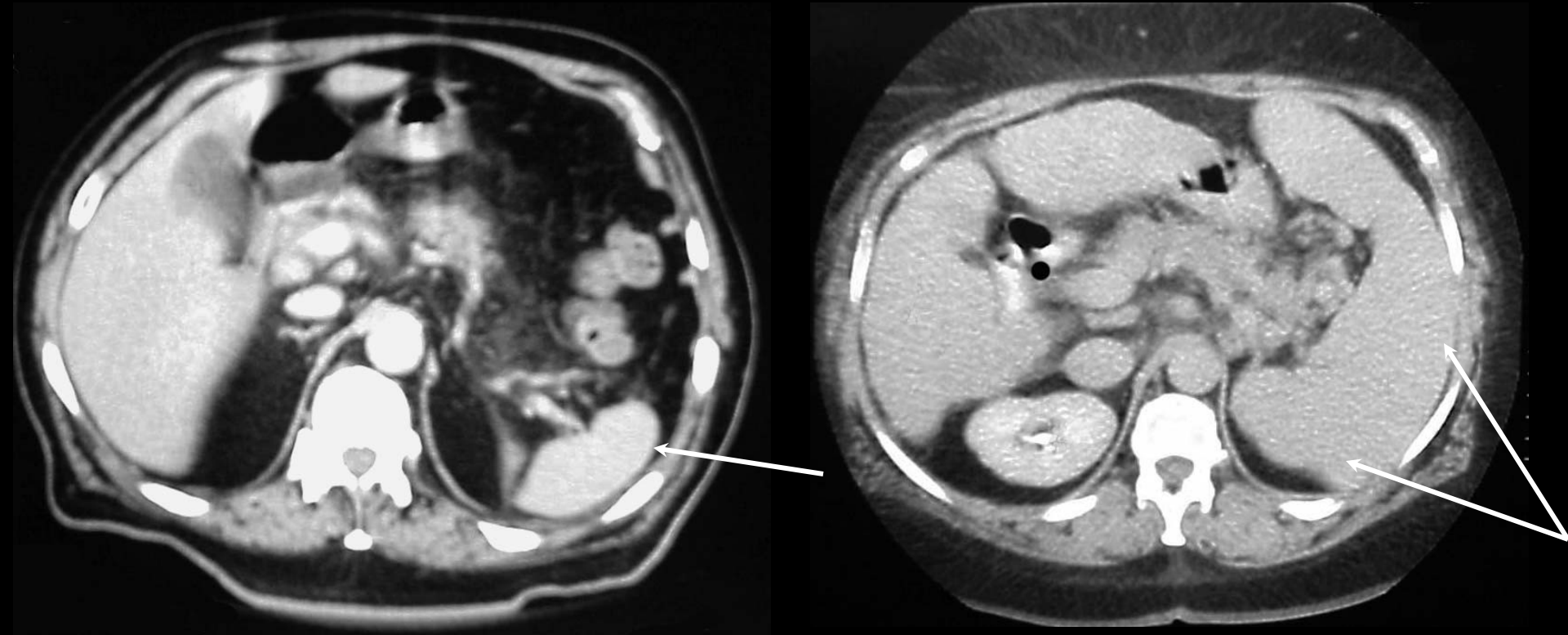
The arrow on this CT scan of the abdomen is pointing to a **normal spleen**.

Hypertrophy: Splenomegaly



The arrows on this CT scan of the abdomen are pointing to an **enlarged spleen**. This condition is referred to as **splenomegaly**.

Hypertrophy: Splenomegaly



This is a side-by-side comparison of a CT scan of a **normal spleen** on the left (arrow) and an **enlarged spleen** on the right (arrows).

Neoplasm:

- This is the abnormal proliferation of foreign cells that form a mass of tissue within an organ or structure.
- A neoplasm will compete for nutrients from the cells that normally comprise the host organ and it is often referred to as a mass or tumor.
- Oncology is the study of neoplasms.
- A benign neoplasm is one that is self-limited and will not spread or seed to distant sites within the host organism.

Neoplasm:

- A malignant neoplasm (cancer), on the other hand, does possess the ability to spread to distant sites in the body.

This type of tumor will seed by employing either the lymphatic system (primary method) or by using the circulatory system (hematogenous spread).

Cachexia

- If left untreated or undetected, malignant neoplasms will ultimately result in this condition.
- It is characterized by fatigue, atrophy, weakness, and anorexia.
- Cachexia is often seen as an end-stage to cancer.

Neoplasm:

- Four major cancer categories are as follows:

1. Carcinoma/Adenocarcinoma

- This type of cancer will arise from epithelial cells or tissues such as the breast, colon, or pancreas.

2. Sarcoma

- Relatively rare but highly malignant.
- This is cancer of soft tissue or connective tissue such as bone, cartilage, muscle, and fat.

Neoplasm:

3. Leukemia

- This is cancer of the blood and blood forming tissues.
- Acute leukemia is characterized by an abnormal proliferation of *immature* blood cells that do not possess the ability to fight infection.
- Chronic leukemia is characterized by an abnormal proliferation of *mature* blood cells that do not possess the ability to fight infection.

Neoplasm:

4. Lymphoma

- This type of cancer originates in lymphatic tissues and affects the production of lymphocytes (white blood cells).
- There are two major categories.
- Non Hodgkin's Lymphoma (NHL)

This is the most common type of lymphoma and it is found in the spleen, liver, bone marrow, lymph nodes, and GI tract.

NHLs are a diverse group of diseases that can develop in any organ that is associated with the lymphatic system and has an unknown etiology.

Neoplasm:



Non Hodgkin's Lymphoma will begin with the lymph nodes and spleen and can then **metastasize** to the liver, kidneys, spine, brain, lungs, and bone. In this example, it has spread to the spine and has formed an osteoblastic condition that is commonly referred to as an **ivory vertebra**.

Neoplasm:

- Hodgkin's Lymphoma/Disease

This type of cancer is also associated with lymphatic tissue and it was first describe by Thomas Hodgkin in 1832.

This cancer is characterized by the lymph nodes becoming swollen and rubbery yet they remain pain free.

It is definitively diagnosed via lymph node biopsy and finding the presence of Reed-Sternberg Cells.

Hodgkin's disease has an unknown etiology.

Neoplasm:

- Cancer treatment varies according to the type of cancer that is diagnosed and what stage it is in.
- The three primary methods of treating malignancies are as follows:
 1. Surgery
 2. Chemotherapy
 2. Radiation Therapy
 - In some instances, a combination of these treatments may be indicated.

Gastrointestinal System Menu

1. Zenker's Diverticulum
2. Traction Diverticulum
3. Epiphrenic Diverticulum
4. Hiatal Hernia
5. Gastroesophageal Reflux
6. Achalasia
7. Esophageal Varices
8. Esophagus Cancer
9. Candida
10. Peptic Ulcers
11. Gastric Carcinoma
12. Bezoar
13. Bowel Obstruction
14. Adynamic Ileus
15. Mechanical Bowel Obstruction
16. Hernia
17. Bowel Adhesion
18. Volvulus
19. Intussusception
20. Adenomatous Polyp
21. Adenocarcinoma
22. Crohn's Disease
23. Constipation
24. Diverticulosis
25. Diverticulitis
26. Appendicitis
27. Diverticula of the Appendix
28. GI Bleed

Zenker's Diverticulum:

- A diverticulum is an outpouching that occurs due to a weakening in the lining of, in this particular instance, the digestive system.

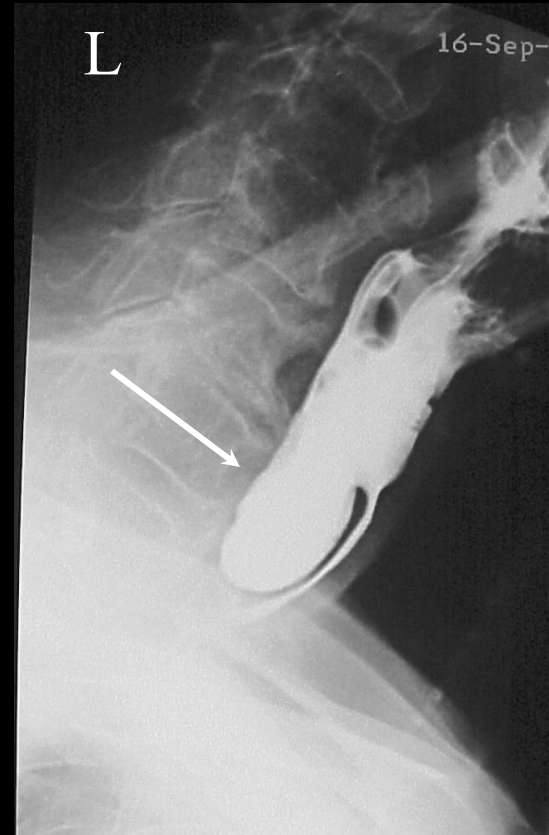
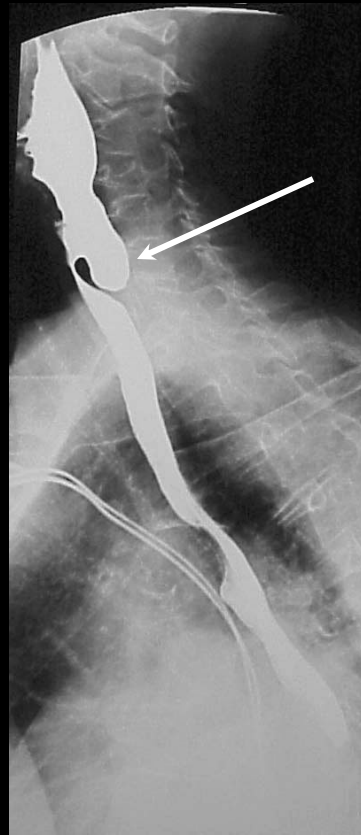
This is not to be confused with a neoplasm which is a new growth that usually develops in towards the lumen of the digestive system.

Diverticulum are often diagnosed with barium studies of the digestive system.

- Zenker's diverticulum arise from the posterior wall of the upper esophagus in the area of the pharynx.

Although often asymptomatic, they can cause dysphagia (difficulty in swallowing) and halitosis (bad breath).

Zenker's Diverticulum:

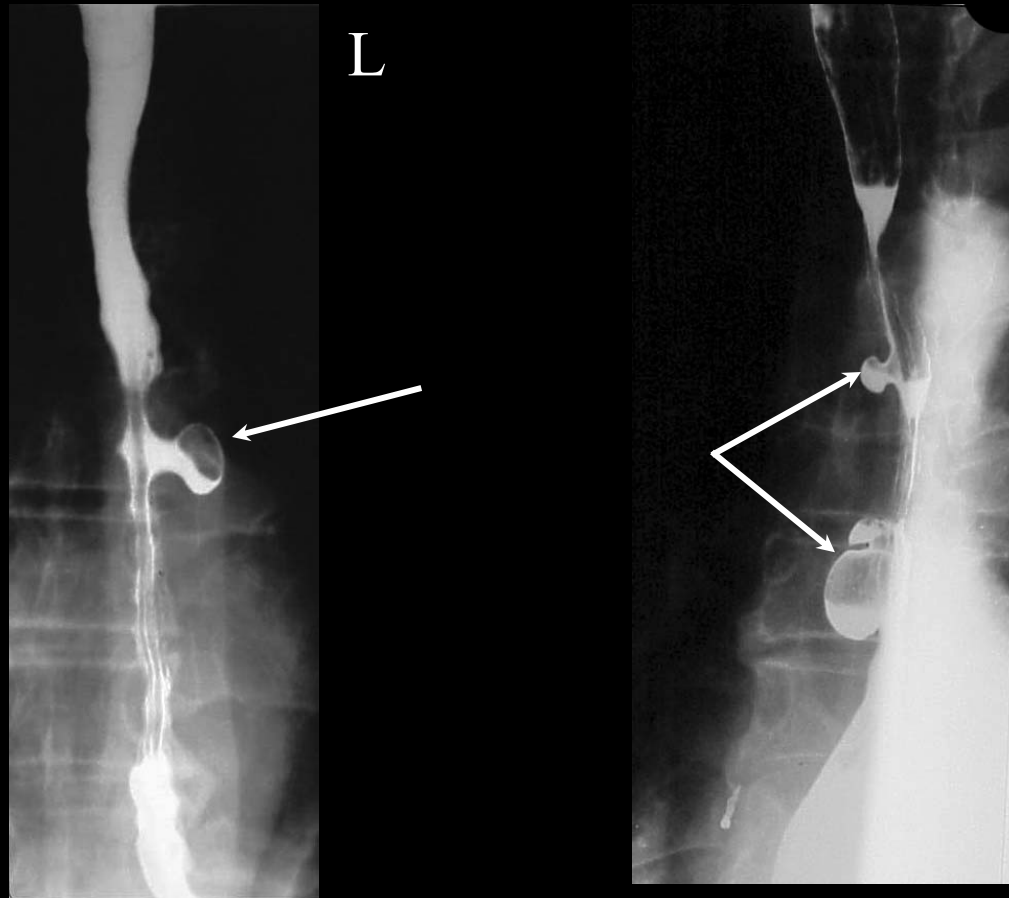


This barium swallow study clearly depicts an outpouching of the posterior aspect of the upper esophagus. This is called a **Zenker's diverticulum**.

Traction Diverticulum:

- This type of diverticulum forms in the mid esophagus area.
- Traction diverticulum may form due to scarring from pulmonary tuberculosis or an inflammatory process within the mediastinum.

Traction Diverticulum:

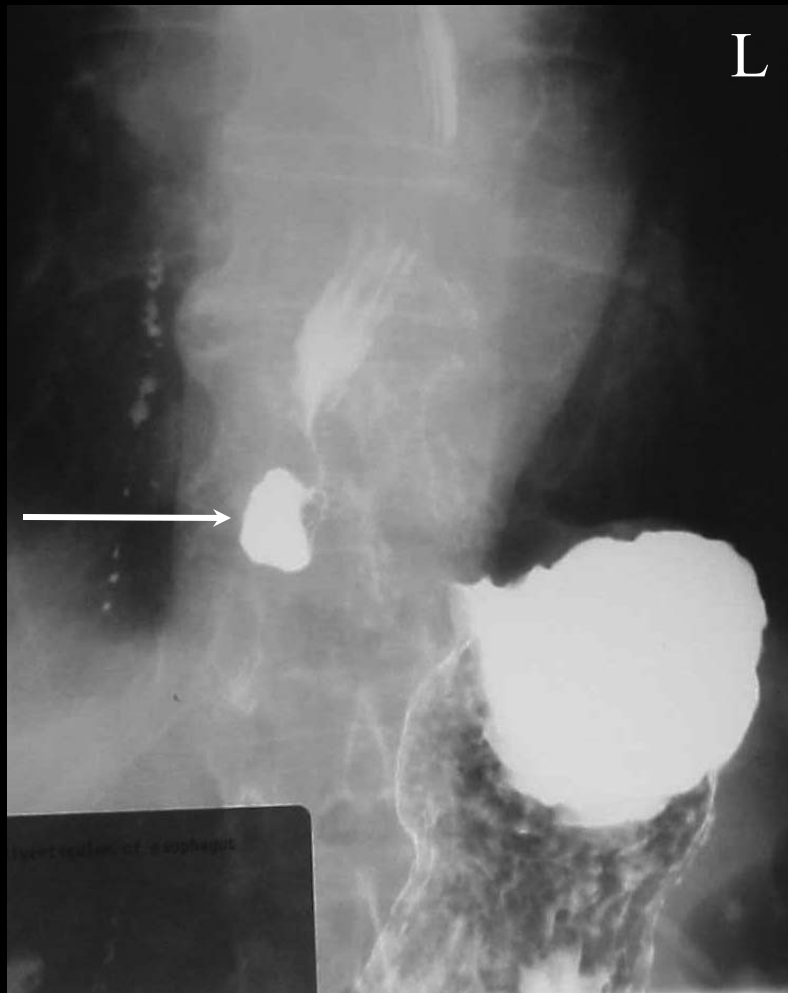


The arrows on these images are pointing to a **mid esophageal diverticulum**. The most likely etiology is an inflammatory process within the mediastinum.

Epiphrenic Diverticulum:

- As the name implies, an epiphrenic diverticulum arises in the distal esophagus just superior to the lower esophageal sphincter (LES).
- They may form as a complication to achalasia.

Epiphrenic Diverticulum:



Diverticula located within the distal 10 cm of the esophagus are referred to as an **epiphrenic diverticula** (arrow).

Hiatal Hernia:

- A hiatal hernia occurs when a portion of the stomach protrudes (herniates) into the thorax through the esophageal opening in the diaphragm.

This is known as a sliding hiatal hernia and it is the most common type of hiatal hernia encountered.

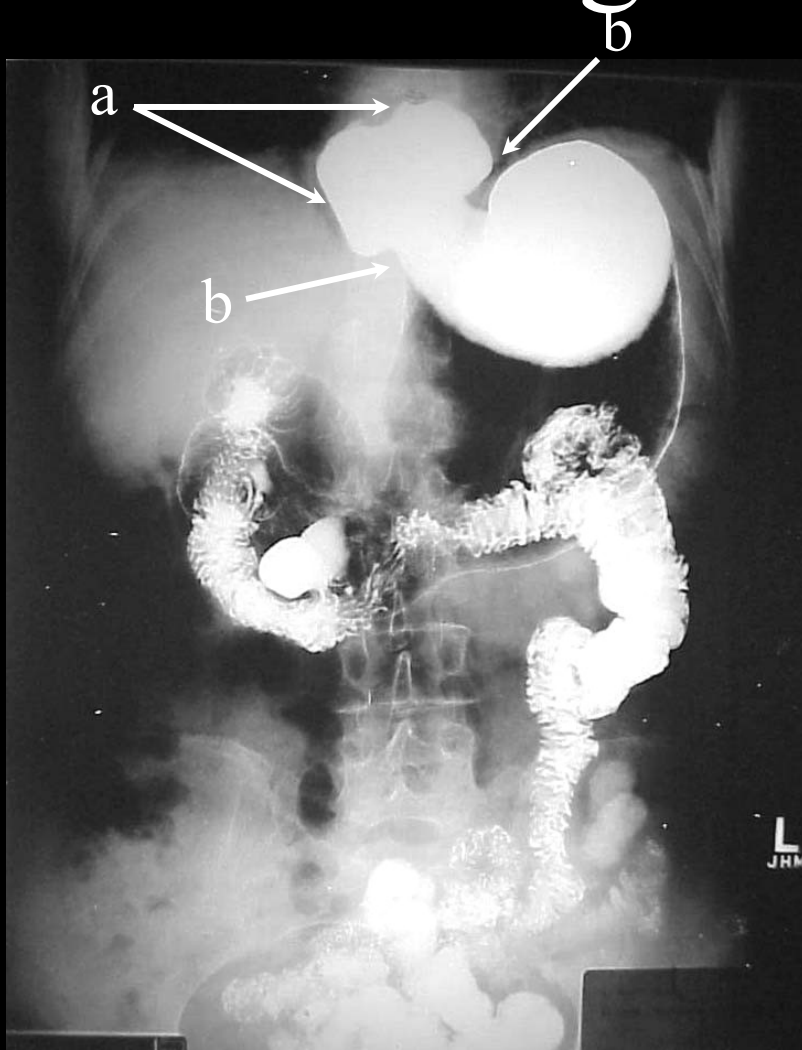
A rolling or paraesophageal hiatal hernia is very rare but occurs when a portion of the stomach herniates into the thorax while the gastroesophageal junction remains stationary.

- This is one of the most common findings on an UGI series.
- It can affect up to 50% of the population at some point in their lives.

Hiatal Hernia:

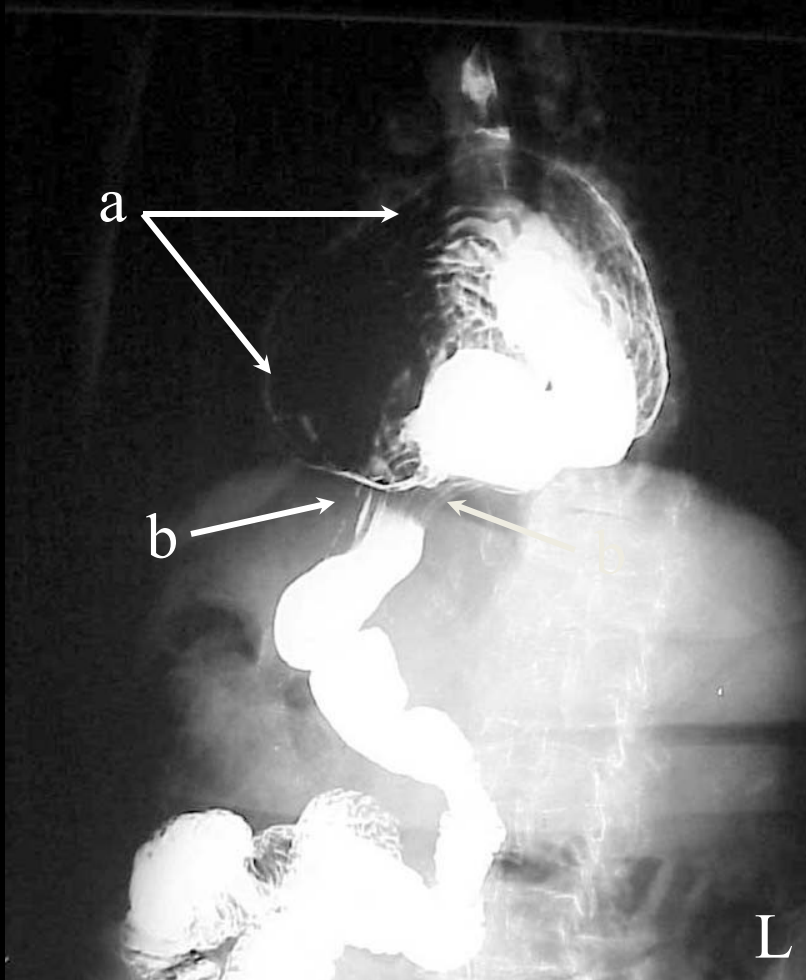
- A hiatal hernia is usually asymptomatic but the patient may experience a fullness in their chest or regurgitation.
 - This acid reflux may lead to inflammation and ulceration of the esophagus.
 - Chronic herniation of the stomach may be associated with gastroesophageal reflux disease (GERD).
- Treatment includes a bland diet, antacids, and medications to reduce reflux.

Sliding Hiatal Hernia:



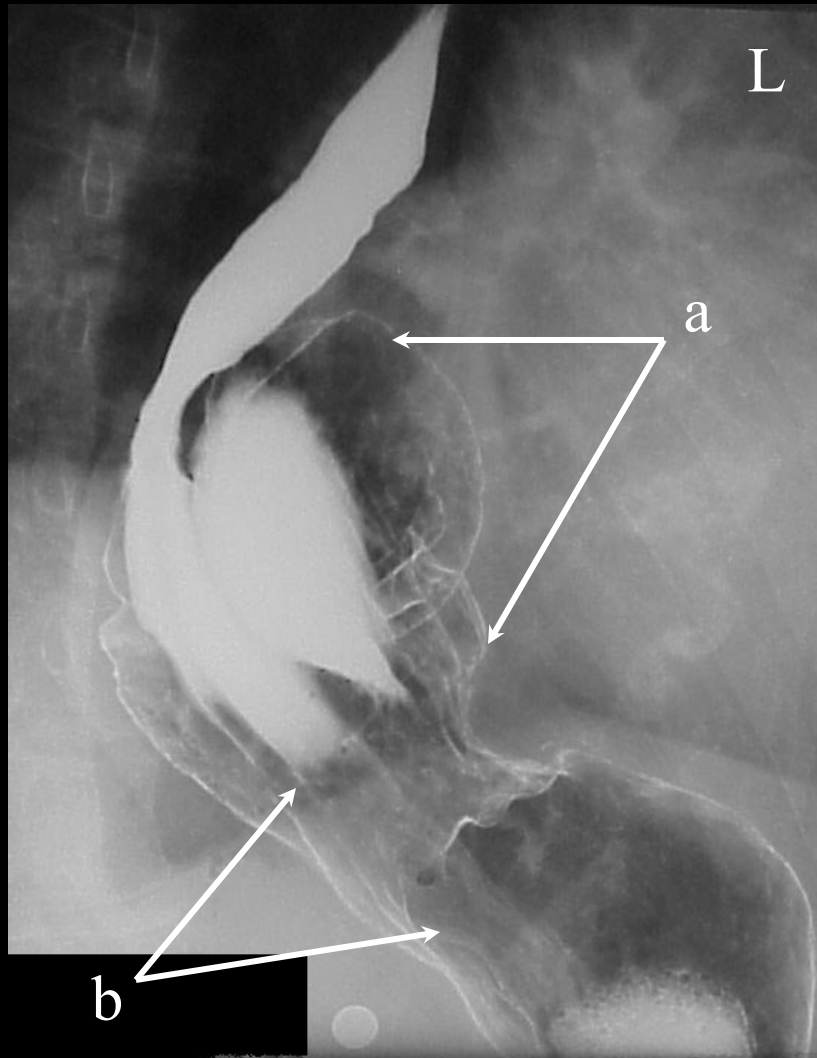
The protrusion of a portion of the stomach (hernia) through the esophageal opening of the diaphragm (hiatus) is referred to as a **hiatal hernia**. In this particular case (a) is pointing to the fundus of the stomach that has herniated through the esophageal opening in the diaphragm (b).

Sliding Hiatal Hernia:



On this UGI radiograph, a significant portion of the stomach (a) has herniated through the esophageal opening of the diaphragm (b).

Paraesophageal Hiatal Hernia:

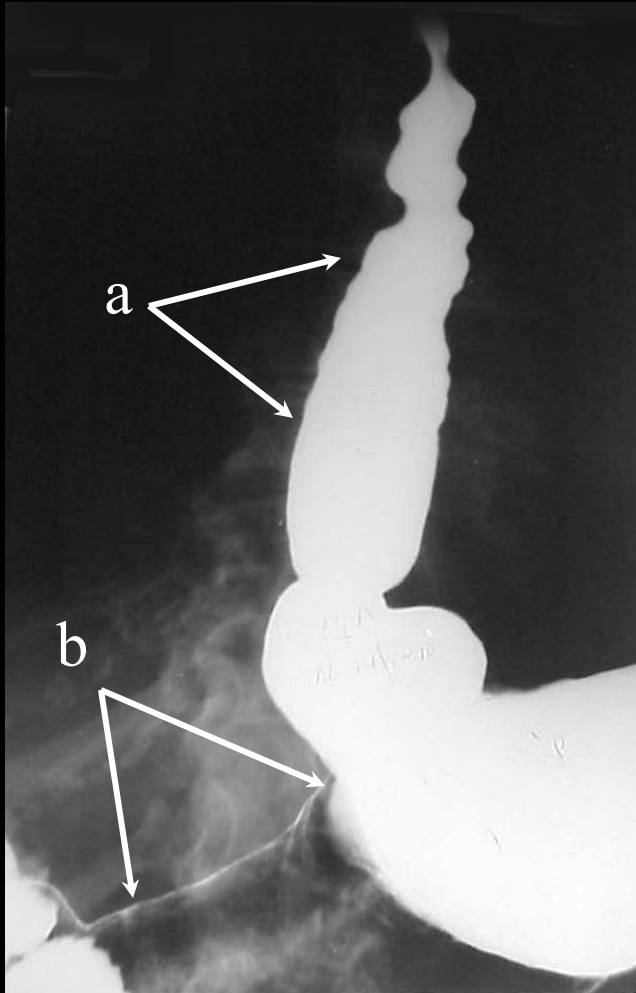


This UGI study provides a great example of a relatively rare **paraesophageal hiatal hernia**. In this case, a portion of the stomach has herniated into the thorax (a) while the esophagus and lower esophageal sphincter remain in place (b).

Gastroesophageal Reflux Disease:

- This is often abbreviated as GERD and it is also often referred to as heartburn and acid reflux.
- This disease is characterized by a backward flow of gastric contents into the esophagus due to an incompetent lower esophageal sphincter (LES).
- GERD is commonly associated with a hiatal hernia.
- It is acquired by poor eating habits, obesity, pregnancy, NG tubes, alcohol abuse, tobacco, and as a side effect of morphine.

Gastroesophageal Reflux Disease:



This UGI radiograph demonstrated a reflux of barium from the stomach (b) back into the esophagus (a). This condition is known as **gastroesophageal reflux disease (GERD), acid reflux, or heartburn.**

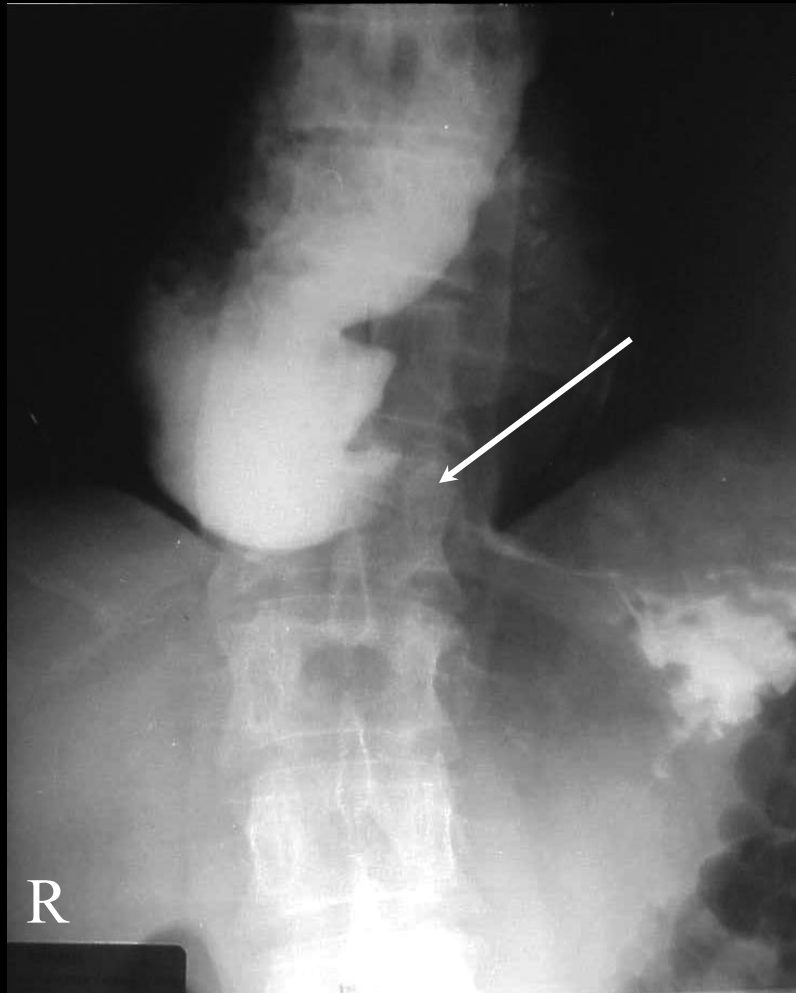
Achalasia:

- This is the exact opposite of acid reflux.
- Achalasia is an esophageal motility disorder that occurs due to the inability of the lower esophageal sphincter (LES) to relax.

As a result, the esophagus fills with ingested food and fluids.

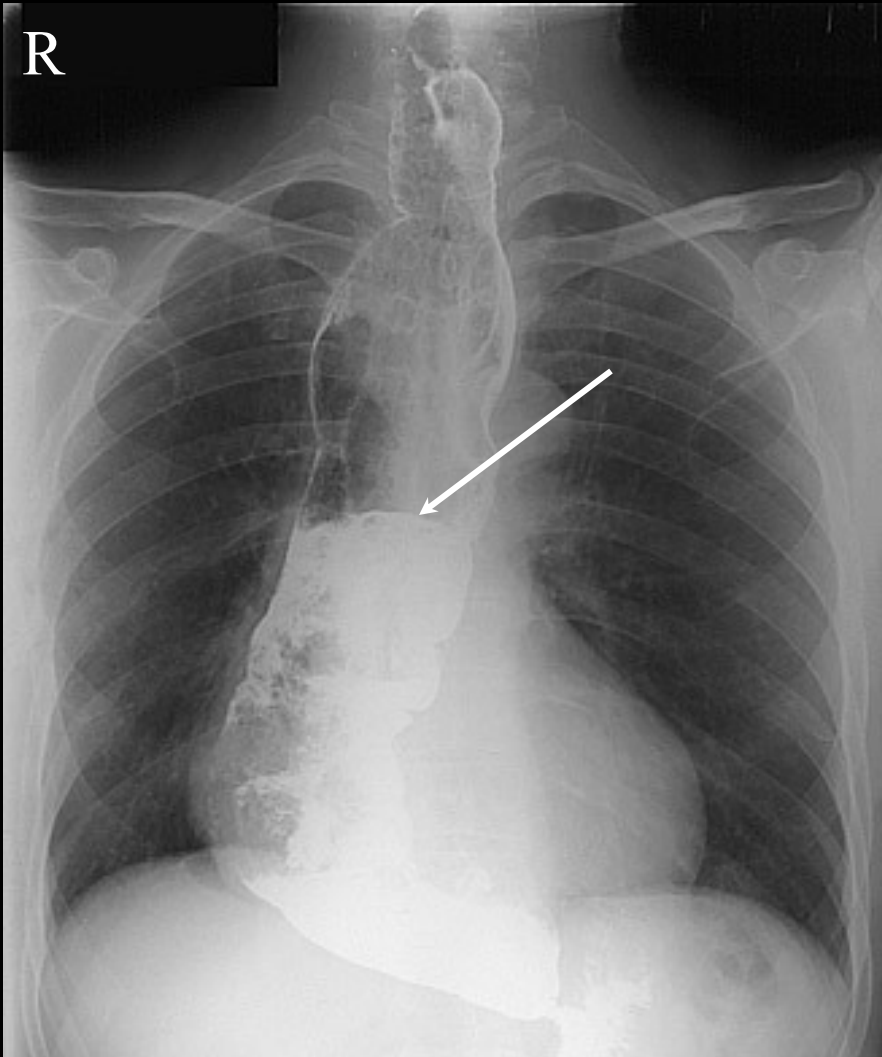
- Treatment includes a bland diet, medication to relax the LES, surgery, and an upright position to reduce regurgitation.

Achalasia:



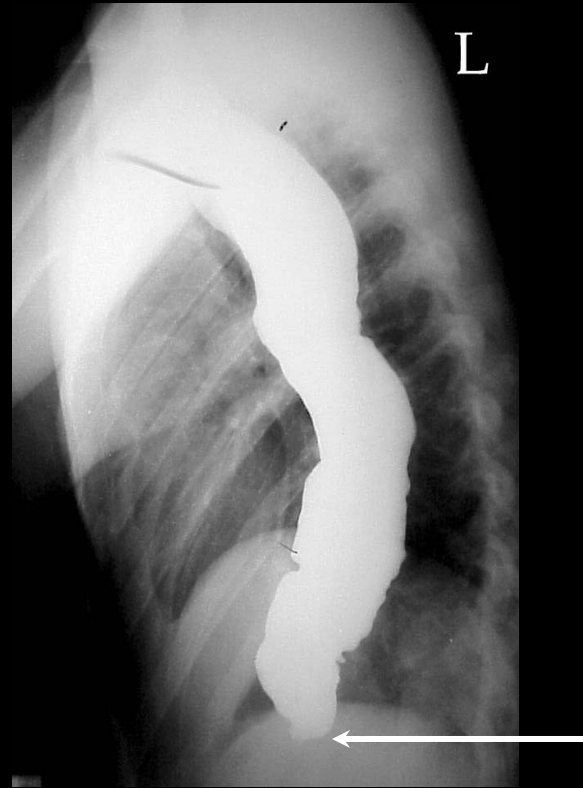
This UGI radiograph demonstrates a condition called **achalasia**. This is an esophageal motility disorder that is caused by a lack of peristalsis. As a result, the lower esophageal sphincter (arrow) fails to relax during swallowing and the esophagus fills with, in this case, barium.

Achalasia:



This example of **achalasia** demonstrates an air-fluid level (arrow) that has been caused during an UGI by the inability of the lower esophageal sphincter (LES) to relax.

Achalasia:



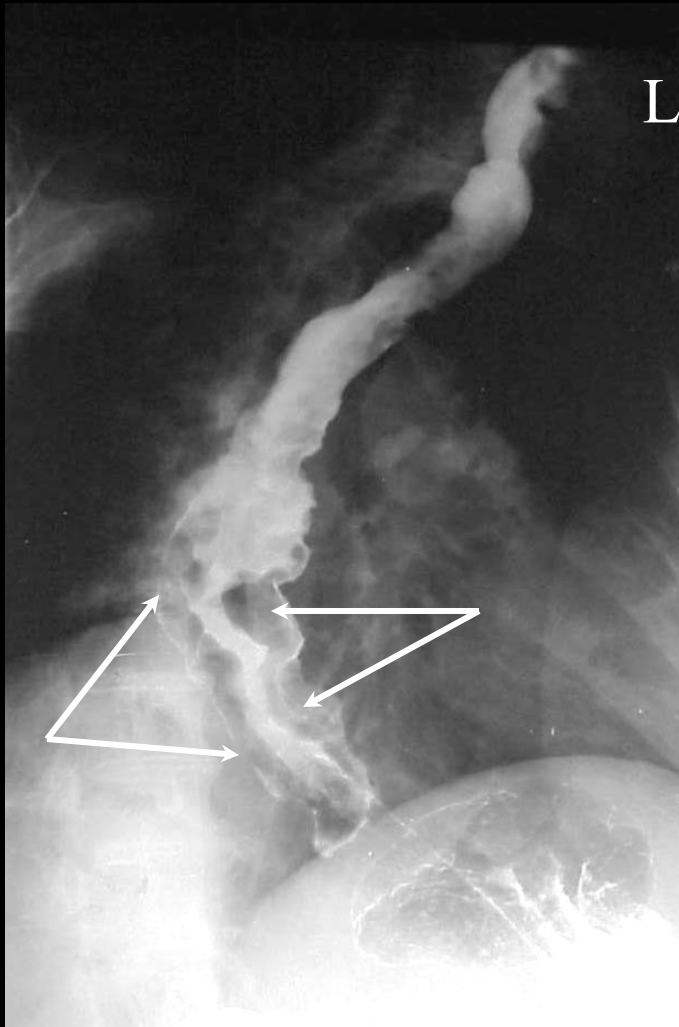
The entire length of this patient's esophagus has been filled with barium during an UGI as a result of a nonfunctional lower esophageal sphincter (arrow). This condition is known as **achalasia**.

Esophageal Varices:

- Esophageal varices are dilated, tortuous veins of the esophagus which may rupture.
- They are commonly a result of portal hypertension and/or liver cirrhosis.

Esophageal varices are often a complication of alcoholism.

Esophageal Varices:

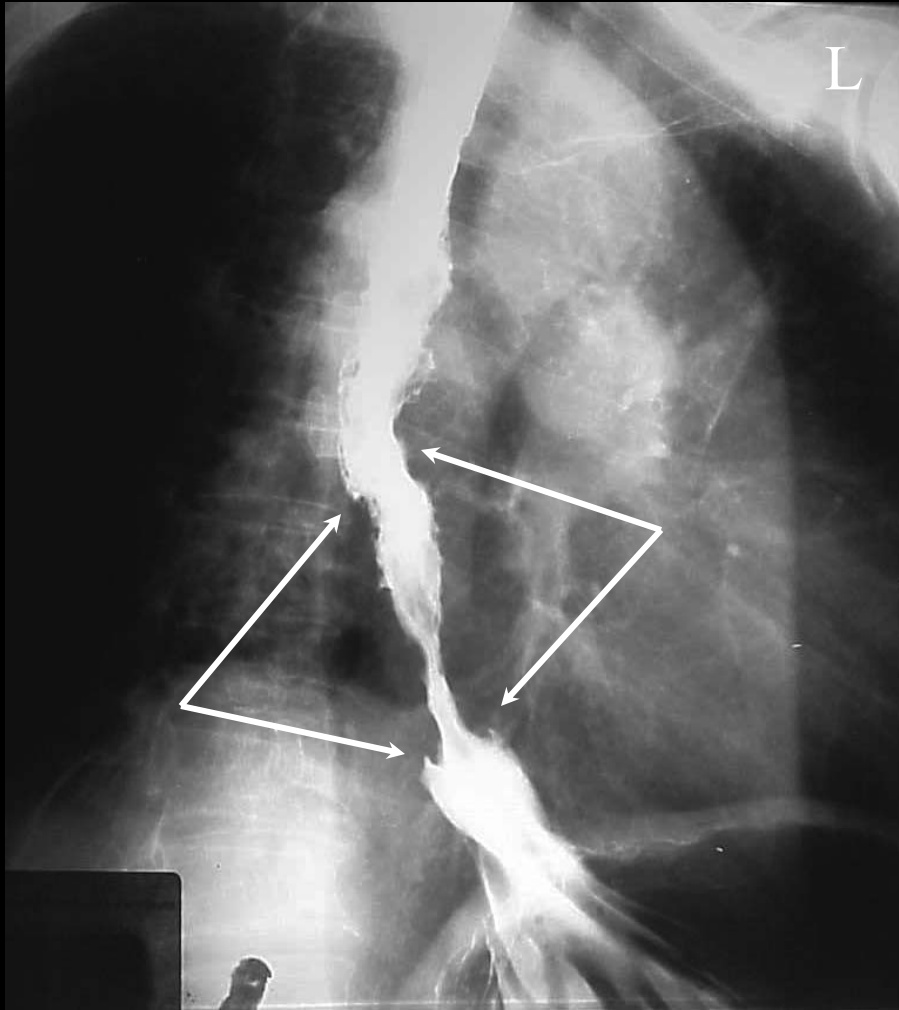


The arrows on this esophagram are pointing to tortuous varicose veins of the esophagus known as **esophageal varices**. They are the result of portal hypertension that is often caused by **cirrhosis** of the liver. This disease is commonly found in patients suffering from alcoholism.

Esophagus Cancer:

- Esophagus cancer represents 2% of all cancers and there is a high incidence in smokers and alcoholics.
- The prognosis for this cancer is very poor as it has a 5 year survival rate of 25%.
- It presents with a very “ratty” radiographic appearance on a barium swallow.
- Treatment includes the following
 - Chemotherapy
 - Radiation Therapy
 - Esophagogastrectomy (gastric pull-up)
 - The affected portion of the esophagus is removed and the stomach is pulled up into the thorax.

Esophagus Cancer:



The arrows on this esophagram are pointing to areas where stenosis of the esophagus has occurred due to the presence of **esophageal cancer**. This type of cancer has a very low survival rate and has a high incidence in smokers and alcoholics. Notice how the distal portion of the lesion has taken on the classic “apple-core” appearance of an **adenocarcinoma**.

Candida:

- Candida occurs as the result of a fungus that has affected the esophagus.

This is sometimes referred to as thrush.

- It is an opportunistic infection that is often found in HIV positive and cancer patients due to the state of their suppressed immune system.

Candida:



Candida is an opportunistic fungus that commonly inhabits the mouth, throat, GI tract and vagina. When it over grows within the body it can lead to conditions such as **thrush** and **candidiasis**.

Immunocompromised patients that are HIV positive or patients on chemotherapy are predisposed to this infection.

Peptic Ulcer Disease (PUD):

- PUD is a general term that is used to describe ulcers of the stomach and duodenum.
- This is usually a chronic disease.
- Causes include the use of aspirin, steroids, spicy foods, stress, and it can be the result of a bacterial infection.
- Complications include the potential for an obstruction, perforation, and bleeding.
- Treatment consists of a bland diet, antacids, decrease stress, surgery, antibiotics and abstinence from smoking, alcohol, and aspirin.

Peptic Ulcer Disease (PUD):

- Gastric Ulcers

These are very rare and may be a complication of gastric carcinoma.

- Peptic Ulcers

These are located in the duodenum and are much more common than gastric ulcers.

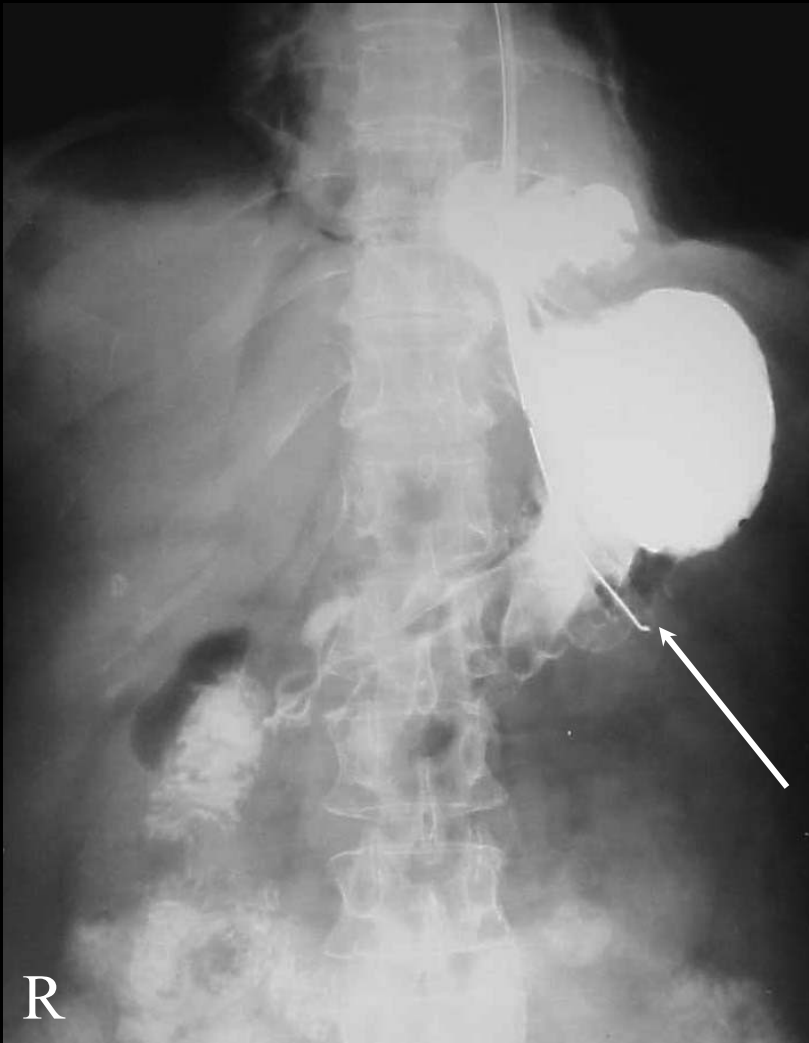
They are mostly located in the duodenal bulb and are usually not associated with cancer.

Peptic Ulcer Disease: Duodenal



The arrow on this radiograph is pointing to a **duodenal ulcer**. This is the most common type of peptic ulcer and it is usually located within the duodenal bulb. Duodenal ulcers are usually not associated with cancer.

Peptic Ulcer Disease: Gastric

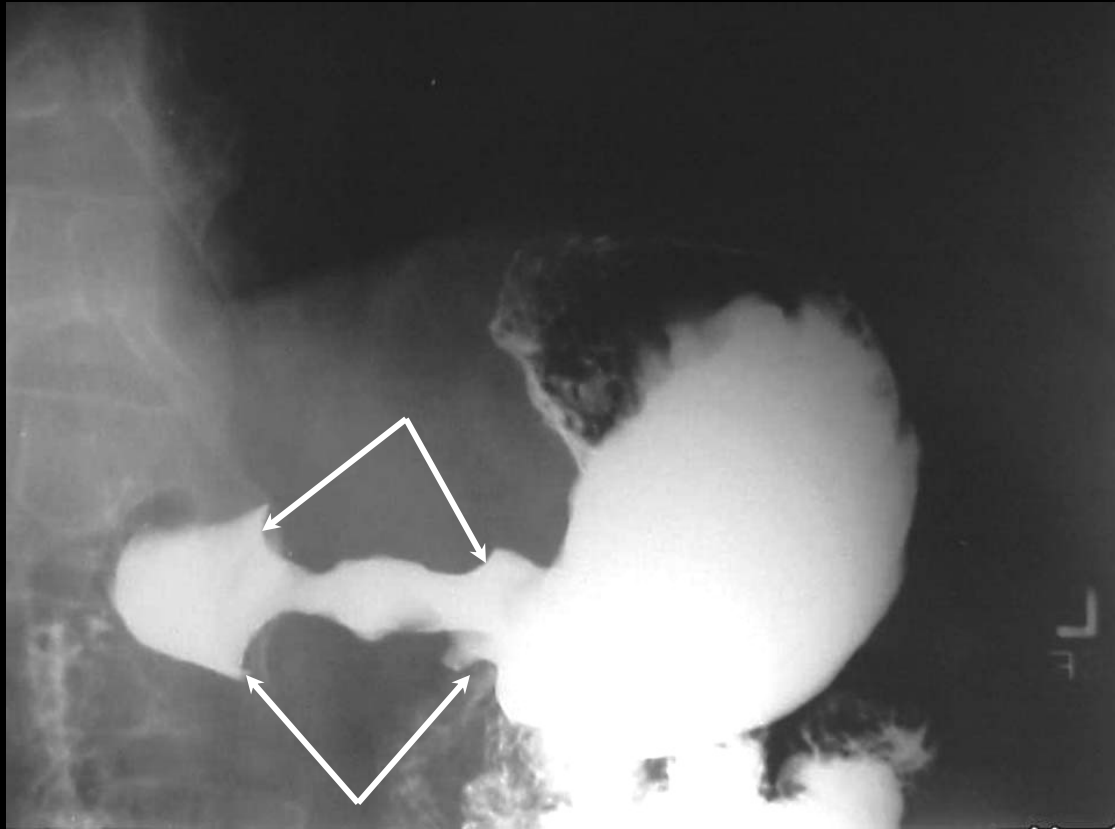


It is imperative that the etiology of a **gastric ulcer** be determined to ensure that it was not caused by stomach cancer. A biopsy of the stomach will be performed to rule this out. On this UGI radiograph, the tip of the NG tube (arrow) is lodged within a gastric ulcer.

Gastric Carcinoma:

- It is generally asymptomatic in the early stages and has generally metastasized to other areas of the body by the time it has been diagnosed.
- As a result, it has a poor prognosis.
- UGI studies present thick, irregular, and rigid (linitis plastica) folds.
- Treatment includes gastrectomy, chemotherapy, and radiation therapy.

Gastric Carcinoma:

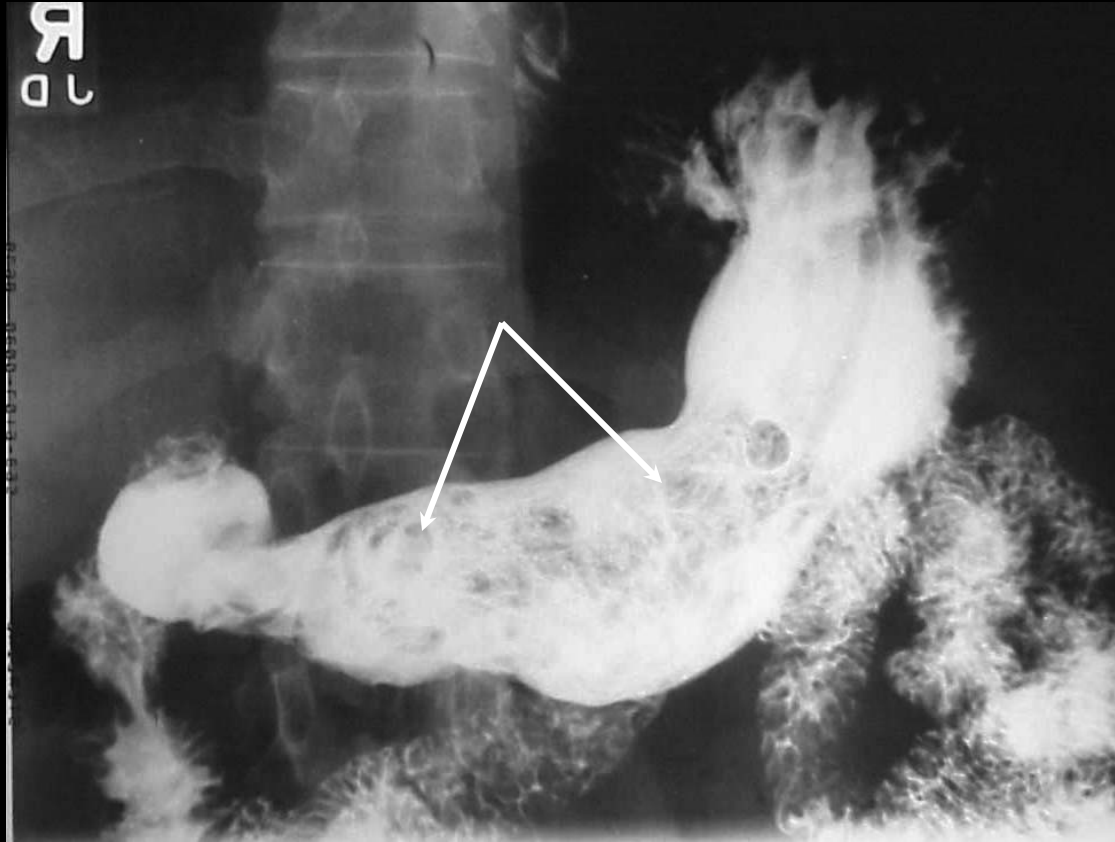


The arrows on this UGI radiograph are pointing to a **gastric carcinoma**. Note the classic “apple-core” appearance that is a characteristic of an adenocarcinoma.

Bezoar:

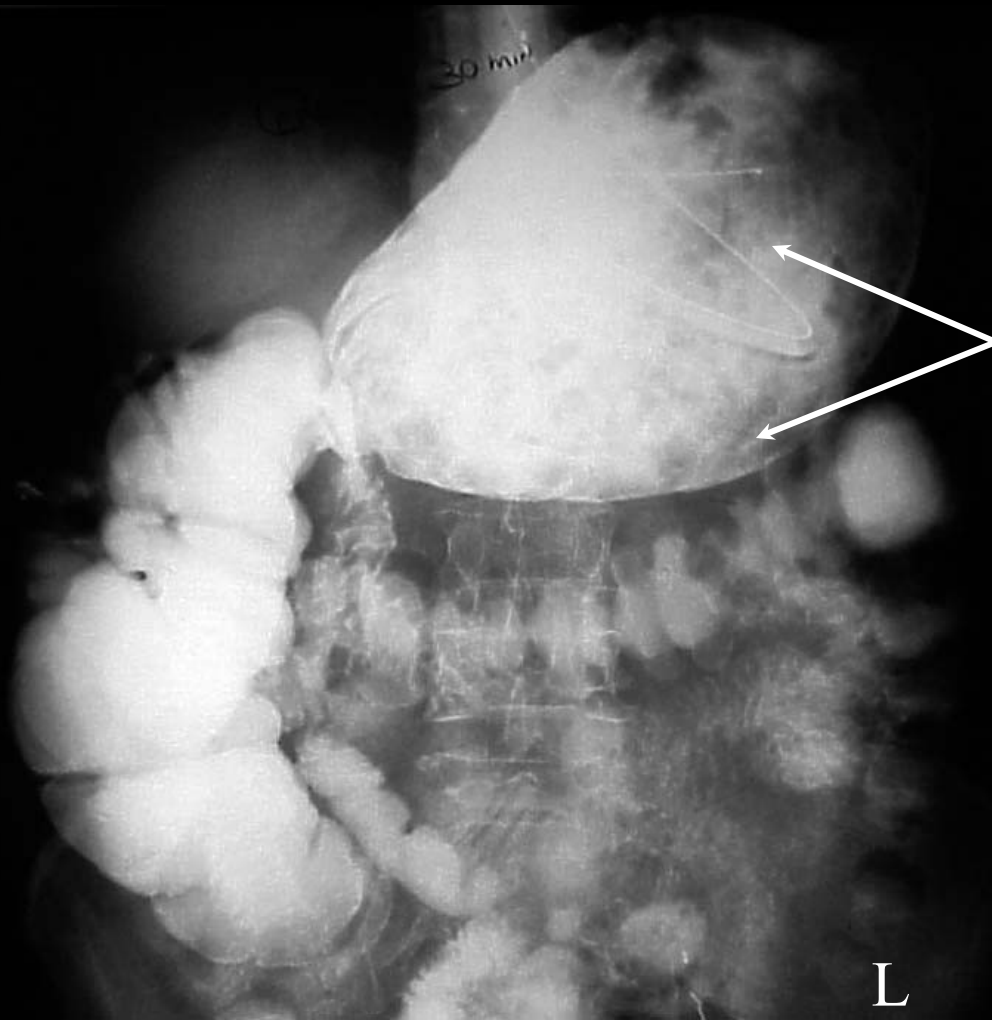
- This is a hard mass of entangled material found within the stomach or intestines that cannot be digested.
- They are often made of hair and food fibers.

Bezoar:



The artifact (arrows) depicted on this radiograph consists of a hard ball of entangled materials called a **bezoar**. It consists of large mass of hair and/or vegetable fibers that cannot be digested.

Bezoar:



The arrows on this radiograph are pointing to another example of how large a **bezoar** can become. In fact, they can sometimes be found to be the cause of a **mechanical bowel obstruction**.

Bowel Obstruction:

- The two broad categories of bowel obstructions are as follows: adynamic or paralytic ileus and a mechanical bowel obstruction.
- In either case, the net result is a partial or complete loss of the normal parastaltic action of the small and/or large intestine thus impeding the normal transit of chyme.
- Signs and symptoms of a bowel obstruction would include the following:
 - Abdominal Pain and/or Cramping
 - Abdominal Distention
 - Vomiting and Fecal Vomiting (unpalatable!)
 - Constipation

Adynamic or Paralytic Ileus:

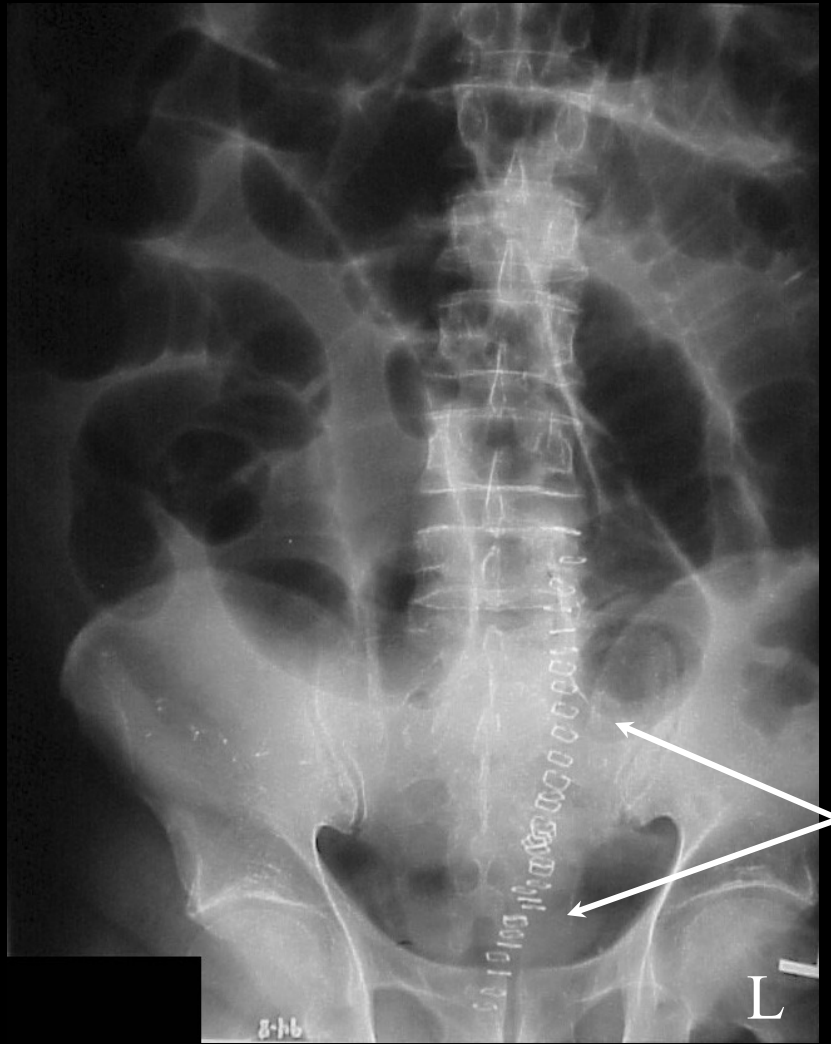
- This type of bowel obstruction is caused by a reduction in the normal peristaltic action of the intestines.
- This loss of peristalsis will cause the lumen of both the small and large intestines to fill with air and fluid.
- Therefore, the radiographic appearance of air in both the small and large intestines is an indication of this condition.
- Some common causes of an adynamic ileus are as follows:

Anesthesia/Some Medications

Abdominal Surgery

Illness

Adynamic or Paralytic Ileus:



The dilated loops of small bowel found on this radiograph indicate the presence of a **small bowel obstruction**. The surgery staples (arrows) in the lower abdomen are an indication that this obstruction may have been caused by a combination of exposure to anesthesia and abdominal surgery. Therefore, this obstruction would be categorized as an **adynamic** or **paralytic ileus**.

Mechanical Bowel Obstruction:

- This is the second category for bowel obstructions.
- A mechanical obstruction is caused by a motility disorder that results from some type of structural abnormality.

Many factors can contribute to a mechanical bowel obstruction and some of them are listed below:

- Hernia
- Adhesions
- Volvulus
- Intussusception
- Neoplasm (Adenoma/Polyp, Adenocarcinoma)
- Crohn's Disease
- Constipation

Hernia:

- This type of obstruction is caused by a weakening of the abdominal wall that allows a portion of the small and/or large intestine to protrude through it.
- A *reducible hernia* can be pushed back into the abdominal cavity while an *incarcerated hernia* cannot and could therefore lead to a bowel obstruction.
- A common hernia in men is called an inguinal hernia.
This condition occurs when the inguinal ring is compromised thus allowing a portion of the bowel to rupture through the abdominal wall.
In some instances, the bowel will descend into the scrotum.

Hernia: Inguinal



A large portion of this patient's bowel (arrows) has protruded through an unnatural opening within the abdominal wall. This is called an **inguinal hernia** and it is estimated that about 5% of the population will develop an abdominal wall hernia.

Bowel Adhesion:

- Adhesions are bands of fibrous connective tissue that connect organs and tissues that are normally separate.
- They are an almost inevitable outcome of abdominal surgery.
- Adhesions can lead to abdominal pain, infertility, and bowel obstruction.

This blockage will lead to death in about 5% of all cases.

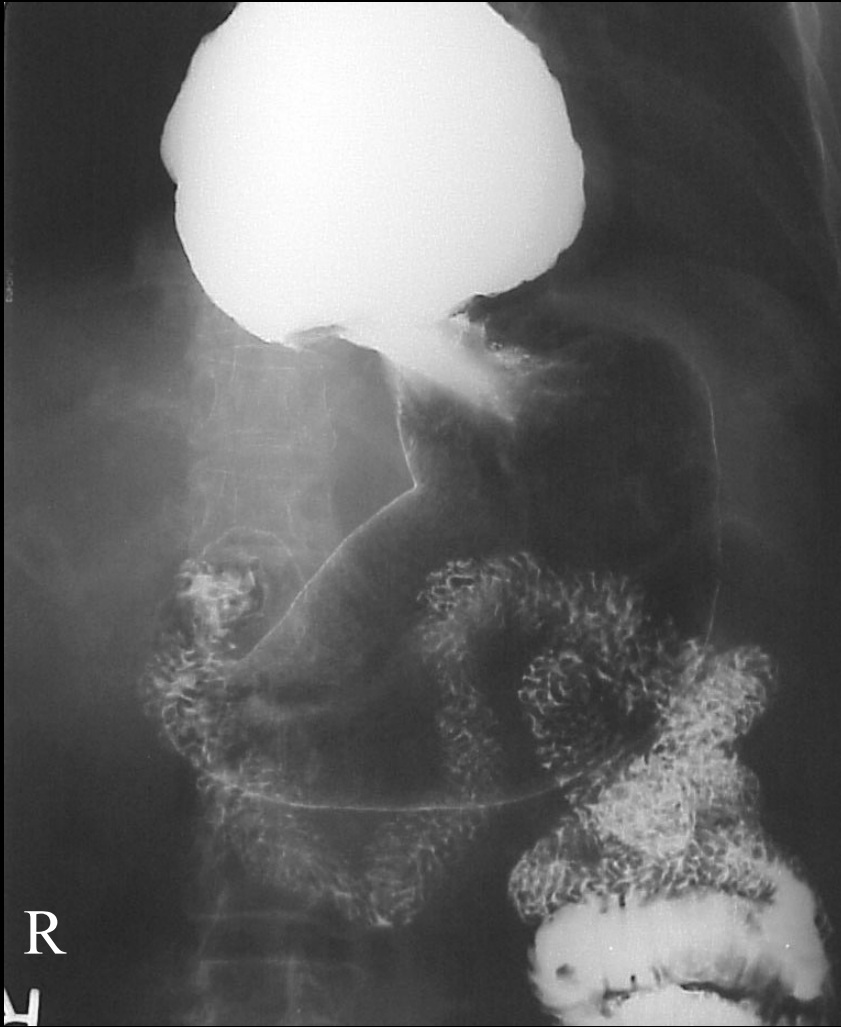
- A bowel adhesions can cause a twisting of the bowel and loss of blood supply to the affected area.

The resultant bowel strangulation will result in death in as high as 37% of all cases.

Volvulus:

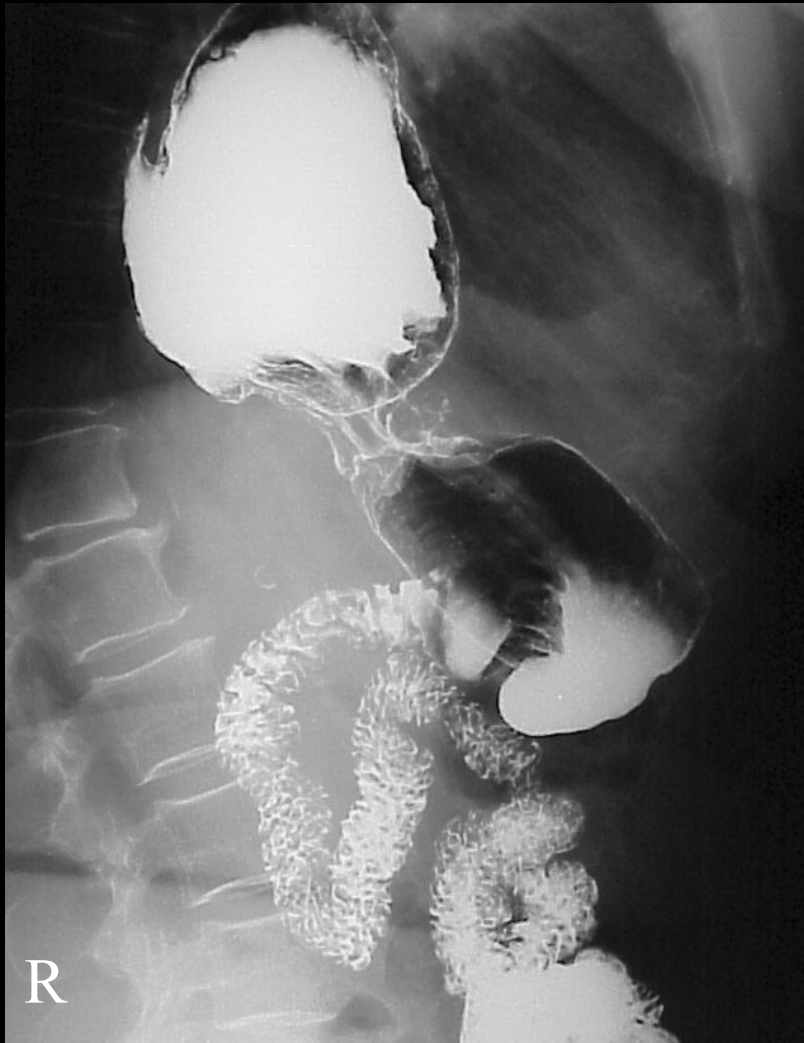
- A volvulus is a loop of intestine that has twisted around itself causing either a partial or complete obstruction.
- They may resolve on their own but some will require surgical intervention in order to prevent a loss of blood supply to the affected area and relieve the obstruction.

Volvulus: Gastric



This AP UGI radiograph depicts an abnormal twisting of the stomach which can lead to an obstruction. This is called a **gastric volvulus** or **stomach torsion**.

Volvulus: Gastric



This is a lateral on the same patient demonstrating a **gastric volvulus or stomach torsion.**

Volvulus: Gastric

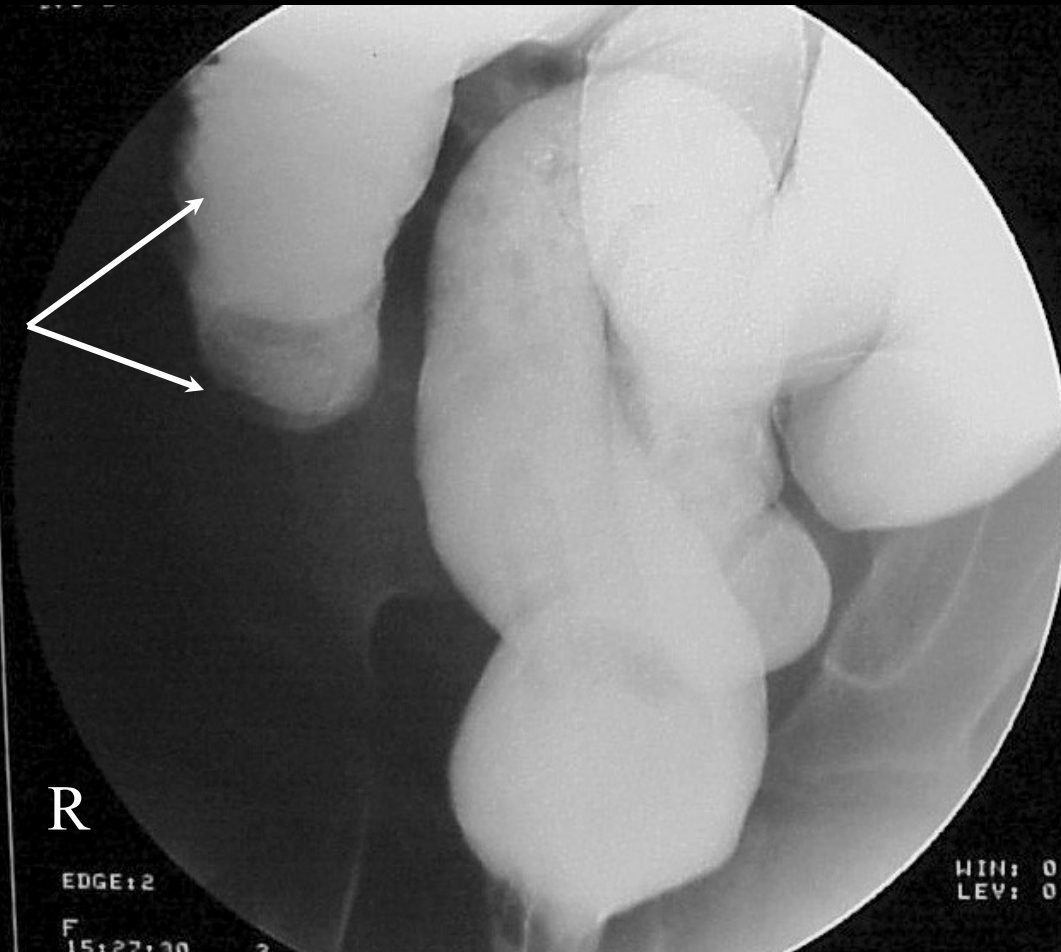


This is an RAO on the same patient demonstrating a **gastric volvulus or stomach torsion.**

Intussusception:

- Intussusception occurs when a section of bowel is constricted by peristalsis causing it to prolapse or telescope into itself.
- This condition is primarily confined to infants aged 2 to 36 months and occurs more frequently in boys than girls at a ratio of 3:1.
- Intussusception is the cause of approximately 1% of all adult bowel obstructions and commonly affects the ileocecal valve.
- It is commonly corrected with a barium enema.

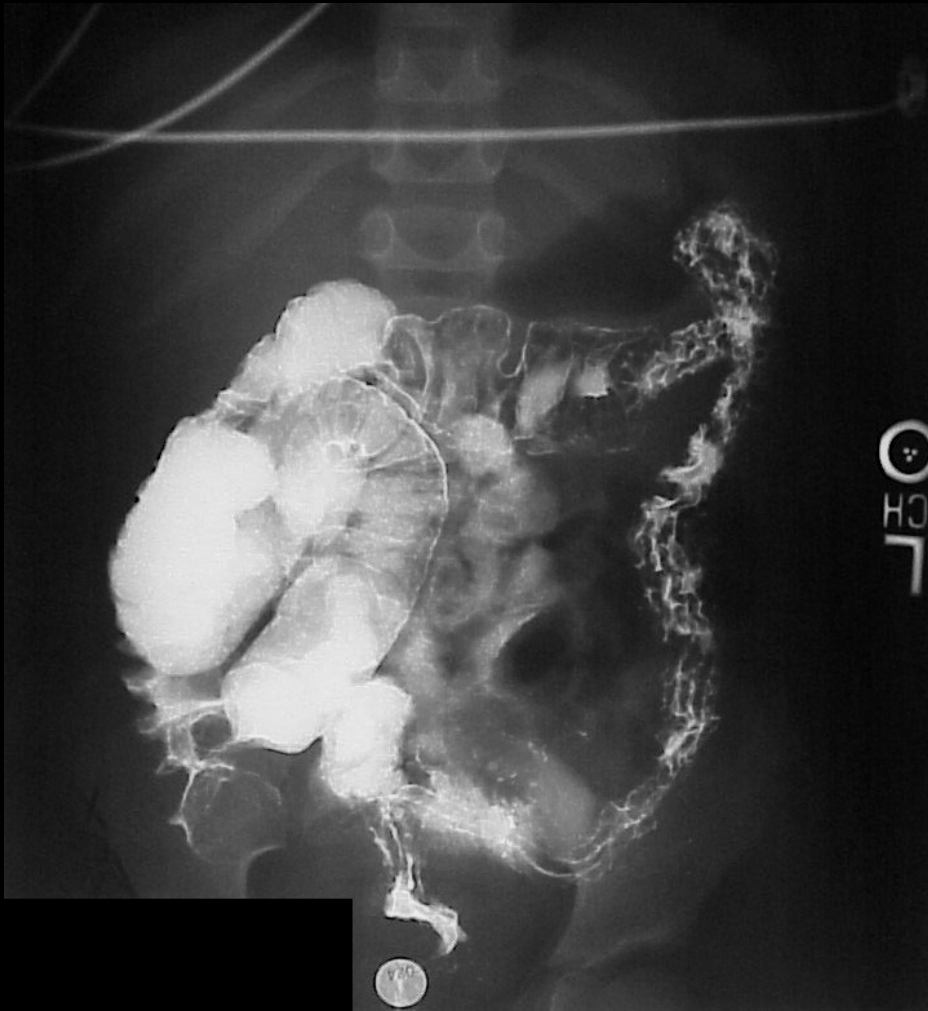
Intussusception:



The arrows on this barium enema on a 2 year old are pointing to an area near the cecum that has constricted by peristalsis and has prolapsed or telescoped in to itself. This condition is a type of **bowel obstruction** referred to as **intussusception**.



Intussusception:



This is a KUB on the previous patient after successful reduction of the **intussusception** by means of applying pressure with a barium enema.

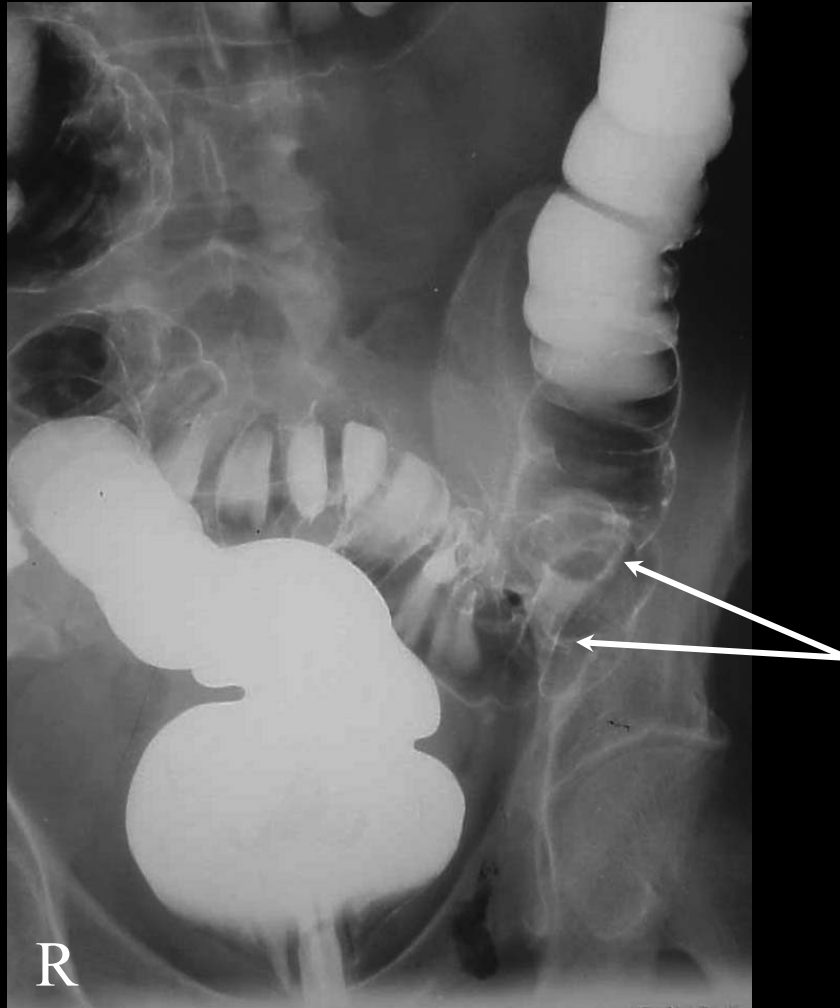
Adenomatous Polyp:

- A neoplasm that grows into the lumen of the colon is called a polyp.
- A pedunculated polyp possess a stalk while a sessile (barnacle) polyp is attached directly to the bowel wall.
- Most polyps are benign but an adenomatous polyp may transform into a malignancy and must be removed.

This is sometimes referred to as simply an adenoma.

- Colon polyps are generally asymptomatic but some may cause rectal bleeding, pain, diarrhea, and/or constipation.

Adenomatous Polyp:



The arrows on this image are pointing to a **pedunculated polyp**. This type of neoplasm can lead to cancer and is therefore routinely removed.

Adenomatous Polyp:

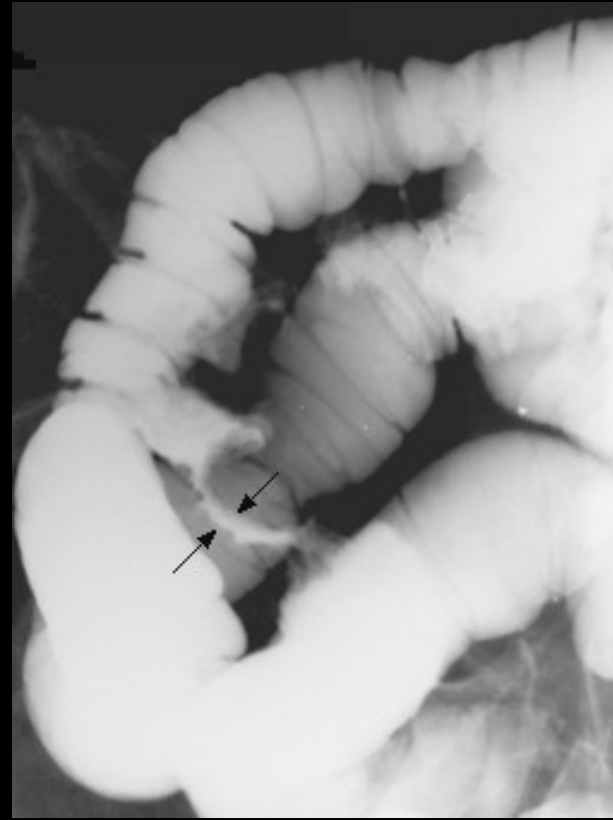
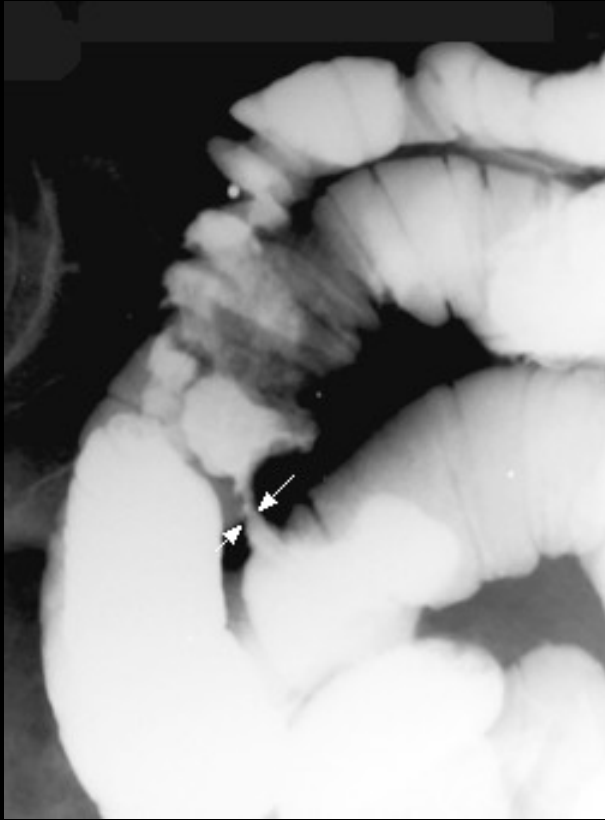


This is a magnified view of the previous image. The presence of a stalk (arrows) is a characteristic of a **pedunculated polyp**.

Adenocarcinoma:

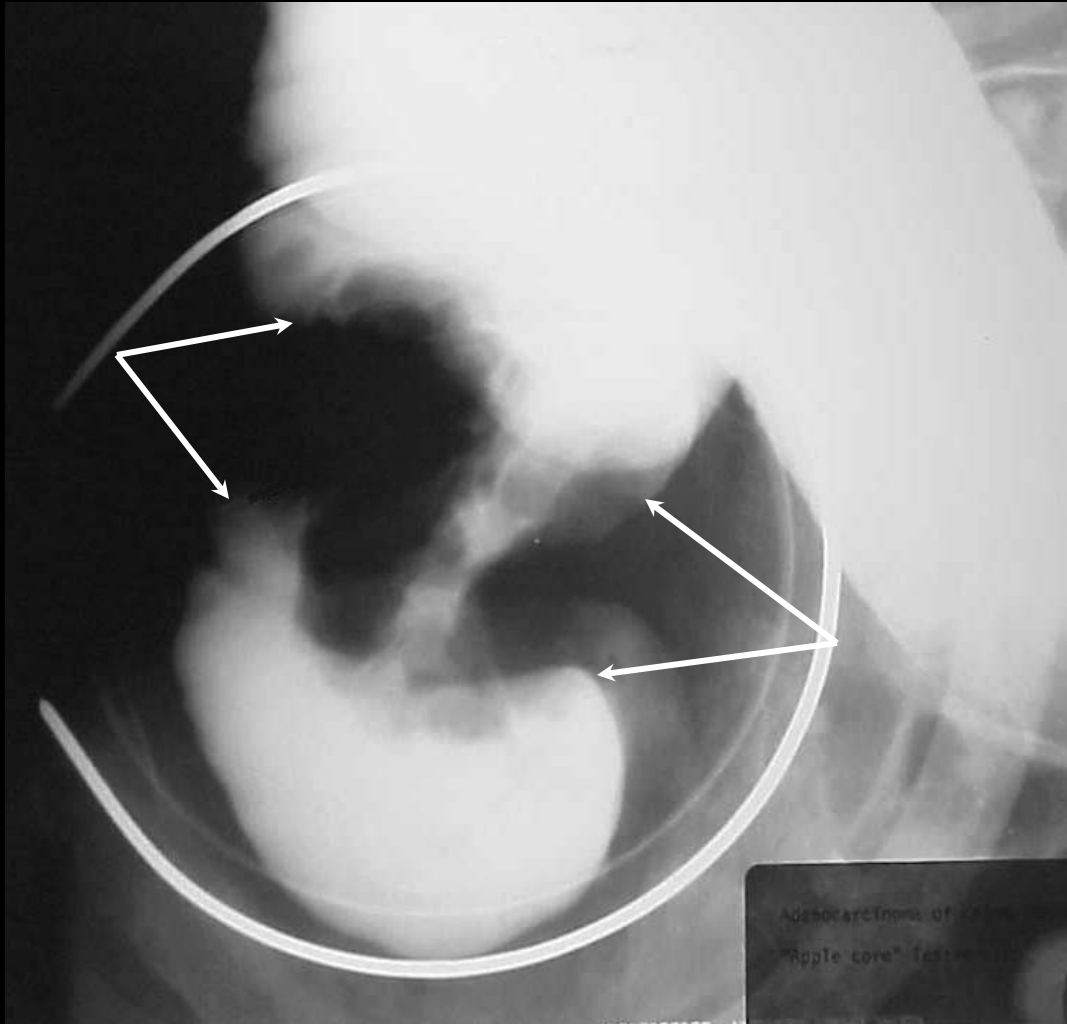
- An adenocarcinoma is a type of neoplasm that originates in glandular tissue and can be the cause a bowel obstruction.
- In the colon, it is also commonly referred to as colorectal cancer and is thought to arise from adenomatous polyps.
- The lifetime risk of developing colon cancer in the US is 7% and it is the second most common cause of cancer mortality.
- Unfortunately, this type of metastatic cancer often goes unnoticed until it reaches a relatively advanced stage.
- A colonoscopy is the method of choice for diagnosis.
 - A positive diagnosis is followed by surgical removal and in many instances, chemotherapy.

Adenocarcinoma :



The arrows on this image are pointing to a cancer that has formed within the lining of the small intestine. This type of cancer is called an **adenocarcinoma** since it originates within glandular tissue.

Adenocarcinoma :



This **adenocarcinoma** has formed in the large intestine and possesses a classic the “**apple-core**” appearance (arrows) that it is often characterized by. This type of metastatic cancer is often referred to as **colorectal cancer**.

Regional Enteritis or Crohn's Disease:

- This is the last example of a disease that may be the cause of a mechanical bowel obstruction.
- Crohn's disease is characterized by a chronic inflammation of the bowel and has an unknown etiology.
- It is characterized by abdominal cramping, diarrhea, constipation, weight loss or gain, and vomiting.
- Fistulas may form in response to the chronic inflammation that characterizes this disease.
- There is no known cure for Crohn's disease.

Regional Enteritis or Crohn's Disease:



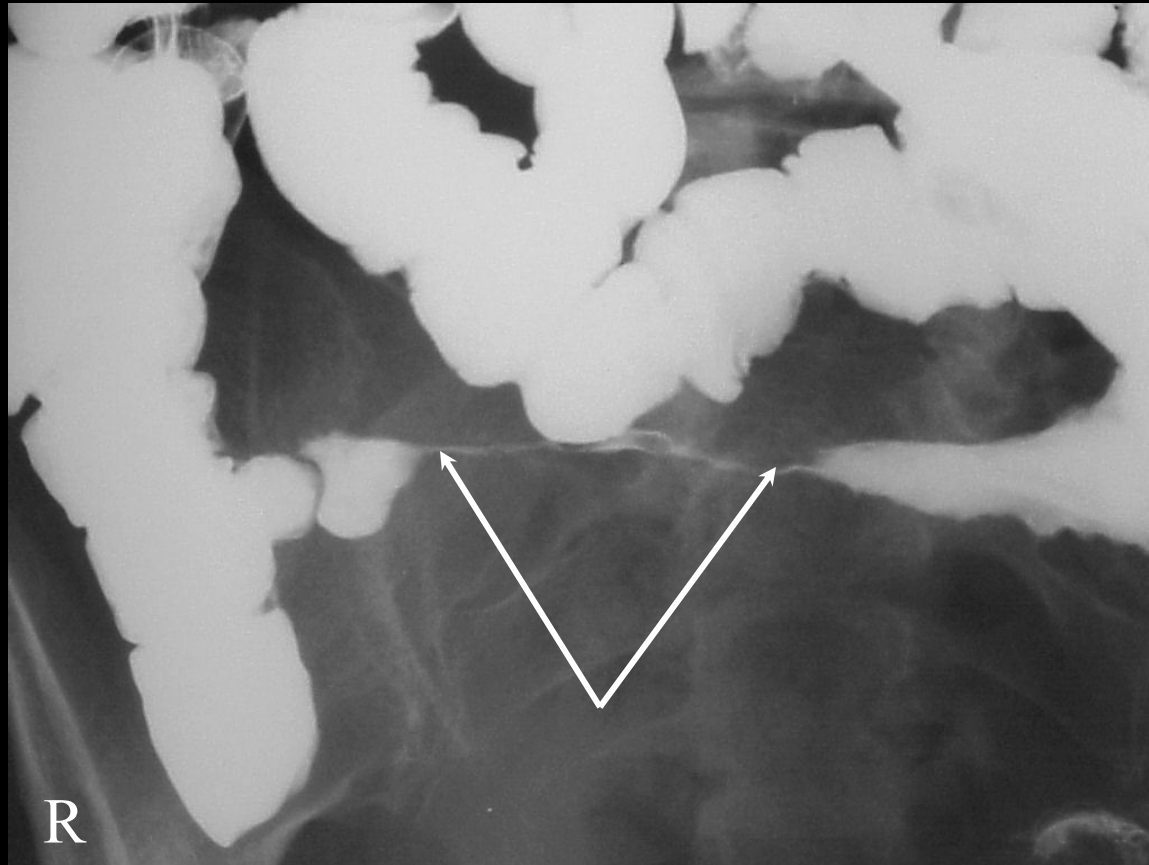
This image demonstrates the classic radiograph appearance of the “string sign” that is a characteristic of Crohn's disease.

Regional Enteritis or Crohn's Disease:



This is an even better depiction of the classic radiograph appearance of the “string sign” that is a characteristic of Crohn's disease.

Regional Enteritis or Crohn's Disease:



This is a magnified view of the previous image depicting the radiographic appearance of the “**string sign**” that is a characteristic of **Crohn's disease**.

Constipation:

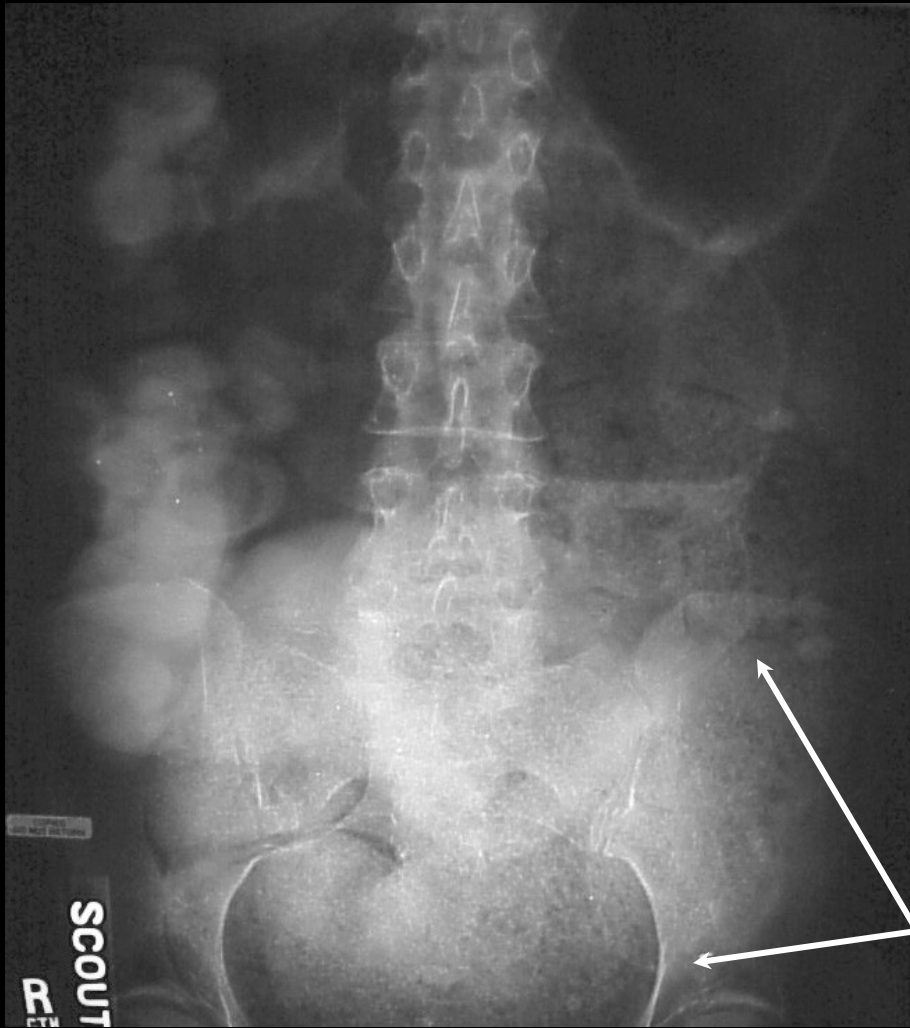
- Constipation is a very common digestive complaint where the patient experiences hard stool that can be difficult to defecate.
- Straining to defecate can lead to anal fissures and hemorrhoids (varicose veins of the rectum).
- Severe cases can lead to a mechanical bowel obstruction called a fecal impaction.
- Causes of constipation include lack of dietary fiber, dehydration, a decrease in peristalsis, stenosis, tumors, anxiety, and abdominal surgery.

Constipation:

- Treatment usually consists of an increased intake of fluid and dietary fibers and the use of laxatives.

In some instances, the impaction will require the use of enemas and/or manual removal.

Constipation:



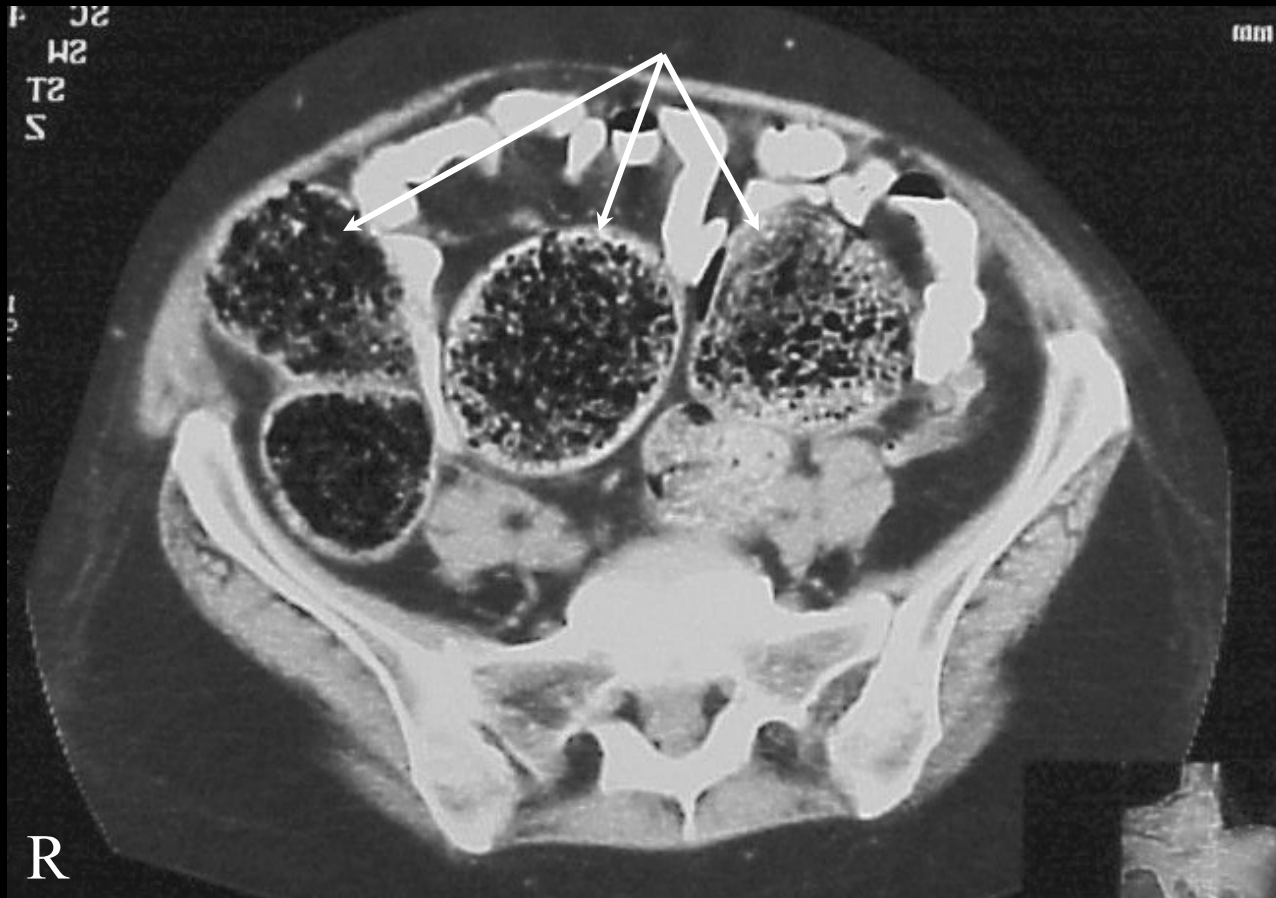
The grainy appearance on this KUB is the result of a **fecal impaction** (arrows). **Constipation** is a very common digestive complaint where the patient experiences hard stool that can be difficult to defecate.

Constipation:



This is a magnified view of the previous image that demonstrates how a **constipation** can lead to a **fecal impaction**.

Constipation:

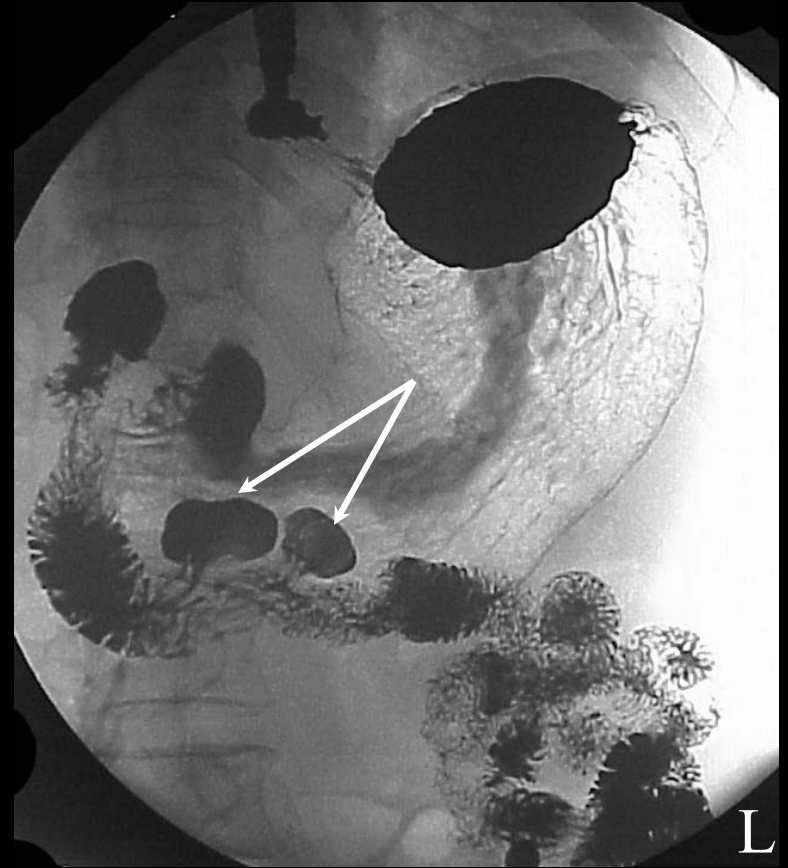
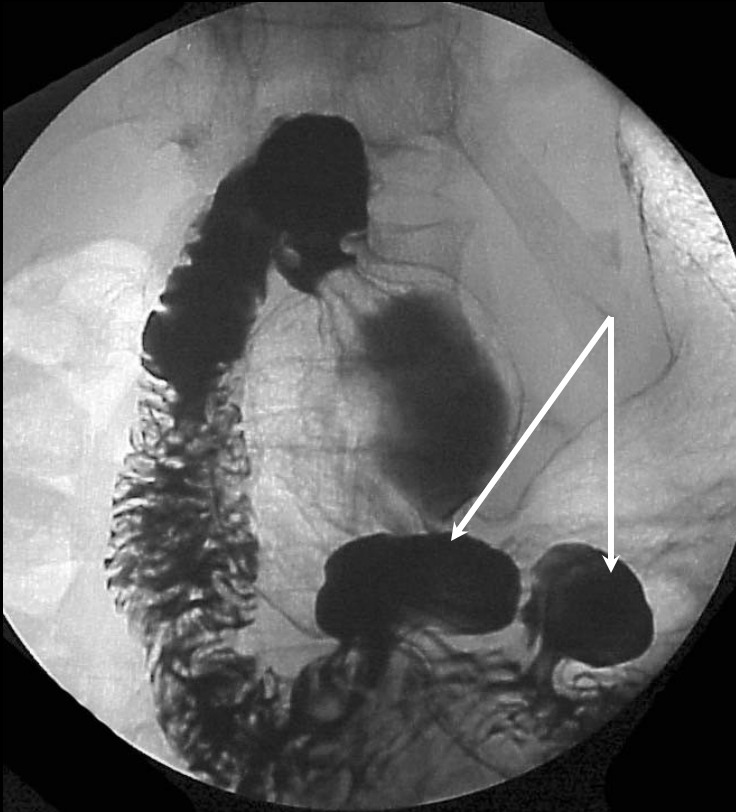


The arrows on this CT are pointing to a large **fecal impaction** that is located throughout the large intestine. The etiology was **constipation**.

Diverticulosis:

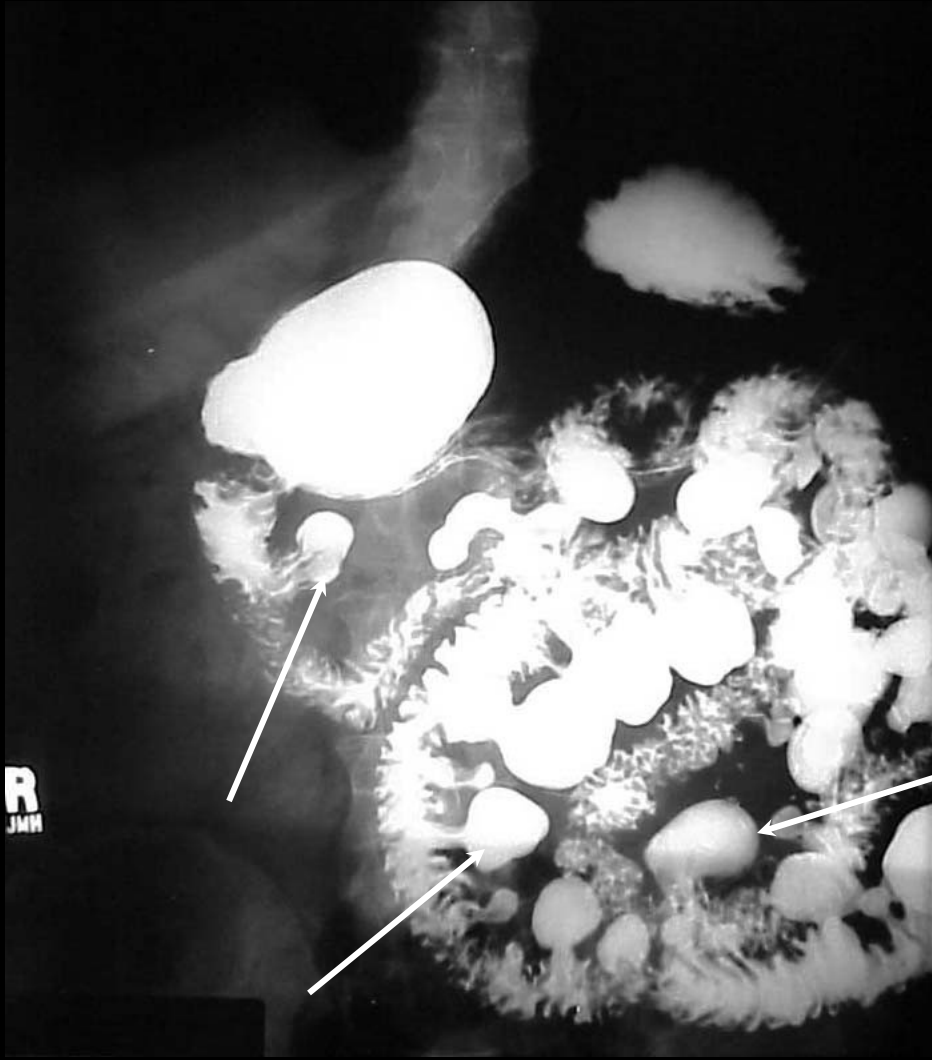
- As mentioned earlier, diverticulum can occur along the entire length of the GI tract.
- In regards to the large intestine, they are commonly found in the area of the sigmoid colon.
- Diverticulum often have no signs or symptoms and are often a serendipitous discover on a barium study or colonoscopy.

Diverticulosis:



The arrows on these UGI radiographs are pointing to multiple **diverticula** that have formed on the distal portion of the duodenum.

Diverticulosis:



The arrows on this small bowel series radiograph are pointing to innumerable **diverticula** that have formed throughout the small intestine.

Diverticulosis:

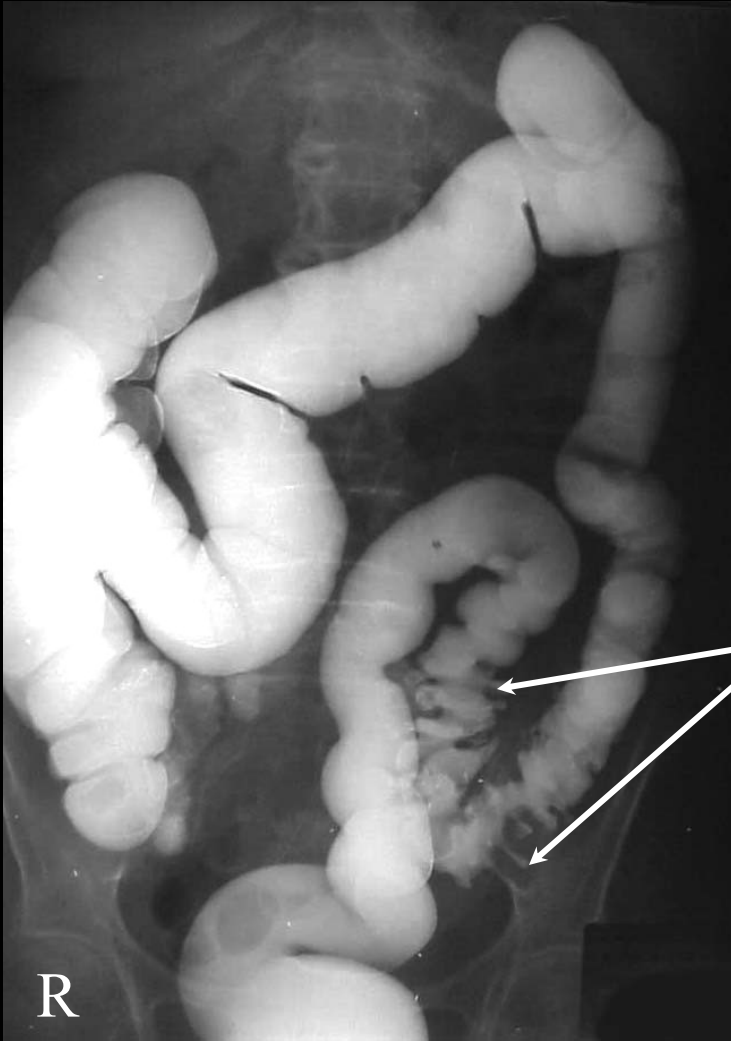


The arrows on this barium enema radiograph are pointing to innumerable **diverticula** that have formed throughout the large intestine.

Diverticulitis:

- Diverticulitis occurs when a diverticulum become infected and bleeds.
- This is often caused by entrapment of chyme or feces within the diverticulum.

Diverticulitis:



The arrows on this barium enema radiograph are pointing to **diverticula** within the large intestine that have become infected with feces. This condition is referred to as **diverticulitis** and will likely result in rectal bleeding.

Appendicitis:

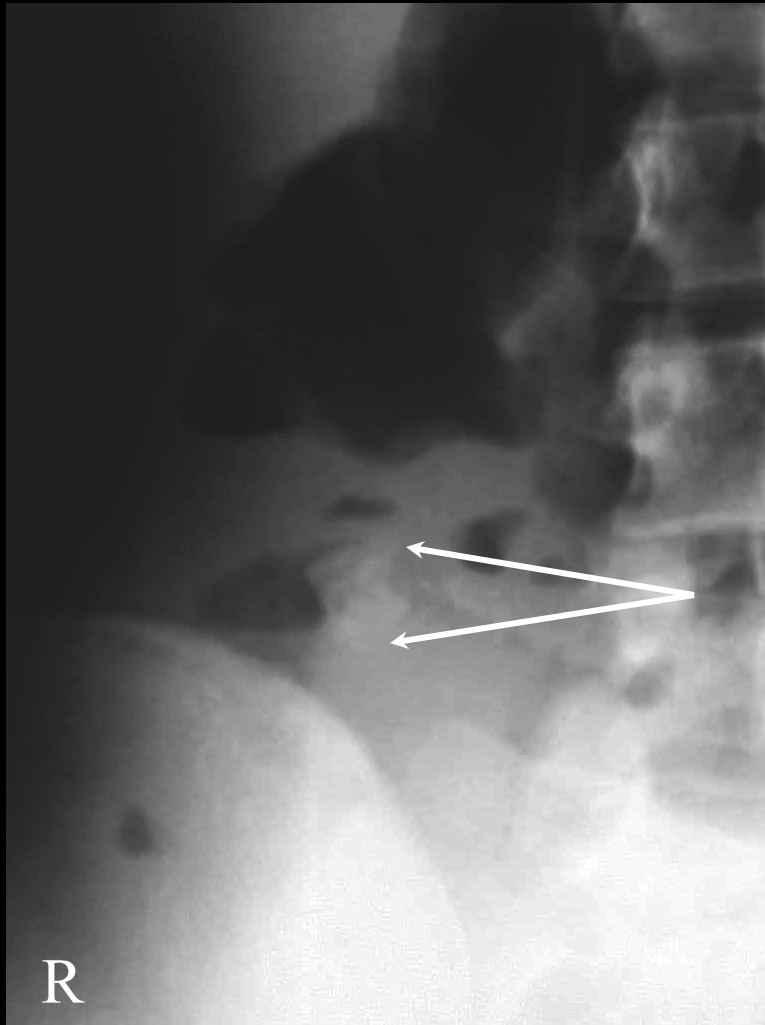
- Appendicitis occurs as a result of entrapment of feces within the appendix and the presence of an appendicolith.
- Symptoms include right lower quadrant pain and an increase in the white blood cell count.
- A barium enema will demonstrate a spasm of the cecum and a non filling appendix.
- Mild cases may resolve on their own but more severe infections may require the surgical removal of the appendix.

Appendicitis:



The arrow on this radiograph is pointing to an **appendicolith** that has become inflamed. As a result, this patient was diagnosed with **appendicitis** and had the appendix surgically removed.

Appendicitis:



This is a magnified view of the previous image and better depicts the size and shape of the **appendicolith** (arrow).

Diverticula of the Appendix:



Diverticula can form anywhere along the alimentary canal. In this instance, the lining of the appendix has weakened resulting in the formation of a small diverticula.

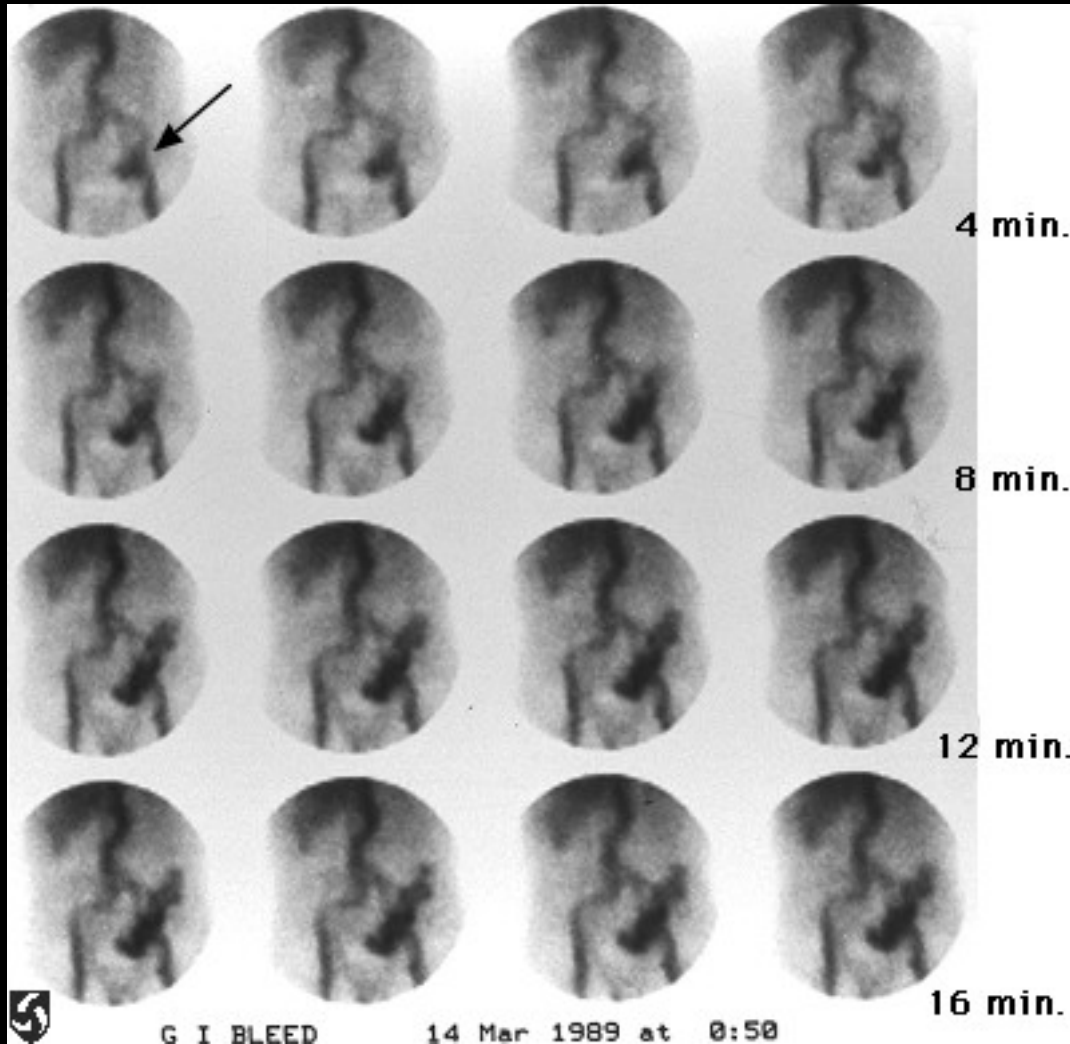
GI Bleed:

- A GI bleed can occur throughout the GI tract.
- The most common causes of lower GI bleeding are diverticulitis and angiodysplasia.

The primary symptom is rectal bleeding with bright red blood.

- Endoscopy, nuclear medicine scans, and/or special procedure studies (IMA/SMA) can be performed to diagnose this condition.
- Transcatheter embolization or an infusion of vasopressin have proven to be effective strategies employed to stop the bleeding.

GI Bleed:



The arrow on this nuclear medicine scan is pointing to an area where a **GI bleed** is present.

GI Bleed:



The arrow on this arteriogram is pointing to an area where contrast material is escaping into the large intestine. This is referred to as a **GI bleed**.

Hepatobiliary System Menu

1. Co-Joined Twins at the Liver
2. Hepatic Cysts
3. Hepatic Hemangioma
4. Hepatocellular Carcinoma
5. Hepatomegaly
6. Liver Metastasis
7. Cholelithiasis
8. Emphysematous Cholecystitis
9. Porcelain Gallbladder
10. Splenomegaly
11. Spleen with a Calcified Cyst

Co-Joined Twins at the Liver:

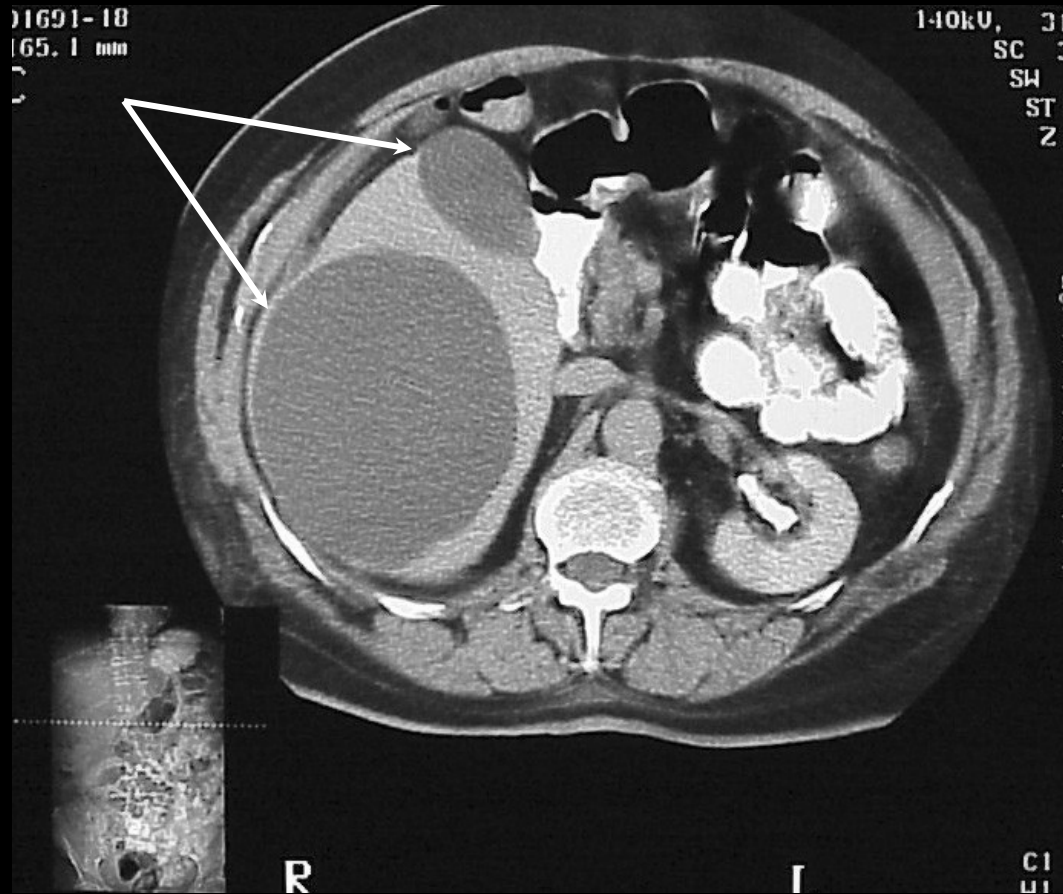


The radiograph depicts two twins that are joined at the liver.

Hepatic Cysts:

- A hepatic cyst is a benign, thin-walled sac that may be either empty or full of fluid.
- They may be located within the liver or on its external surface.
- Hepatic cysts generally have no symptoms and are usually incidental findings on ultrasounds, CT scans and/or MRI scans of the abdomen.
- No treatment is usually required.

Hepatic Cysts:



The arrows on this CT scan of the abdomen are pointing to rather large **hepatic cysts**. These are usually incidental findings and no treatment is usually required.

Hepatic Hemangioma:

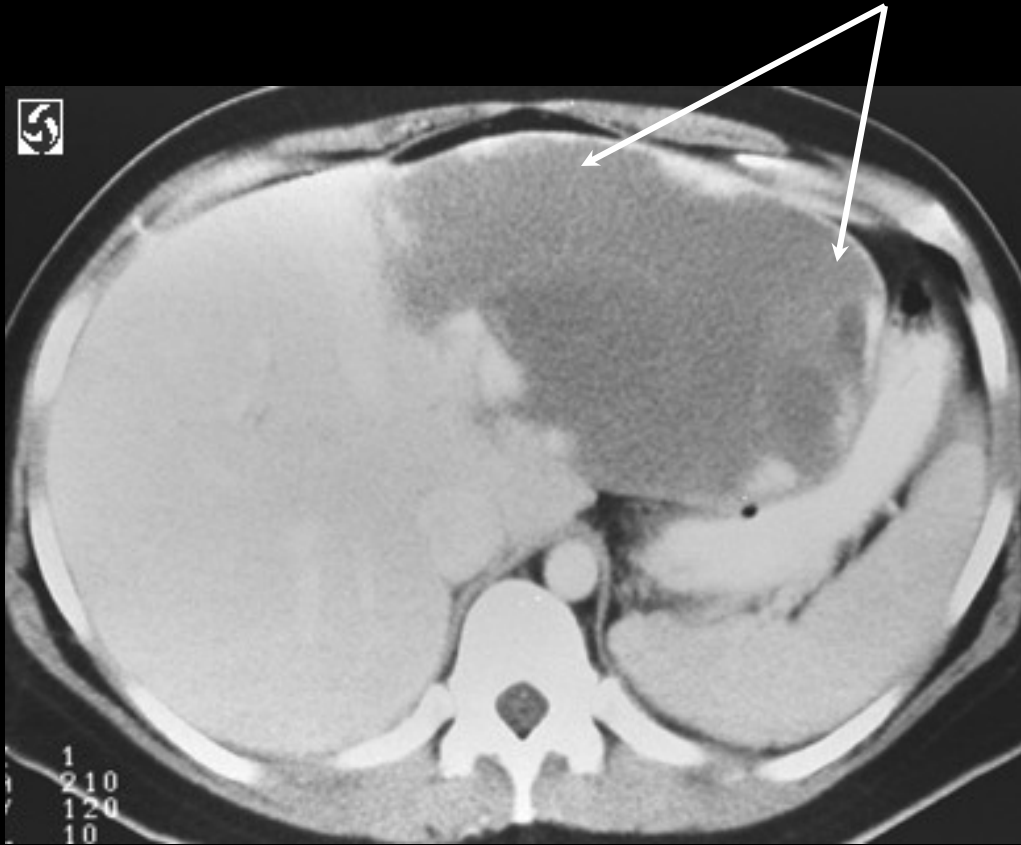
- A hepatic hemangioma is the most common benign tumor of the liver.
- It consists of dilated blood vessels that create pools or lakes of blood within the liver.
- They commonly manifest between the ages of 30 to 50 and are more prevalent in women than in men.
- A needle biopsy is not indicated with this condition and may even be considered a contraindication due to the increased potential for excessive bleeding.
- MRI is the modality of choice in differentiating between a hepatocellular carcinoma and a hepatic hemangioma.
- There is no treatment for this condition although surgery may be indicated in severe cases.

Hepatic Hemangioma:



The arrows (b) on this MRI scan of the abdomen are pointing to large **hemangioma**. The hepatocytes of the liver enhance with contrast material (a) while the “lakes” of blood within the neoplasm do not (b).

Hepatic Hemangioma:



The arrows on this CT scan of the abdomen are pointing to large **hemangioma**. This is the most common type of benign liver neoplasm and is characterized by forming large cavities or “lakes” of blood.

Hepatocellular Carcinoma:

- Hepatocellular carcinoma is a rare primary liver cancer that is also known as a hepatoma.
- It is very common in alcoholics and patients with hepatitis.
- It has a propensity to metastasize to the lungs but it will also spread to the colon and breasts.
- This type of cancer may not have any symptoms.

However, patients may experience any combination of the following:

- Dull Pain in the Right Upper Quadrant
- Anorexia
- Hepatomegaly
- Jaundice

Hepatocellular Carcinoma:

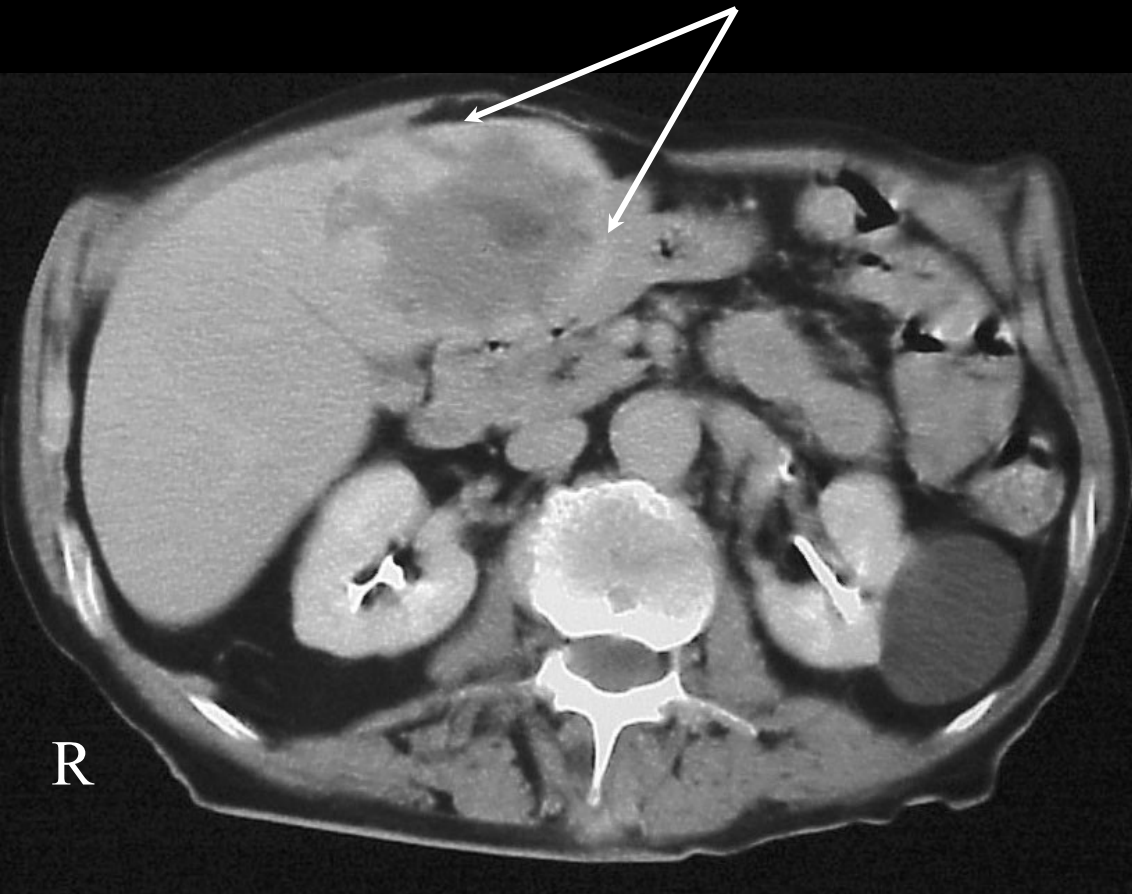
- MRI is the method of choice to diagnose this type of cancer but CT and ultrasound are often employed as well.
- There are a myriad of treatments available for hepatocellular carcinoma including surgical resection, liver transplant, and chemotherapy.

Hepatocellular Carcinoma:



The arrows on this CT scan of the abdomen are pointing to a large **hepatocellular carcinoma**. This rare primary liver cancer is also referred to as a **hepatoma**.

Hepatocellular Carcinoma:



The arrows on this CT scan of the abdomen are pointing to another example of **hepatocellular carcinoma** or **hepatoma**.

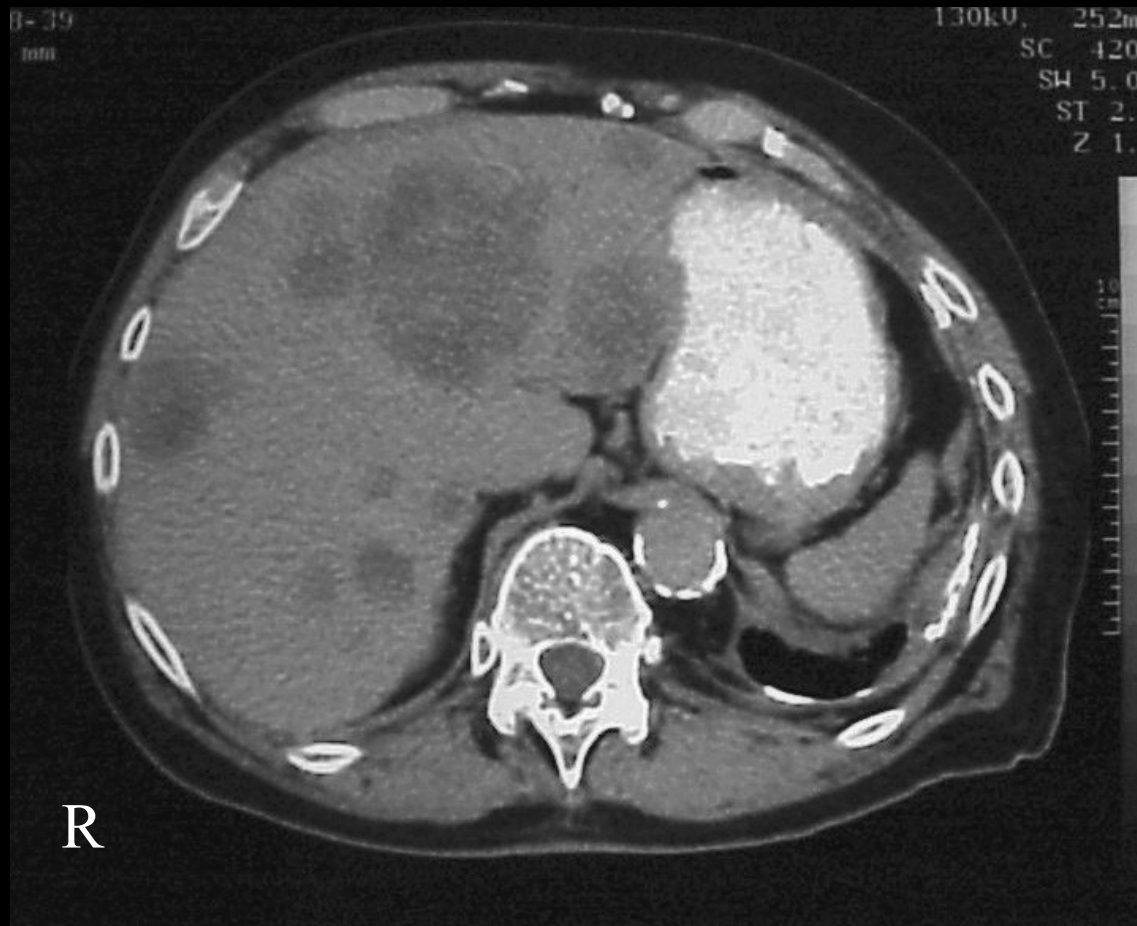
Hepatomegaly:

- Hepatomegaly refers to an enlarged liver.
- It can have a plethora of causes some of which are as follows:
 - Infection
 - Drugs and Alcoholism (Cirrhosis)
 - Tumors
 - Hepatitis
- Treatment varies according to the cause of the hepatomegaly.

Liver Metastasis:

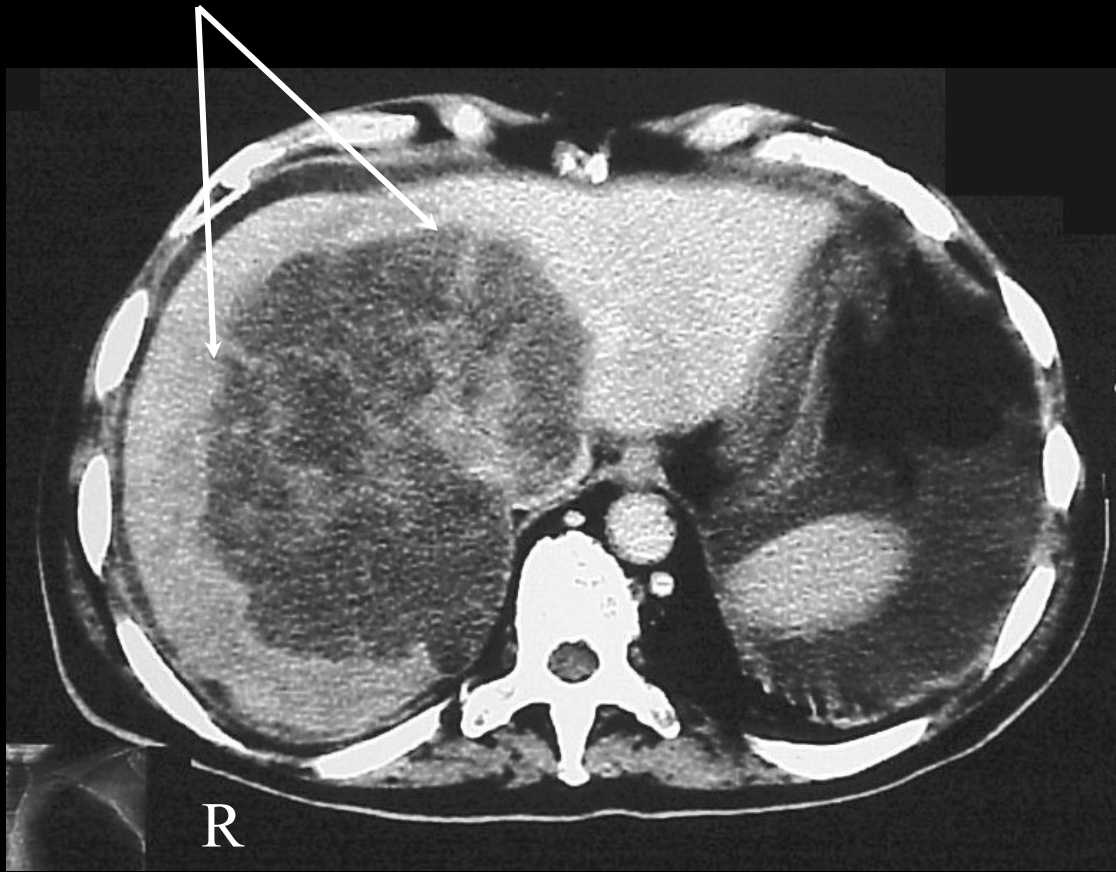
- The liver is a common site for most any cancer metastasis.
- The following is a partial list of cancers that like to spread to the liver:
 - Breast Cancer
 - Colon Cancer
 - Malignant Melanoma
 - Ovarian Cancer
- Symptoms include abdominal pain, jaundice, ascites, and distension.
- It is almost always treated with chemotherapy and the response is dependent on controlling the underlying primary cancer.

Liver Metastasis:



This CT image of the abdomen demonstrates multiple circular densities that are consistent with **liver metastasis**. The liver is a very common site for malignant cancers to metastasize.

Liver Metastasis:



This CT image of the abdomen demonstrates a large neoplasm that has been caused by **liver metastasis** (arrows). This patient had colon cancer that metastasized to the liver.

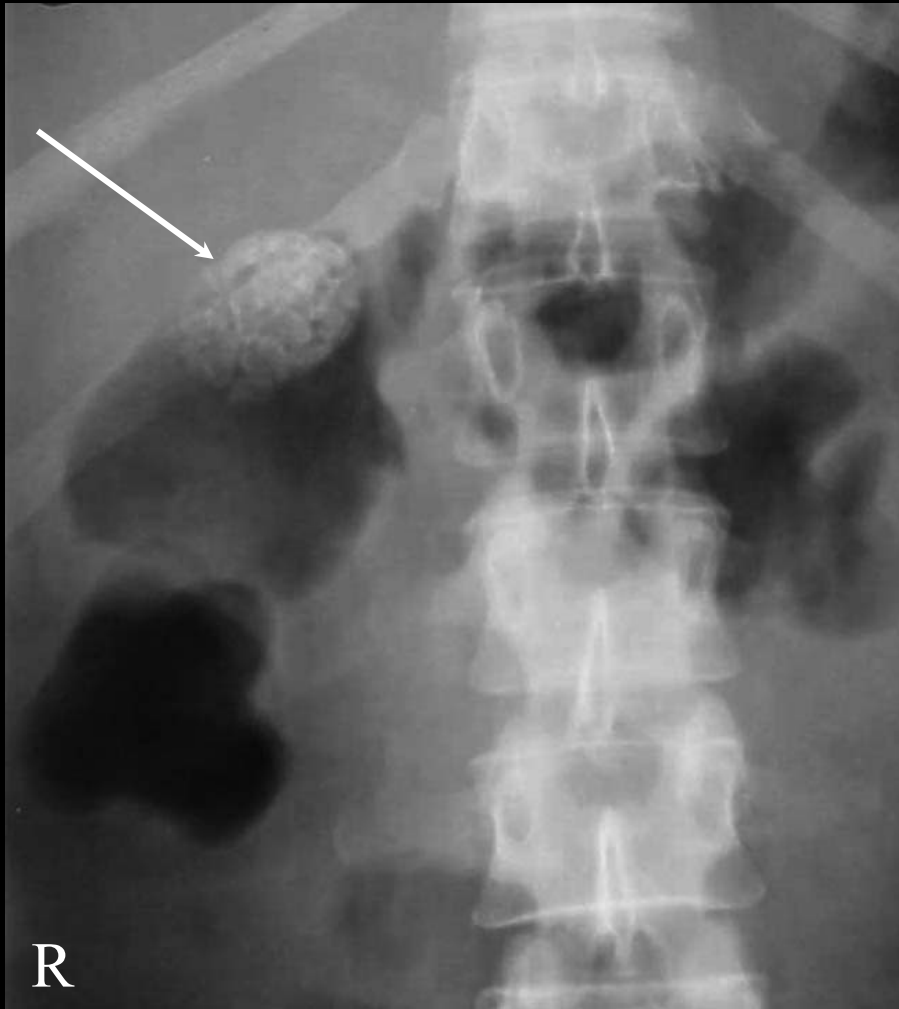
Cholelithiasis:

- Cholelithiasis is the condition of having gallstones.
- This only becomes a problem if the stones cause an inflammation of the gallbladder which is called cholecystitis.

This is often secondary to cystic duct obstruction.

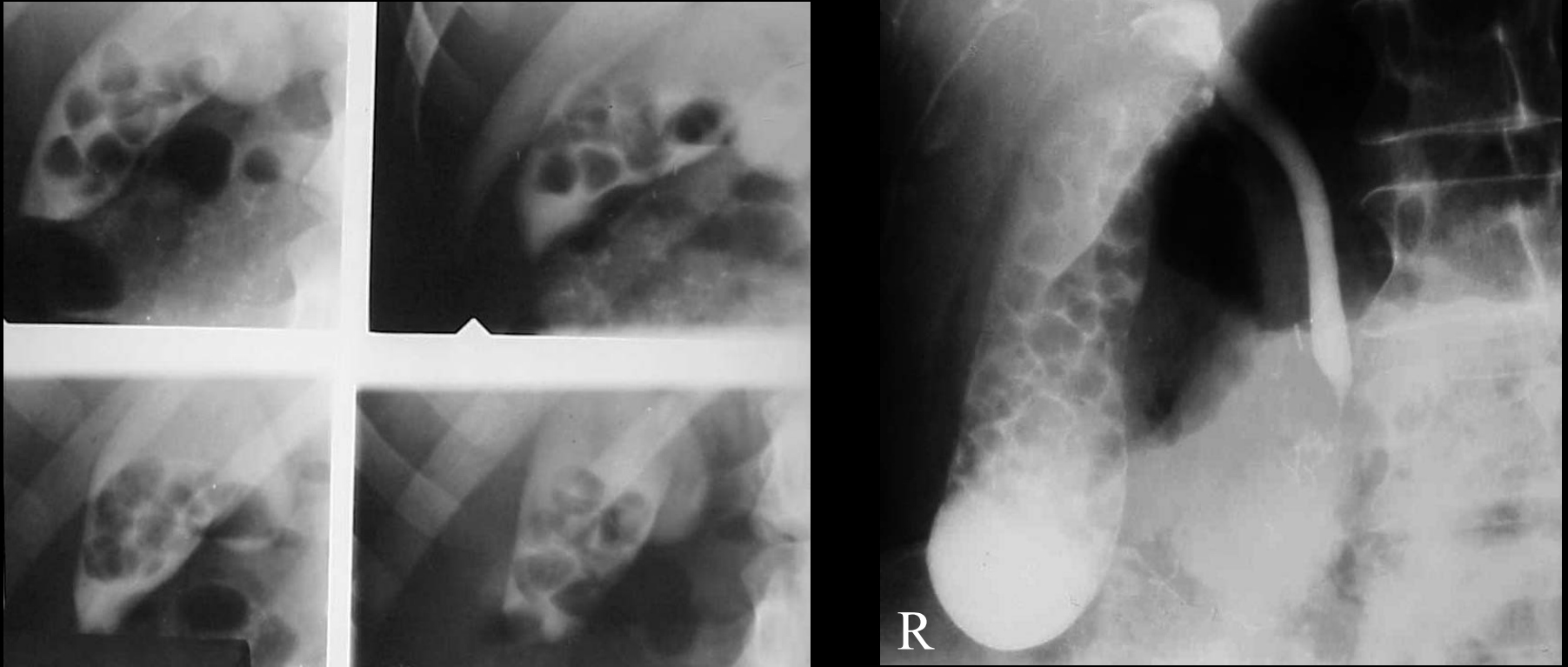
- Nuclear medicine and ultrasound are the imaging modalities of choice in the diagnosis of cholelithiasis although 15% of gallstones appear radiopaque on a KUB.

Cholelithiasis:



The arrow on this abdominal radiograph is pointing to a large **radiopaque cholelith**.

Cholelithiasis:



These radiographs were taken as part of an antiquated exam called an oral cholecystogram (OCG). This study clearly demonstrates innumerable **radiolucent choleliths**.

Cholelithiasis:



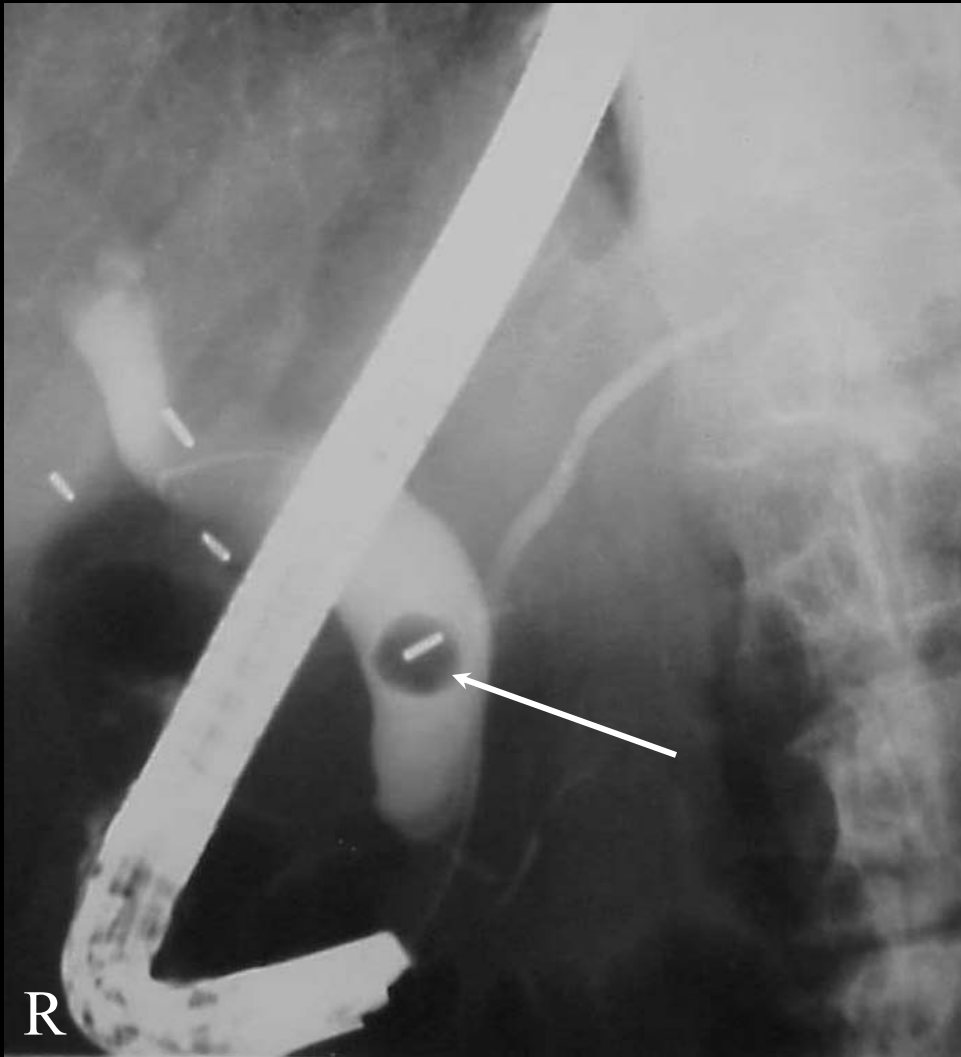
These cholecystograms demonstrate innumerable **radiolucent choleliths**.

Cholelithiasis:



This percutaneous transhepatic cholangiogram (PTC) clearly demonstrates a large **radiolucent cholelith** in the distal common bile duct.

Cholelithiasis: Pearl Stone



This ERCP demonstrates a **radiolucent cholelith** that has formed around a surgical clip within the common bile duct. This is sometimes referred to as a **pearl stone**.

Emphysematous Cholecystitis:

- Emphysematous cholecystitis is characterized by the presence of bacteria within the gallbladder.

In this particular instance, bacteria has managed to work their way from the small intestine, through the biliary tree, and finally into the gallbladder.

Bacteria produce gas as an excrement and as a result, the gallbladder will produce a distinct air-fluid level on an upright abdomen radiograph.

- Treatment involves cholecystectomy and broad spectrum antibiotic coverage.

Emphysematous Cholecystitis:



The arrows on this radiograph of the abdomen are pointing the gallbladder that has been outlined with air. This has been caused by an air producing bacterial infection that has reached the confines of the gallbladder and is referred to as **emphysematous cholecystitis**.

Emphysematous Cholecystitis:



This is a magnified view
of the previous image
depicting
**emphysematous
cholecystitis.**

Emphysematous Cholecystitis:



The arrows on this upright abdomen radiograph are pointing to an air producing bacterial infection of the gallbladder. This infection is referred to as **emphysematous cholecystitis**. Note the air-fluid (bile) level that has been created within the gallbladder as a result of this infection.

Emphysematous Cholecystitis:



This is a magnified view of the previous image depicting an air-fluid level caused by **emphysematous cholecystitis**.

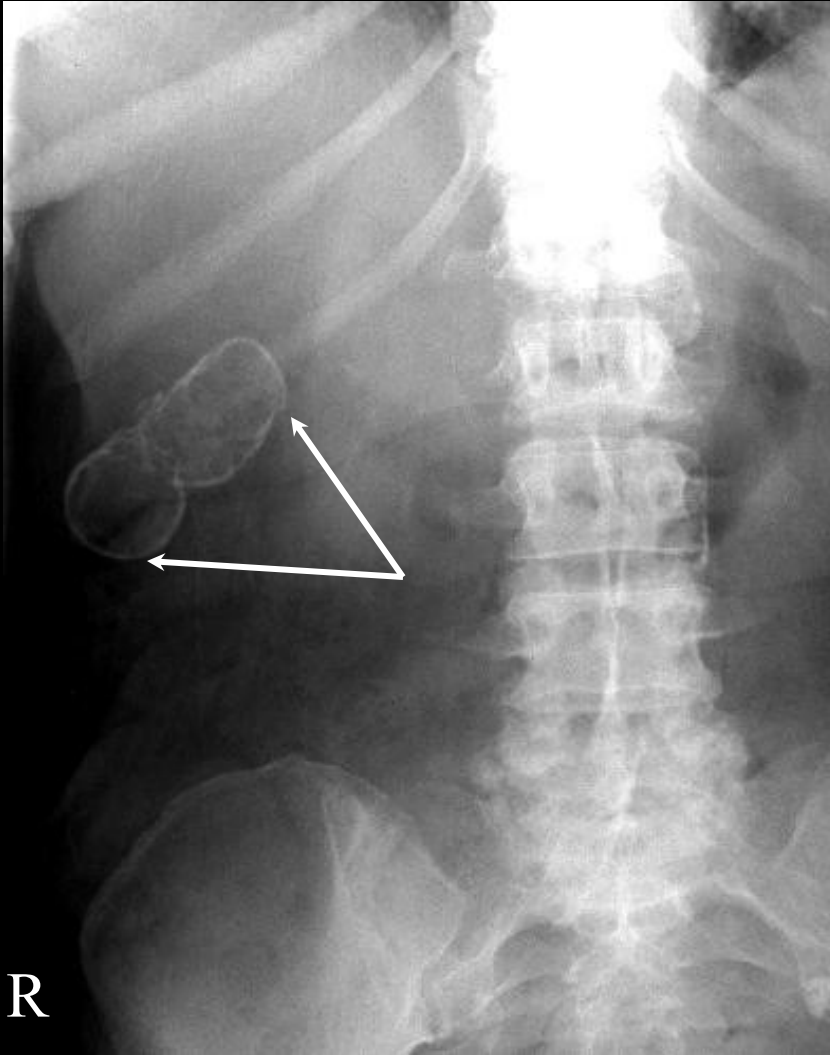
Porcelain Gallbladder:

- Calcification of the gallbladder is commonly referred to as a porcelain gallbladder.

The walls of the gallbladder can calcify and form a hard, bluish color that resembles porcelain.

- It may be associated with gallbladder cancer which is very rare or it may be brought on by excessive gallstone production.
- Treatment includes cholecystectomy.

Porcelain Gallbladder:



The arrows on this abdominal radiograph are pointing to a **porcelain gallbladder**. This condition occurs when the walls of the gallbladder calcify and form a hard, bluish white texture that resembles porcelain.

Porcelain Gallbladder:



This CT image of the abdomen demonstrates a **porcelain gallbladder** that contains a large gallstone (arrow). The presence of a porcelain gallbladder is clinically significant because it may be an indication that the patient may have gallbladder cancer.

Splenomegaly:

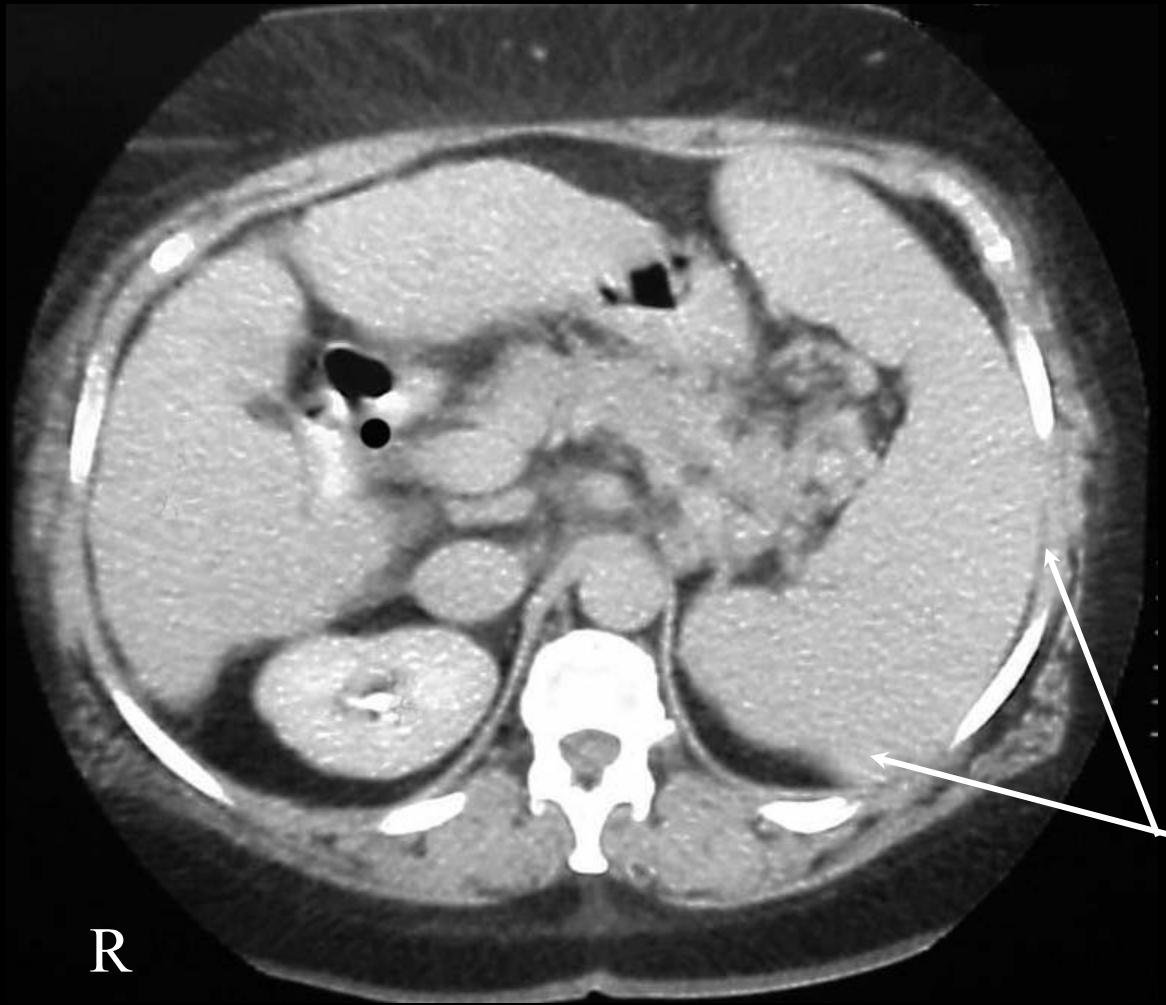
- Splenomegaly simply refers to an enlargement of the spleen.
- It is usually associated with any disease that involves the destruction of a large number of defective red blood cells.
 - It is also linked to leukemia, lymphoma, and portal hypertension.
- Treatment for this condition usually includes a splenectomy.

Splenomegaly:



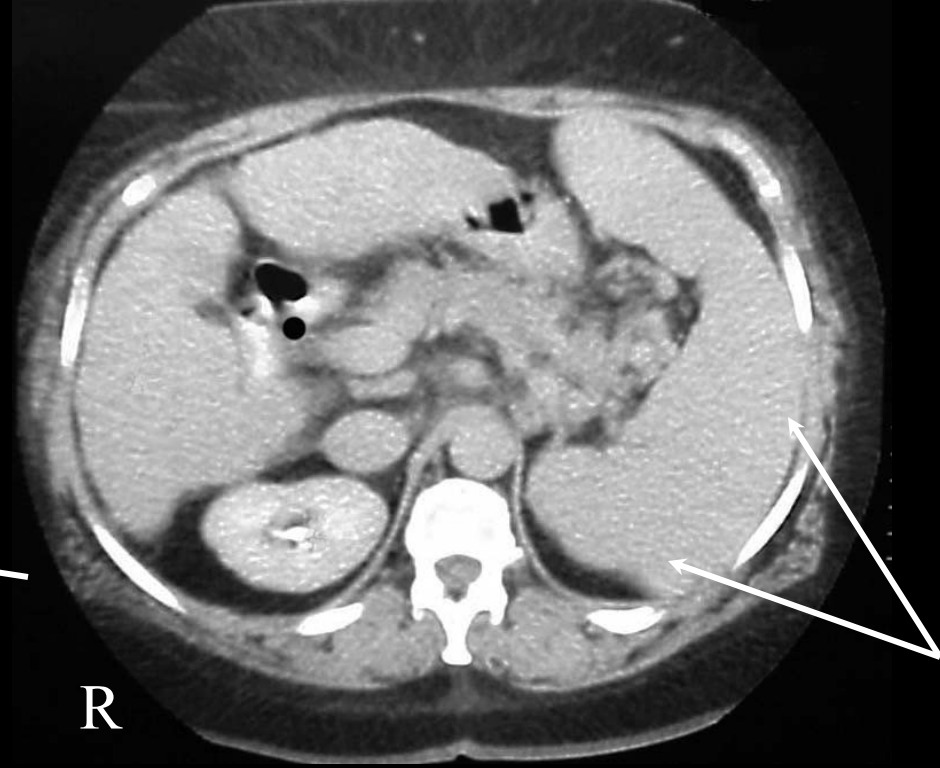
The arrow on this CT scan of the abdomen is pointing to a **normal spleen**.

Splenomegaly:



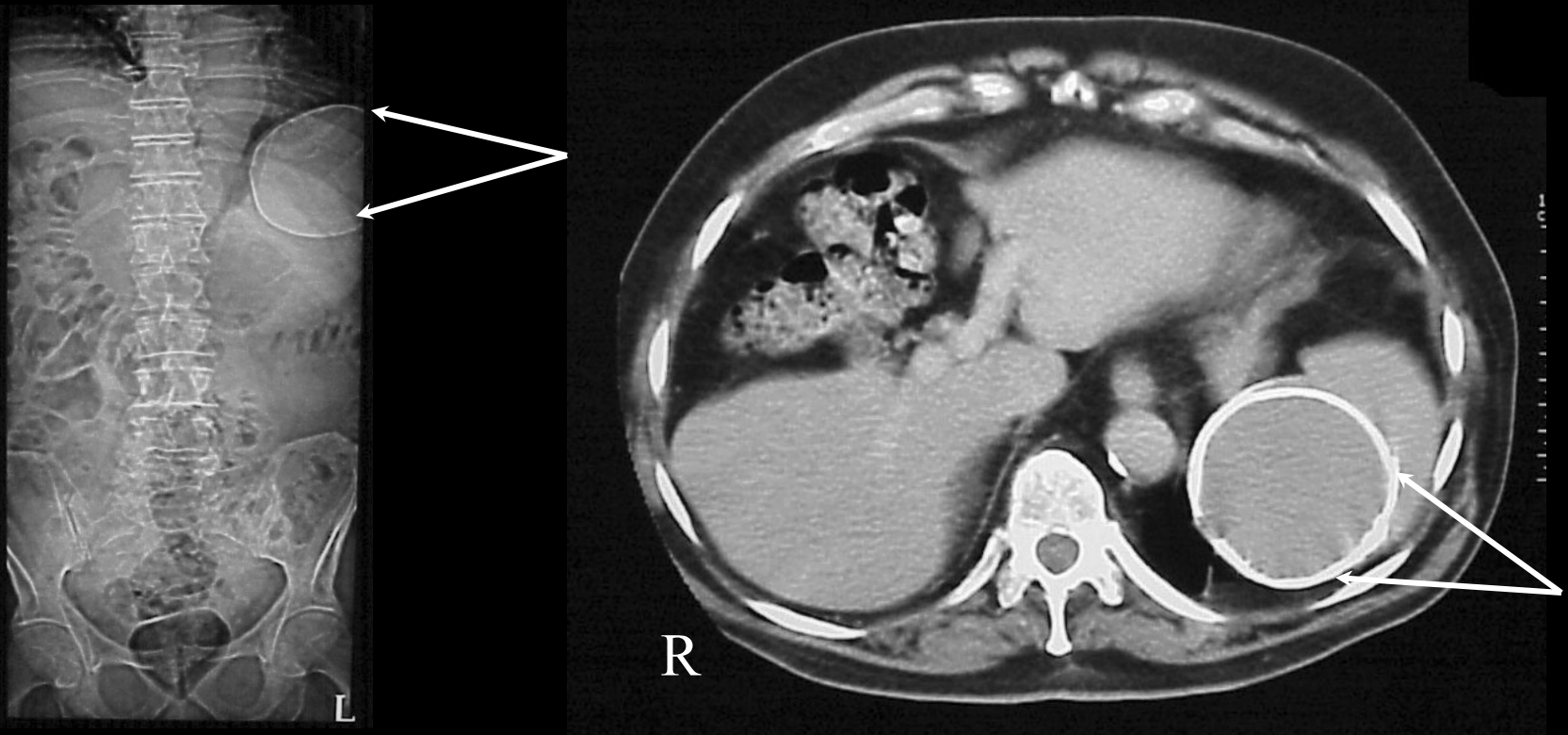
The arrows on this CT scan of the abdomen is pointing to an **enlarged spleen**. This condition is referred to as **splenomegaly**.

Splenomegaly:



This is a side-by-side comparison of a CT scan of a **normal spleen** on the left (arrow) and an **enlarged spleen** on the right (arrows).

Spleen with a Calcified Cyst:



This patient has a very large cyst attached to their spleen that has become calcified. There is no clinical significance for this condition

Test:

There are **60** questions on this test. All answers can be found within the context of this program. The “hint” button located next to each question will provide you the information needed to answer the question. At any time during the test you may skip a question and return to it later. You must successfully answer 70% of the questions in order to receive credit for the course. To access the test, please close out of this course by clicking the “x” in the top right corner.

Good luck!!!

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