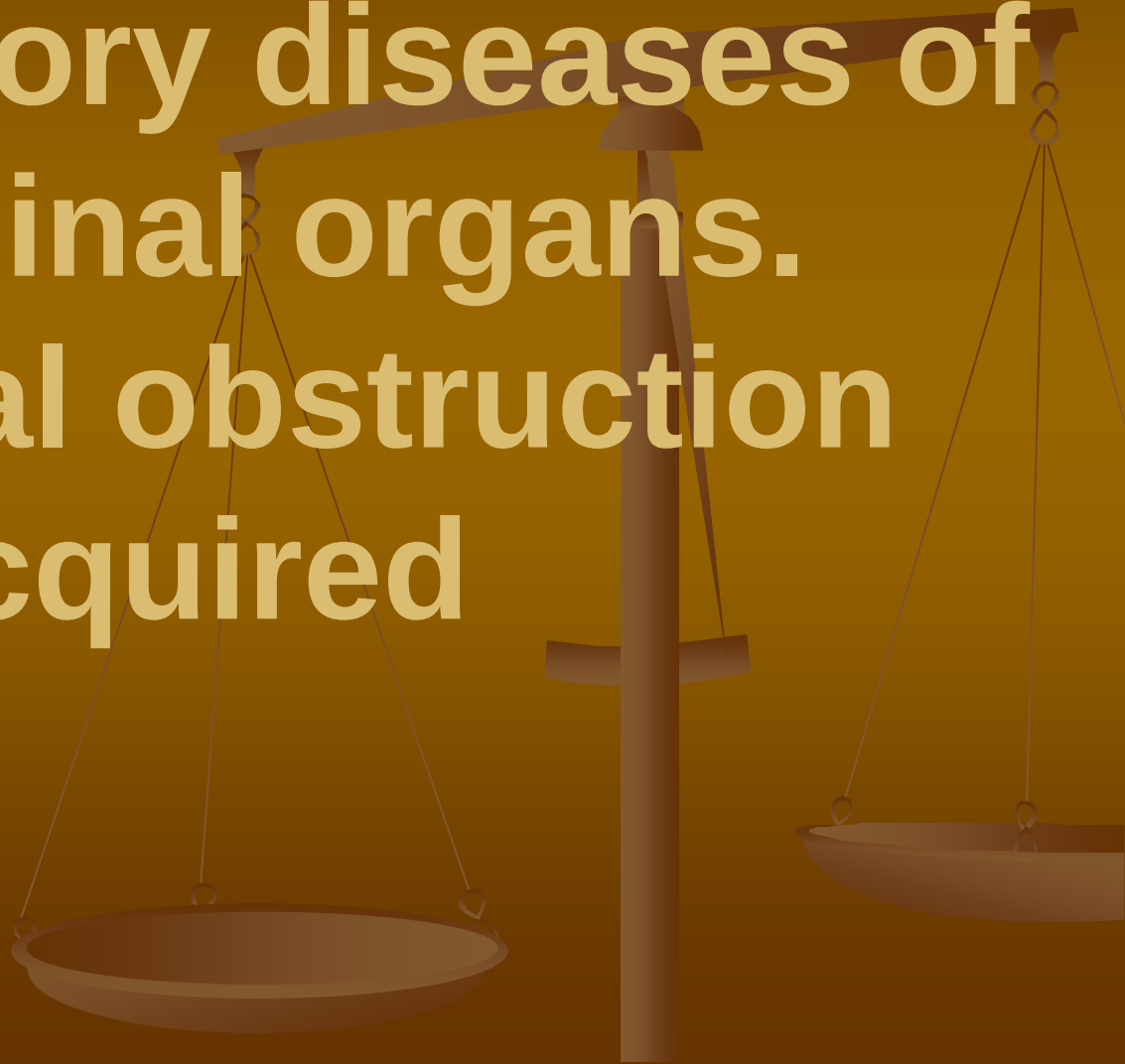
# Inflammatory diseases of abdominal organs. Intestinal obstruction acquired

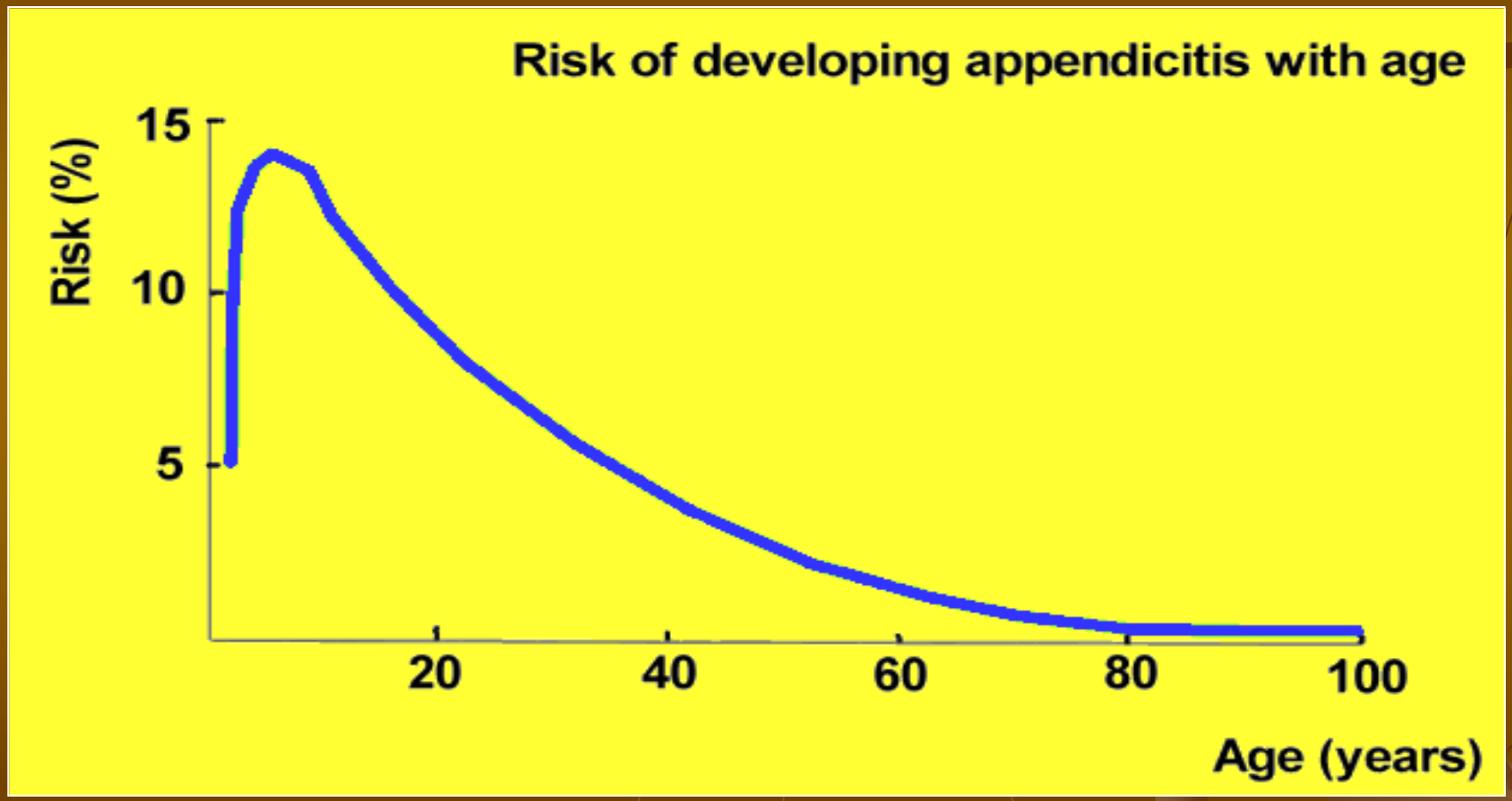


# Plan of the lecture

**Inflammatory diseases of abdominal organs. Intestinal obstruction acquired**

1. Current views on the etiology and pathogenesis of acute appendicitis.
2. Features of the structure of the abdominal cavity and appendix, which determine the clinical course of appendicitis in children.
3. Features of acute appendicitis in young children (up to 3 years).
4. Features of the examination of young children with suspected acute appendicitis.
5. Differential diagnosis of acute appendicitis.
6. Supportive methods of examination of children with suspected acute appendicitis, their informativeness and diagnostic value.
7. Complicated forms of acute appendicitis: appendicular infiltrate, abscess, peritonitis.
8. Primary peritonitis.
9. Peritonitis of newborns.
10. Classification of intestinal obstruction in children
11. The main causes of spastic and paralytic bowel obstruction.
12. Classification, pathogenesis, prevention of postoperative connective bowel obstruction.
13. Principles of treatment of connective bowel obstruction.
14. Etiology, pathogenesis, clinic, diagnosis of idiopathic invagination in children.
15. Differential diagnostics with infectious diseases.
16. Indications for conservative and surgical treatment, prevention of complications

# RISK OF DEVELOPING APPENDICITIS WITH AGE



# Causes:

- Most causes of appendiceal inflammation, infection, and perforation begin with something obstructing the appendiceal lumen. Items such as stool, barium, food, and parasites can block the lumen. Malignant tissue such as that caused by carcinoid, leukemia, and lymphoma can cause tissue swelling and lumen obstruction.
- Blunt abdominal trauma has been identified as a cause for appendicitis.

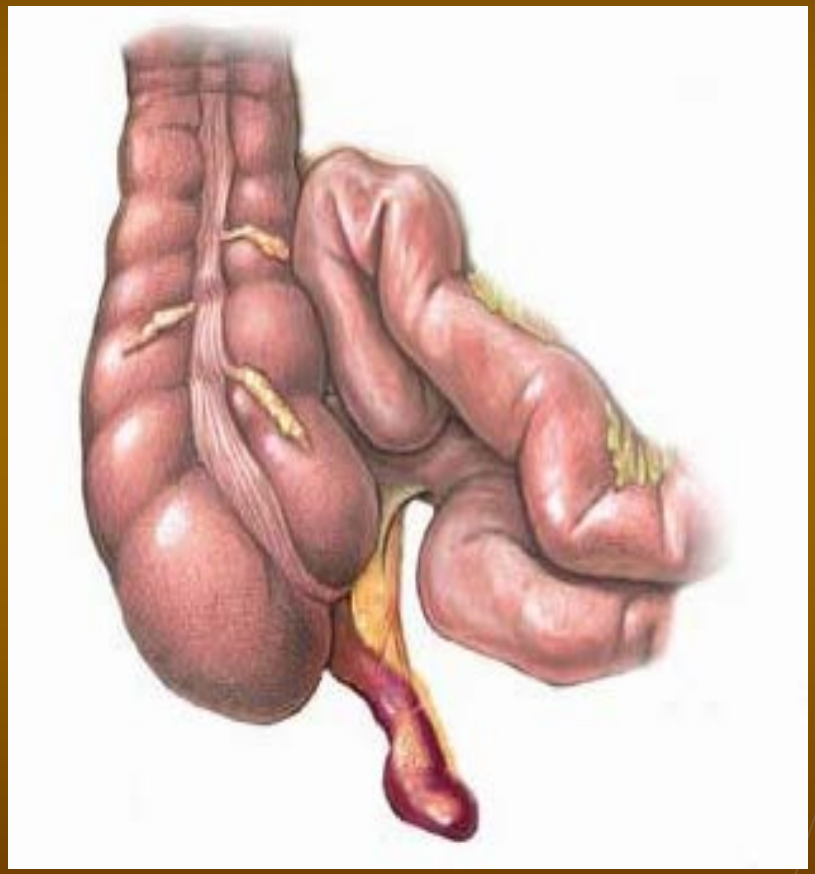
# Age:

- The mean age in the pediatric population is 6-10 years.
- Appendicitis is rare in the neonate, and the diagnosis in this age group is typically made after perforation.
- Younger children have a higher rate of perforation, with reported rates of 50-85%.

# Classic history for appendicitis

- Patients with a classic history for appendicitis require prompt surgical consultation but may not require emergency surgery. In fact, emergency appendectomy (operation within 6 h) in children has no advantages over urgent appendectomy (operation with 12 h) with respect to gangrene and perforation rates, readmissions, postoperative complications, hospital stay, or hospital charges. This does not mean the emergency physician who has made the diagnosis of appendicitis will not contact the surgeon right away, but the hospital admission and course must be discussed with the surgeon, patient, and family

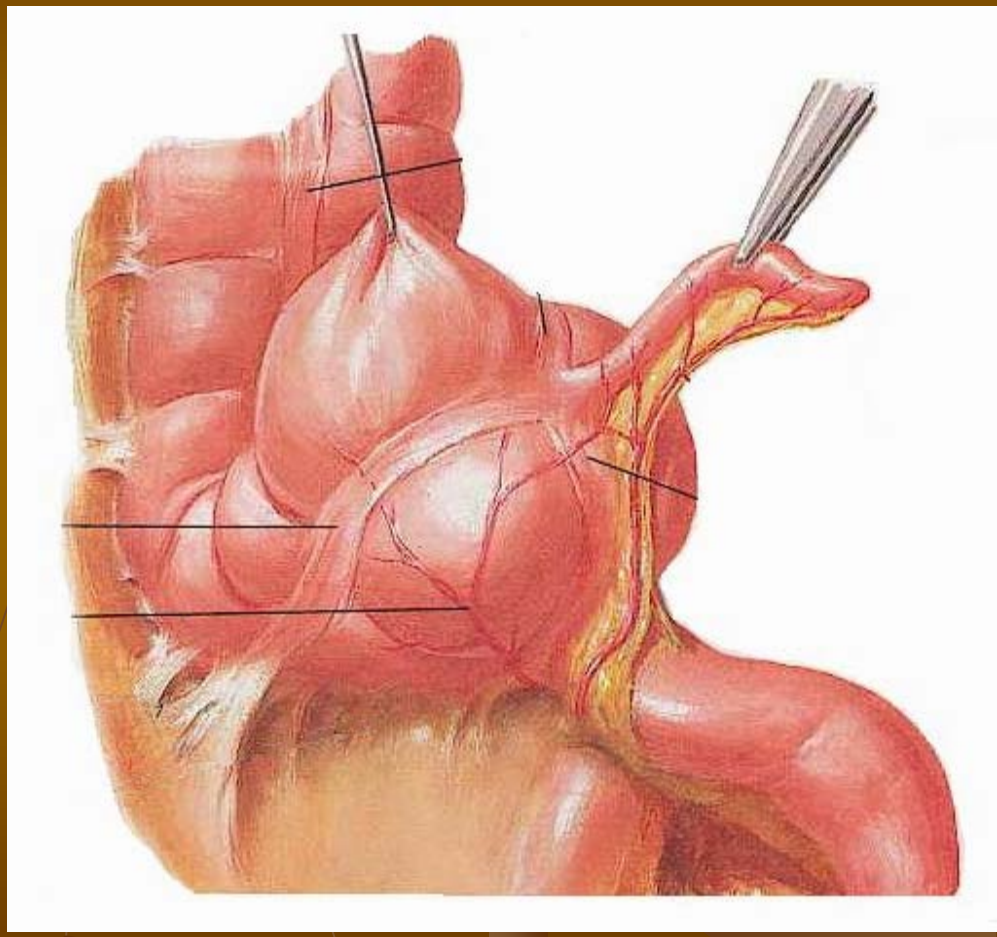
# Acute appendicitis



Most common reason for consultation in the emergency department for abdominal pain and emergency abdominal surgery in children

# Relevant anatomy

- The appendix is a wormlike extension of the cecum, and its average length is 8-10 cm (ranging from 2-20 cm)
- It appears during the fifth month of gestation
- The convergence of teniae coli is detected at the base of the appendix, beneath the Bauhin valve



# Structure of the appendicle wall:

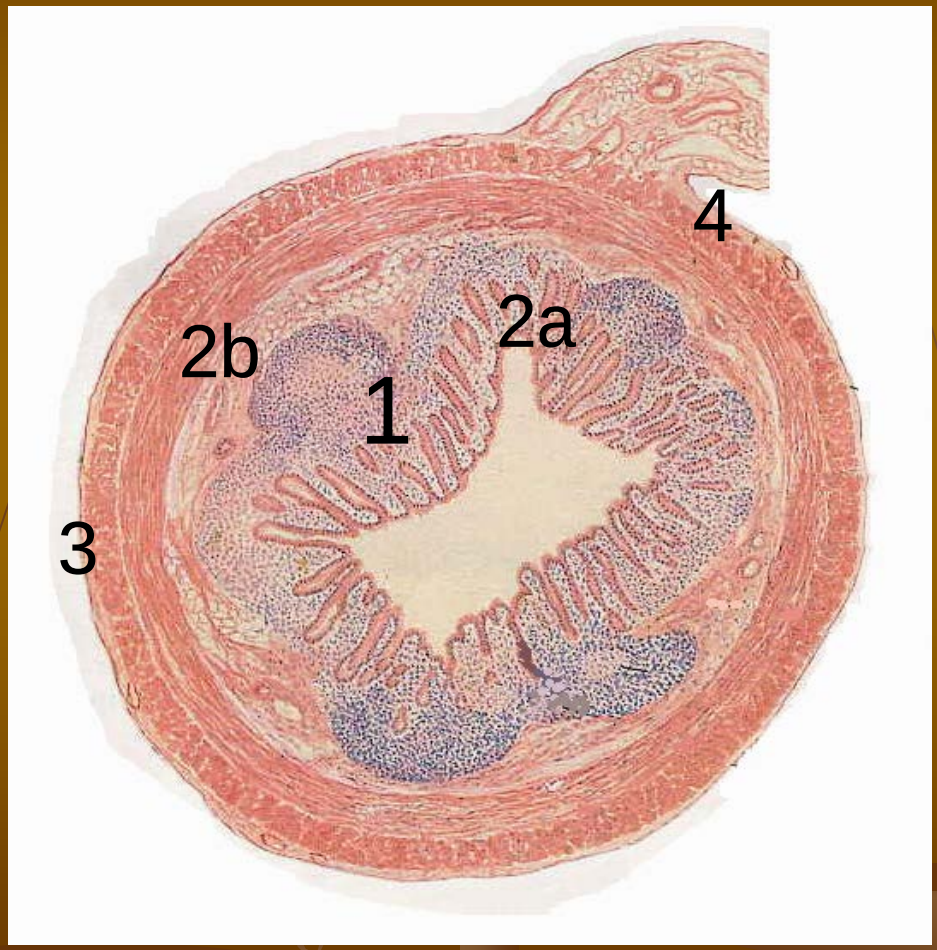
1-mucosal layer (lymphoid follicles are scattered in its mucosa. Its number increases when individuals are aged 8-20 years

2a - inner muscular layer (circular )

2b - outer muscular layer (longitudinal, derives from the taenia coli)

3 – serosa

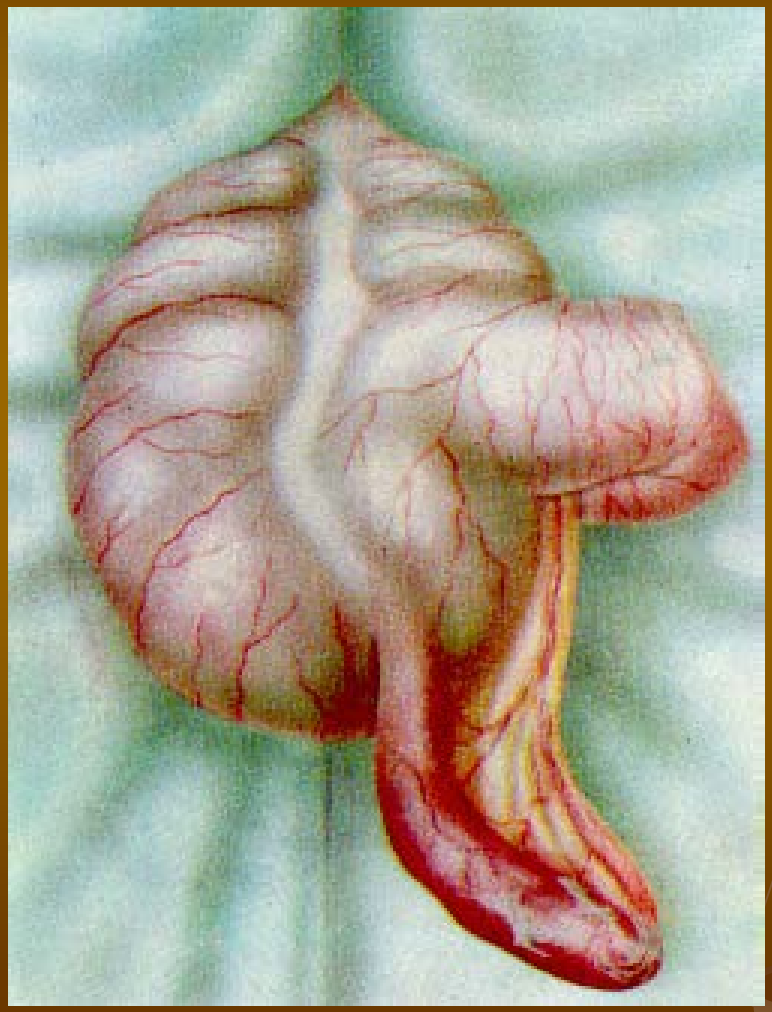
4 - mesoappendix



# *Early stage of appendicitis*

- Obstruction of the appendiceal lumen
- mucosal edema
- mucosal ulceration
- diapedesis of bacteria
- distention of the appendix due to accumulated fluid
- and increasing intraluminal pressure

# Suppurative appendicitis



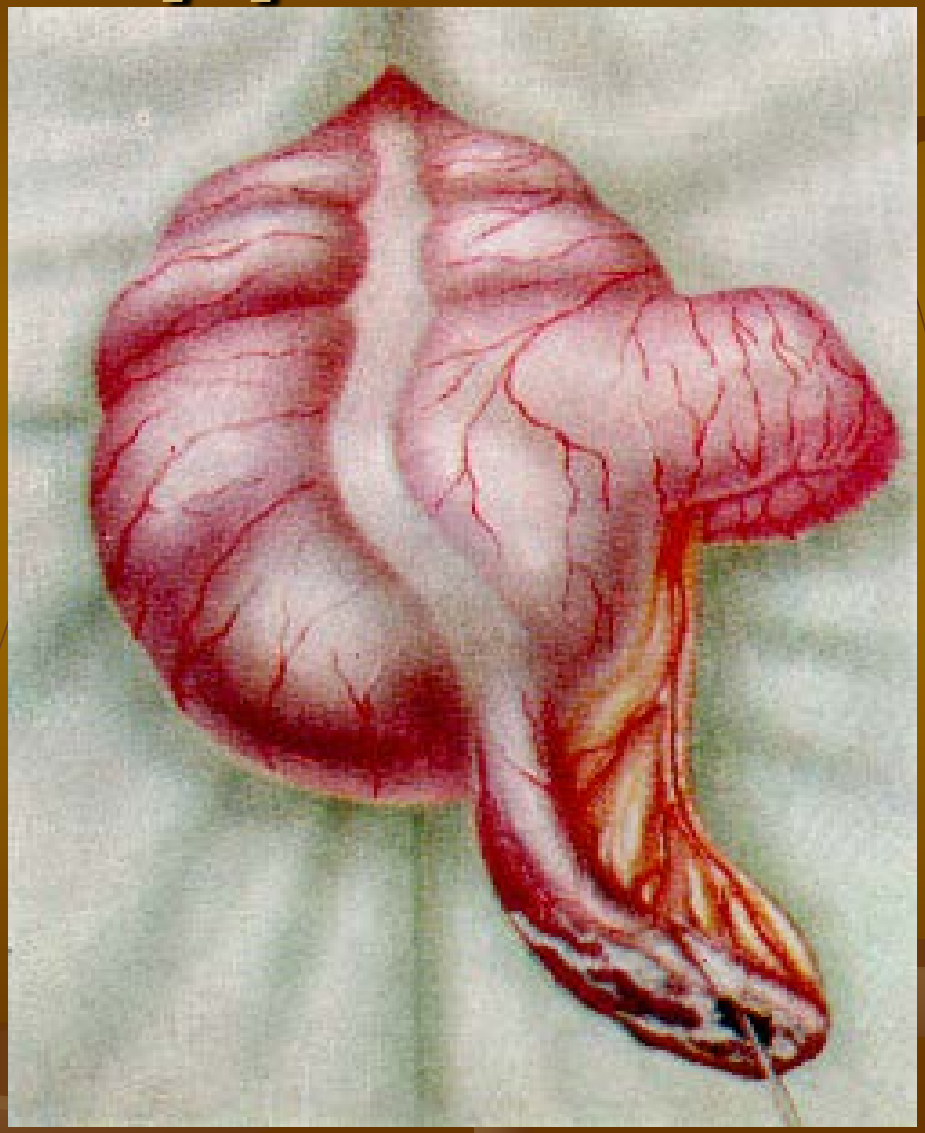
- the appendiceal wall grossly appears thickened
- the lumen appears dilated
- a serosal exudate (fibrinous or fibrinopurulent) may be observed as granular roughening.
- At this stage, mucosal necrosis may be observed microscopically.

# *Gangrenous appendicitis*

- **Intramural venous and arterial thromboses ensue, resulting in gangrenous appendicitis**
- **microscopy may demonstrate multiple microabscesses of the appendiceal wall and severe necrosis of all layers**

# Perforated appendix

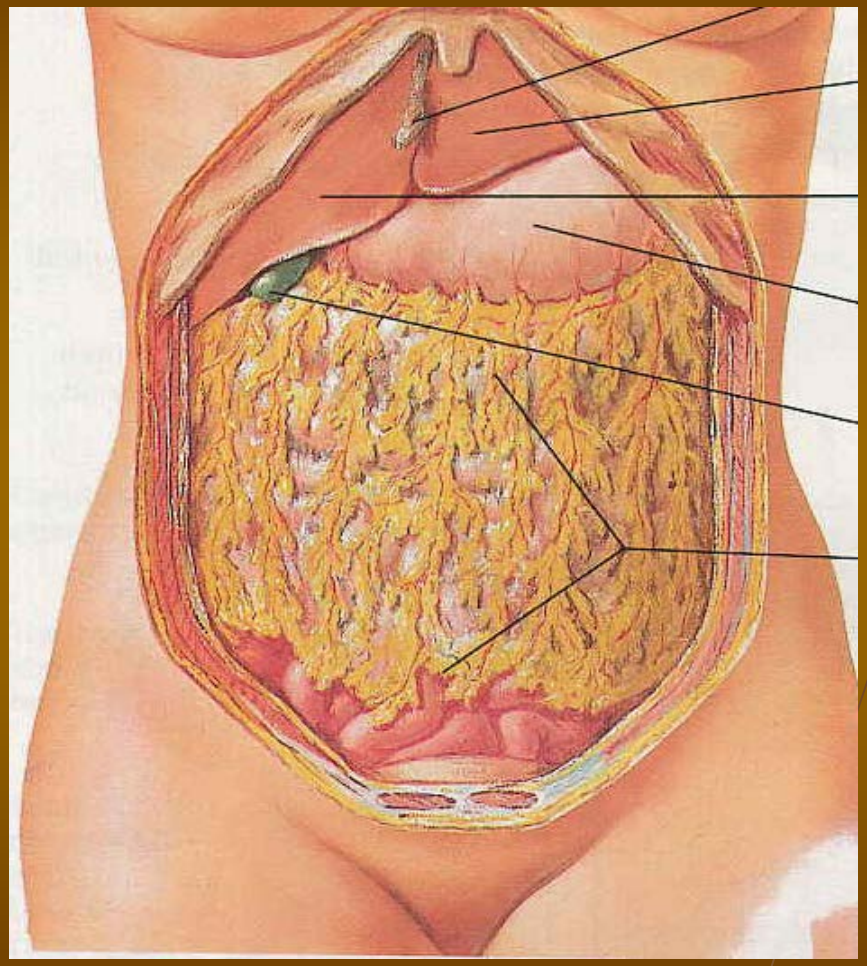
- Persisting tissue ischemia results in appendiceal infarction and perforation
- Perforation usually occurs at the antimesenteric border

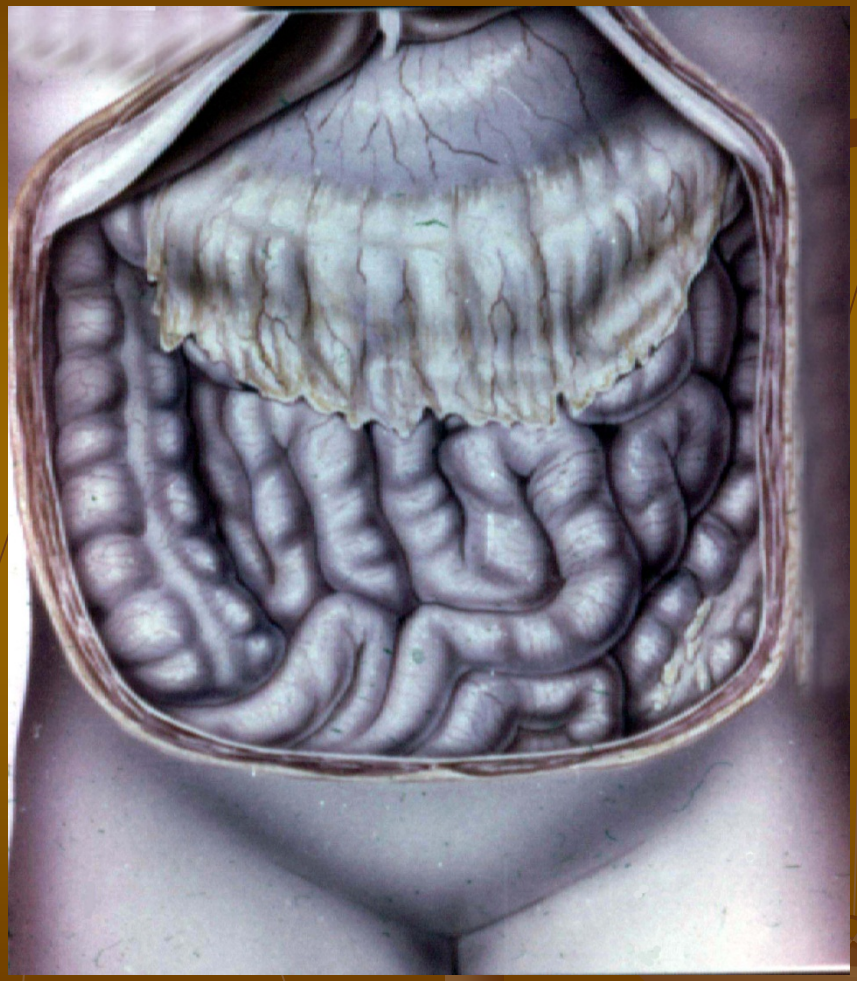


# *Phlegmonous appendicitis or abscess*

- **An inflamed or perforated appendix can be walled off by the adjacent greater omentum or small bowel loops and phlegmonous appendicitis or focal abscess occurs.**

# Omentum of the adult  Omentum of the child





# Typical position:

**McBurney point** (two thirds of the way between the umbilicus and the anterior superior iliac spine)

**Inconstancy of position:**

Retrocecal – 74 %;

Pelvic – 21 %;

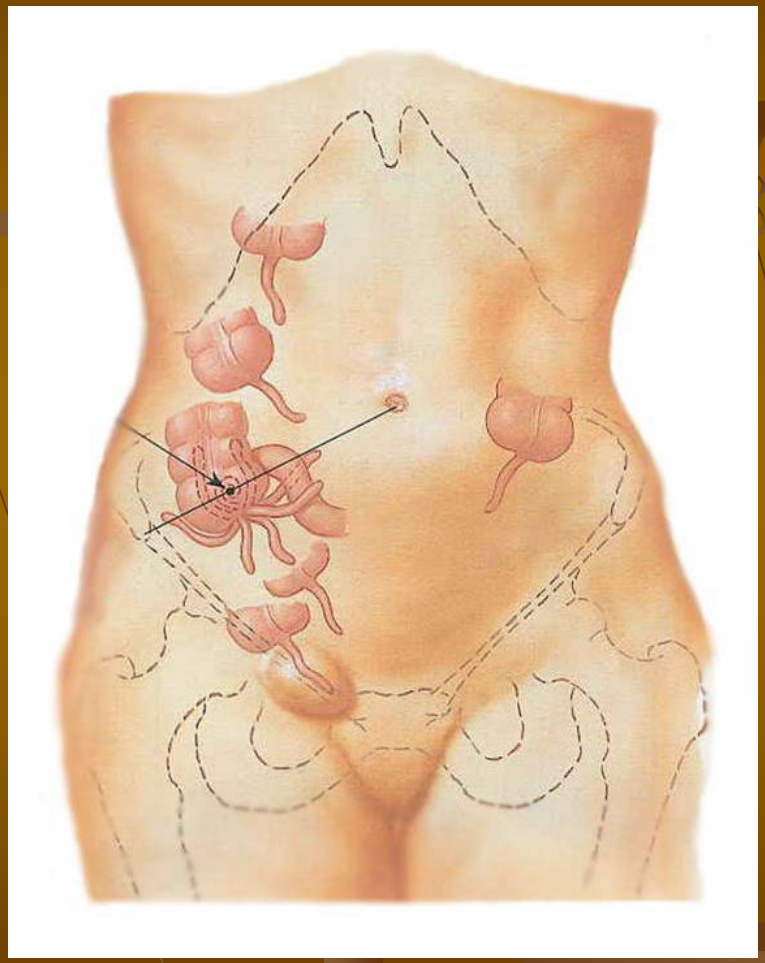
Subcaecal – 1 – 5 %;

Postileal – 5%;

Preileal – 1%;

Paracecal – 2%;

In left iliac fossa or in the hypochondrium – very occasionally



# Acute appendicitis
## Clinical presentation

- Gradual onset of generalized, periumbilical pain
- Gradual location of pain to right lower quadrant
- Anterior abdominal tenderness
- Peritoneal signs, guarding, rebound tenderness
- Gradual worsening of pain
- Fever
- Leucocytosis

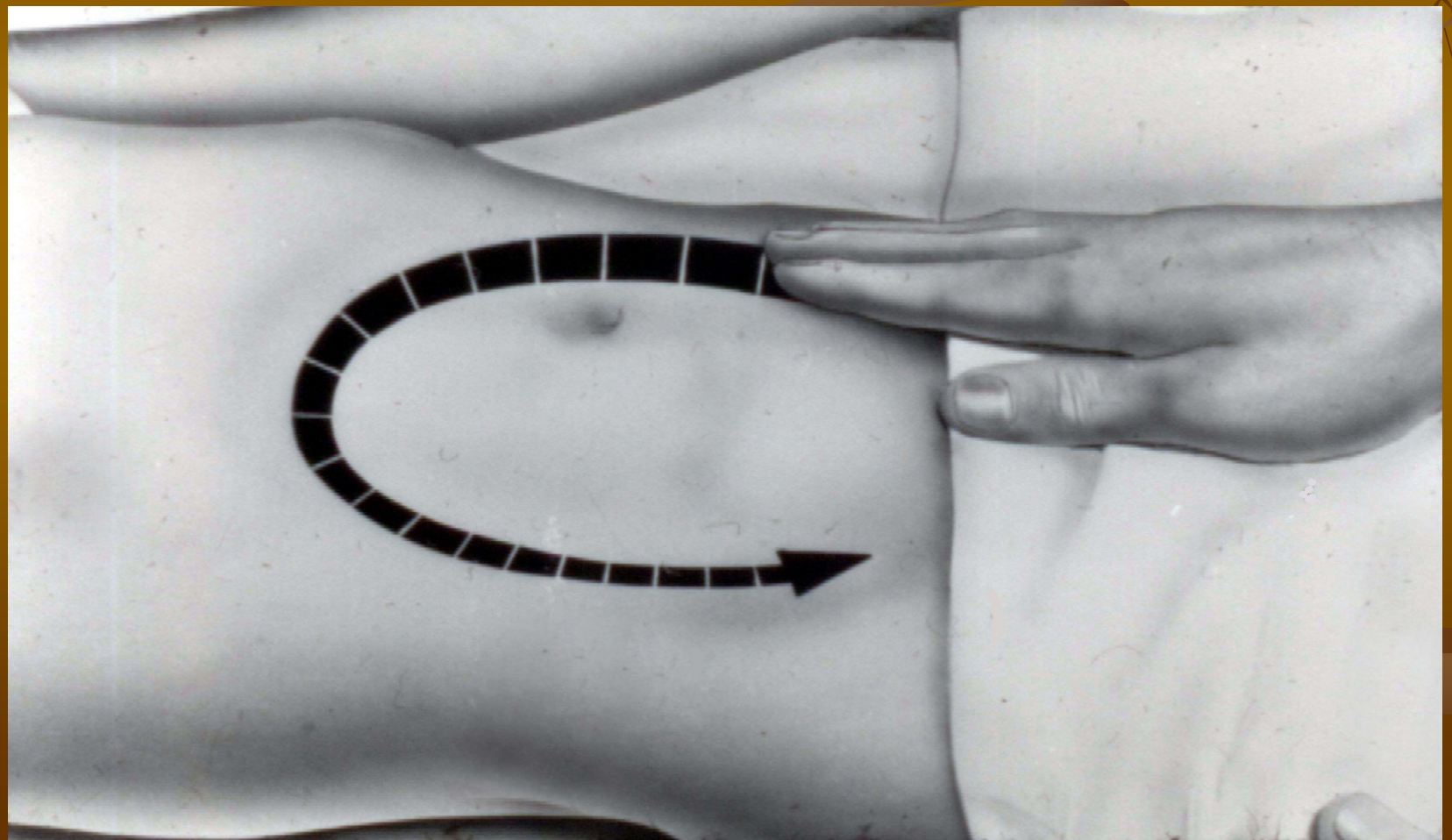
# Signs of the appendicitis

- ***cough sign*** **(sharp pain in the right lower quadrant after a voluntary cough, ie, Dunphy sign)**
- **rebound tenderness related to peritoneal irritation elicited by deep palpation with quick release (*Blumberg sign*)**
- **pain in the right lower quadrant in response to left-sided palpation (*Rovsing sign* )**

# Rovsing sign

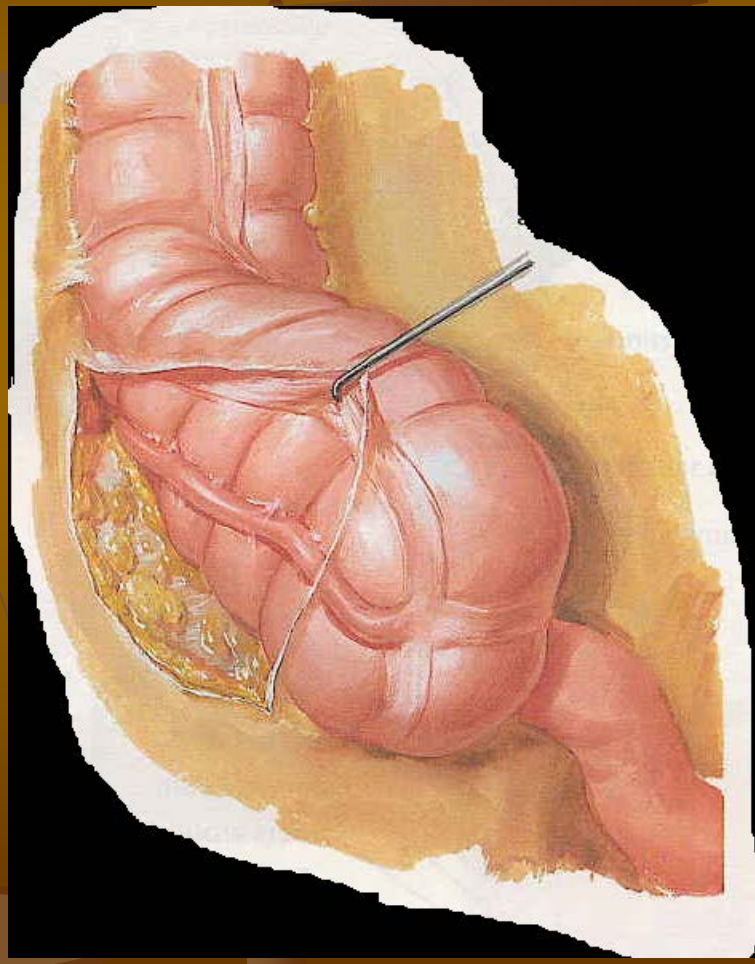
## is pain in the right lower quadrant in response to left-sided palpation

(strongly suggests peritoneal irritation)



# Retrocecal appendicitis

- A child walks with exaggerated lumbar lordosis and have a slightly flexed right hip
- Pain with extension of the right hip with the patient in left lateral decubitus position (*psoas sign*) and with internal rotation of the thigh (*obturator sign*)

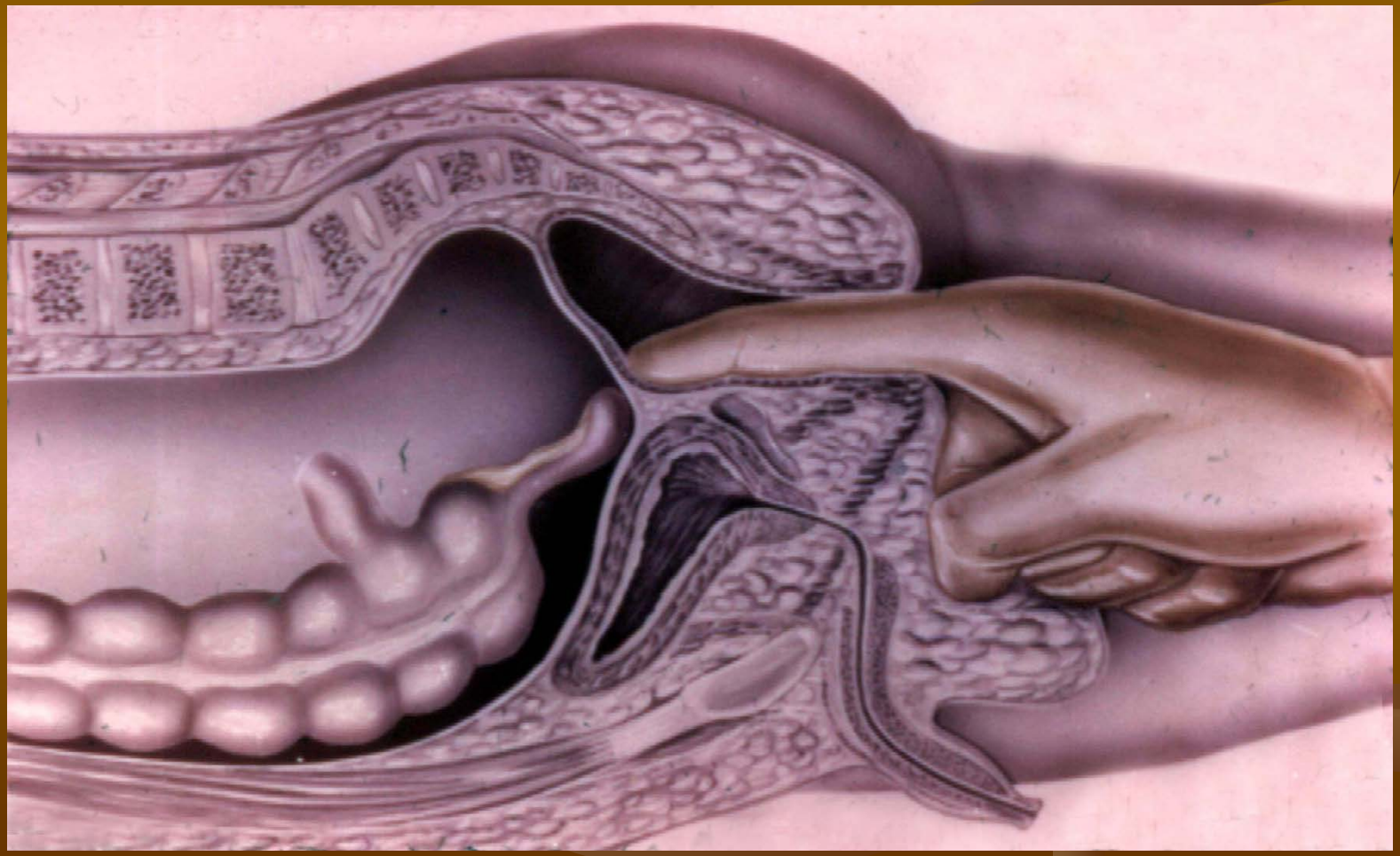


# *Appendix in the right paracolic gutter*

- **Location of the inflamed appendix in the right paracolic gutter typically results in flank pain mimicking acute pyelonephritis or ureteral calculus.**
- **Symptoms resembling those of gastroenteritis may result from colonic irritation.**

# Pelvic appendix

may result in pain on rectal examination



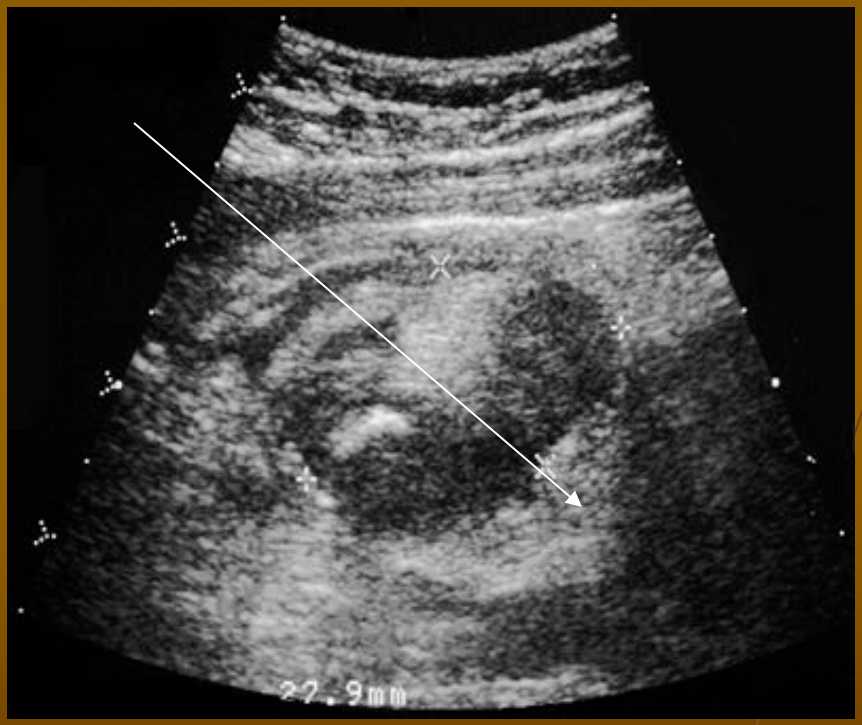
# Lab Studies

- ***WBC count*** is elevated in approximately 70-90% of patients.
- ***Urinalysis*** (presence of over 20 WBCs suggests a urinary tract infection)
- ***Electrolytes and renal function*** (in children with significant history of vomiting or clinical suspicion of dehydration)
- ***Additional studies (***liver function tests, serum amylase, and serum lipase) may be helpful when the etiology of the abdominal pain is unclear
- ***Urinary levels of human chorionic gonadotropin-beta subunit*** (in sexually active adolescent females to exclude ectopic pregnancy)

# US signs of the inflamed appendix

- An outer diameter of greater than 6 mm
- Noncompressibility
- lack of peristalsis
- presence of a periappendiceal fluid collection

# Acute appendicitis




- Abdominal US
- Enlarged noncompressible appendix

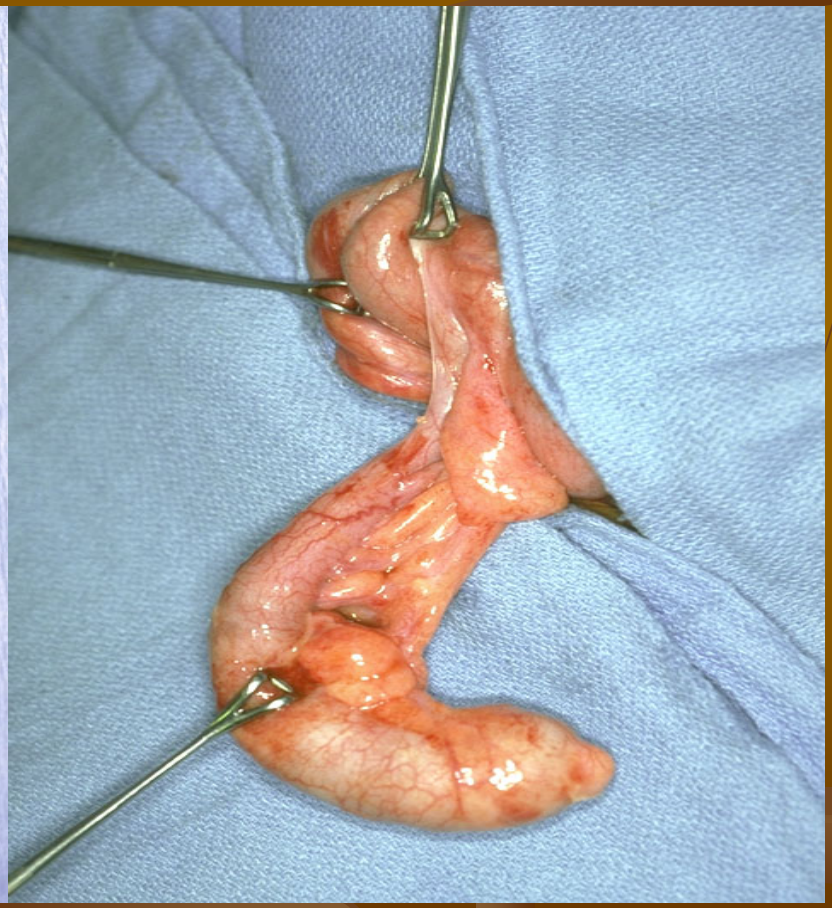
# Differential diagnosis of acute appendicitis

- Mesenteric adenitis
- Viral gastroenteritis
- Meckel's diverticulitis
- Urinary tract infection
- Psoas abscess
- Ovarian pathology
- Pneumonia

# Complications of acute appendicitis

- Perforation
- Periappendicular abscess
- Peritonitis
- Wound infection
- Intraabdominal abscesses
- Small bowel obstruction

# Open appendectomy



# Antibiotic therapy

- is an important aspect of the treatment of ruptured appendicitis. Antibiotic therapy should be directed against gram-negative and anaerobic organisms such as *Escherichia coli* and *Bacteroides* species. The administration of antibiotics, nasogastric tubes, intravenous lines, urethral catheters, antiemetic medicine, antipyretic medicine, and analgesia should ideally be part of the ED protocol for managing the preoperative child. Proponents of preoperative antibiotic recommend that all children with appendicitis receive gentamicin and clindamycin

# Preoperative antibiotics

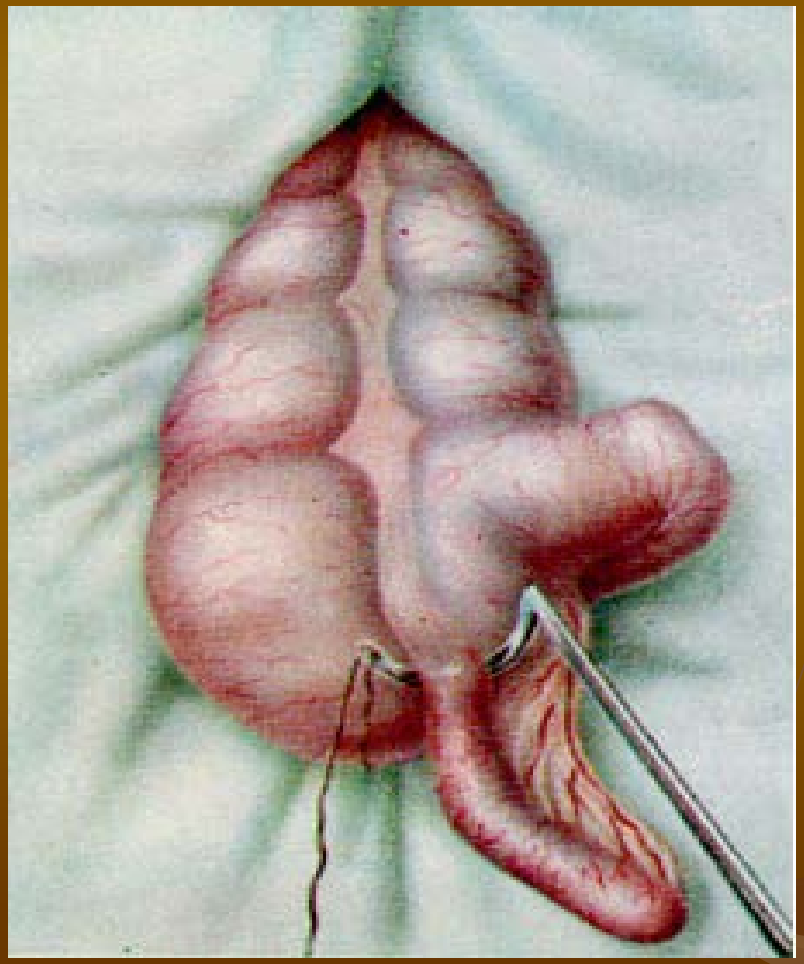
- are given to children with suspected appendicitis and stopped after surgery if no perforation exists. Patients presenting with perforated appendicitis may be volume depleted and require aggressive fluid resuscitation. The combination of ampicillin, clindamycin, and gentamicin is administered to treat infection from aerobic and anaerobic organisms. Alternative regimens include ampicillin and sulbactam,

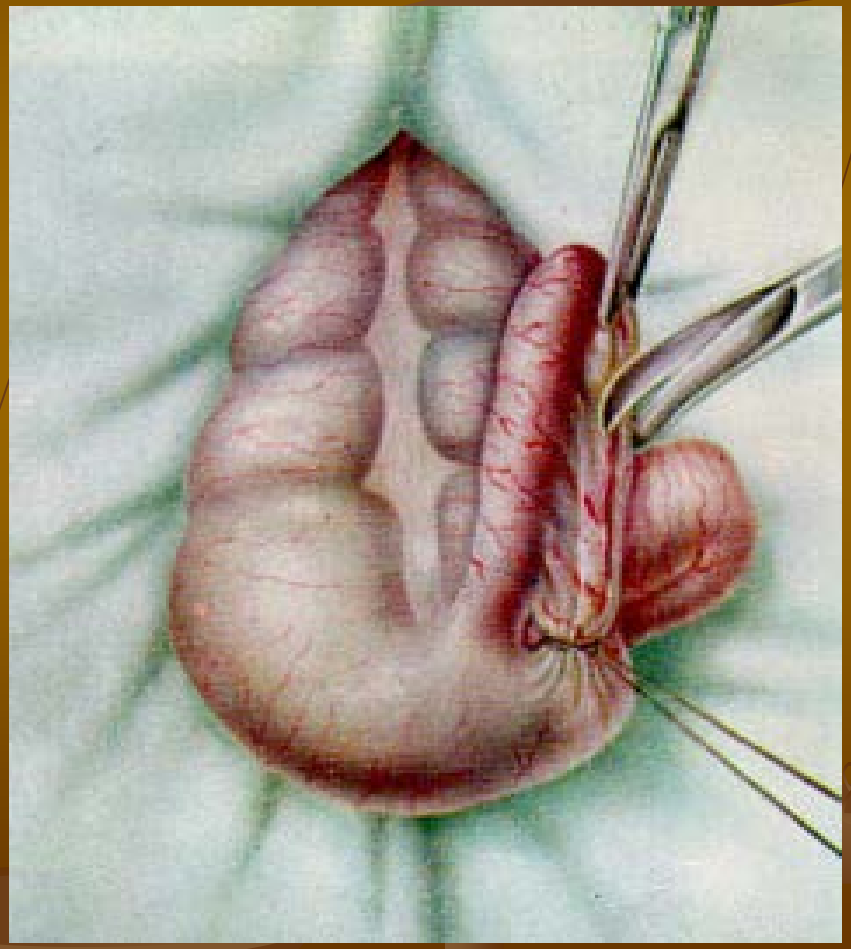
# access

- Open appendectomy requires a transverse incision in the RLQ over the McBurney point ( two thirds of the way between the umbilicus and the anterior superior iliac spine).
- The vertical incisions ( the Battle pararectal) are rarely performed because of the tendency for dehiscence and herniation.

- The abdominal wall fascia (ie, Scarpa fascia) and the underlying muscular layers are sharply dissected or split in the direction of their fibers to gain access to the peritoneum
- The peritoneum is opened transversely and entered
- The cecum is identified and medially retracted
- The convergence of teniae coli is detected at the base of the appendix

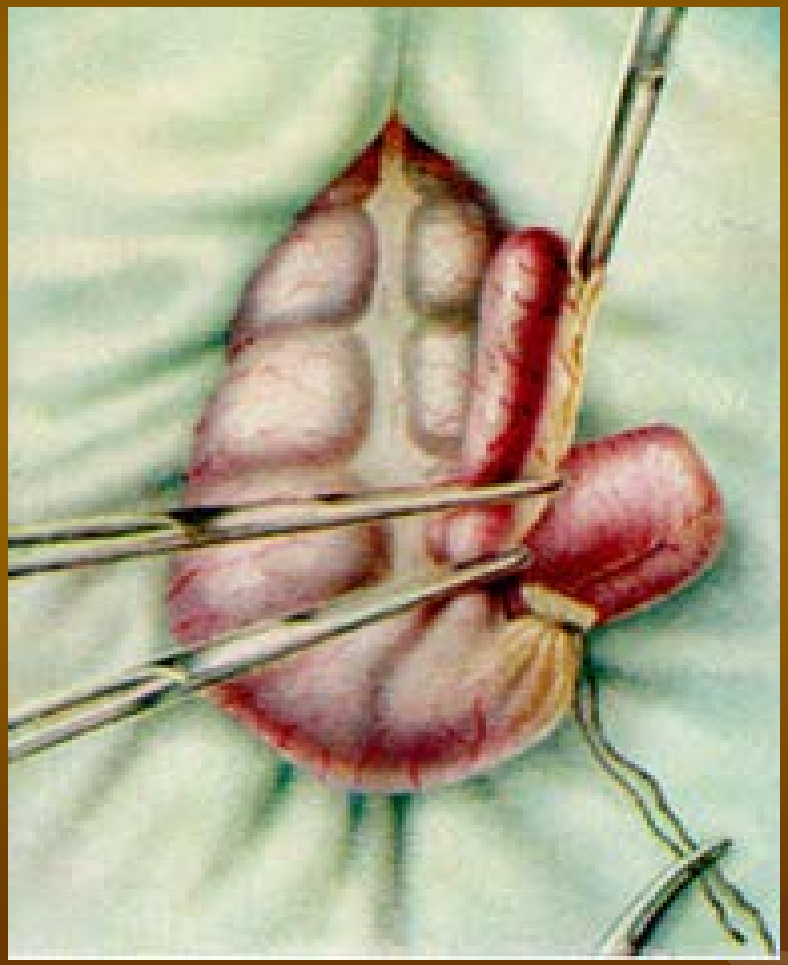
# The mesoappendix is held between clamps, divided, and ligated

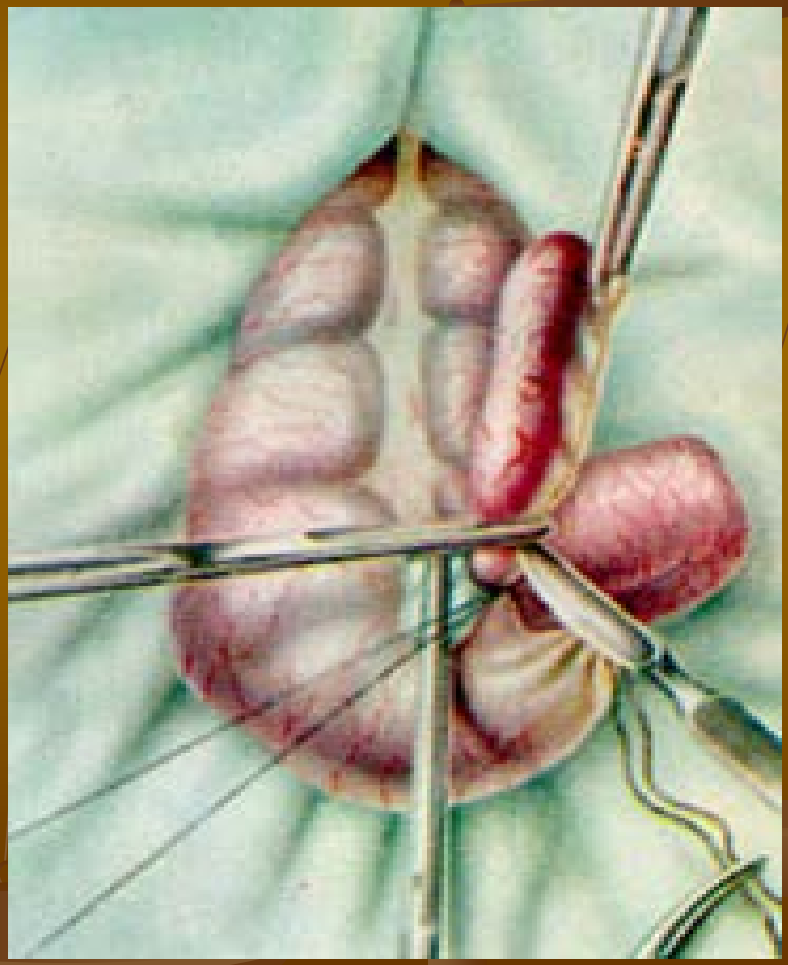




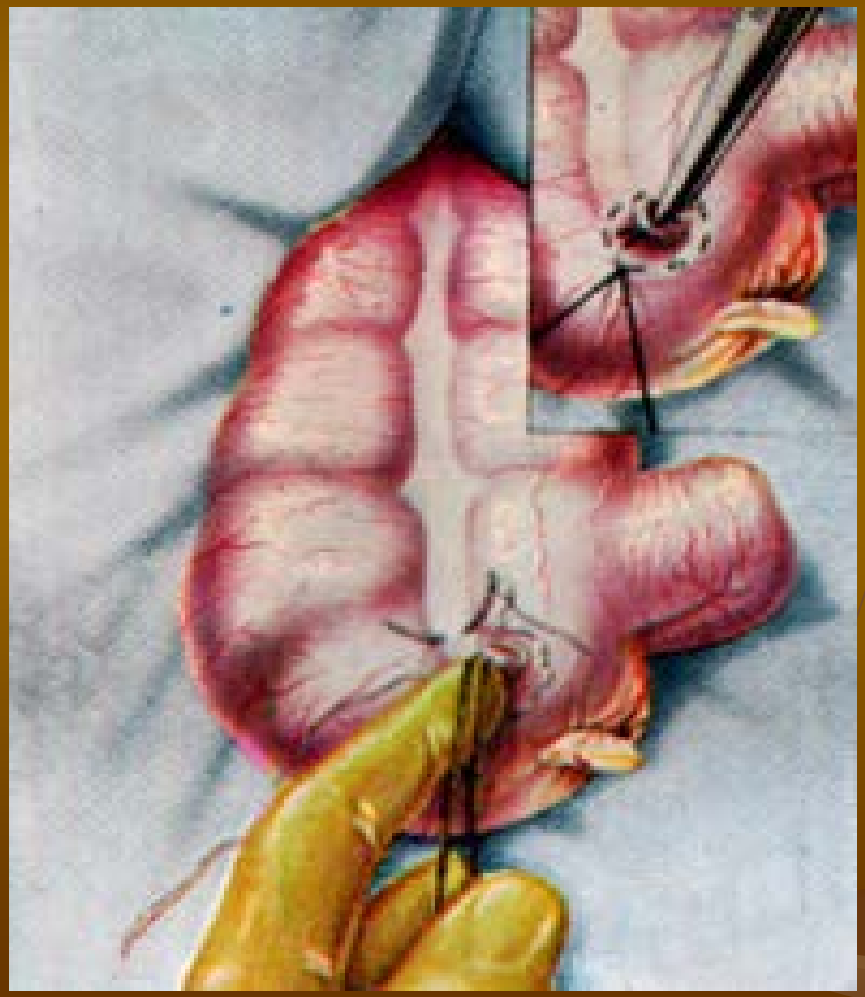
**The appendix is clamped proximally about 5 mm above the cecum to avoid contamination of the peritoneal cavity and is**

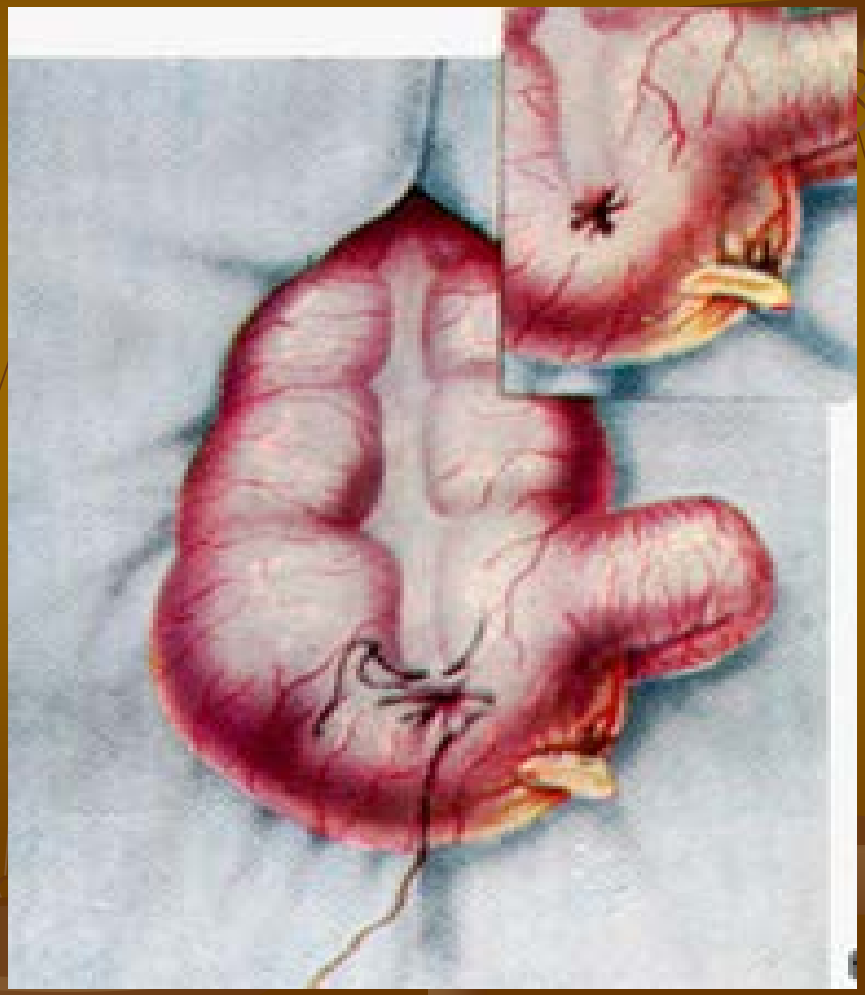
**cut above the clamp by a scalpel**

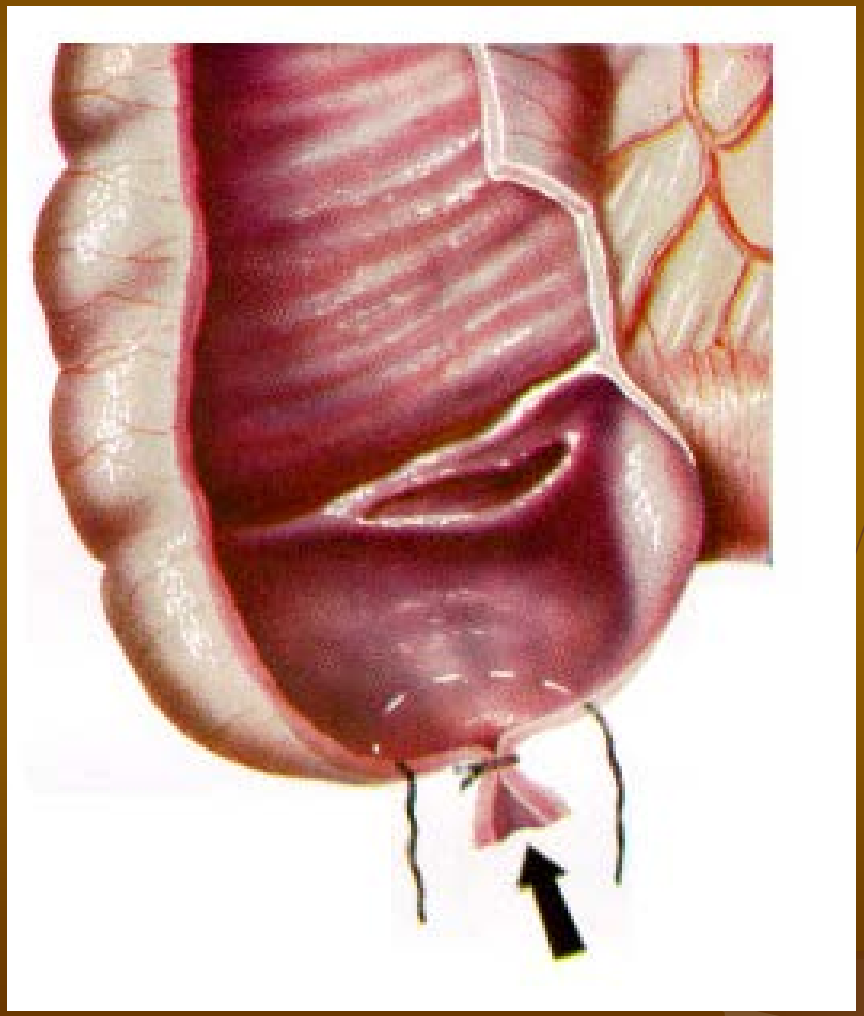


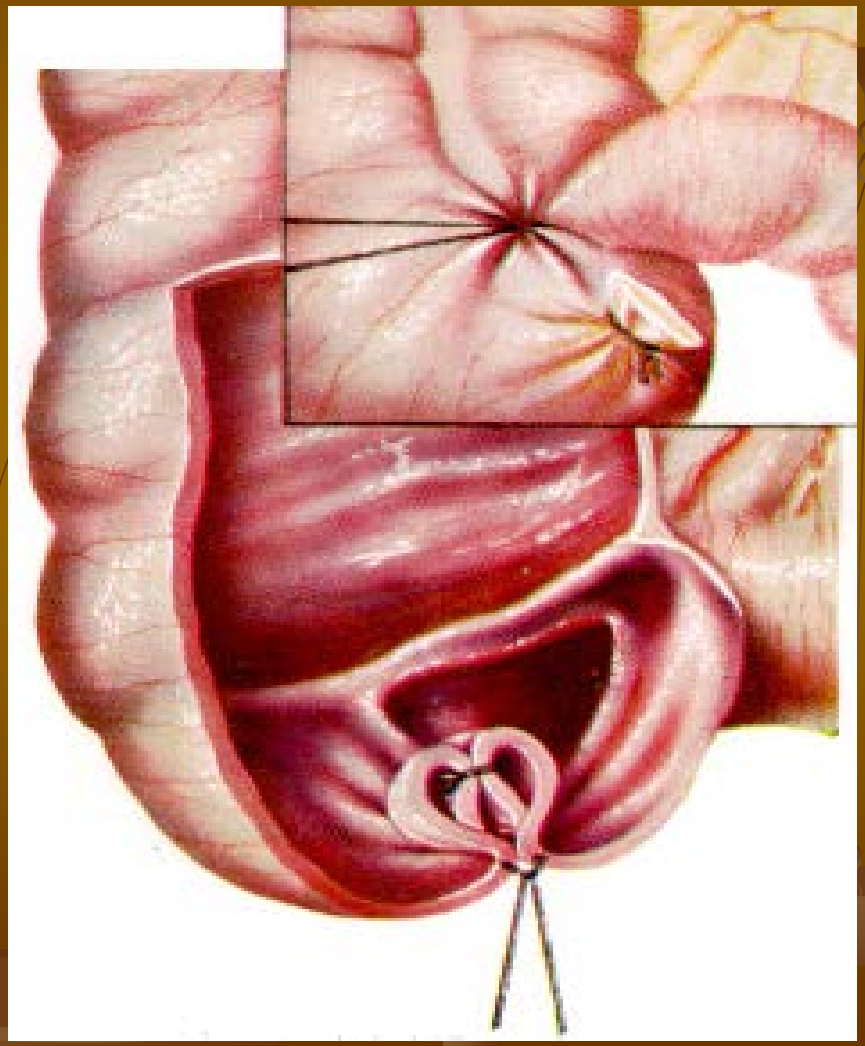


# The appendix may be inverted into the cecum with the use of a pursestring suture









- The cecum is placed back into the abdomen.
- The abdomen is irrigated.
- When evidence of free perforation exists, peritoneal lavage with several liters of warm saline is recommended.
- Obvious abscess with gross contamination requires drainage

# wound closure

- close the peritoneum with a running suture
- the fibers of the muscular and fascial layers are reapproximated and closed with a continuous or interrupted absorbable suture
- the skin is closed with subcutaneous sutures or staples

# Indications for the surgical treatment of appendicitis:

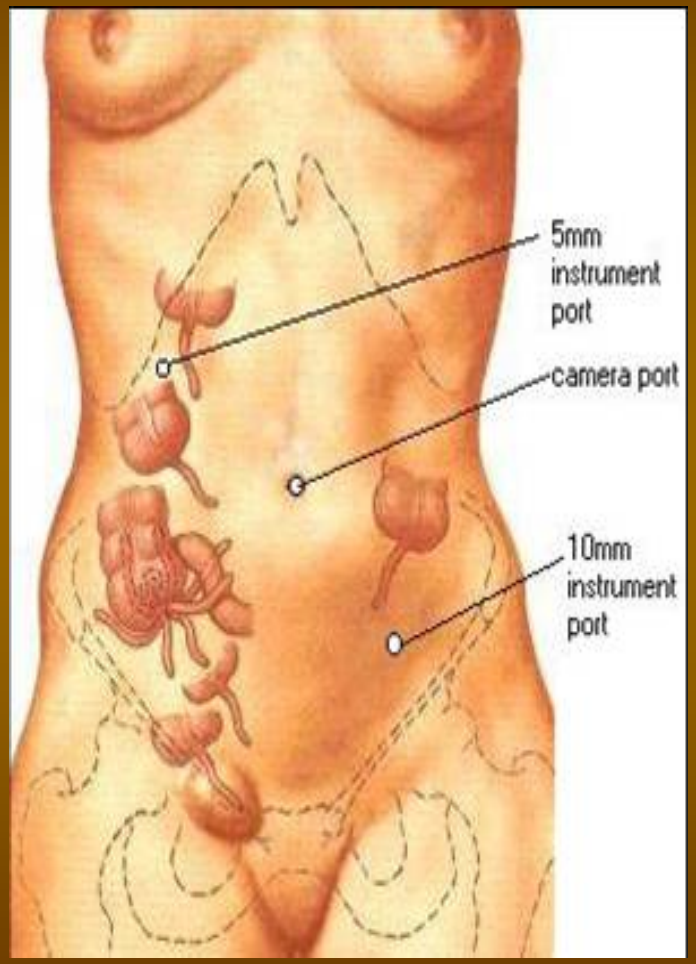
| Laparoscopic appendectomy | Open appendectomy |
|---|---|
| Female of reproductive age group | Complicated appendicitis |
| Female of pre-menopausal group | COPD or Cardiac disease |
| Suspected appendicitis | Generalized peritonitis |
| High working class | Previous lower abdominal surgery |
| Obese patients | Hypercoagulable sates |
| Disease conditions like Cirrhosis of liver and sickle cell disease | Stump appendicitis after previous Incomplete appendectomy |
| Immune-compromised patients | |

# Further Inpatient Care:

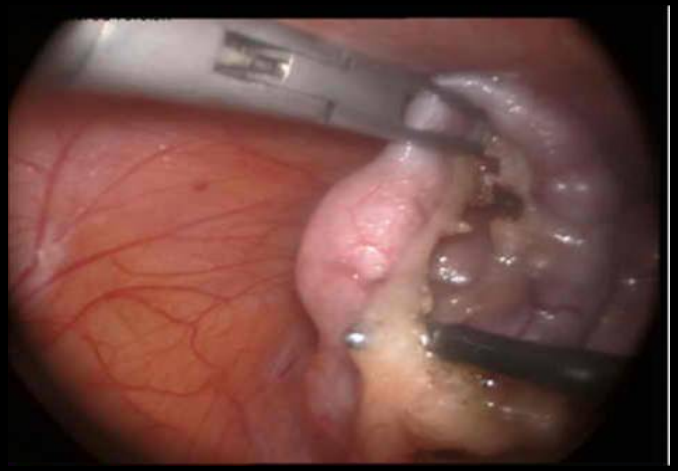
- Laparoscopic appendectomy seems to be a safe alternative for the treatment of complicated appendicitis in children.
  - Potential advantages of laparoscopic appendectomy include reduced postoperative pain and lower wound infection rate.
  - Pediatric laparoscopic patients have fewer wound problems and shorter duration of oral pain and medication usage.
  - In addition to advantages for the patient, their parents returned to work quicker than parents of children who had open appendectomy.
  - Laparoscopy can be diagnostic for alternative diagnosis in the adolescent female.

# LAPAROSCOPIC APPENDECTOMY

# Port Position.




- Total 3 trocar should be used
- Two 10mm, umbilical and left lower quadrant trocar and
- One 5 mm Right upper quadrant trocar
- The right upper quadrant trocar can be moved below the bikini line in females



# Window in Mesoappendix

# The appendix is now amputated.

**The appendix held by the grasper and is placed into the specimen bag or if not inflamed take it out after hiding it inside reducer or cannula itself.**

# Amputated Appendix inside cannula

# Acquired obstruction of bowel

- Refers to the common diseases of the abdominal cavity in children who require operative intervention: are taken a third place after surgery for acute appendicitis, congenital obstruction. For a long time was the most frequent cause of mortality in childhood.
- The reason can be some congenital malformations, and the appearance of pathological factors that  are explained in the classification.

# Classification of Acquired obstruction of bowel

- **Depending on the level: high and low.**
- **According to character of the process:** acute, chronic, chronic-recurrent.
- **According to a particular mechanism of pathogenesis:** mechanical, functional, strangulated, obstructive, obstructive-strangulated.
- **Mechanical:** adhesive, intussusception (invagination of bowel), obstruction of the lumen of the intestine hair ball, biliary, fecal stones, helminth ravel, compression by external tumors, cysts, blood vessels and a Meckel`s diverticulum.
- **Dynamic obstruction:** paralytic, spastic.
- **Intussusception** (invagination of bowel):idiopathic on the basis of polyps, tumors, Meckel's diverticulum.

  Small intestine-small intestine, small intestine-large intestine (ileocecal), large intestine-large intestine intussusception.
- **Adhesive obstruction:** early (paretic, delayed), late (after one month from the date of the surgery).

- The most common type of the late obstruction of bowel (80%) is an adhesive intestinal obstruction.

# symptoms

- Depending on the severity of obstruction of bowel may be a different symptomatic disease. Cramping abdominal pain, vomiting with intestinal contents, bile, not passing of bowel gas and feces, anxiety of the child, deterioration of general condition due to dehydration - the main anamnestic information. Examination of a patient shows that the patient changes position frequently, in some cases is knee-elbow position. There are tachycardia, dry tongue, decreased tissue turgor. At the beginning abdomen is moderately swollen, soft, involved in breathing, occasionally can be observed asymmetry of the abdomen. Intestine loops are visible on the front wall of abdomen, peristalsis is reinforced, can be audible "noise of a falling drop," "transfusion liquid", drum belly bowel noise (tympanitis) above the extended Intestine loops. In the rectal investigation is determined that rectum is inlarged and without fecal content

- later arise peritoneal symptoms: tension of the abdominal wall and other symptoms of irritation of the peritoneum. Very strong pain (even up to the development of collaptoid condition) is observed at strangulated ileus in which the abdomen is soft, painful at the place of a strangulation.

- Diagnosis is clarified by roentgenography in an upright position (Kloyber`s cups), ultrasound (roentgenograms).

# Treatment

- In acute and subacute, chronic recurrent types of obstruction initially is used conservative treatment for 8-12 hours [probe into the stomach, hypertonic solution into the vein (10% NaCl, 2 ml per life-year, 0.05% Neostigmine 0.1 ml per year of life , during 30-40 min. siphon enema], which allows to cure obstruction in 70-80% in patients. If this treatment is inefficient in children with strangulated ileus, they must be operated on urgently. A surgeon must  eliminate the cause of ileus, necrotic part of bowel must be removed with the next creation of anastomosis of bowel if it`s possibly.

# Intussusception

**Intussusception is the implantation (intrusion) of a gut in to an its part which is lying below**

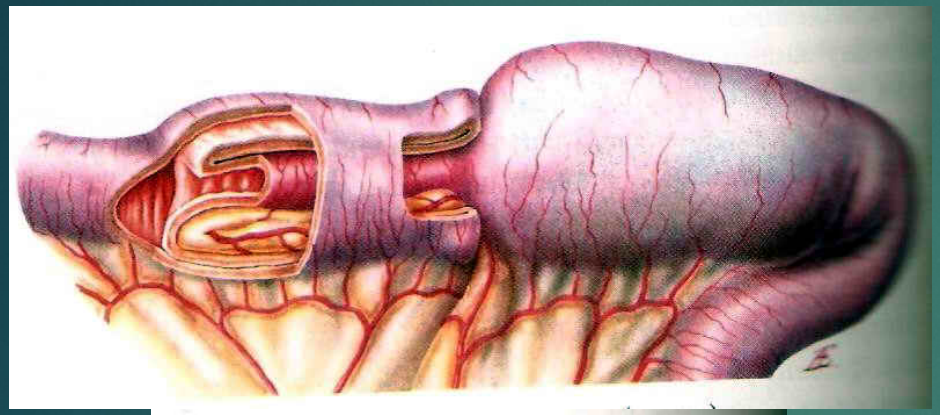
**The components of the intussusception:**

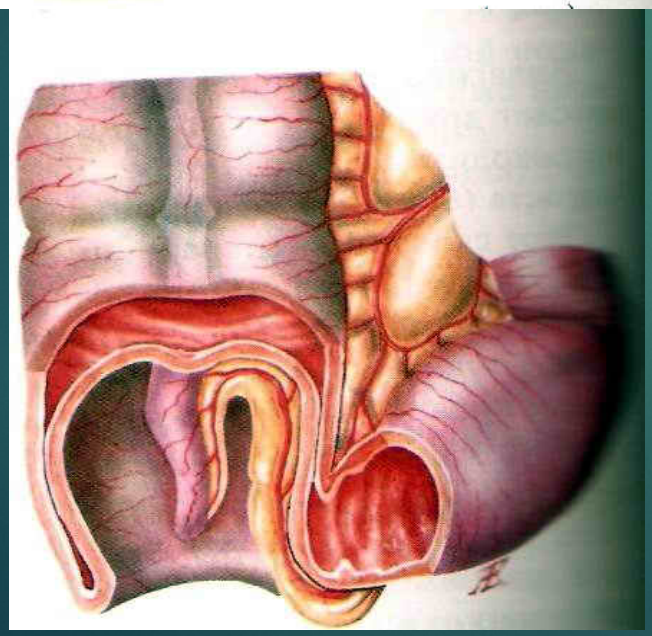
- **deferent part of the intestine,**
- **a head of the intussusceptum,**
- **outer cylinder of the intussusceptum,**
- **neck of the intussusceptum,**
- **adducent part of the intestine.**

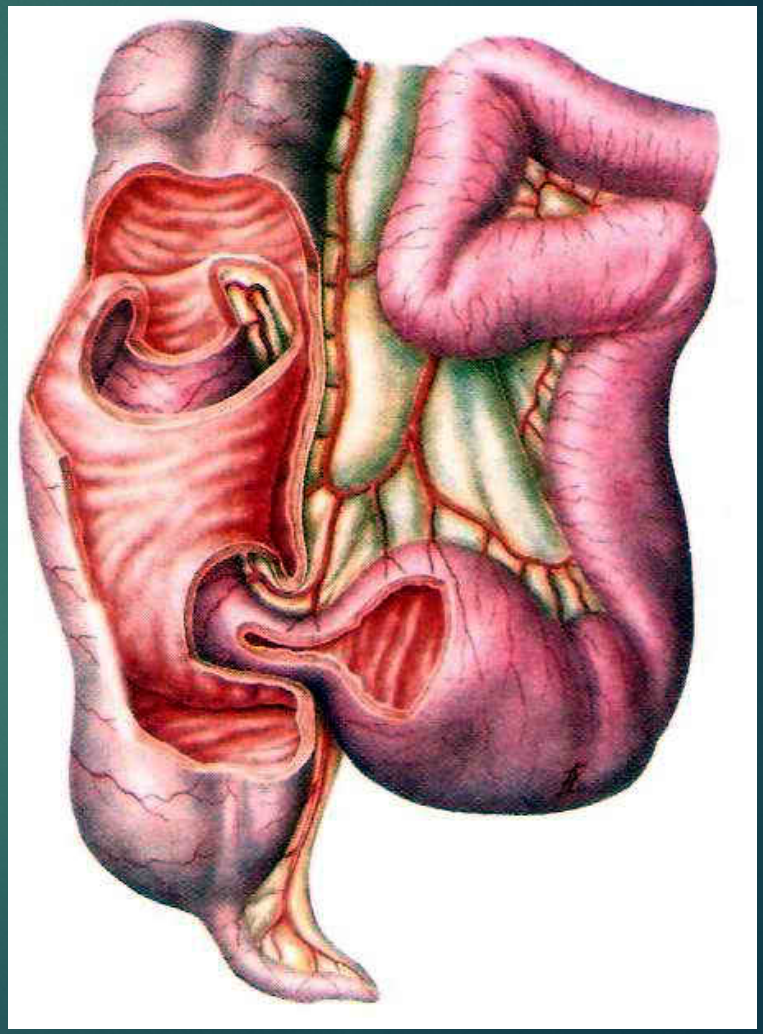
**A loop of bowel which was stacked in two cylinders (external and internal) is named an intussusceptum.**

# Classification.

Small intestine-small intestine,
small intestine-large intestine (ileocecal),
large intestine-large intestine intussusception







**Intussusception - a mixed form of intestinal obstruction:**
**obstructed, strangulated.**
**The intravascular hemolysis appears.**
**Serum is enriched of hemoglobin.**
**Increases the hydrostatic pressure.**
**Blood plasma is filtered from the blood in the mucous membrane of intestine.**
**The child has bloody stools appear dark cherry color.**
**Blood is not coagulated.**
**Age of children - 80% are children of first year of life, from 3 to 9 months.**

# Reasons:

**Functional:**

**in boys with a large mass of the body;**
**wrong feeding of children until one year old;**
**especially in age of 3-9 months.**

**Restriction (after 1 year)**
**Meckel's diverticulum;**
**Enlarging of lymphatic nodes;**
**Tumors of the intestine.**

# Forming Stages of intussusceptum:

**hemafecia**

**determination of intussusceptum in palpation.**

**- Painful episodes lose sharpness;**

**- The child is lethargic, does not play, and is sleepy;**

**- Stomach is enlarged, but soft;**

**- Vomiting contains greenness and bile.**

**Stages of a desease:**

Early symptoms can include nausea, vomiting (sometimes bile stained (green color), pulling legs to the chest area, and intermittent moderate to severe cramping abdominal pain. Pain is intermittent not because the intussusception temporarily resolves, but because the intussuscepted bowel segment transiently stops contracting. Later signs include rectal bleeding, often with "red currant jelly" stool (stool mixed with blood and mucus), and lethargy.

Physical examination may reveal a "sausage-shaped" mass felt upon palpation of the abdomen.

In children or those too young to communicate their symptoms verbally, they may cry, draw their knees up to their chest or experience dyspnea (difficult or painful breathing) with paroxysms of pain.

Fever is not a symptom of intussusception.

# Diagnosis

Intussusception is often suspected based on history and physical exam, including observation of Dance's sign. Per rectal examination is particularly helpful in children as part of the intussusceptum may be felt by the finger. Ultrasound is today considered the imaging modality of choice for diagnosis and exclusion of intussusception due to its high accuracy and lack of radiation. A target-like mass, usually around 3 cm in diameter, confirms the diagnosis.

# Differential diagnosis

Intussusception has three main differential diagnoses.

-acute gastroenteritis,

-Henoch–Schönlein purpura

-rectal prolapse.

# Treatment

The intussusception can be treated with either a barium or water-soluble contrast enema or an air-contrast enema, which both confirms the diagnosis of intussusception, and in most cases successfully reduces it. The success rate is over 80%. However, approximately 5–10% of these recur within 24 hours

In a surgical reduction, the abdomen is opened and the part that has telescoped in is squeezed out (rather than pulled out) manually by the surgeon or if the surgeon is unable to successfully reduce it or the bowel is damaged, the affected section will be resected.

More often, the intussusception can be reduced by laparoscopy, whereby the segments of intestine are pulled apart by forceps.