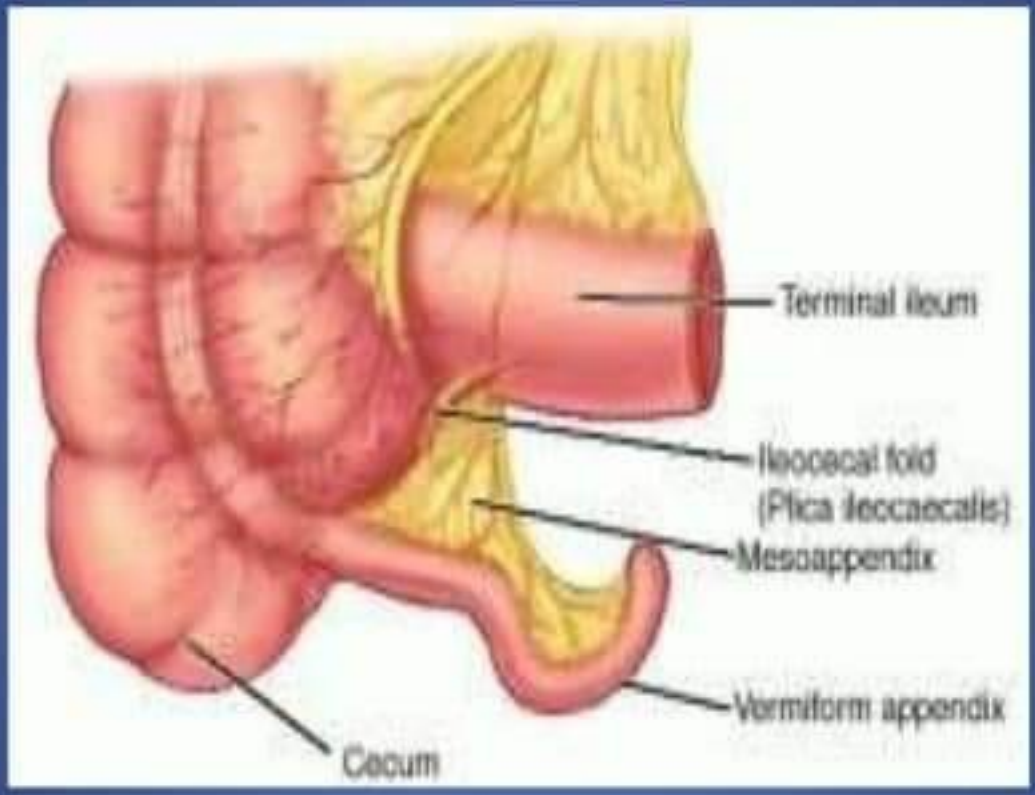
ACUTE APPENDICITIS



Fb/Nurse-Info

Introduction

- Vestigeal organ
- Surgical importance: Propensity for inflammation
- Most important cause of "Acute Abdomen" in young adults
- Appendicectomy is most common surgery performed worldwide

Anatomy

- Present only in humans,
- At birth: Short & broad at its junction with the Caecum
- Typical tubular structure produced by 02 years of age
- Results from differential growth of caecum

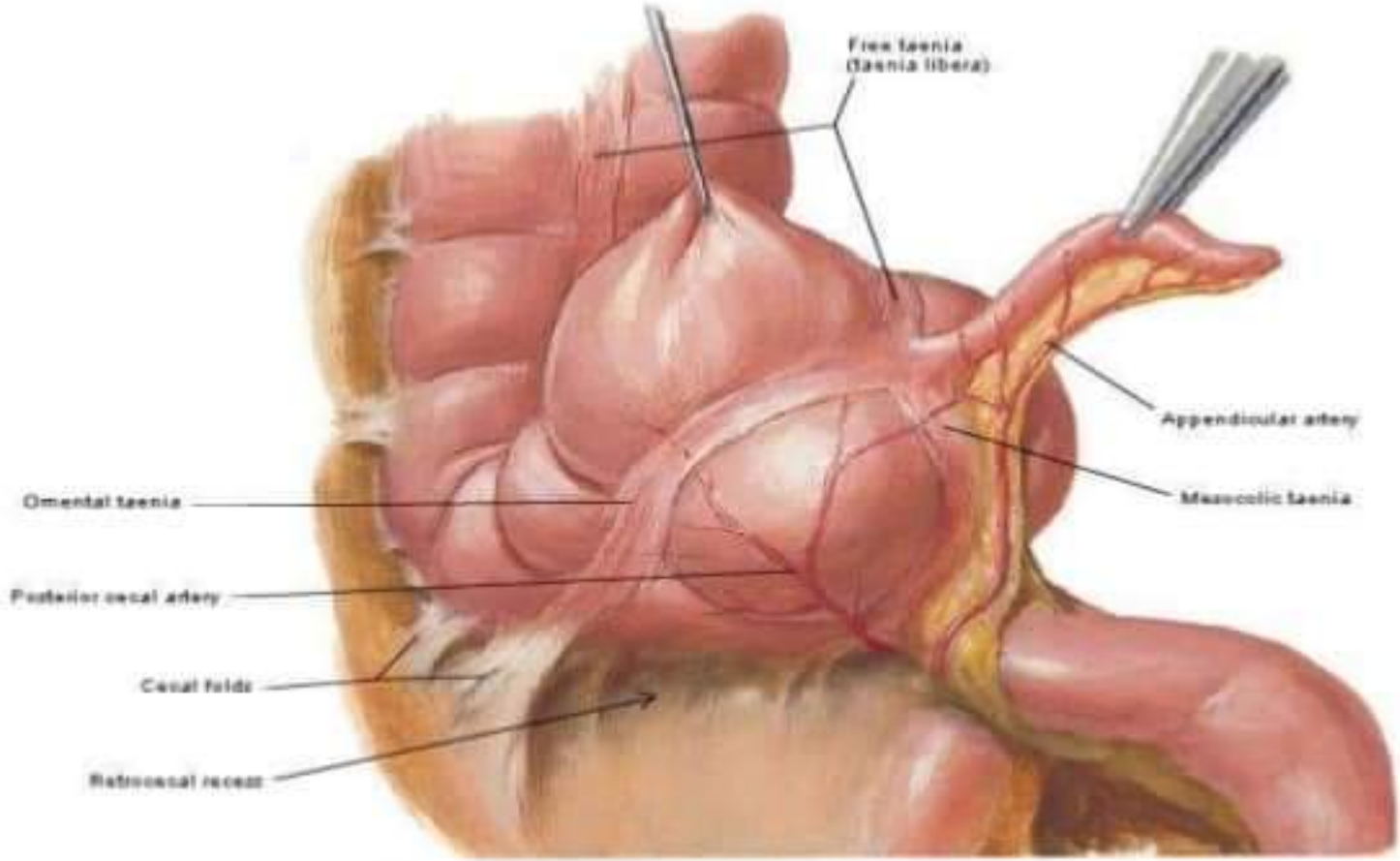
Anatomy

- Position: constant → at the confluence of the 03 taenia coli of caecum
- Mesoappendix : Arises from the lower surface of the mesentery of terminal ileum
- Appendicular Artery: Branch of Ileo-colic artery – End Artery
- 04-06 Lymphatic channels traverse Mesoappendix ----------> Ileo-caecal LNs

Anatomy

- The three taeniae coli converge at the junction of the cecum with the appendix and can be a useful landmark to identify the appendix.
- The appendix can vary in length from <1 cm to >30 cm; most appendices are 6 to 9 cm long.

ANATOMY


Free taenia
(taenia libera)
Appendicular artery
Mesocolic taenia
Omental taenia
Posterior cecal artery
Cecal folds
Retrocecal recess

Microscopic anatomy

- Layers:
  - Mucosa
  - Submucosa
  - Muscularis
  - Serosa

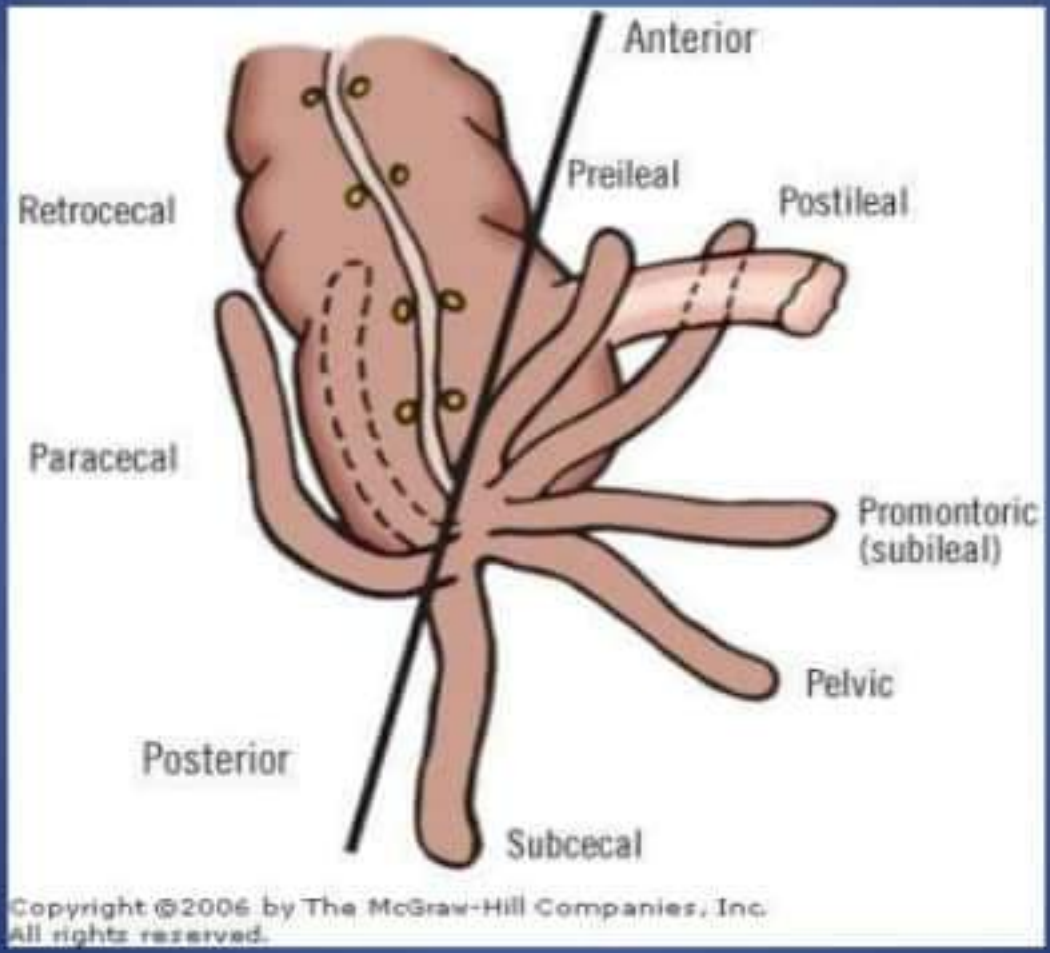
Microscopic anatomy

- Lumen has longitudinal folds of mucous membrane
- Lining: Columnar cells of colonic type
- Crypts: Argentaffin (Kulchitsky cells)
- Submucosa: Lymphatic aggregations/Follicles

Anatomical Positions

RETROCAECAL	**74%**
PELVIC	**21%**
PARACAECAL	**2%**
SUBCAECAL	**1.5%**
PREILEAL	**1%**
POSTILEAL	**0.5%**

Anatomical positions

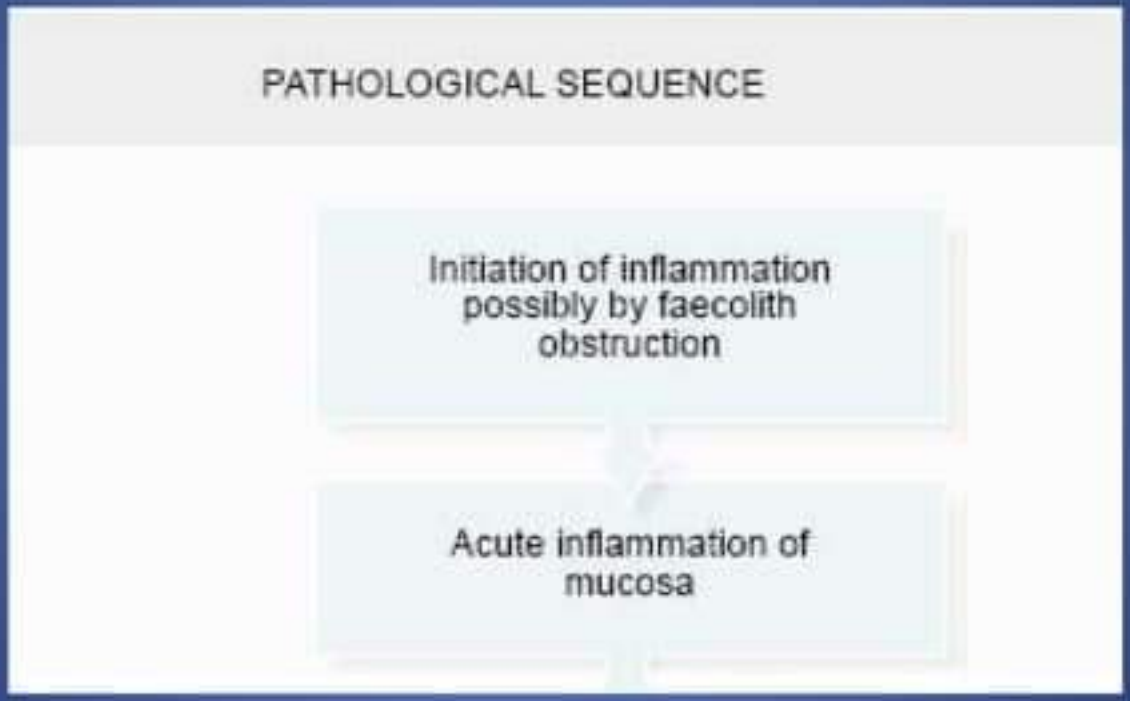


Etiology

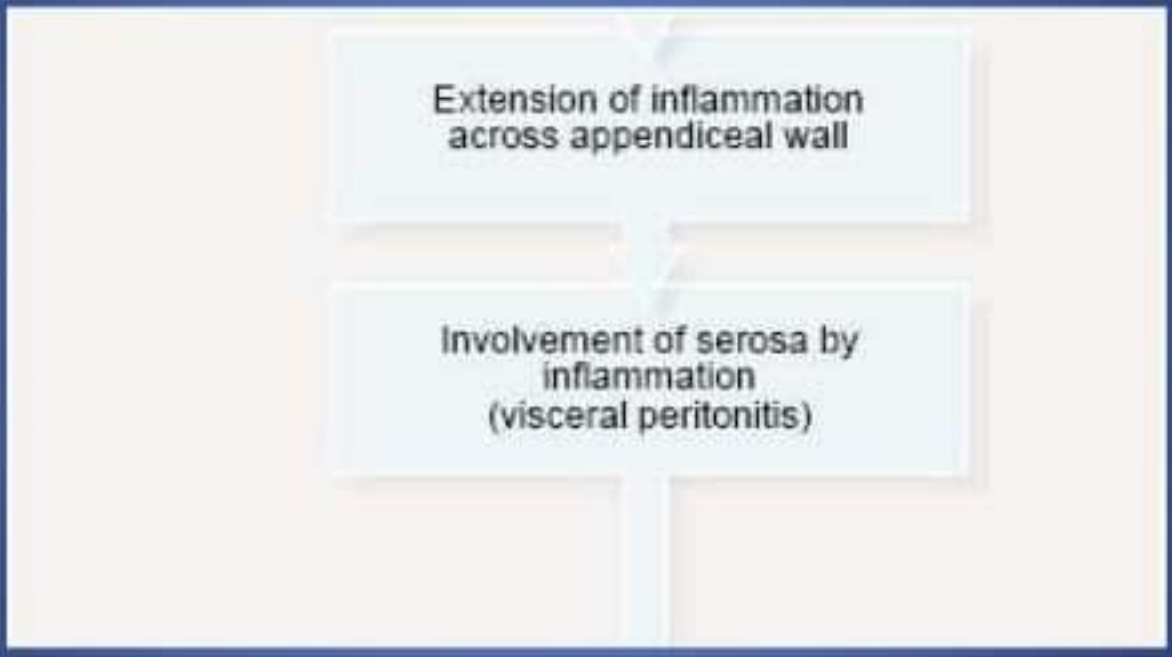
- No unifying hypothesis
- Bacterial proliferation
- Initiating event is controversial
- Obstruction of appendix lumen
- Faecolith or fibrotic stricture
- Worm infestations: Oxyuris vermicularis
- Neoplasms: Ca caecum, carcinoids
- Viral
- No luminal obstruction
- Low dietary fibre

- A **faecolith** (sometimes referred to as an 'appendicolith') is composed of inspissated faecal material, calcium phosphates, bacteria and epithelial debris

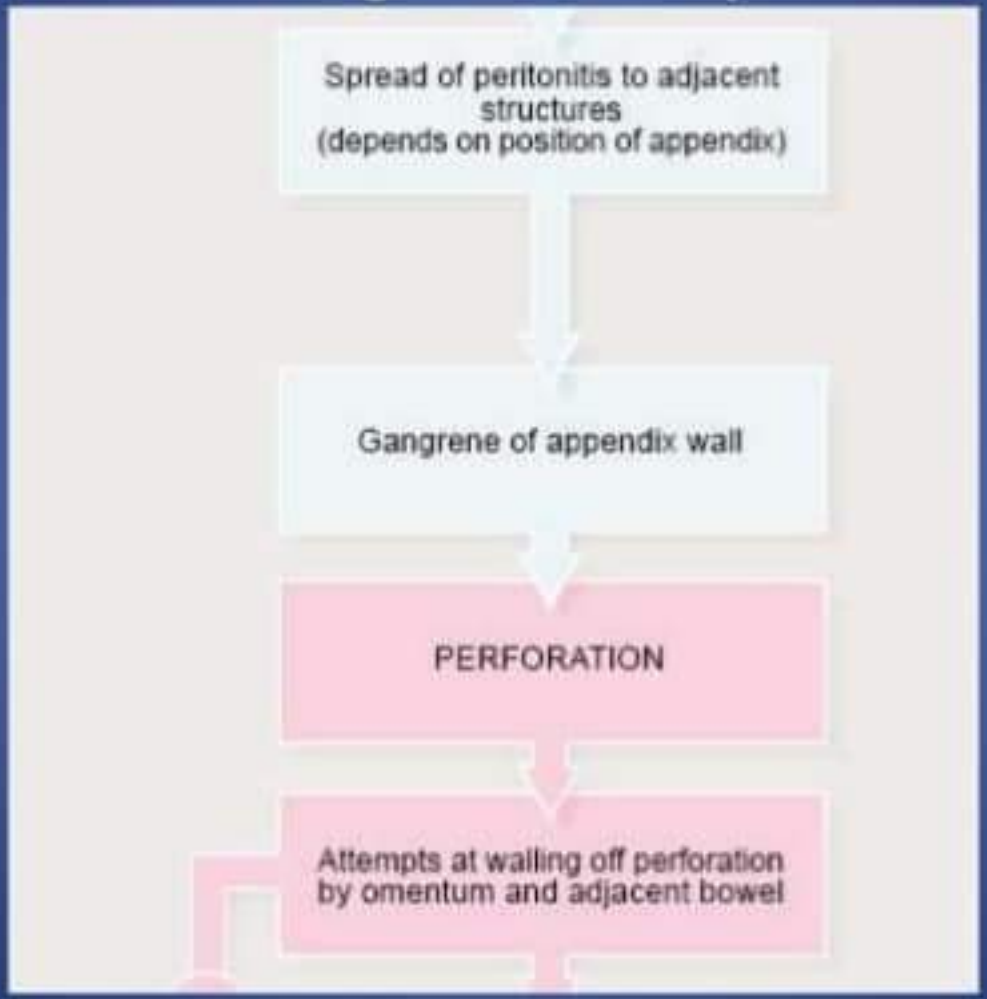
Pathological sequence



Pathological sequence



Pathological sequence



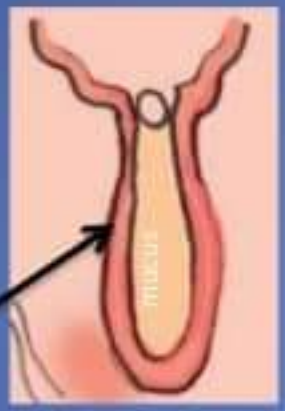
Pathology

- Continued mucous secretion and inflammatory exudation → intraluminal pressure → obstructing lymphatic drainage.
- Edema and mucosal ulceration develop with bacterial translocation to submucosa .
- Further distention may cause venous obstruction and ischcemia of the appendix wall.
- Bacterial invasion through muscularis externea producing acute appendicitis.
- Ischaemic necrosis of appendicular wall gangrenous appendix bacterial contamination of peritoneal cavity.

Pathology cont.

- Greater omentum becomes adherent to inflamed appendix paracaecal abscess
- Extremes of age
- Immunosuppression
- Faecolith obstruction
- Pelvic appendix
- Previous abdominal surgery

Pictorial Explanation



Distention

Distention causing Ischemia

Gangrene

Appendiceal obstruction/early appendicitis – visceral peritoneal irritation	Appendiceal distension	Irritation of parietal peritoneum (localised	Perforation, localised/generalised peritonitis, mass

Appendix – Normal

Pathology

Lymphatic hyperplasia

Luminal obstruction

Increased intra-luminal pressure

Edema, mucosal ulceration

Bacterial translocation to submucosa

Pathology

Resolution

Venous obstruction

Ischaemia of appendix wall

Invasion of muscularis propria, submucosa

Pathology


Acute Appendicitis
Lump/mucocele
Gangrenous appendicitis
Peritonitis

Bacteriology of perforated appendicitis

TYPE OF BACTERIA	PATIENTS (%)
ANAEROBIC	
B. fragilis	80
B. thetiaotaomicron	61
Bilophila wadsworthia	55
Peptostrptococcus spp	46
AEROBIC	
E.coli	77
S.viridans	43
Group D streptococcus	27
P.aeruginosa	18

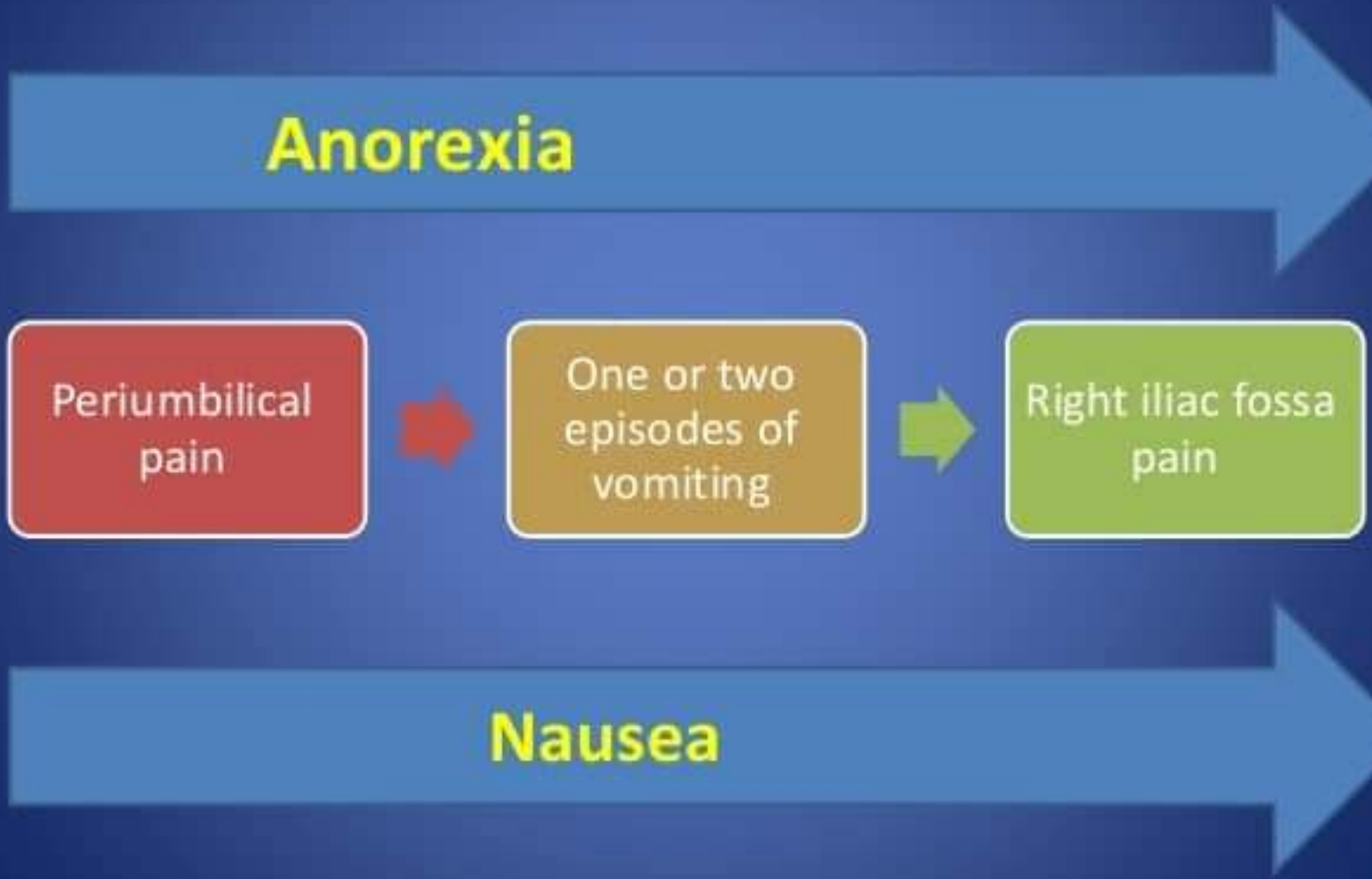
Clinical features

Symptoms:

1. Periumbilical pain 50% cases
2. Pain shifts to RIF
3. Anorexia
4. Nausea/vomiting

Two clinical syndromes of acute appendicitis can be discerned, **acute catarrhal (non-obstructive) appendicitis** and **acute obstructive appendicitis, the latter characterised by a** more acute course.

The classical history



Abdominal pain

- Visceral abdominal pain
- Somatic abdominal pain
- referred abdominal

Visceral abdominal pain

- Visceral abdominal pain, organs, visceral peritoneum, mesentery

  1-distention of a hollow viscus

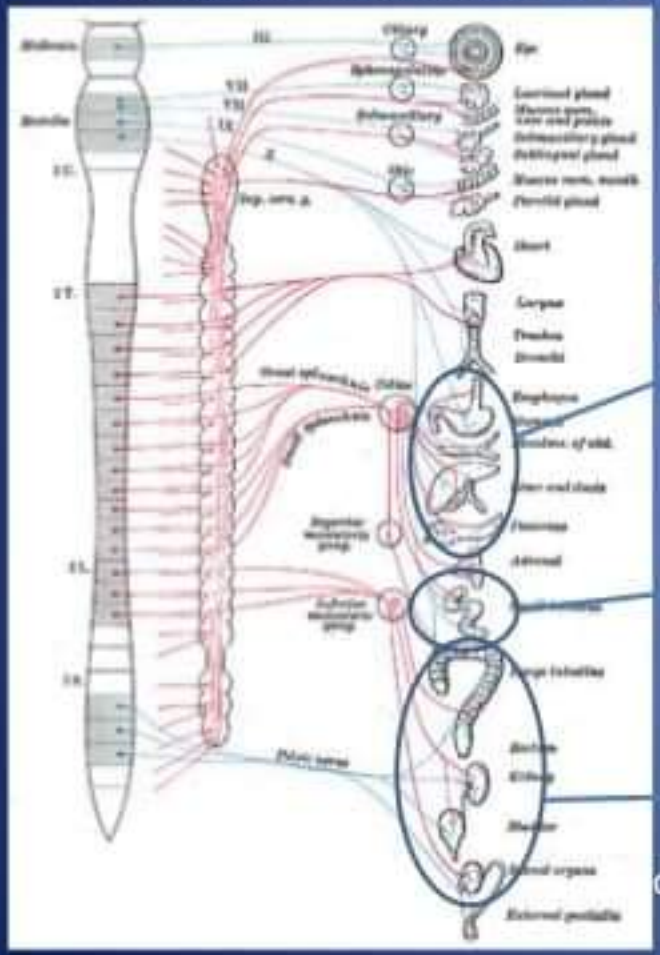
  2-ischemia to a viscus

  3-inflammation

Referred to midline embryological development

Relevant Anatomy

4. Innervation of appendix & other organs



Foregut
(inc. duodenum)

Midgut
(inc. appendix)

Hindgut
ower urinary tract
Sexual organs

Paired organs

unpaired

T6

costal

margin

T10
umbilicus

ASIS

T12

Pubic
symphisis

Colicky pain

- Colicky pain form of visceral pain rhythmic pain resulting from smooth muscle spasm as a reaction to luminal obstruction
- intestinal obstruction, passage of gallstone in biliary ducts, ureteric colic
- Often thought to be indigestion, constipation and is frequently ignored.
- Lasts for a variable period, usually few hours / 2 or 3 days, rarely longer

Referred pain

- The vague referred pain in the periumblical
- stretching of the lumen or spasm.
- The visceral innervation comes from the 10th thoracic spinal segment.
- Accompany the sympathetic nerves through the superior mesenteric plexus and the lesser splanchnic nerve
- If the visceral innervation is higher, then the mid-line pain will be higher.
- Testicular pain due to visceral referral of afferent nerve impulses to the same spinal segment

Somatic pain

- Skin, fascia, muscle and parietal peritoneum
- Sever and precisely localized
- Inflamed parietal peritoneum cutaneous hyperesthesia and tenderness
- The right iliac fossa pain is due to the irritation of parietal peritoneum
- **somatic pain as opposed to earlier visceral**.

Guarding and rigidity

- Guarding is the protective phenomenon
- abdominal muscles increase in tone
- attempts to localize the inflammation
- There is tenderness causing the patient to constantly tense the abdominal wall muscles in palpation
- Voluntary guarding /apparent guarding
- Involuntary guarding /true guarding
- Muscular spasm rigidity
- localized initially progressing to generalized with perforation or increasing peritonitis

Tenderness

- Tenderness:
  - localised over McBurney's point
  - not evident before later inflammation of serosa and parietal peritoneum
  - often masked in obese due to inability to displace viscus
- Blumberg's sign The pain is elicited with pressing the abdominal wall deeply with fingers and abruptly releasing it.

Reflexes

- Visceral afferent fibers participate in reflex activities. Reflex sweating, salivation, nausea, vomiting and tachycardia may accompany visceral pain.
- Carried by autonomic nerve fibers

Signs

- lying still, with shallow breaths and reluctant to cough
- fever 37.5-38.5C, worsening with perforation
- Foetor oris - halitosis
- Furred tongue
- Flushed
- infrequently, diarrhoea:
  - early and transient as a result of visceral pain
  - later if retroileal or pelvic involvement appendix; this is typically prolonged and mucoid
- constipation - sometimes for a few days before the attack

Signs to elicit in appendicitis

- Pointing sign
- Rovsing's sign
- Psoas sign
- Obturator sign

Clinical features

- Signs:

1. Pyrexia
2. Localized tenderness in RIF
3. Muscle guarding
4. Rebound tenderness
5. Rovsing's sign
6. Pointing sign
7. Psoas sign
8. Obturator sign

Clinical features

- Risk factors for perforation:

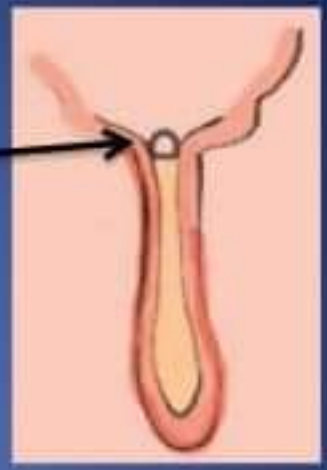
1. Extremes of age
2. Immunosuppression
3. Diabetes mellitus
4. Pelvic appendix
5. Previous abdominal surgery

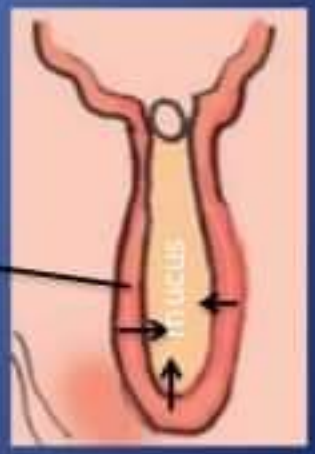
"Typical" Presentation

- Dull, crampy central abdo pain
- Malaise/vomiting/anorexia/low grade fevers
- Pain worsens & localises to RIF with cough/movement tenderness
- Systemic symptoms

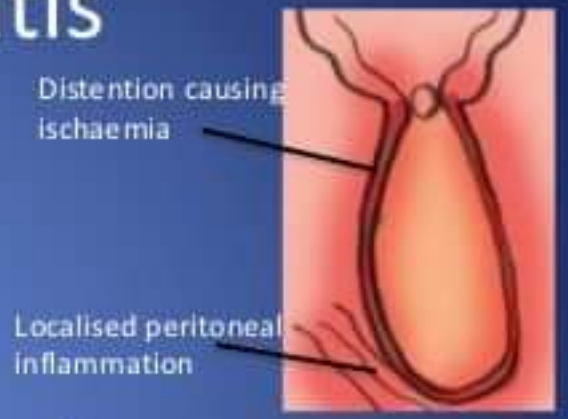
Early Appendicitis

- Pain:
  - Location: Periumbilical (T10)
  - Character: Dull
  - Over time: Colicky
  - Associated symptoms:
    - Vomiting
    - Anorexia



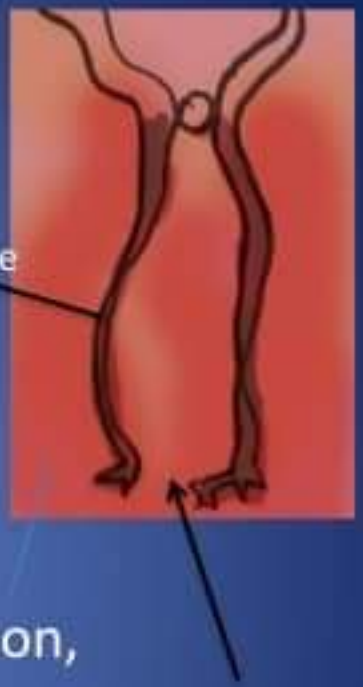


Later Appendicitis



- Pain:
  - Location: R Iliac Fossa
  - Character: Localised
  - Over time: Constant
  - Aggravating: going over bumps, coughing, walking
  - Relieving: hip flexion, staying still
- Exam findings:
  - "peritonism"
    - Guarding
    - rebound tenderness
    - percussion tenderness
  - Rovsing, psoas, other signs

Late Appendicitis



- Pain:
  - Location: lower abdominal/generalised
  - Character: diffuse, severe
  - Over time: constant
  - Aggravating: movement, coughing, palpation, rebound
  - Associated: Fever
- Exam findings:
  - Systemic features- fever, tachycardia, hypotension
  - Abdominal – severe, generalised "peritonism"
  - RIF mass (sometimes)

Time Course

Appendiceal obstruction/early appendicitis – visceral peritoneal irritation

- Periumbilical colicky pain

Appendiceal distension

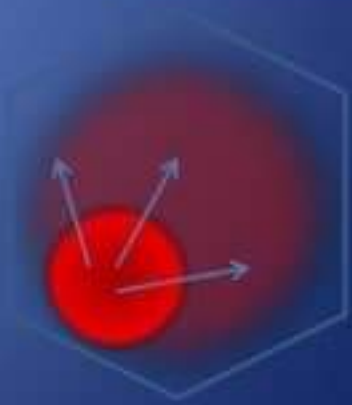
- Anorexia, vomiting, malaise

Irritation of parietal peritoneum (localised)

- Constant RIF pain, pain on coughing, going over bumps etc

Perforation, localised/generalised peritonitis, mass

- ***Fever/Sepsis***



Special clinical scenarios

- According to position:

1. Retro-caecal
   - Silent appendix
   - Quadratus lumborum rigidity
   - Psoas sign
   - Loin tenderness

Special clinical scenarios

2. Pelvic
   - Early diarhoea
   - Increased urinary frequency
   - Deep tenderness over symphysis pubis
   - DRE: Rectovesical pouch/POD tenderness
   - Obturator/Psoas sign +ve

Special clinical scenarios

3. Post-ileal
   - Diarrhoea
   - Marked retching
   - Ill defined tenderness to rt of umbilicus

Special clinical scenarios

- As per age:

1. Infants
   - Uncommon <36 mths
   - Difficult to diagnose
   - Diffuse peritonitis common
   - High incidence of perforation

Special clinical scenarios

2. Children
   - Vomiting
   - Marked anorexia
3. Elderly
   - High incidence of gangrene & perforation
   - Features of SAIO
4. Obese
   - Diminished signs/ delayed dignosis
   - Midline/ Laparoscopic approach

Special clinical scenarios

5. Pregnancy
   - Most common extra-uterine cause of acute abdomen
   - Delayed presentation
   - Fetal loss

- 3-5%
- Upto 20% : Perforation

Going through the sea of DDX

- Mesenteric lymphadenitis
- Acute appendicitis
- Henoch Schonlein purpura
- lobar pneumonia
- Meckel's diverticulitis
- Intussusception
- Ureteric stone
- Enterocolitis
- Familial Mediterranean fever

Differential Diagnosis

1. Children
   - Gastroenteritis
   - Mesenteric adenitis
   - Meckel's diverticulitis
   - Intussusception
   - HS purpura
   - Lobar pneumonia

Differential Diagnosis

2. Adults
   - Regional enteritis
   - Ureteric colic
   - Perforated peptic ulcer
   - Torsion of testis
   - Pancreatitis
   - Rectus sheath haematoma

Differential Diagnosis

3. Adult female
   - Mittelschmerz
   - PID
   - Pyelonephritis
   - Ectopic pregnancy
   - Torsion/ rupture of ovarian cyst
   - Endometriosis

Differential Diagnosis

4. Elderly
   - Diverticulitis
   - Intestinal obstruction
   - Ca colon
   - Mesenteric infarction
   - Torsion of appendix epiploicae
   - Leaking aortic aneurysm

Differential Diagnosis

5. Rare
   - Tabetic crisis
   - Spinal conditions
   - Porphyria
   - Diabetes
   - Typhilitis

Investigations

- Diagnosis is essentially clinical
- Clinical diagnosis alone
  - 15-30% negative appendicectomy
- Use of
  - Clinical scoring systems
  - Imaging modalities
  - Diagnostic Laparoscopy
  - Routine laboratory examinations

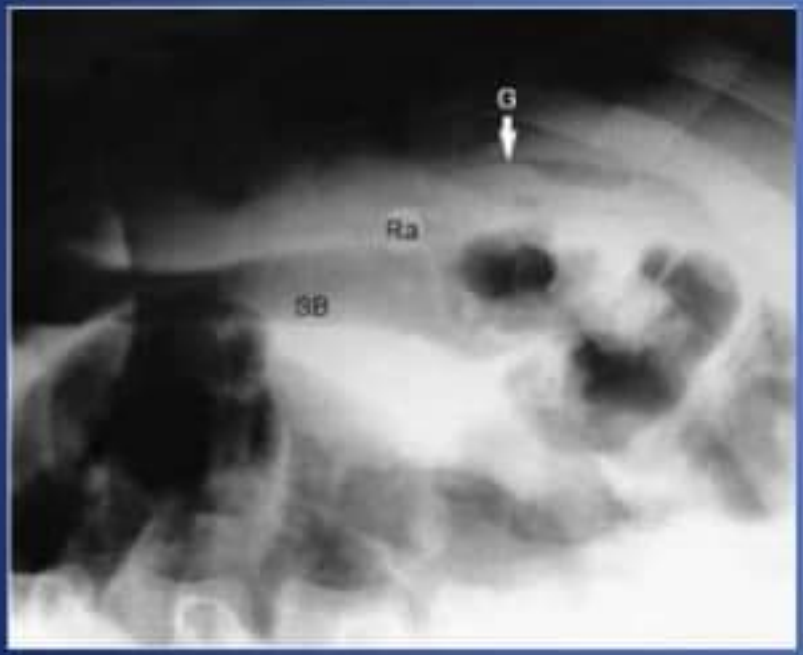
X-ray signs

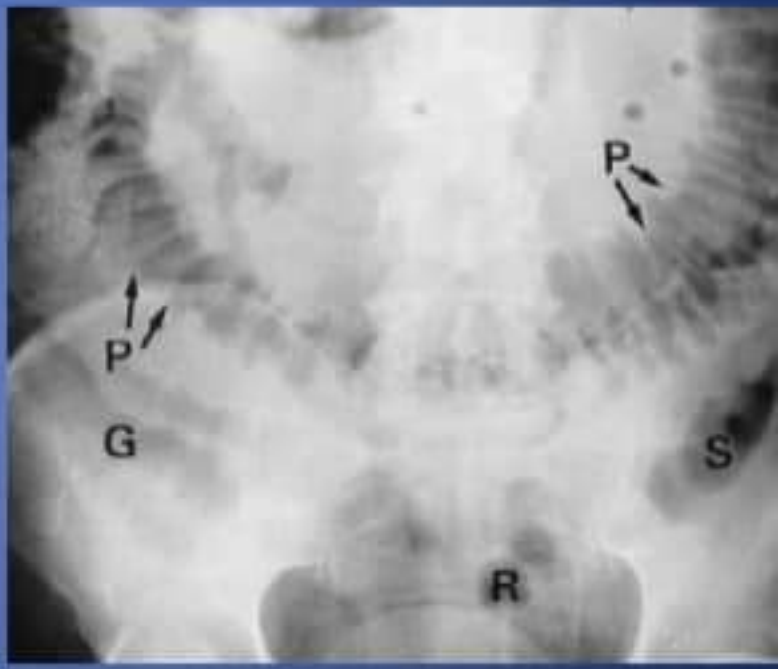
- Reported signs include:
- increased soft tissue density in the right lower quadrant
- a faecolith in the right iliac fossa
  - the majority are radio-opaque
  - occur in about 10% of those with appendicitis
  - often mistaken for ureteric calculus or gallstones
- a gas-filled appendix
- free intraperitoneal gas

Plain Abdominal X-Rays

- Low sensitivity
- Appendicoliths picked up in only 10-15% cases
- Can be combined with Barium enema
- Failure of appendix to "Fill up"
- Low specificity → 20% of normal Appendices do not fill up

X-rays





X ray abdomen

US Scans

- Sensitivity = 85% Operator based
- Specificity > 90%
- AP dia appendix > 7mm
- CROSS SECTIONAL VIEW:
  - Thick walled
  - Non compressible luminal structure : Target Lesion
- Periappendiceal fluid/ Mass

Computed Tomography

- Commonly used in the West
- 5mm slices :
  - Sensitivity: 90%
  - Specificity: 80 – 90%
- RCT for 64-MDCT: 95% accuracy
- Sensitivity PROPORTIONATE TO Severity
- Faecoliths/Appendicoliths detected in 50% pts of appendicits ???

Computed Tomography

- Classical findings:
  - Distended appendix > 7mm diameter
  - Halo/ Target sign
  - Periappendiceal fat stranding
  - Edema
  - Peritoneal fluid
  - Phlegmon
  - Periappendiceal abscess

Computed Tomography

- Rational use:
  - Elderly
  - Atypical presentations
  - Neoplasms
  - Acute diverticulits
  - Intestinal obstruction
- MRI: ??

Diagnostic Laparoscopy

- Small fraction of pts
- Women of child bearing age
- Prompt intervention ------- Implications on future fertility

Laboratory Examinations

- WBC's elevated
- Normal in 10% cases
- TLC > 20,000 s/o PERFORATION
- Polymorphs > 75%
- Minimal pyuria Common
- Microscopic haematuria

Appendiceal Rupture

Immediate appendectomy has long been the recommended treatment for acute appendicitis because of the presumed risk of progression to rupture.
The overall rate of perforated appendicitis is 25.8%. Children <5 years of age and patients >65 years of age have the highest rates of perforation (45 and 51%, respectively)
delays in presentation are responsible for the majority of perforated appendices.

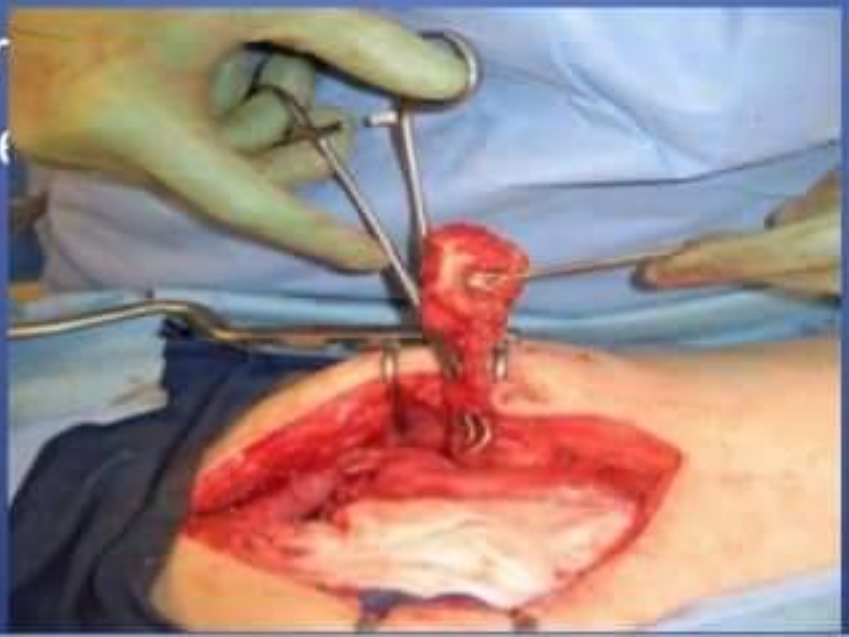
Appendiceal rupture occurs most frequently distal to the point of luminal obstruction along the antimesenteric border of the
appendix. Rupture should be suspected in the presence of fever with a temperature of >39°C (102°F) and a white blood cell
count of >18,000 cells/mm3

Options

- Open / traditional surgery
- Laparoscopic
- Natural orifice surgery (no incision appendectomy)

Appendicectomy - Open

- Incision over McBurney's point or point of maximal tenderness
- Straightforward, good exposure, technically easier
- Longer r hesions, can't see



Open appendetomy

- For open appendectomy most surgeons use either a McBurney (oblique) or Rocky-Davis (transverse) right lower quadrant muscle-splitting incision in patients with suspected appendicitis. The incision should be centered over either the point of maximal tenderness or a palpable mass

Open / traditional

- if incision is perpendicular to the line :
- Grid iron incision
- Why called grid iron ?
- if better access is needed , on
  can change gridiron to
  Rutherford Morrison's incisio
- Lanz incision (transverse skin crease incision , 2cm below umbilicus at mid-clavicular line)

Laparoscopic appendetomy

- Laparoscopic appendectomy usually requires the use of three ports. Four ports may occasionally be necessary to mobilize a retrocecal appendix. The surgeon usually stands to the patient's left. One assistant is required to operate the camera. One trocar is placed in the umbilicus (10 mm), and a second trocar is placed in the suprapubic position. Some surgeons place this second port in the left lower quadrant. The suprapubic trocar is either 10 or 12 mm, depending on whether or not a linear stapler will be used.
- The placement of the third trocar (5 mm) is variable and usually is either in the left lower quadrant, epigastrium, or right upper quadrant.

Appendicectomy - Laparoscopic

- "Keyhole" surgery
- Lower complication rate, quicker recovery

LA	OA
Decreased wound infection rate	Cheaper
Earlier return to normal life	Shorter operating time
Shorter Hospital stay	
Can assess the rest of the abdominal cavity with ease	
? Associated with increased intra-abdominal infections	
More beneficial in obese, females and employed pts	

Natural orifice surgery

- No incision appendectomy
- Using the natural orifices like anal canal endoscopically or trans-vaginally .
- Less pain
- No scar
- Less hospital stay
- Fewer complications
- It takes about 50 minutes

Meckel's diverticulum

Management of Appendicular abscess/Lump

- Late presentation
- Clinically mass & fever
- Subject to imaging studies to ascertain:
  - Presence
  - Size
- > 4-6cms → Antibiotics+Drainage
- < 4 cms → Conservative mgt(Oschner Sherren's Regime)

Management of Appendicular abscess/Lump

- Criteriae for stopping conservative mgt:
  - Rising pulse rate
  - Increase in the size of the mass
  - Increasing/ spreading abdominal pain