# Appendix

It is located at the terminal end of the caecum where three taeniae join, about 2 cm below the ileocaecal orifice. Usually, around 5-10 cm in size but can be varible. Size of its lumen is that of matchstick.

Diameter of appendix is 3-8 mm; diameter of lumen is 1-3 mm.

Mesoappendix is extension of the mesentery contains appendicular artery, a branch of ileocolic artery. Often an accessory appendicular artery *may be present*.

Thrombosis of these vessels leads to gangrenous appendicitis.

Most common position *is retrocaecal (75%)*, *pelvic (21%)*. Preileal—(1%) Postileal Paracaecal Subcaecal Subhepatic

Often it may be in subserosal plane leading to difficult dissection during appendicectomy.

In situs inversus appendix is on the left side.

Mucosa of appendix is lined by columnar cells with crypts.

Submucosa contains numerous lymphatic aggregations (follicles) ('abdominal Tonsil').

Opening of the appendix into caecum is guarded by 'valve of Geralch'.

#### **ACUTE APPENDICITIS**

Aetiology;- It is common in young males. - It is common in white races.

Fibre rich diet prevents appendicitis. Less fibre diet increases chance of appendicitis.

It is common in May and August-often called as *epidemic appendicitis*.

Viral infection may cause mucosal oedema and inflammation which later gets infected by bacteria causing appendicitis.

**Family** history may be relevant in 30% of appendicitis in children with appendicitis occurring in first degree relatives.

Obstruction of the lumen of appendix causing obstructive appendicitis.

Blockage occurs due to-faecoliths, stricture, foreign body, round worm or threadworm.

Adhesions and kinking—carcinoma caecum near the base, ileocaecal Crohn's disease.

Distal colonic obstruction.

Abuse of purgatives. Faecolith is the most common cause.

#### **Organisms:**

E. Coli, enterococci, streptococci, Anaerobic streptococci, Cl. welchii, bacteroides.Pseudoappendicitis is appendicitis due to acute ileitis following Yersinia infection.It is often due to Crohn's disease.

## Types

1. Acute nonobstructive appendicitis (catarrhal):

Inflammation of mucous membrane occurs with redness, oedema

and haemorrhages which may go for following courses:

Resolution. Ulceration. Fibrosis. Suppuration. Recurrent appendicitis.

Gangrene—rare initially in nonobstructive type but later can occur. Peritonitis.

2. Acute obstructive appendicitis:-pus collects in the blocked lumen

of appendix which is blackish, Gangrenous, oedematous and rapidly progresses leading to perforation either at the tip or at the base of appendix. This leads to peritonitis, formation of appendicular abscess or pelvic abscess. Most often, there will be thrombosis of the appendicular artery.

3. *Recurrent appendicitis: Repeated attacks of nonobstructive* appendicitis leads to fibrosis, adhesions causing recurrent appendicitis.

4. Subacute appendicitis is milder form of acute appendicitis.

5. *Stump appendicitis is retained long stump of appendix after* commonly laparoscopic appendicitomy.

## **Clinical Features**

It is rare before the age of two, common in children and other age groups.

1- Pain: It is the earliest symptom.

*Visceral pain starts around* the Umbilicus due to distension of appendix, later after few hours, somatic pain occurs in right iliac fossa due to irritation of parietal peritoneum due to inflamed appendix.

Pain eventually becomes severe and diffuse which signifies spread of Infection into the general peritoneal cavity.

2- Vomiting: Due to reflex pylorospasm.

*3-Constipation is the usual feature but diarrhoea can occur* if appendix is in postileal or pelvic positions.

4- Fever, tachycardia, foetor oris are other features.

5- *Urinary frequency: Inflamed appendix may come in contact* with Bladder And can cause bladder irritation.

#### Signs ;-

1- Tenderness and rebound tenderness at McBurney's point in right Iliac Fossa (release sign— Blumberg's sign) are typical.

2-Rovsing's sign: On pressing left iliac fossa, pain occurs in right iliac

fossa which is due to shift of bowel loops which irritates the parietal peritoneum.

3- Hyperextension (in case of retrocaecal appendix—*Cope's psoas test*)

Or internal rotation (in case of pelvic appendix—obturator test) of Right Hip Causes

*pain in right iliac fossa* due to irritation of psoas muscle and obturator internus muscle respectively.

4-Baldwing's test is positive in retrocaecal appendix—when legs are lifted off the bed

with knee extended, the patient complains of pain while pressing over the flanks.

5- P/R examination shows tenderness in right side of the rectum.

6-*Hyperaesthesia* in 'Sherren's triangle'. This triangle is formed by Anterosuperior iliac spine, umbilicus, pubic symphysis.

Often infection gets localised by omentum, dilated ileum and parietalperitoneum leading to *appendicular mass.Often* suppuration occurs in the localised area resulting in *appendicular abscess*.

### Acute appendicitis in infancy:

it is rare, when it occurs, it has got 80% chances of perforation with high mortality .

#### Acute appendicitis in children:

Here localisation is not present, and so peritonitis occurs Early.

It requires early surgery. Dehydration, septicaemia are common.

In elderly: Gangrene and perforation are common.

Because of lax abdominal wall, localisation is poor and so peritonitis sets in early.

In pregnancy: Incidence is 1 in 2,000 pregnancies.

It is more common in 1st and 2<sup>nd</sup> trimesters.

Appendix shifts to upper abdomen. So pain is higher and more lateral.

Rebound tenderness and guarding may not be evident.

TC will be very high with neutrophilia.

Risk of premature labour is 15%.

*Foetal death in early appendicitis is 5% but becomes* 29% once appendix perforates in Pregnancy.

After 6 months, maternal mortality increases by 10 times than usual and also leads to premature labour.

Appendicitis is the most common non-gynaecologic surgical emergency during pregnancy. Incidence of perforation is highest in 3rd trimester.

Surgery is the treatment.

#### **Differential diagnosis**

GIT =( Perforated peptic ulcer -Acute cholecystitis- Enterocolitis - Crohn's disease Acute pancreatitis -Meckel's diverticulitis - Typhlitis
URINARY=( Right ureteric colic - Right acute pyelonephritis
CHILDREN= Mesenteric lymphadenitis - Intussusception - Roundworm colic
RESPIRATORY= Lobar pneumonia
METABOLIC= Acute crisis of porphyria -Diabetic abdomen.

#### Differential diagnosis in females

- Ruptured ectopic gestation
- Mittelschmerz rupture of ovarian follicle during midmenstrual period
- Ovarian cyst torsion
- Salpingo-oophoritis

## Differential diagnosis in elderly

- Acute diverticulitis
- Carcinoma caecum—acute features
- Mesenteric ischaemia
- Intestinal obstruction
- Aortic aneurysm leak
- Crohn's disease

## Sequelae of acute appendicitis

- 1- Resorption
- 2-Relapse and recurrent appendicitis
- 3-Appendicular mass
- 4-Appendicular abscess
- 5-Perforation—has got 20% mortality
- 6-Peritonitis, septicaemia
- 7-Portal pyaemia

8- *Intestinal obstruction due to obstructive ileus, inflammatory* adhesion, formation of band between appendix and omentum or between appendix and small bowel.

#### Investigations

1- BLOOD ;- \*Total leucocyte count is increased.

\**C*-reactive protein, even though nonspecific increases in acute phase.

2-IMAGINGS;-

\*Plain X-ray -X-ray is useful to rule out ;-

1=DU perforation, 2- intestinal obstruction, 3-ureteric stone.

\* Ultrasound is done to rule out other conditions like;-

*\*ureteric* stone, pancreatitis, ovarian cyst, ectopic pregnancy and also to confirm appendicular mass or abscess.

\*-Contrast CT scan is very much useful when diagnosis is difficult especially in old people.

3- Laparoscopy is the most useful method.

Alvarado scoring for appendicitis (1986):	Score
Migrating pain	1
Anorexia	1
Nausea and vomiting	1
Tendemess in right iliac fossa	2
Rebound tendemess	1
Elevated temperature	1
Leucocytosis with count more than 10,000	2
Shift to left with neutrophilia in peripheral smear	1
Total score	10
Score less than 5: Not sure.	
Score between 5-6: Compatible.	
Score between 6-9: Probable.	
Score more than 9: Confirmed.	

#### Treatment;- Surgery-Appendicectomy

#### Approaches

*1-Gridiron incision: Incision is placed perpendicular to the* right spinoumbilical line at the McBurney's point=

(i.e. at the junction of lateral one-third and medial two-third of spinoumbilical line).

- 2. Rutherford Morison's muscle cutting incision (Muscles are cut upwards and laterally).
- 3. Lanz crease incision centering at McBurney's point—cosmetically better.
- 4. Right lower paramedian incision/lower midline incision-

when in doubt or when there is diffuse peritonitis.

5. Laparoscopic approach: Becoming popular and better.

6. Fowler-Weir approach by cutting muscle medially over the rectus.



### **Complications after appendicectomy**

- 1- Paralytic ileus.
- 2- Reactionary haemorrhage due to slipping of ligature of the appendicular artery.
- 3- Residual abscess (pelvic, paracolic, local, sub diaphragmatic).
- 4-Adhesions, kinking and intestinal obstruction.
- 5- Right inguinal hernia (direct)—due to injury to ilioinguinal nerve.
- 6- Wound sepsis 10%.
- 7- Faecal fistula.
- 8- Respiratory problems and DVT.

9- Pylephlebitis (Portal pyaemia).

## INCIDENTAL APPENDICECTOMY

\* removal of normal appendix is done at laparotomy for other conditions.

\* It is done in vague lower abdominal pain of doubtful severity.

\* It is a useful procedure to tackle *'Munchausen syndrome*, i.e. the patient is always worried of pain abdomen and gets relieved after the procedure (psychological benefit).

\* It is done along with Ladd's procedure for malrotation.

\* It is also done during on table colonic lavage.

\*It is not done in Crohn's disease (during acute phase of appendicitis), postradiation, immunosuppression, aortoiliac grafts.

# **APPENDICULAR MASS -(Periappendicular Phlegmon)**

It is the localisation of infection occurring 3 to 5 days after an attack of acute appendicitis.

Inflamed appendix, greater omentum, oedematous caecum, parietal peritoneum

and dilated ileum (Ileus) forms a mass in the right iliac fossa.

This mass is tender, smooth, firm, well localised, not moving with respiration,

not mobile, all borders well made out (well localised) and resonant on percussion.

Patient may have fever and features of toxicity.

# **Differential diagnosis**

Carcinoma caecum	Actinomycosis
Crohn's disease	Mesenteric lymphadenitis
Ovarian disease	Ruptured ectopic pregnancy
Twisted ovarian cyst	Ileocaecal tuberculosis

### Investigations

1- Total leucocyte Count is increased.

2- U/S confirms the mass.





### Treatment ;-

- 1- Conservative (Ochsner-Sherren Regimen) = Includes observation:
- 1- Temp, BP, pulse chart.( Marking the mass to identify the progression/regression).
- 2- Antibiotics (Ampicillin, metronidazole, genta micin, ..)

3- IV fluids. 4- Analgesics. 5- Initial nasogastric aspiration.

Patient usually shows response by 48 to 72 hours and mass reduces in size, temperature and pulse becomes normal. Appetite is regained.

90% of patients respond to conservative therapy.

Patient is discharged and advised to come for interval appendicectomy after 6 weeks.

Contraindications for Ochsner-Sherren regimen

1. When diagnosis is in doubt.2. In acute appendicitis in children andelderly.

3. In burst, gangrenous appendicitis.4. In patients in whom diffuse peritonitis sets in.

#### Criteria to discontinue Ochsner-Sherren regimen

1- Patient becomes more toxic (tachycardia, high fever). 2- Persistent vomiting.

3- Increase or spread of pain abdomen (means onset of diffuse peritonitis).

4- Increased size of the mass5- Suppuration (abscess formation) inthe mass.

In these patients the regimen is discontinued.

The patient is taken for immediate surgery, either through laparotomy or through classic approaches

#### APPENDICULAR ABSCESS

It occurs due to suppuration in an acute appendicitis or suppuration in an already formed appendicular mass.

Abscess commonly *occurs in retrocaecal region but often* can occur in subcaecal, preileal lumbar or postileal regions.

Pelvic abscess is also common after an attack of acute appendicitis.

### **Clinical Features**

High fever, features of toxicity, tender, smooth, dull (to percuss), soft swelling in right iliac fossa which lies towards right lateral and lower side with clear upper margin but indistinct lower margin.

U/S confirms the diagnosis.

Treatment ;- Antibiotics are started.

Under G/A, incision is made in the lower lateral aspect of the swelling

above the inguinal ligament. Skin, external oblique muscle is cut.

Abscess cavity is opened and pus is drained extraperitoneally, which is

sent for culture and sensitivity. Wound is closed.

A drain is placed through a separate incision. Antibiotics are continued.

Interval appendicectomy is done after 3 months.

Pelvic abscess is drained per-rectally or through vagina

(posterior colpotomy in females).

### **MUCOCELE OF APPENDIX**

It can be neoplastic or non-neoplastic.

It occurs when proximal end of the lumen of appendix gets slowly and completely occluded, usually by a fibrous stricture causing collection of sterile fluid (mucus) in the Lumen. It is a retention cyst.

Appendix is grossly enlarged with features of sub-acute appendicitis.

Mucocele can get infected leading to empyema of appendix.

Rupture of mucocele can lead to pseudomyxoma peritonei.

Neoplastic type causes generalised pseudomyxoma peritonei;
non-neoplastic type causes localised pseudomyxoma peritonei.
Often mucocele of appendix is also caused by a mucus secreting adenocarcinoma and if
it is so right Hemicolectomy is done.
Clinical Features ;- Colicky pain in right iliac fossa.
Tenderness in the right iliac fossa.

Investigations;- U/S abdomen.

Treatment;- Appendicectomy.

#### Pseudomyxoma peritonei

Jelly like mucoid yellowish-brown substance accumulates in peritoneal cavity.

Due to ruptured adenocarcinoma appendix/mucocele or mucinous carcinoma of ovary. Common in females.

Painless progressive distension of abdomen with intestinal obstruction occurs eventually Shifting dullness is absent.

Surgical debulking, oophorectomy, appendicectomy, omentectomy are often done.

Chemotherapy is useful—cisplatin.

Carries poor prognosis.

Pseudomyxoma peritonei is presently considered to be due to neoplastic adenocarcinoma

of appendix with gelatinous fluid collection in the peritoneal cavity.

It is also seen in cystadenocarcinoma of ovary.

Treatment is surgery and chemotherapy.

### **NEOPLASMS OF THE APPENDIX**

It is rare. = It is often postappendicectomy histological diagnosis.

*Cystic neoplasms of appendix: Simple cyst (non-neoplastic* mucocele); mucinous cystadenoma; mucinous cystadenocarcinoma (most common form of cystic neoplasms); pseudomyxoma peritonei.

Simple cyst is non-neoplastic obstruction of the lumen and is less than 2 cm in size which contains

mucin.

Mucinous cystadenoma attains progressively large size of up to 8 cm with CT showing calcification

of the wall. Laparoscopic appendicectomy is not used in mucinous cystadenoma.

Treatment ;-Hemicolectomy is done in mucinous cystadenocarcinoma and cystadenoma of large size and if base is involved.

## Carcinoid tumour is the most common type.

*It is less* aggressive. It is often incidentally found. It is arising from Kulchitsky cells in crypts of Lieberkuhn (argentaffin tissue).

It is ten times more common than other types (One in 400 ppendices).

Commonly its location is in the tip.

Carcinoid of appendix may be goblet cell type or classical type histologically.

Treatment is appendicec-tomy.

Right hemicolectomy is done if base is involved or size is more than 2 cm or nodes are involved.

### Primary adenocarcinoma of the appendix is rare.

It can be mucinous (common) or colonic (less Common) type.

Acute presentation as appendicitis is common in colonic type.

Mucinous type has got better prognosis.

Mucinous type can rupture into the peritoneal cavity and can cause pseudomyxoma peritonei.