

الجامعة السورية الخاصة

كلية الطب البشري

قسم الجراحة

## The Peritoneum , Omentum, Mesentery , and Retroperitoneal Space

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# Learning Objectives

## To recognise and understand

- The clinical features of localised and generalised peritonitis
- The common causes and complications of peritonitis
- The principles of surgical management in patients with peritonitis

- The clinical presentations and treatment of abdominal /pelvic abscesses
- The clinical presentations of tuberculosis peritonitis
- The causes and pathophysiology of ascites
- The spectrum of mesenteric and retroperitoneal conditions

# Peritoneum Development

The **peritoneum** develops ultimately from the mesoderm of the trilaminar embryo. As the mesoderm differentiates, one region known as the lateral plate mesoderm splits to form two layers separated by an intraembryonic coelom. These two layers develop later into the visceral and parietal layers found in all serous cavities, including the peritoneum.

As an embryo develops, the various abdominal organs grow into the abdominal cavity from structures in the abdominal wall. In this process they become enveloped in a layer of peritoneum. The growing organs "take their blood vessels with them" from the abdominal wall, and these blood vessels become covered by peritoneum, forming a mesentery.

# Peritoneum

In higher vertebrates, the **peritoneum** is the serous membrane that forms the lining of the abdominal cavity - it covers most of the intra-abdominal organs. (The corresponding serous membranes in the pleural and pericardial cavities of the thorax are called the pleura and the pericardium respectively.) The peritoneum both supports the abdominal organs and serves as a conduit for their blood and lymph vessels and nerves.

## The peritoneum consists of two layers and a potential space between them:

1. The outer layer, called the **parietal peritoneum**, is attached to the abdominal wall.
2. The inner layer, the **visceral peritoneum**, is wrapped around the internal organs that are located inside the abdominal cavity.
3. The potential space between these two layers is the **peritoneal cavity**; it is filled with a small amount (about 50 ml) of slippery serous fluid that allows the two layers to slide freely over each other.

# the Structures

**There are two main regions of the peritoneum, connected by the epiploic foramen:**

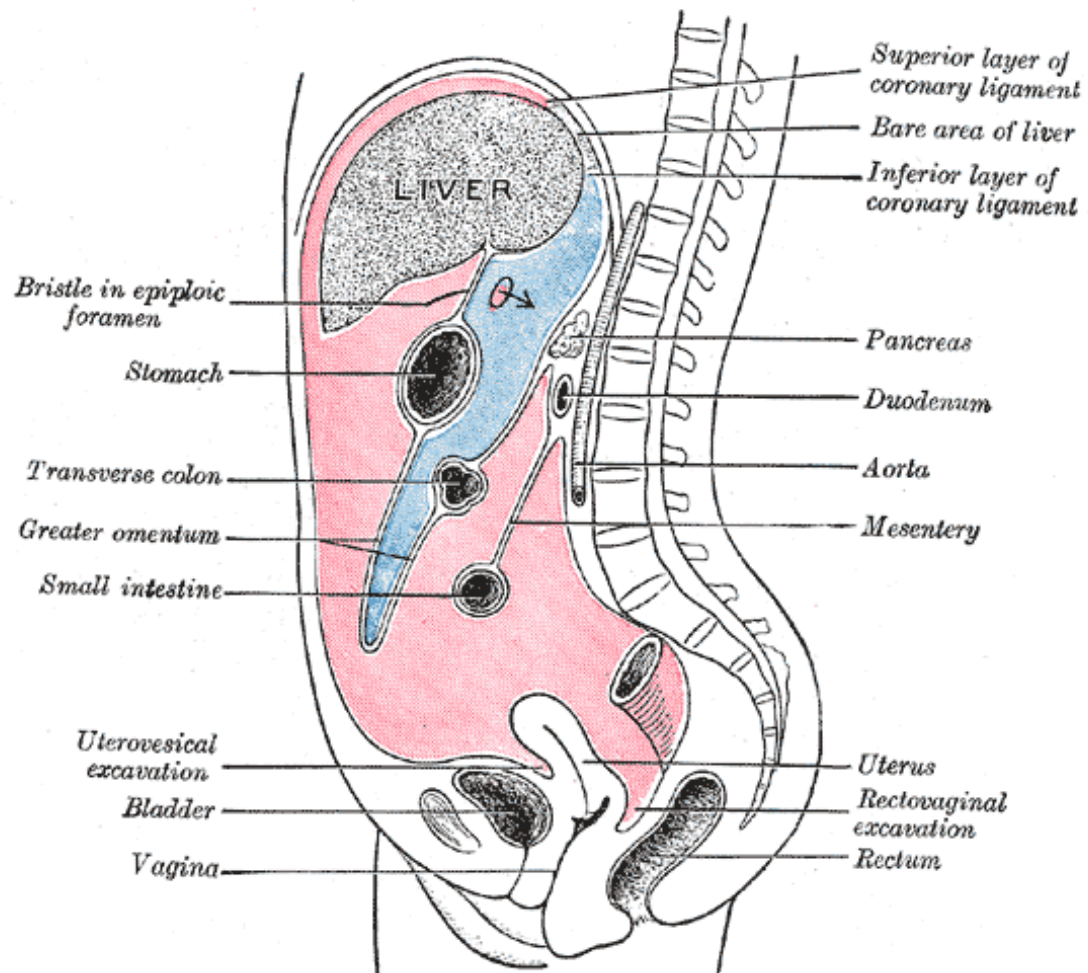
- the greater sac (or *general cavity of the abdomen*), represented in red in the diagrams below .
- the lesser sac (or *omental bursa*), represented in blue. The lesser sac is divided into two "omenta":
  - The lesser omentum (or *gastro hepatic*) is attached to the lesser curvature of the stomach and the liver.
  - The greater omentum (or *gastro colic*) hangs from the greater curve of the stomach and loops down in front of the intestines before curving back upwards to attach to the transverse colon. In effect it is draped in front of the intestines like an apron and may serve as an insulating or protective layer.

# Omentum

**Definition:** The omentum is a large fatty structure which literally hangs off the transverse colon and drapes over the intestines inside the abdomen. but it does reach every organ in the abdomen, draping over and attaching itself to areas of inflammation. It is called the Abdominal Scavenger so, as part of its function, it may act as a bandage in case of bad infection or intestinal rupture (such as appendicitis), limiting spread of infection.

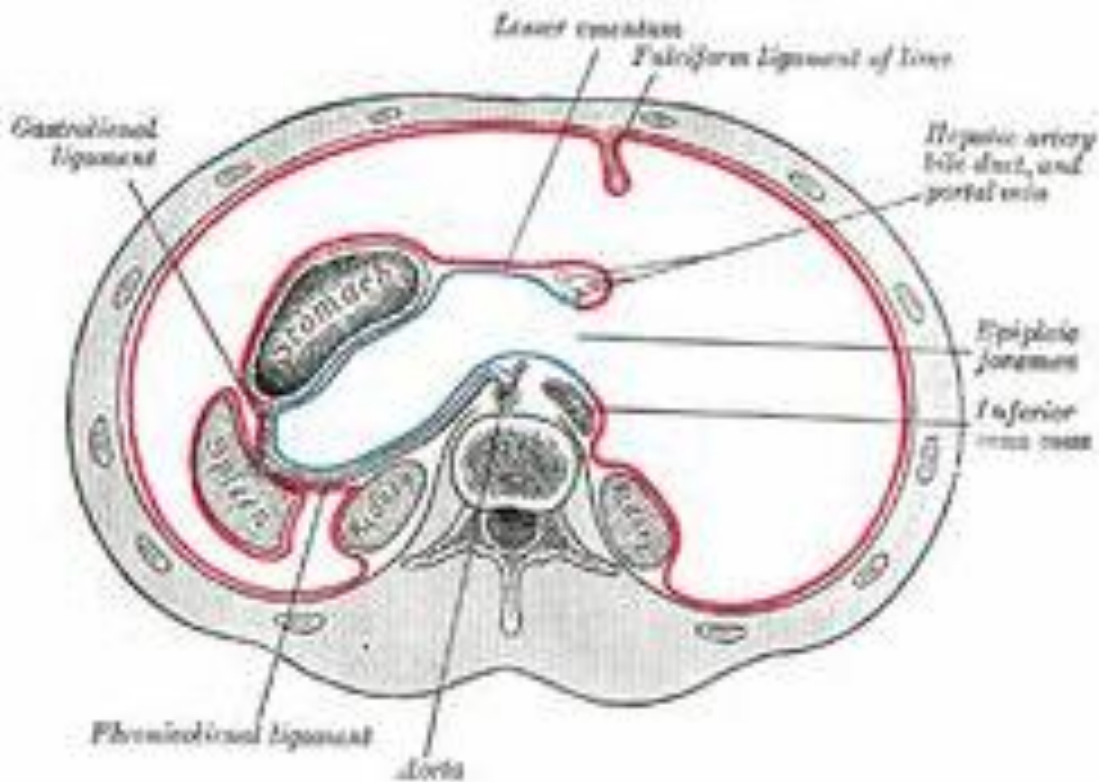






## **The mesentery**

is the part of the peritoneum through which most abdominal organs are attached to the abdominal wall and supplied with blood and lymph vessels and nerves.



Horizontal disposition of the peritoneum in the upper part of the abdomen. (Areas outlined in blue and red correspond to above diagram.)

# Functions of the peritoneum

- **Pain perception (parietal peritoneum)**
- **Visceral lubrication**
- **Fluid and particulate absorption**
- **Inflammatory and immune responses**
- **Fibrinolytic activity**

## **Disease states**

- **Pneumoperitoneum is the presence of gas within the peritoneal cavity, as may occur when a perforation forms in the stomach or intestines, and heralds a perilous situation.**
- Peritonitis refers to inflammation of the peritoneal lining or cavity, as may occur with either a perforation or by spread of infection through the wall of one of the abdominal organs. This too is a serious condition, and often requires emergency surgery.
- Ascites is an accumulation of excess fluid within the peritoneal cavity.

# Causes of a peritoneal inflammatory exudate

- **Bacterial infection, e.g. appendicitis, tuberculosis**
- **Chemical injury, e.g. bile peritonitis**
- **Ischaemic injury, e.g. strangulated bowel, vascular occlusion**
- **Direct trauma, e.g. operation**
- **Allergic reaction, e.g. starch peritonitis**

# Bacteria in peritonitis

## Gastrointestinal source

- *Escherichia coli*
- Streptococci (aerobic and anaerobic)
- *Bacteroides*
- *Clostridium*
- *Klebsiella pneumoniae*
- *Staphylococcus*

## Other sources

- *Chlamydia*
- Gonococcus
- $\beta$ -Haemolytic streptococci
- Pneumococcus
- *Mycobacterium tuberculosis*

# Paths to peritoneal infection

- **Gastrointestinal perforation, e.g. perforated ulcer, diverticular perforation**
- **Exogenous contamination, e.g. drains, open surgery, trauma**
- **Transmural bacterial translocation (no perforation), e.g. inflammatory bowel disease, appendicitis, ischaemic bowel**
- **Female genital tract infection, e.g. pelvic inflammatory disease**
- **Haematogenous spread (rare), e.g. septicaemia**



# Clinical Features in Peritonitis

- **Abdominal pain , worse on movement**
- **Guarding / rigidity of abdominal wall**
- **Pain / tenderness on rectal / vaginal examination ( in case of pelvic peritonitis**
- **Pyrexia ( may be absent )**
- **Raised pulse rate**
- **Absent or reduced bowel sounds**
- **Septic shock : systemic inflammatory response syndrome (SIRS) in later stages**

# Acute Peritonitis

## Bacteriology

- **Bacteria within the lumen of the gastrointestinal tract is normally low until the distal small bowel is reached .**
- **High concentration are found in the colon .**
- **Intestinal obstruction , achlorohydrria ,diverticula of small intestine , may increase proxymal colonisation .**
- **The biliary and pancreatic tracts are normally free from bacteria , it may be infected in disease ( GS) .**
- **Peritoneal infection usually caused by two or more bacterial strains.**
- **Gram negative bacteria produce endotoxins( Lipopolysaccarides) in their cell walls that have multiple toxic effect , releasing tumour necrosis factor (TNF ) from host leucocytes.**
- **Absorption of endotoxin may produce endotoxic shock with hypotension and impaired tissue perfusion.**
- **Clostridia Welchii produce harmful exotoxins.**
- **Bactroides Gramnegative none-sporing organisms.**

# Non-Gastrointestinal causes of Peritonitis

- **Pelvic infection via fallopian tubes is responsible for high proportion of non-gastrointestinal infections.**
- **Immunodeficient ( HIV , Immunosuppressive treatment may present with opportunistic peritoneal infection .**



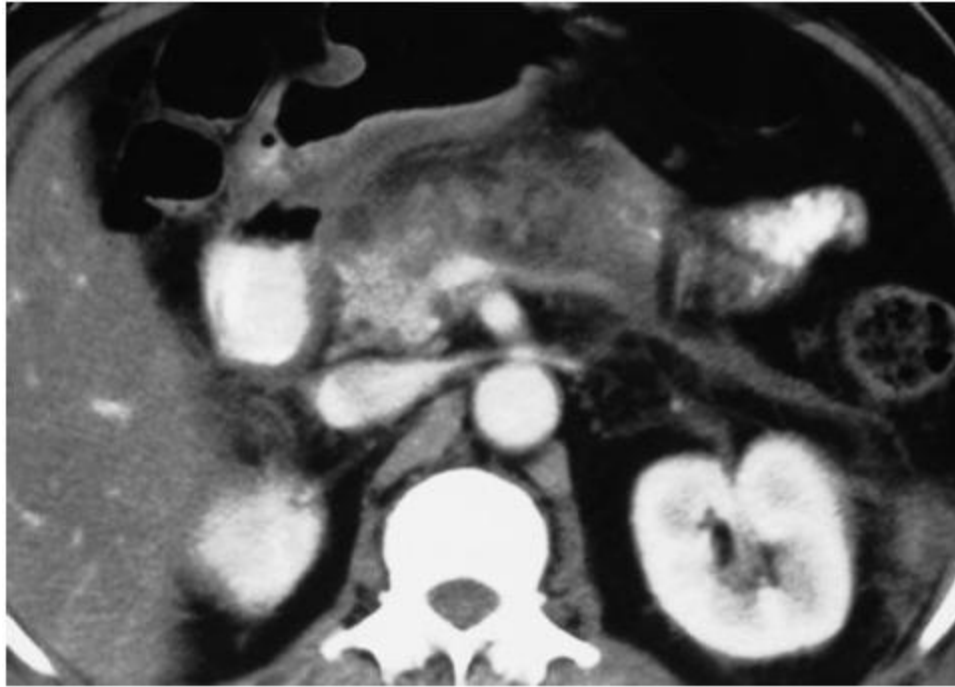
The Hippocratic facies in terminal diffuse peritonitis.

## Investigations in peritonitis

- Raised white cell count and C-reactive protein are usual
- Serum amylase  $> 4\times$  normal indicates acute pancreatitis
- Abdominal radiographs are occasionally helpful
- Erect chest radiographs may show free peritoneal gas (perforated viscus)
- Ultrasound/CT scanning often diagnostic
- Peritoneal fluid aspiration (with or without ultrasound guidance) may be helpful



**Pneumoperitoneum Gas under diaphragm**



Acute pancreatitis seen on computerised tomography scanning with swelling of the gland and surrounding inflammatory changes

## Management of peritonitis

General care of patient:

- Correction of fluid and electrolyte imbalance
- Insertion of nasogastric drainage tube
- Broad-spectrum antibiotic therapy
- Analgesia
- Vital system support

Operative treatment of cause when appropriate with peritoneal debridement/lavage



## Systemic complications of peritonitis

- Bacteraemic/endotoxic shock
- Bronchopneumonia/respiratory failure
- Renal failure
- Bone marrow suppression
- Multisystem failure

## Abdominal complications of peritonitis

- Adhesional small bowel obstruction
- Paralytic ileus
- Residual or recurrent abscess
- Portal pyaemia/liver abscess

## Peritoneal dialysis

In one form of dialysis, the **peritoneal dialysis**, a special solution is run through a tube into the peritoneal cavity. The fluid is left there for a while to absorb waste products, and then removed through the tube. The reason for this effect is the high number of arteries and veins in the peritoneal cavity. Through the mechanism of diffusion, waste products are removed from the blood.

The **omentum** easily stores fat, since it is readily accessible to the body. When people lose weight, the omentum shrinks, helping to reduce risks for a number of conditions.

The great concern with a fatty omentum is that it starts inflammatory processes, which can lead to [diabetes](#), **high blood pressure**, and **hardening of the arteries**. Essentially the bigger the omentum, the more you are at risk for a variety of difficult illnesses.



# Torsion of The Omentum

**Definition :** Torsion of the Greater Omentum is defined as a twist of the organ in its longitudinal axis around pedicle .

It may be **primary** or **secondary**

# Aetiology

## The Primary torsion

- **Idiopathic** torsion redundant , mobile segment of omentum rotates around a proximal fixed point in the absence of any associated intra abdominal pathology . It is relatively rare condition ( 200 cases reported in the literature ) .
- **Factors predispose to torsion** : Anatomical abnormalities of the omentum such as accessory omentum , bifid omentum , narrowed omental pedicle , anatomical arrangement of omental blood vessels ( Veins are are larger , longer , and more tortuous than arteries ) .
- **Incidence of torsion** : on the right side of omentum is higher related to the greater size and mobility of the right side of the omentum .
- **Factors precipitating torsion** : blunt trauma to the abdomen , coughing , straining , heavy exertion , sudden change in body position , hyperperistalsis in bowels

# Aetiology

## Secondary torsion

**More common than primary type .**

**Associated with pre-existing abdominal pathology .**

**Omentum usually twisted between two fixed points .**

**Distal edge attached directly or by adhesions to intra abdominal lesion**

**( Cysts , Tumours , Foci of intra abdominal inflammation , Post surgical wound or scarring , Internal hernia , External hernia . )**



## Pathology

- The omentum twists a number of times around a pivotal point , usually clockwise direction.
- The venous return is compromised and distal omentum becomes congested and oedematous .
- Haemorrhagic extravasation stimulate aseptic peritonitis with accumulation of serosanguinous fluid in the peritoneal cavity .
- As the torsion proceeds , arterial occlusion leads to acute haemorrhagic infarction and eventual necrosis of the omental segment.
- If the infarcted segment is not excised it becomes atrophic and fibrotic , on rare occasions it may even auto – amputated.



# Clinical Features

1. Occurs in the fourth or fifth decades of life .
2. Men are more affected twice as often as women .
3. The majority of patients are overweight .
4. The signs and symptoms reflected the underlying pathology .
5. The affected segment is usually on the right .

# Clinical Symptoms

1. Sudden onset of pain .
2. Rebound tenderness .
3. Guarding right sided often mistaken for acute appendicitis , or acute cholecystitis or twisted ovarian cyst .

The clinical symptoms are not usually sufficient to allow an accurate pre operative diagnosis .

The clinical finding warrant laparotomy even in the absence of definitive diagnosis .

The finding of serosanguinous fluid in association with normal appendix ,gallbladder ,pelvic organs , and bowel should alert the surgeon to the possibility of omental torsion .

# Treatment

- **This condition only becomes apparent once vascular thrombosis of omental vessels' has occurred and is irreversible even if the omentum is derotated .**
- **Treatment consists resection of the affected portion of omentum .**
- **Any associated disease with torsion should be dealt with .**
- **Post operative recovery is usually rapid and morbidity is minimal.**

# Cysts of The Omentum

## Pathology of Omental cysts

Most cysts are of lymphatic or mesothelial origin , all are rare .

### Cystic Lymphangioma :

In childhood , usually caused by development abnormalities of lymphoid tissue , such as obstruction of lymphatic channels or by growth of congenitally misplaced lymphatic tissue . They are variously called chylous cysts , cystic hygromas , cystic lymphangiomas , and are benign . They vary greatly in size many centimeters ,can be unilocular or multilocular . Histologically the cysts contain foamy Macrophages , giving the fluid a milky appearance ,and each cyst has endothelial lining.

### Cystic mesothelioma :

Occur almost in adult life , usually in women under the age of 50 years , benign , recurrence after excision is expected .

### Dermoid Cysts and Pseudocyst .







# Clinical features and Treatment

Cysts may be small and asymptomatic and may be discovered incidentally during surgery or CT scan or Echo of the abdomen .

Large cysts may present with diffuse abdominal distension , or smooth , mobile , palpable mass in lower midline .

They are non-tender unless complicated by torsion .

Clinical examination , plain abdomen xray , abdominal ecko , CT scan and multislices CT can be helpful in making the diagnosis .

Differential diagnosis include mesenteric , peritoneal , retroperitoneal cysts and abdominal tumours .

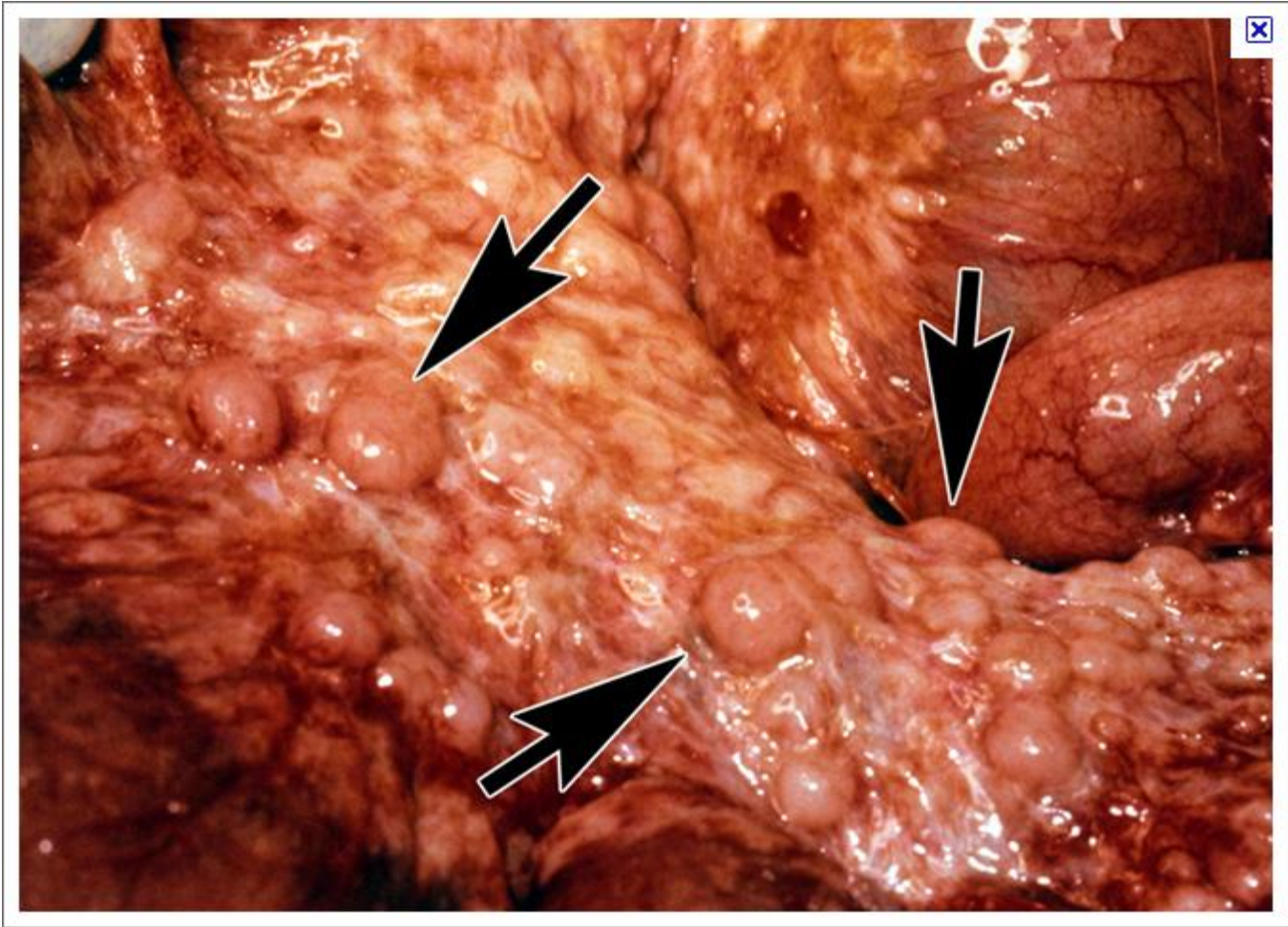
Treatment consist of surgical excision .

# Solid tumours of the Omentum

**Pathology :**

**Secondary tumour , Primary tumour**

**Clinical features and treatment**





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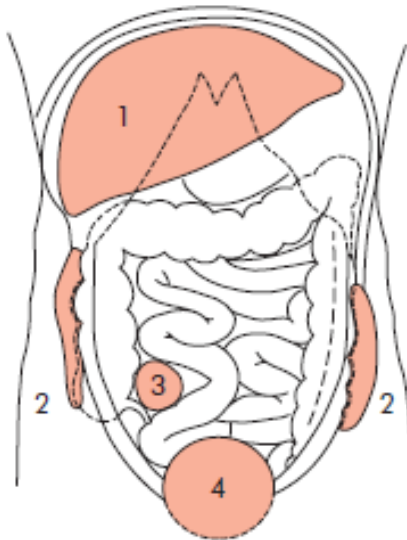
**2nd lecture**

# Abdominal and pelvic abscesses

- It may appear following local or diffused peritonitis .
- It usually occupies one of the abdominal or pelvic spaces

- Symptoms may consist ( Lassitude , Anorexia and Malaise ).
- Signs may consist ( Pyrexia often low grade , tachycardia , Leucocytosis , raised C-reactive protein, Localised or Generalised tenderness, Signs of purulent collection )

# Intraperitoneal and pelvic abscess



Common situations for residual abscesses:  
(1) sub-phrenic; (2) paracolic; (3) right iliac fossa;  
(4) pelvic.

***Anatomy***  
***Complicated arrangement***  
***of the peritoneum result in***  
***the formation of four***  
***intraperitoneal spaces***

# Pelvic Abscess

**The pelvis is the commonest site of intraperitoneal abscess because :**

- Appendix is often in pelvic position .
- Fallopian tubes are frequent sites of infection .
- Because of dependency pelvic abscess can occur as a sequel to any case of diffuse peritonitis .
- Common after anastomotic leakage following colorectal surgery.



# Related Symptoms & Signs

## **Symptoms :**

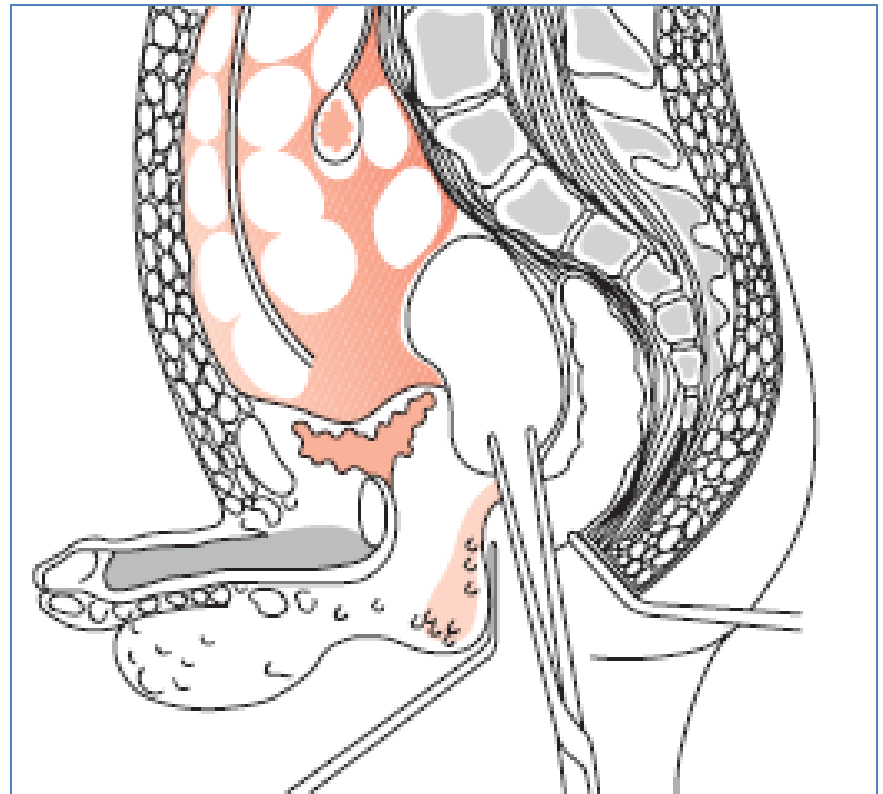
- Diarrhoea .
- Passage of mucus in the stool

## **Signs :**

- Rectal examination reveals a bulging of the anterior rectal wall

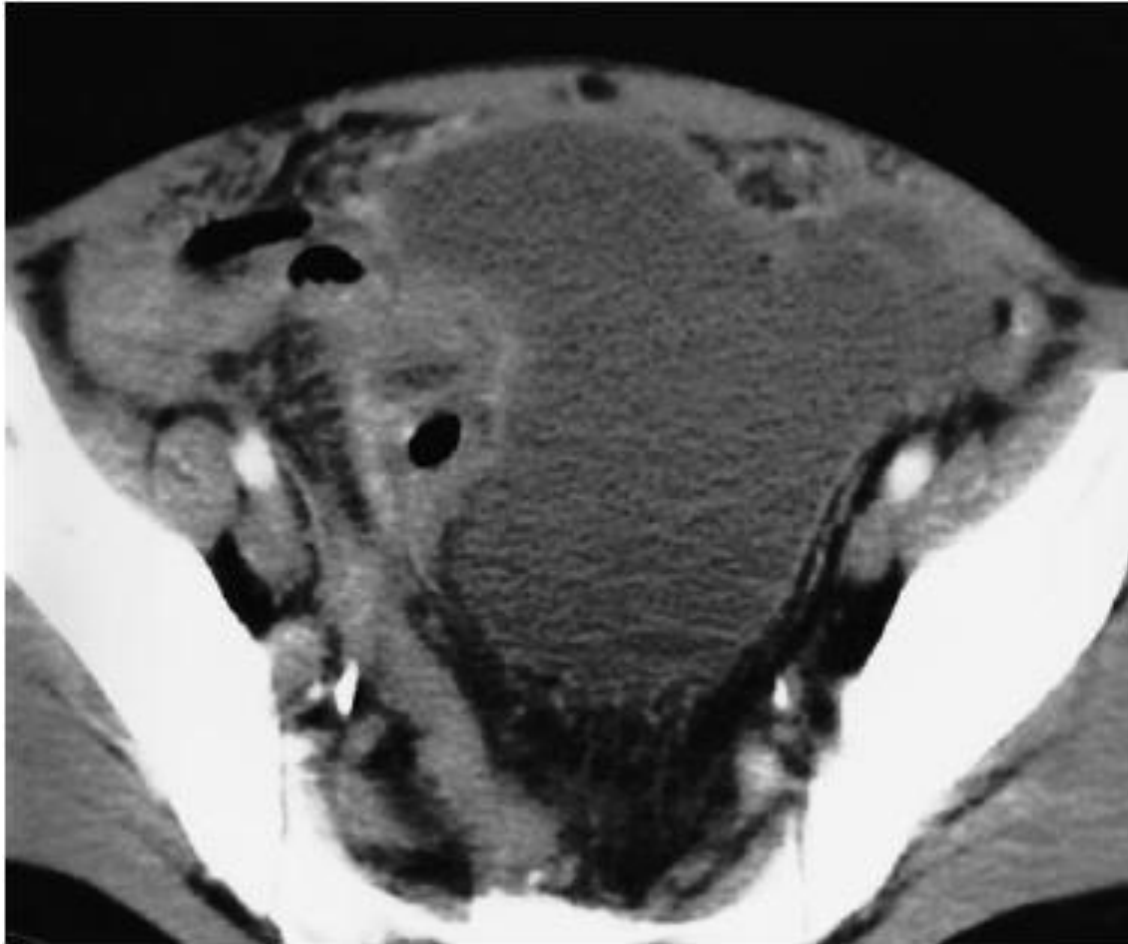
# Treatment

- When abscess is ripe , it becomes softly cystic .
- If left to nature mostly it will burst into the rectum .
- If this did not occur , the abscess should be drained deliberately .
- In male to the rectum , and in women vaginal drainage through the posterior fornix is recommended

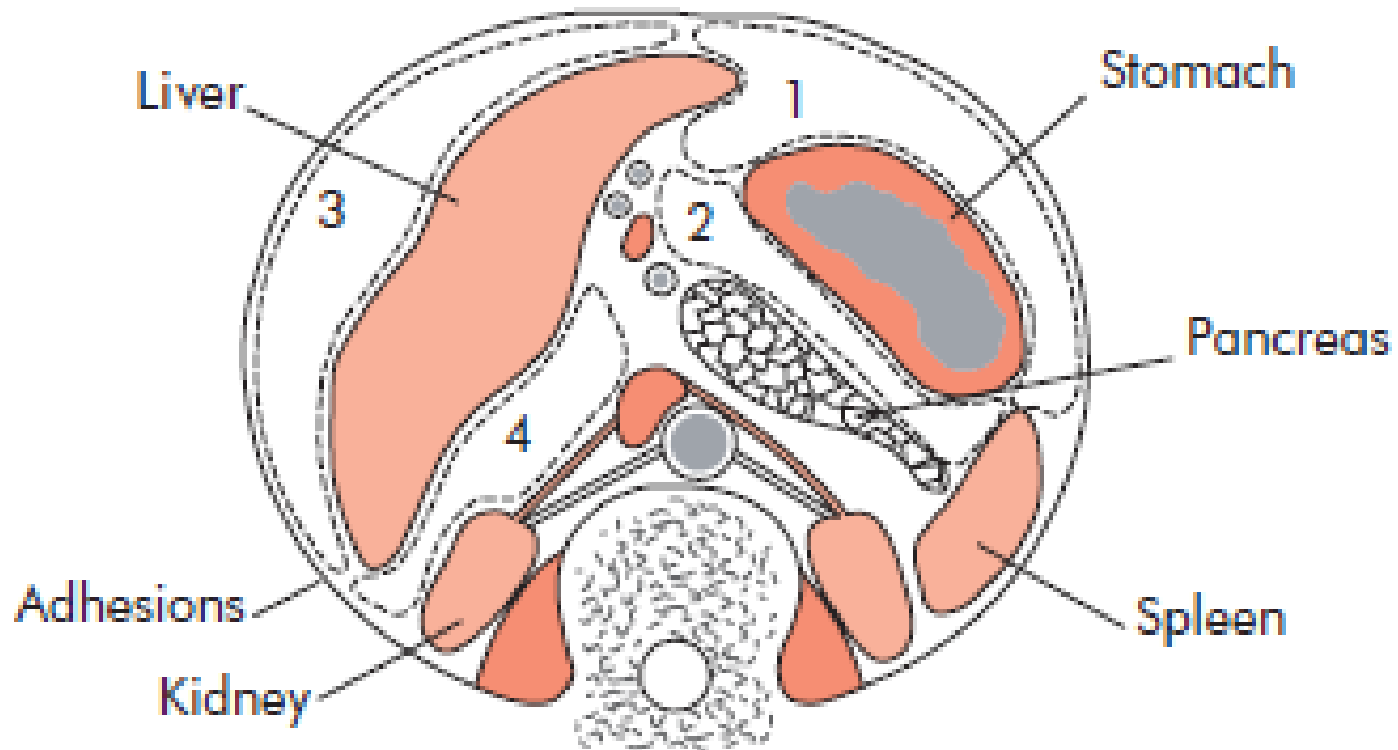


Opening a pelvic abscess into the rectum.

**The diagnosis of pelvic abscess can be confirmed by Ultrasound or CT scanning and pus may be aspirated by needle through the rectum or vagina under ultrasound or CT guidance**

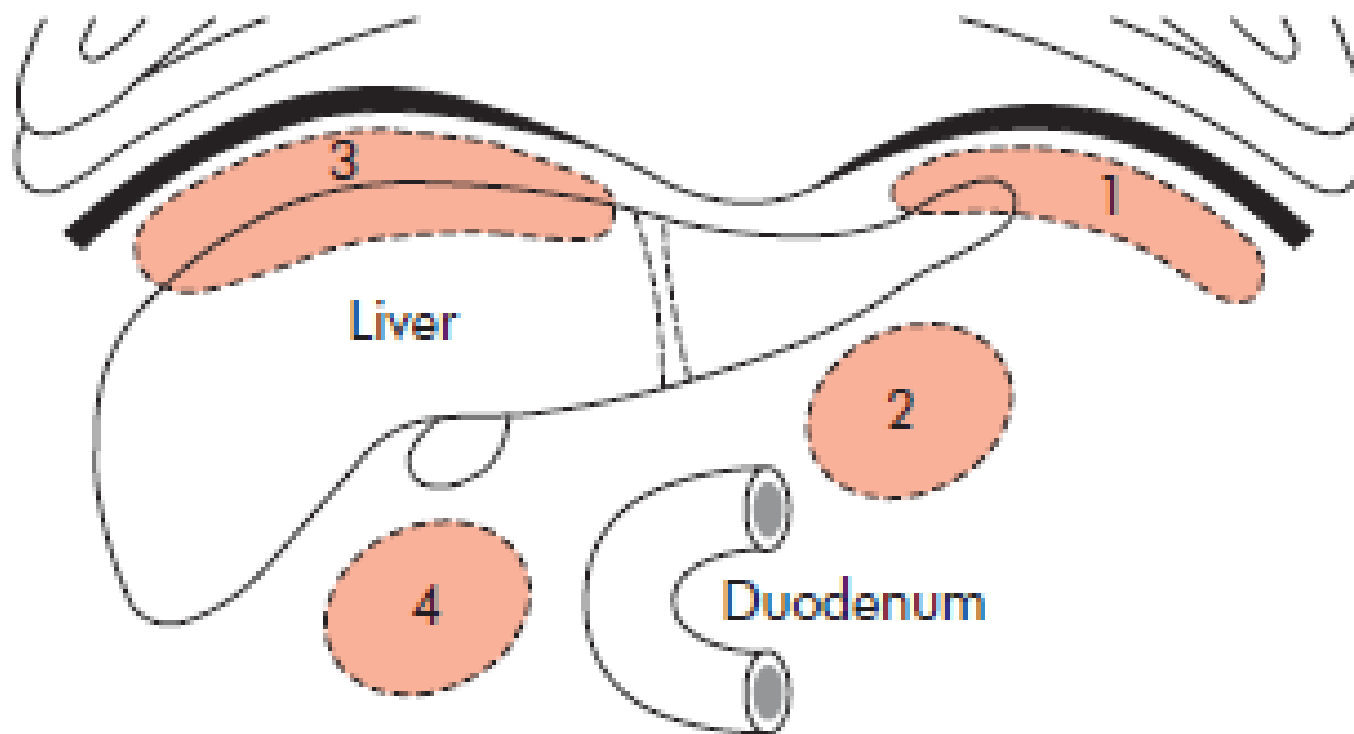


A pelvic abscess seen on computerised tomography scanning



Intraperitoneal abscesses on transverse section.

- (1) The left subphrenic space; (2) left subhepatic : space/lesser sac; (3) right sub-phrenic space; (4) right subhepatic space.



Intraperitoneal abscesses on sagittal section.  
(1) Left subphrenic; (2) left subhepatic/lesser sac;  
(3) right subphrenic; (4) right subhepatic.

## **Lt subphrenic space is bounded :**

- Above by the diaphragm .
- Behind the Lt triangular ligament ,Lt lobe of the liver, the gastro-hepatic omentum and the anterior surface of the stomach .
- Rt the falciform ligament.
- Lt the spleen, the gastro splenic omentum and diaphragm .

**The common cause of an abscess is an operation on the stomach , the tail of the pancreas ,the spleen , and splenic flexure of the colon.**

**Lt subhepatic space/lesser sac :**

**The commonest cause of infection is complicated acute pancreatitis , rarely perforated gastric ulcer .**



## **Rt subphrenic space :**

Lies between the Rt lobe of the liver and the diaphragm , it is limited posteriorly by the anterior layer of the coronary and the Rt triangular ligaments , to the Lt the falciform ligament.

**Common causes of abscess : perforated gall bladder, perforated duodenal ulcer , duodenal cap blow-out following gastrectomy ,and appendicitis .**

**Rt subhepatic space : Lies transversly beneath the Rt lobe of the liver ( Rutherford Morison,s pouch ) .**

- Bounded above by the Rt lobe of the liver
- It is bounded on the right by Rt lobe of the liver and the diaphragm .
- To the left is the foramen of Winslow .
- Below lies the duodenum ,the transvers colon , and hepatic flexure .
- In front are the liver and GB .
- Behind are the upper part of Rt kidney and the diaphragm .

**The commonest cause of abscess : appendicitis , cholecystitis , perforated duodenal ulcer , upper abdominal surgery .**

# Clinical features

**Symptoms and signs of subphrenic infection are frequently non-specific.**

It is well to remember the aphorism ( pus some where , pus nowhere else , pus under the diaphragm.

# Symptoms

## Common history

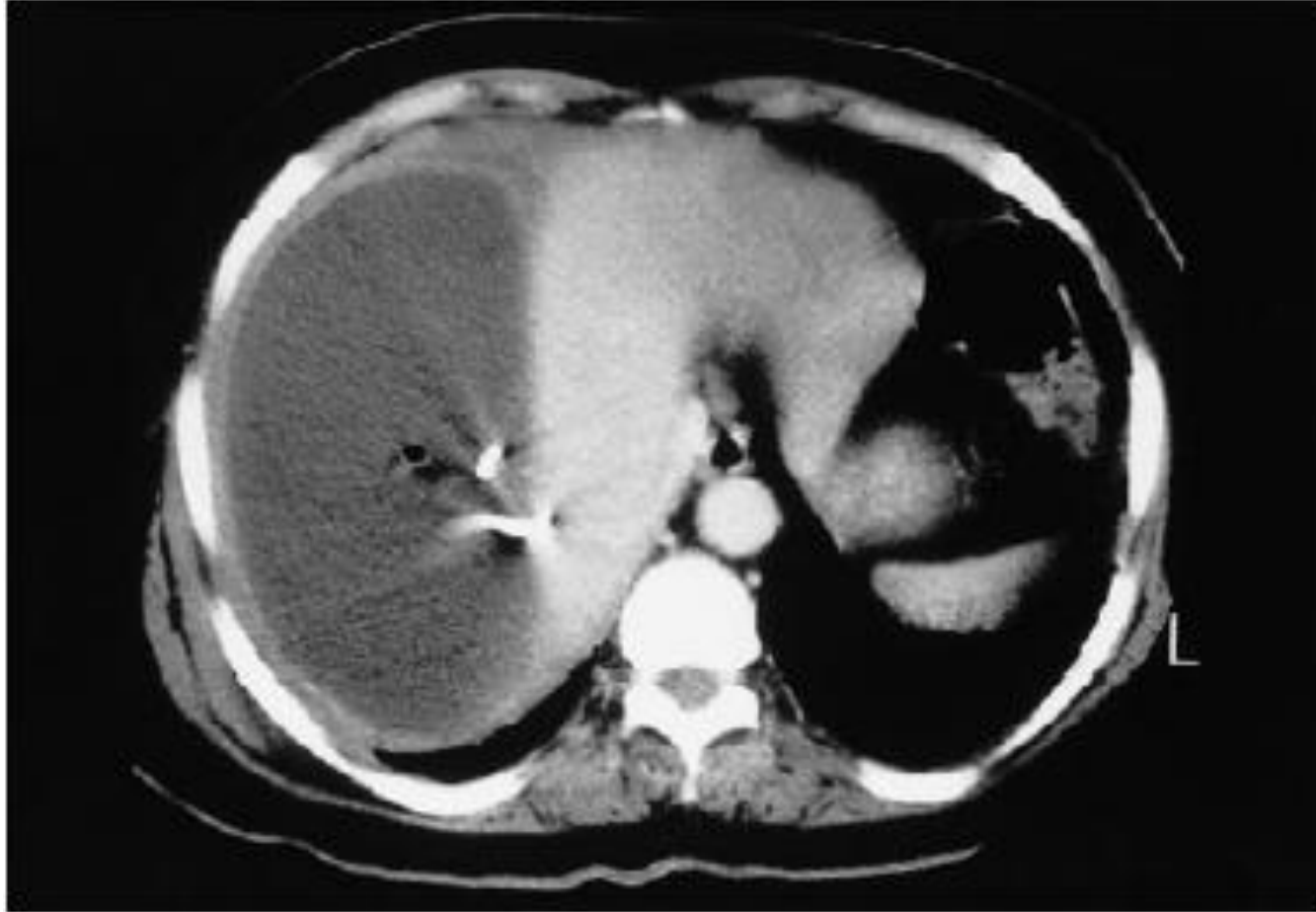
- Infective focus in the abdominal cavity has been dealt with .
- Patient improved temporarily .
- After few days , weeks , the condition of the patient steadily , often rapidly deteriorates .
- Sweating , wasting , anorexia , are present .
- Some times epigastric fullness , and pain .
- Shoulder pain on the affected side .
- Persistent hiccoughs may be present

# Signs

- Swinging pyrexia is usually present .
- Abdominal examination may reveal tenderness , rigidity , some times palpable swelling .
- Some times liver is displaced downwards or fixed due to adhesions.
- Chest examination > collapse of lung , or basal effusion , even empyema of the lung.

# Investigations

- Blood tests >> **Leucocytosis** and raised **C-reactive protein**
- A plain radiograph may demonstrate the presence of **gas** or **pleural effusion** .
- On screening the diaphragm is seen to be elevated ( **Tented diaphragm** ) , and its movements impaired .
- Ultrasound or CT scanning is **the investigation of choice** and permits **early detection of subphrenic**



**Computerised tomography, subphrenic abscess**

# Differential diagnosis

- **Pyelonephritis .**
- **Amoebic abscess .**
- **Pulmonary collapse.**
- **Pleural empyema.**



# Treatment

- **The aim is to evacuate the abscess cavity and drain it.**
- **If Skilled help is available , it is possible to insert a percutaneous drainage tube under ultrasound or CT control .making sure that you would not spread the infection .**
- **Operative intervention.**

# The Retroperitoneal Space

- Retroperitoneal hematoma ,
- Retroperitoneal abscess .
- Retroperitoneal cyst ( unilocular or multilocular , congenital from wolffian duct remnant) .
- Idiopathic retroperitoneal fibrosis .

# Malignant retroperitoneal tumour

- Lymphoma .
- Sarcoma .
- Carcinoid tumours .
- Secondary deposits ( stomach , colon , breast , and prostate , kidneys and ureters , nervous system ) .