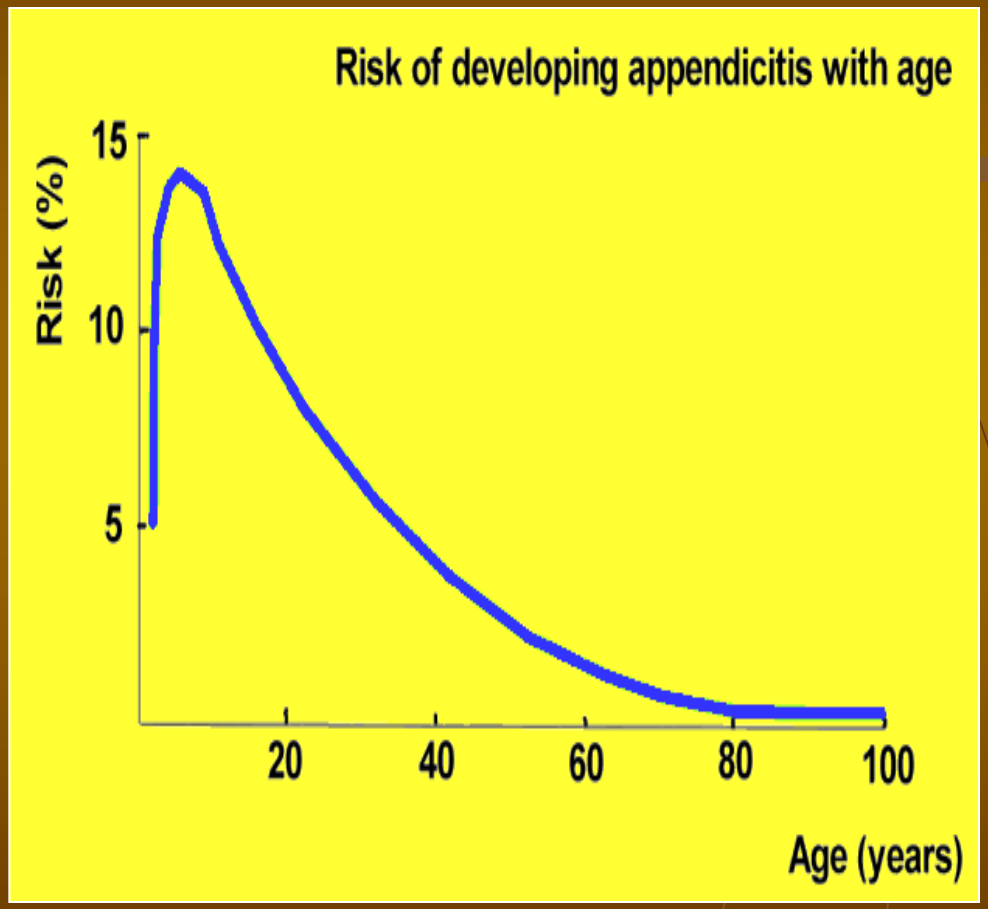
Ministry of healthcare of Ukraine
Poltava state medical university
Surgery department № 2

Inflammatory diseases of abdominal cavity organs.

Plan of the lecture

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 manifestation 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 adhesive bowel obstruction.
13. Principles of treatment of adhesive bowel obstruction.
14. Etiology, pathogenesis, clinic, diagnosis of idiopathic intussusception in children.
15. Differential diagnostics with infectious diseases.
16. Indications for conservative and surgical treatment, prevention of complications

RISK OF DEVELOPING APPENDICITIS WITH AGE



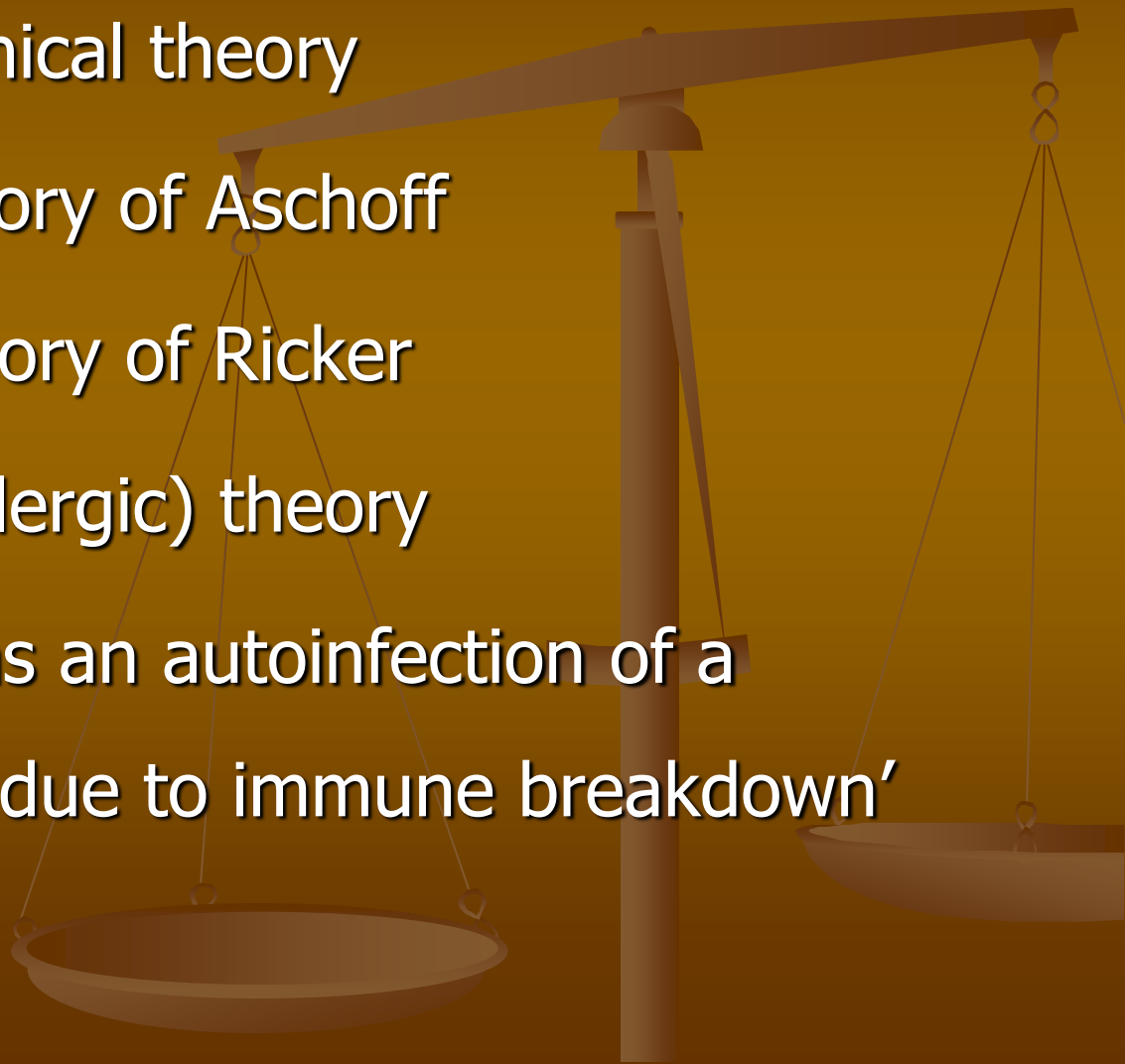
Appendicitis is the most common acute surgical disease of the abdominal cavity and the most common cause of diagnostic failures.

Before making a diagnosis of any other acute abdominal disease, exclude acute appendicitis.(auth)
*Olshanetskiy Oleksandr

Causes:

- Delafoye's mechanical theory
- The infectious theory of Aschoff
- Neurovascular theory of Ricker
- Immunological (allergic) theory

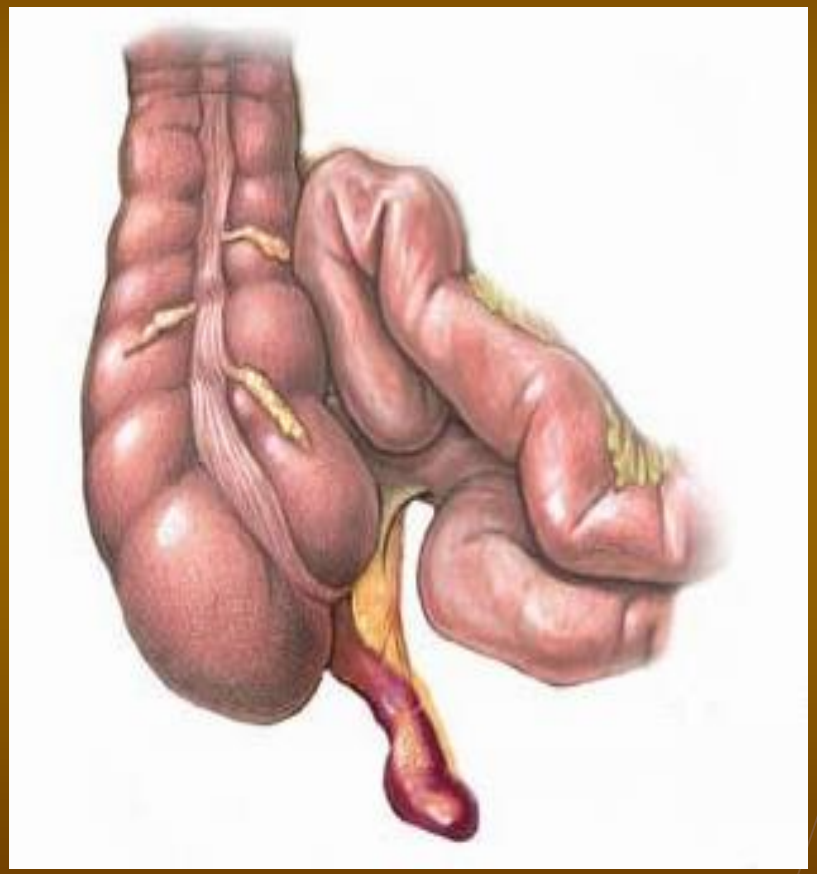
‘Acute appendicitis as an autoinfection of a sensitised organism due to immune breakdown’



Age:

- The main 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%.

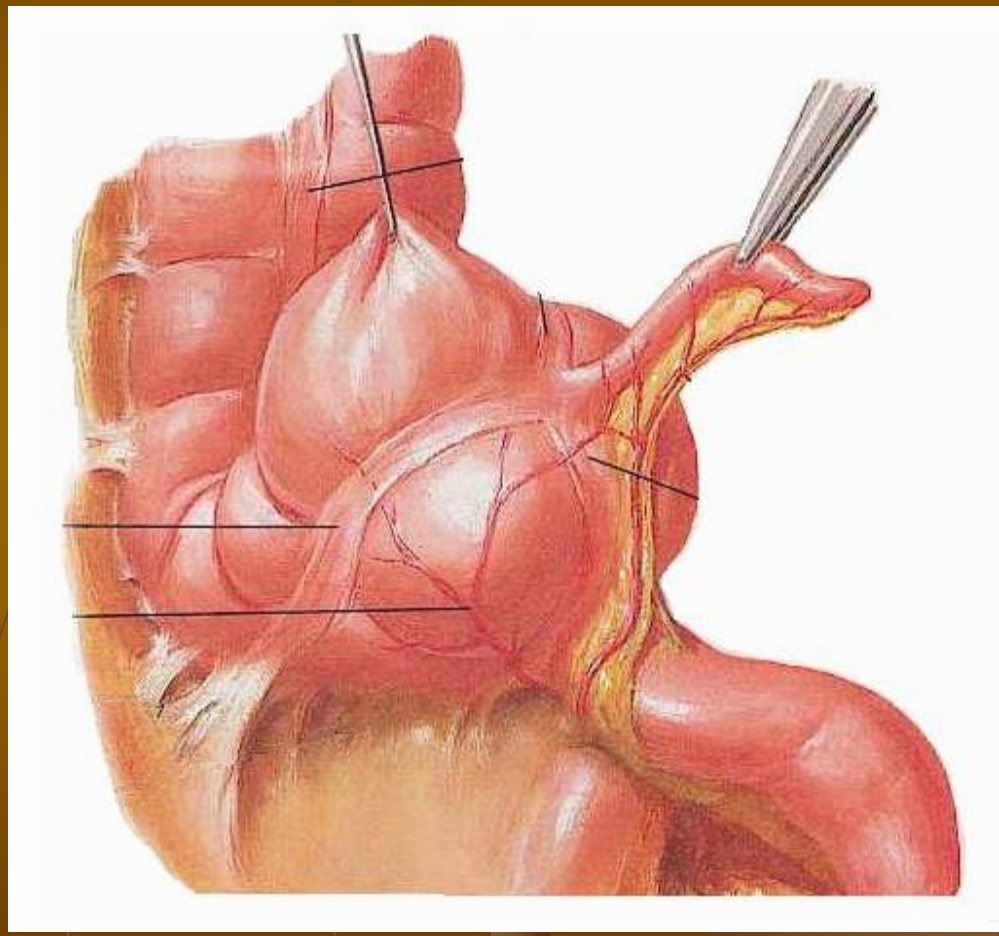
Acute appendicitis



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 appendix wall:

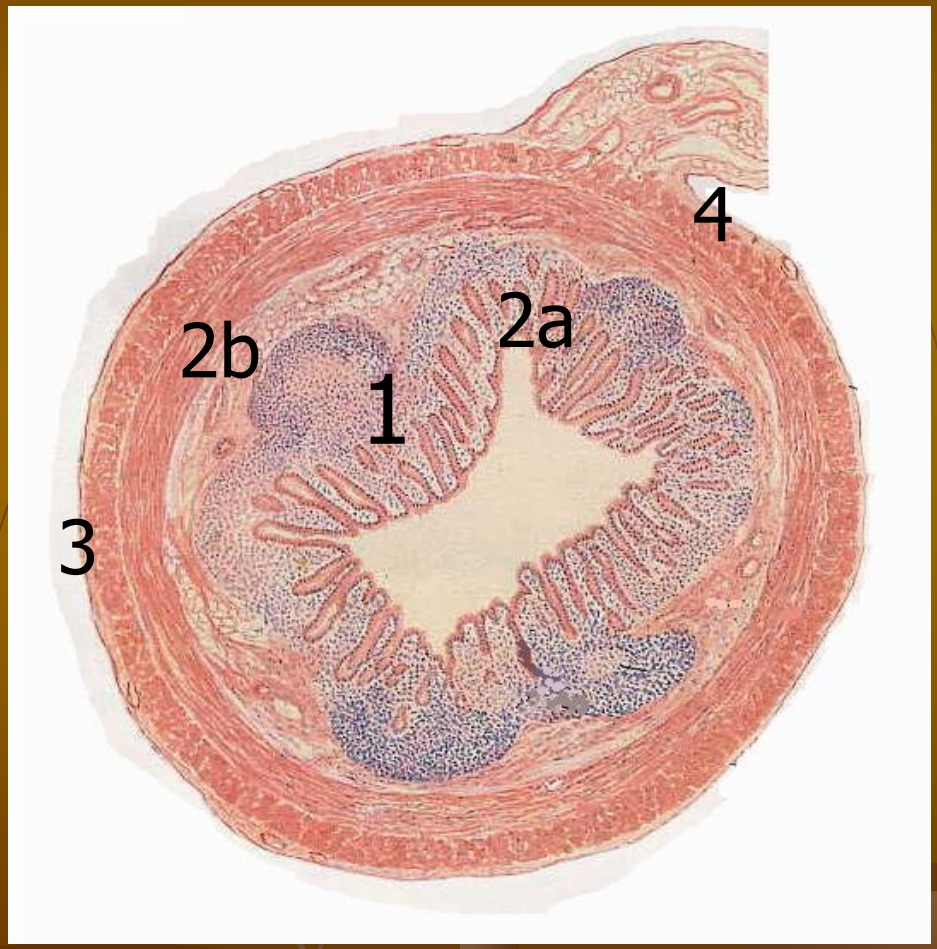
1-mucosal layer (lymphoid follicles are scattered in mucosa. It's number increases when individuals are aged 8-20 years

2a - inner muscular layer (circular)

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

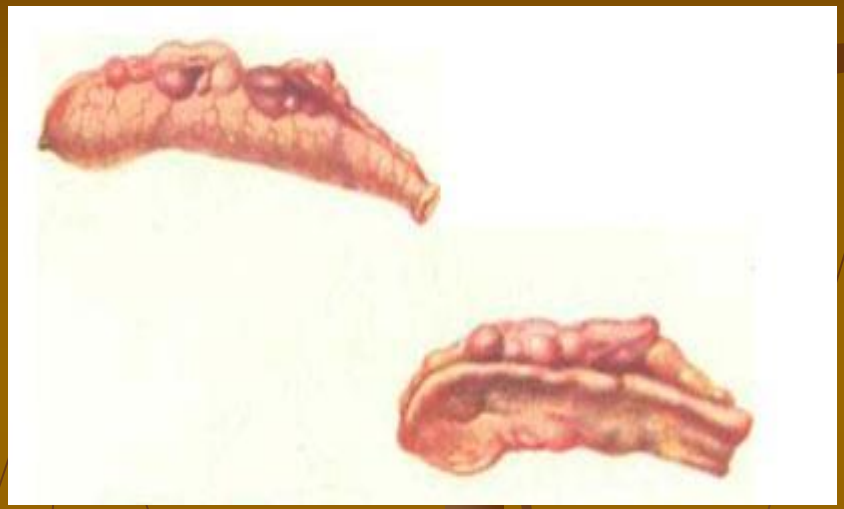
3 – serosa

4 - mesoappendix



Early stage of appendicitis(catharal stage)

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



Phlegmonous 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 thrombosis**
- **microscopy may demonstrate multiple microabscesses of the appendiceal wall and severe necrosis of all layers**

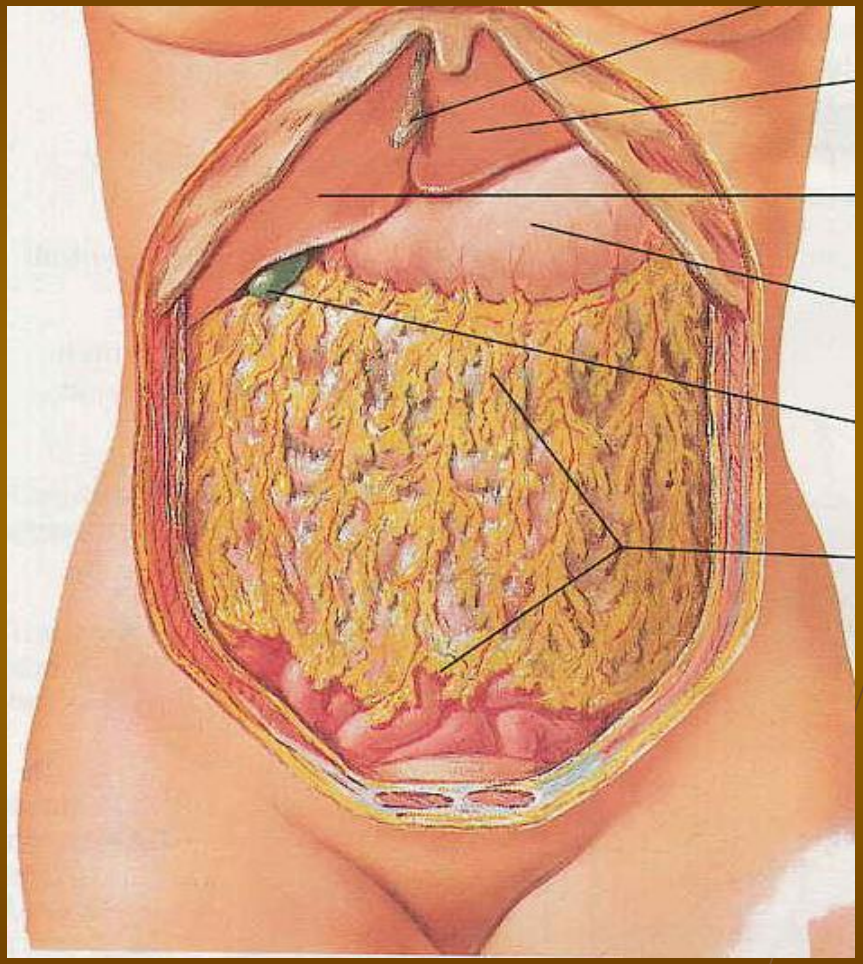
Perforated appendix

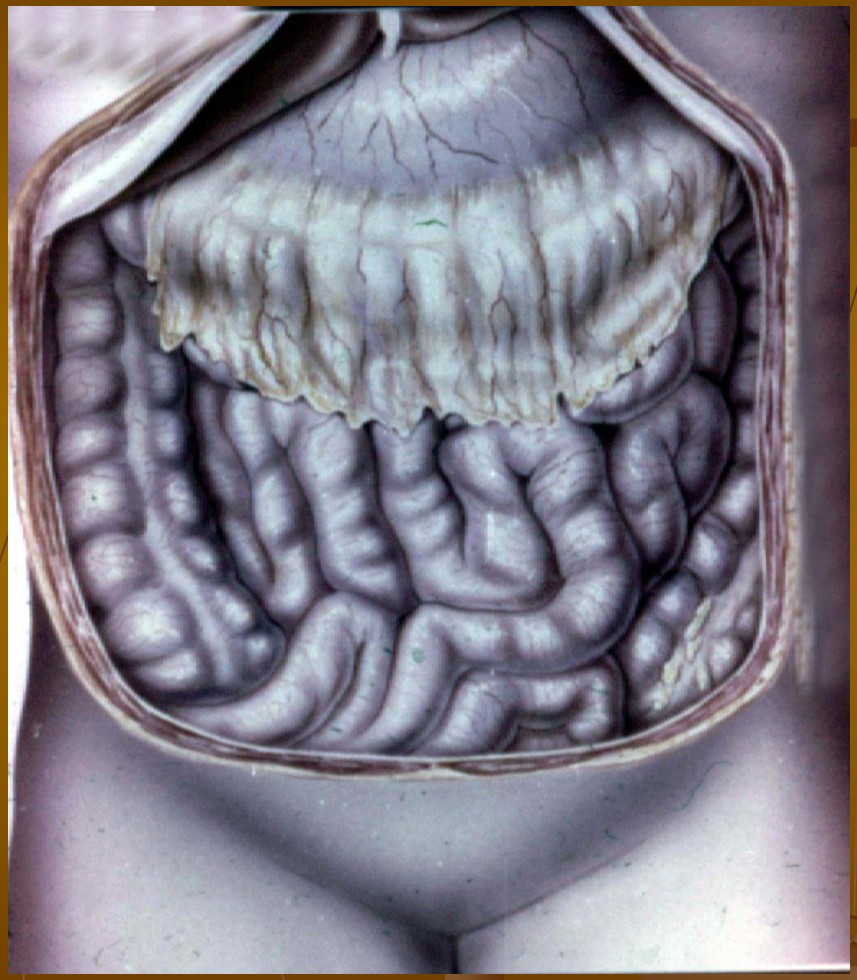
- **Persisting tissue ischemia results in appendix wall infarction and perforation**
- **Perforation usually occurs on the antimesenteric part**

Appendicular infiltrate or abscess

- **An inflamed or perforated appendix can be walled off by the adjacent greater omentum or small bowel loops and inner tissues of abdominal cavity. By this way occurs appendicular infiltrate or abscess(in later period).**

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 %;

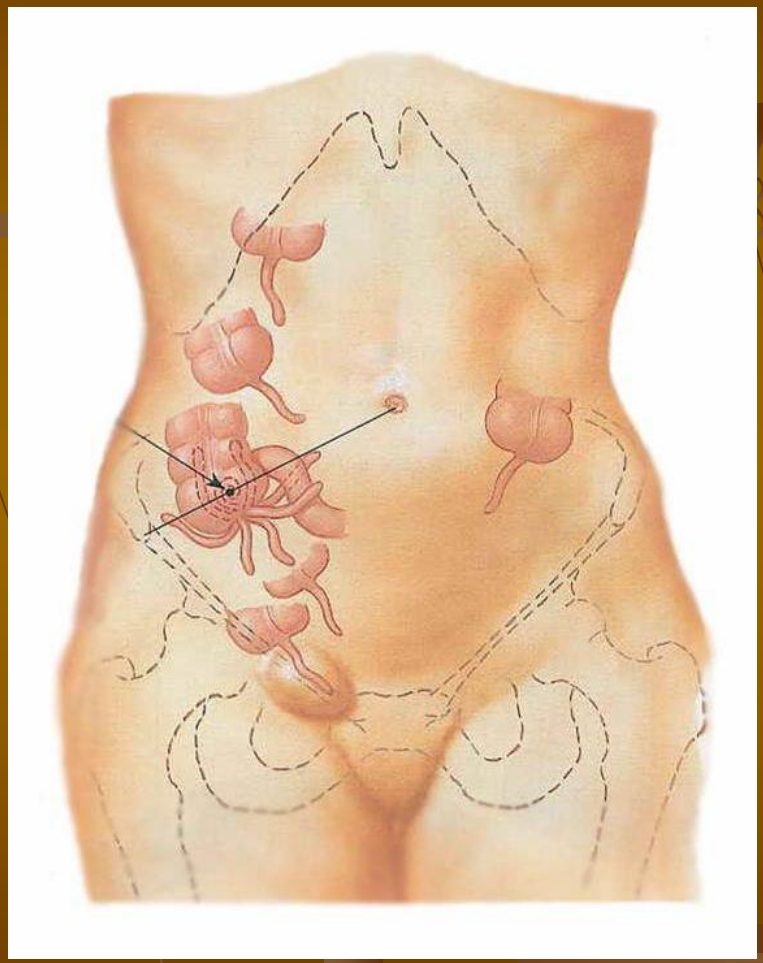
Subcaecal – 1 – 5 %;

Postileal – 5%;

Preileal – 1%;

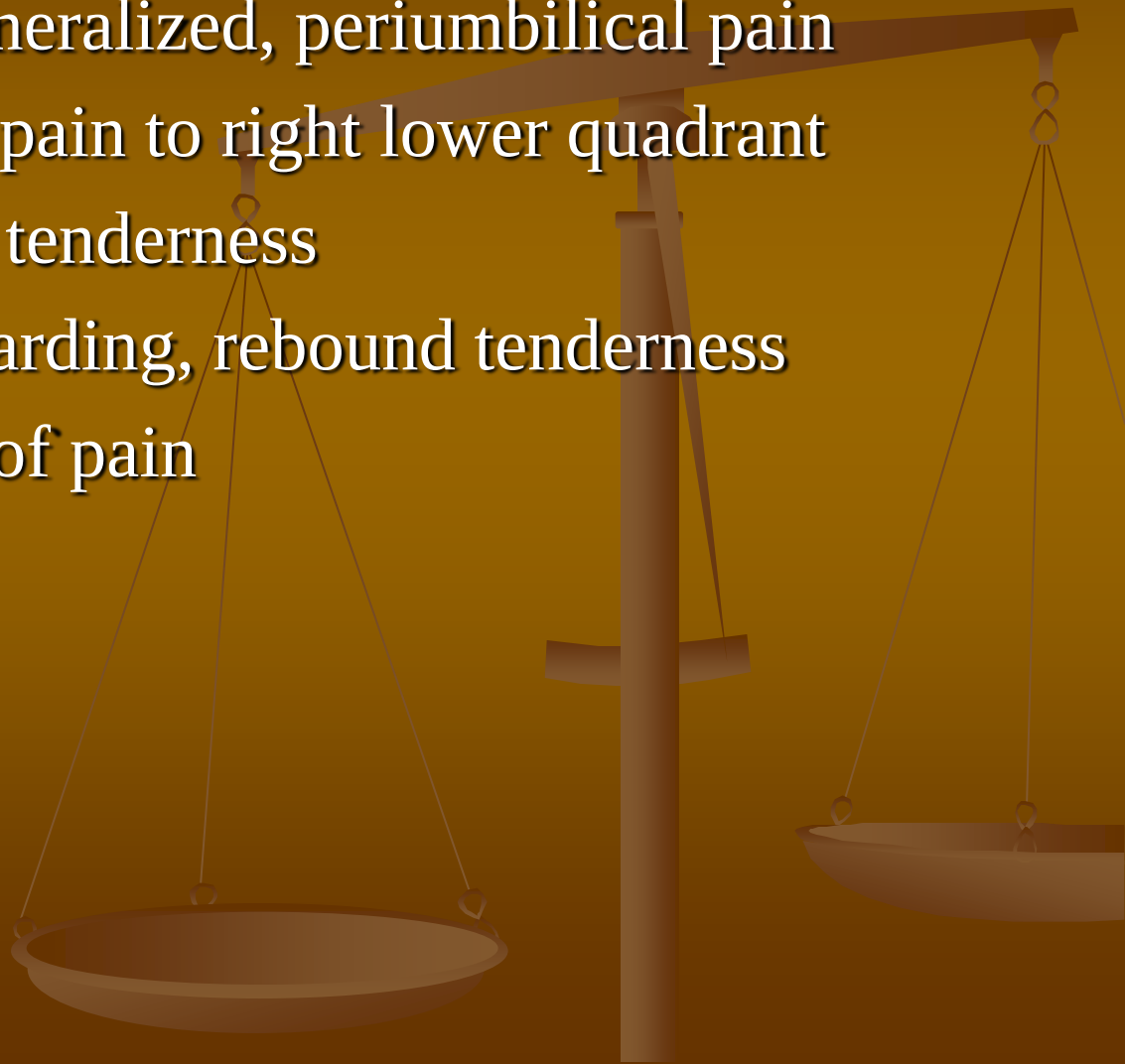
Paracecal – 2%;

In left iliac fossa or in the hypochondrium area – very rarely



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



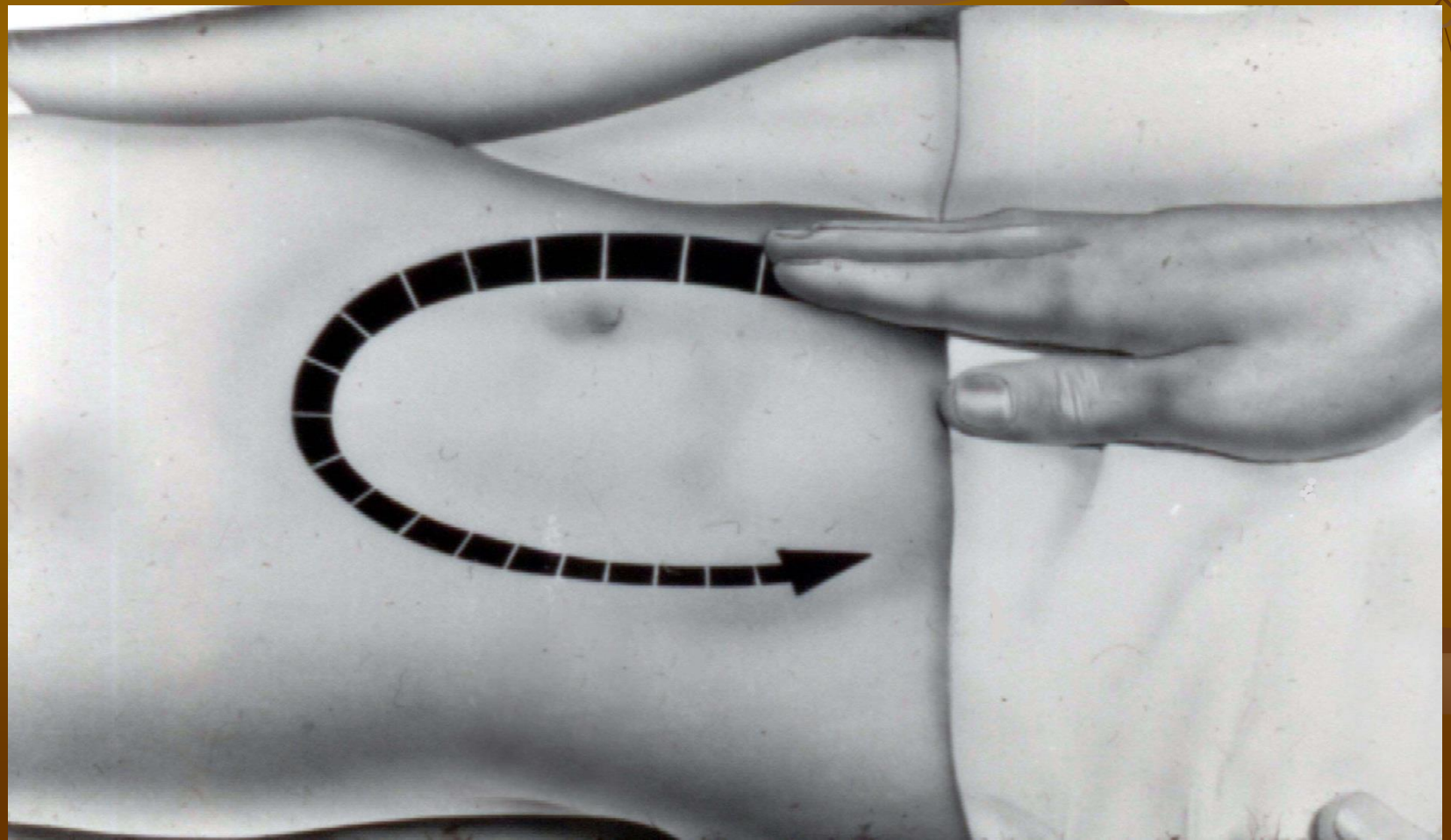
Signs of the appendicitis

- ***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

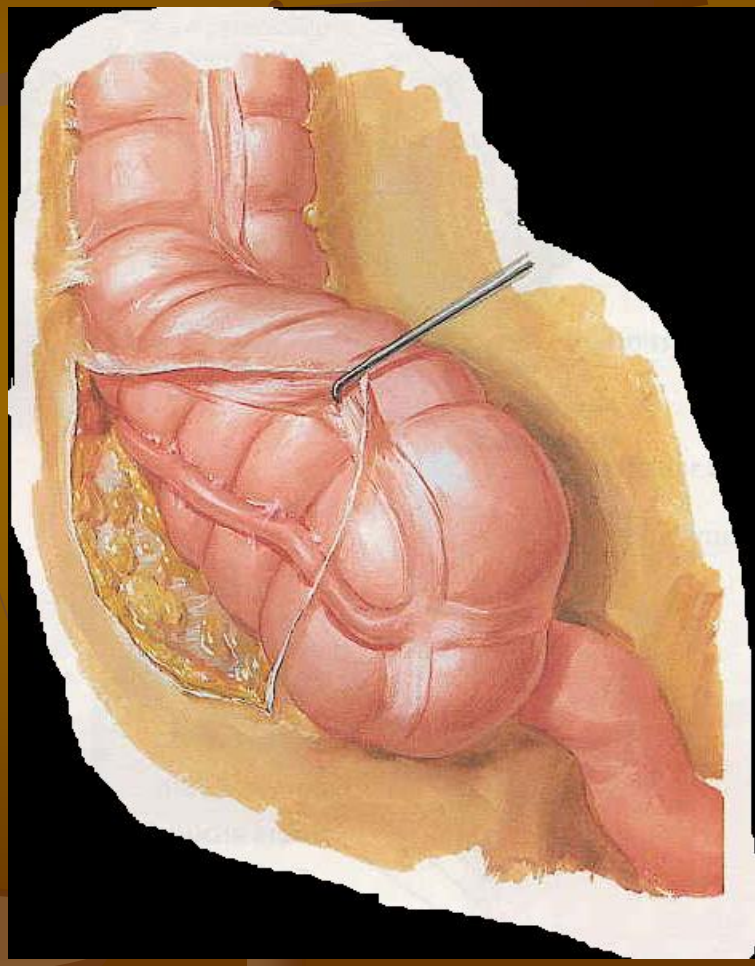
is pain in the right lower quadrant in response to left-sided palpation

(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*)

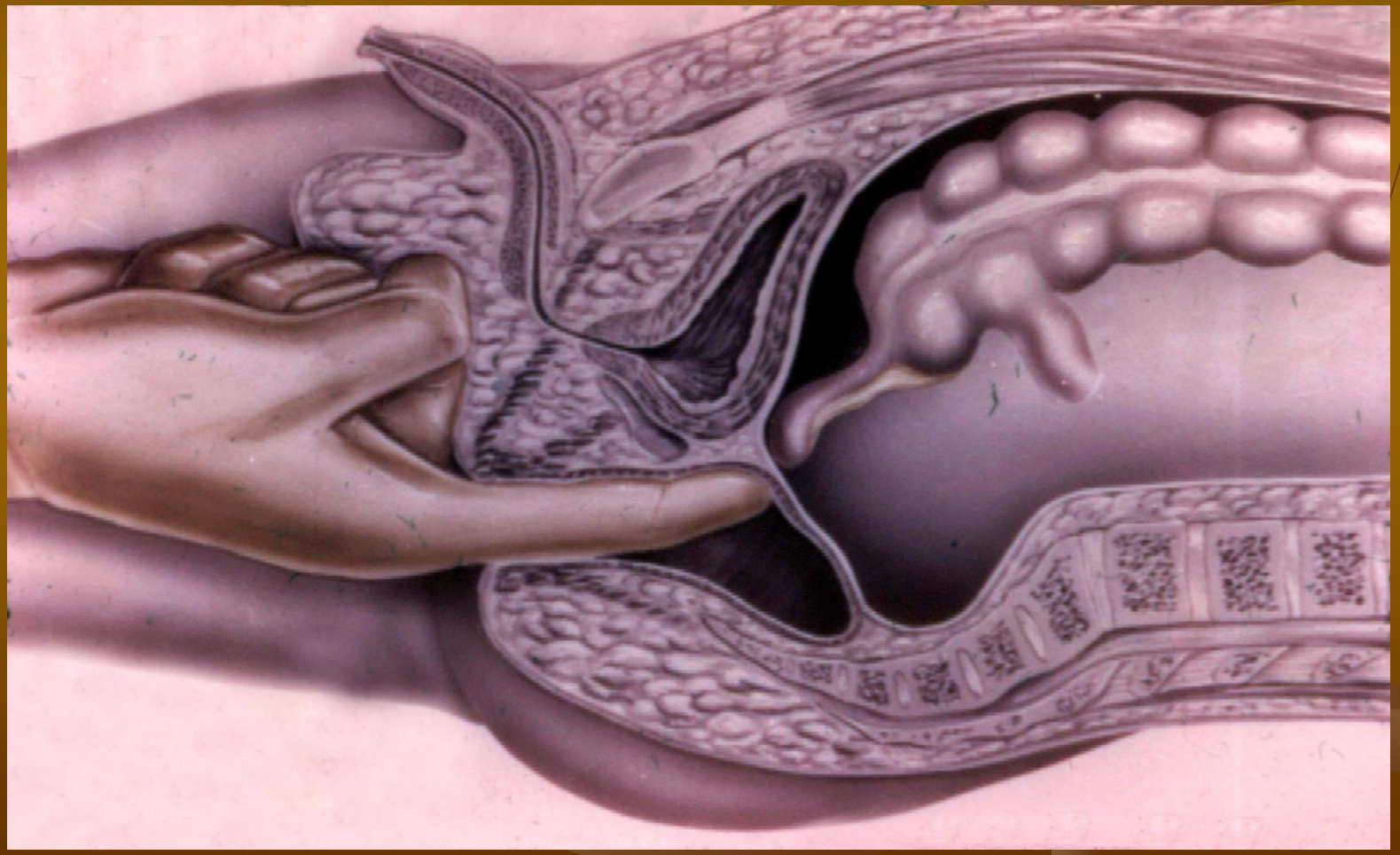


Appendix in the right paracolic gutter

- **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*



Acute appendicitis in young children

Acute appendicitis in young children is quite rare and accounts for up to 5%.

Anatomical and physiological features that determine the rarity of acute appendicitis in young children are as follows-good drainage function of the appendix due to the embryonic (conical) shape of the appendix and cecum, absence of a flap at the opening of the appendix, blunt ileocecal angle, dairy and vegetable diet

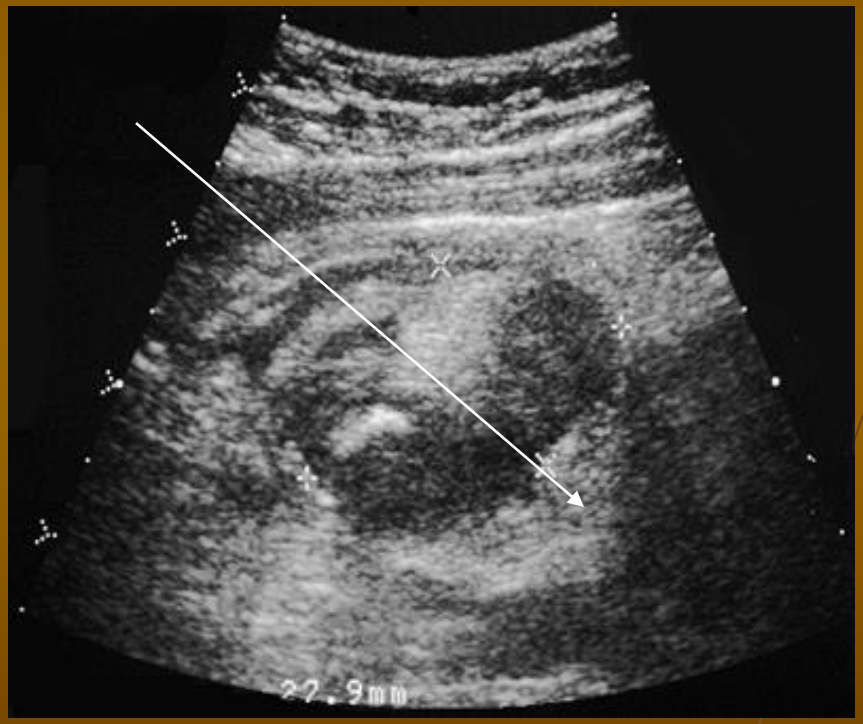
Lab Studies

- ***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

Computer tomography (CT)

1. Widening of the lumen
2. Thickening of the walls
3. Thickening of the adjacent mesenteric fat layer
4. Symptom of ‘arrowhead’
5. Signs of periapendicular inflammation

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
- Appendicular infiltrate and abscess
- Peritonitis
- Wound infection
- Intraabdominal abscesses
- Small bowel obstruction

Causes of diagnostic difficulties and errors in acute appendicitis in young children

Due to the functional immaturity of the nervous system in early age, almost all acute inflammatory diseases have a similar clinical picture.

The inflammatory process in the appendix in children is very rapid with quick onset of destructive changes and perforation.

There are specific difficulties in the examination of young children

Open appendectomy

Antibiotic therapy

- is an important aspect of the treatment of destructive forms of appendicitis. Antibiotic therapy should be directed against gram-negative and anaerobic organisms such as *Escherichia coli* and *Bacteroides* species. The administration of antibiotics of wide spectrum of actions, nasogastric tubes, intravenous lines, urethral catheters, antiemetic medicine, antipyretic medicine, and analgesia should ideally be part of the single protocol for managing the preoperative child.

Preoperative antibiotics

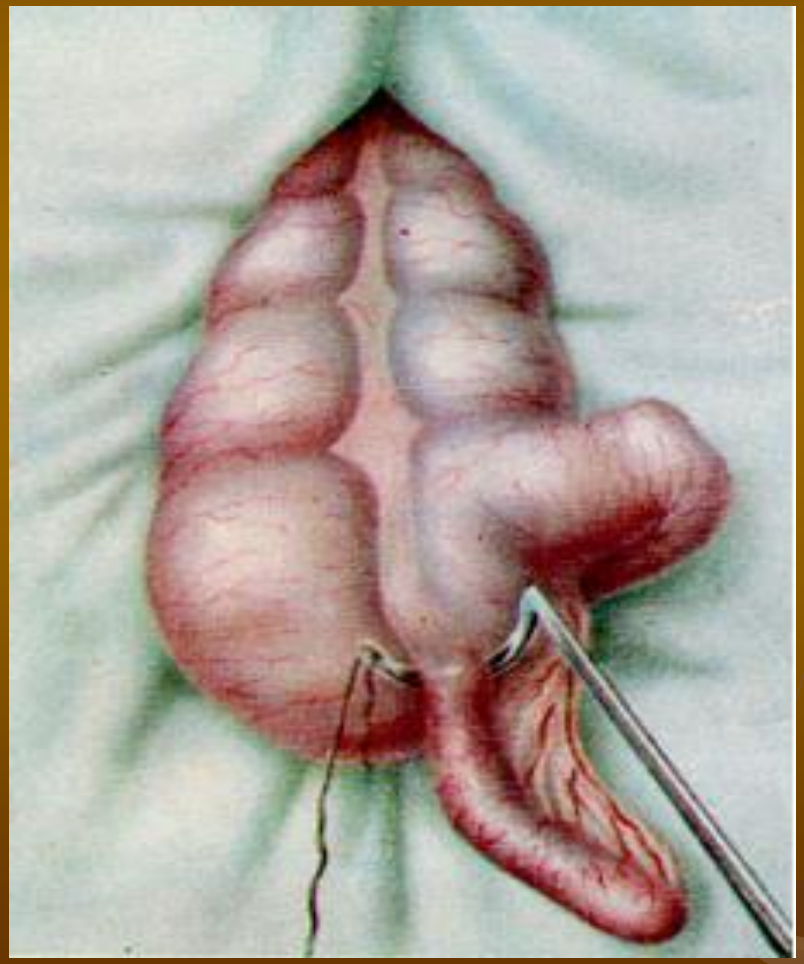
- are given to children with suspected appendicitis and stopped after surgery if no perforation exists.
- Patients with perforated appendicitis may require aggressive fluid resuscitation. The combination of ampicillin, clindamycin and gentamicin is administered to treat infection (aerobic and anaerobic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

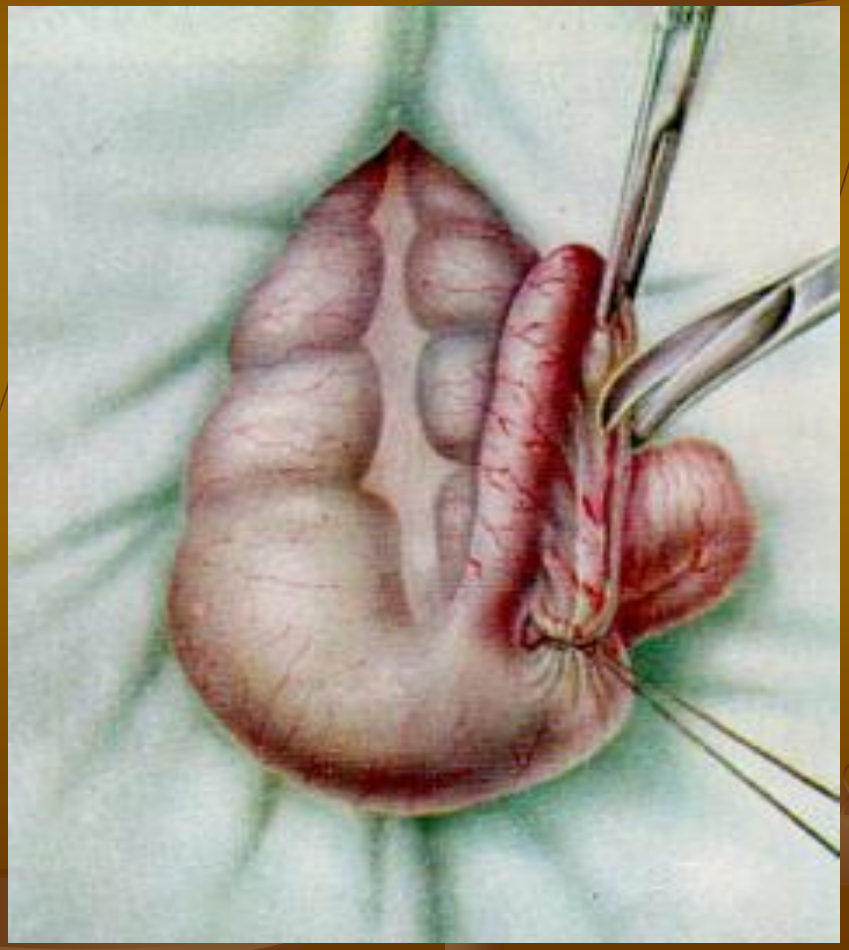
Access

- 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

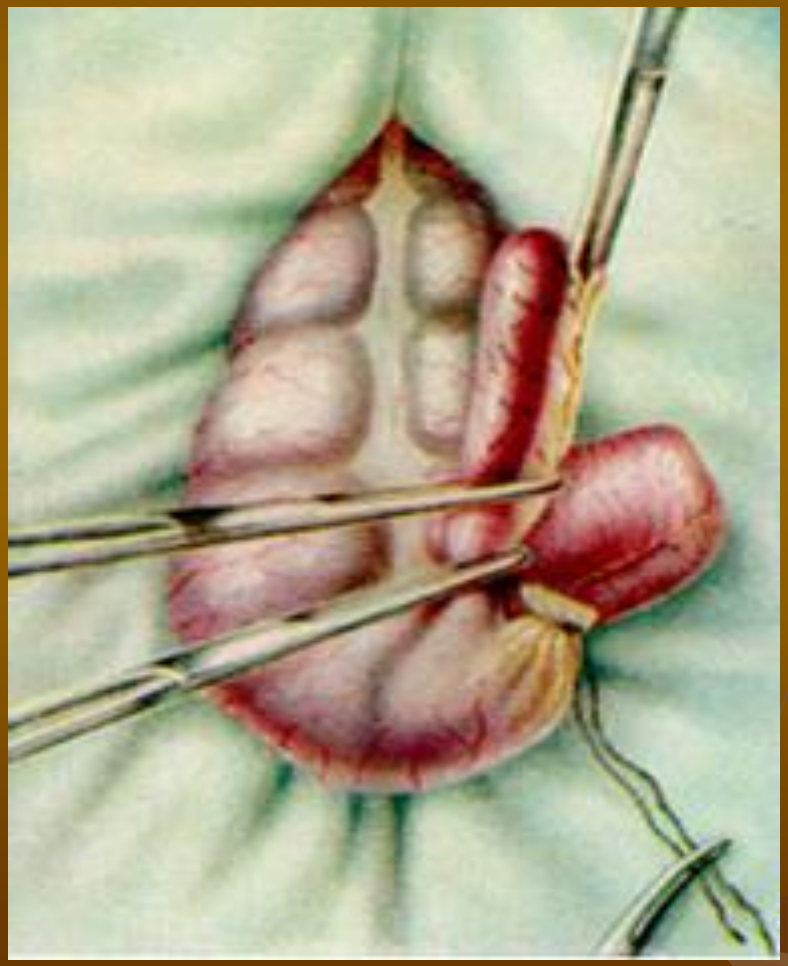
The mesoappendix is held between clamps, divided, and ligated

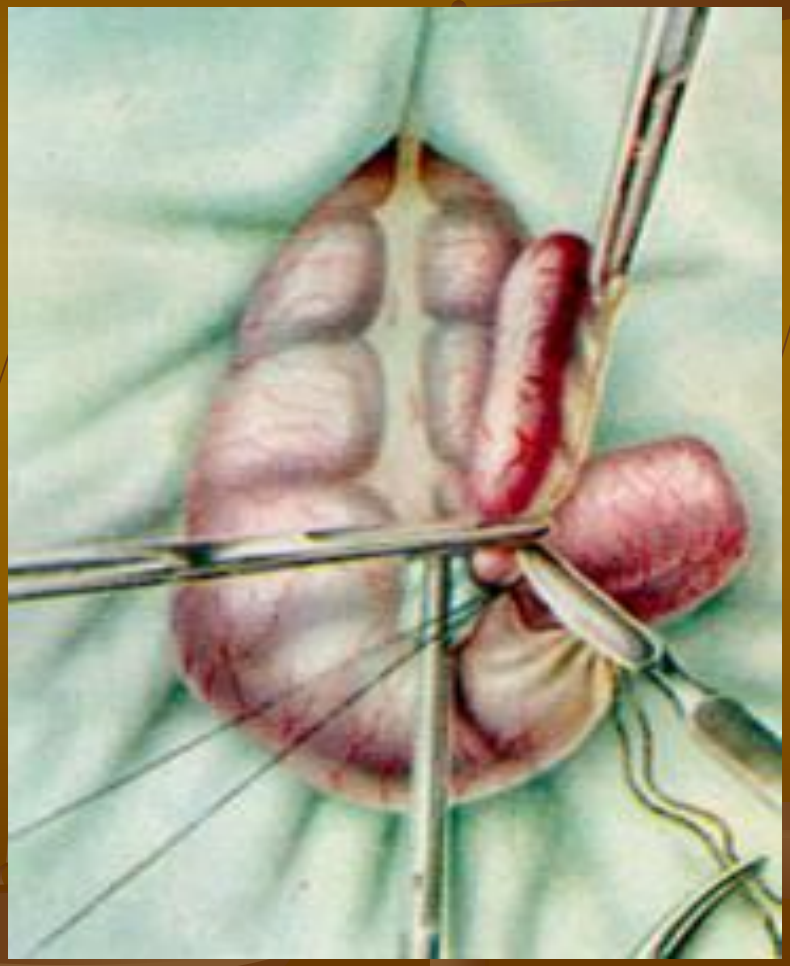




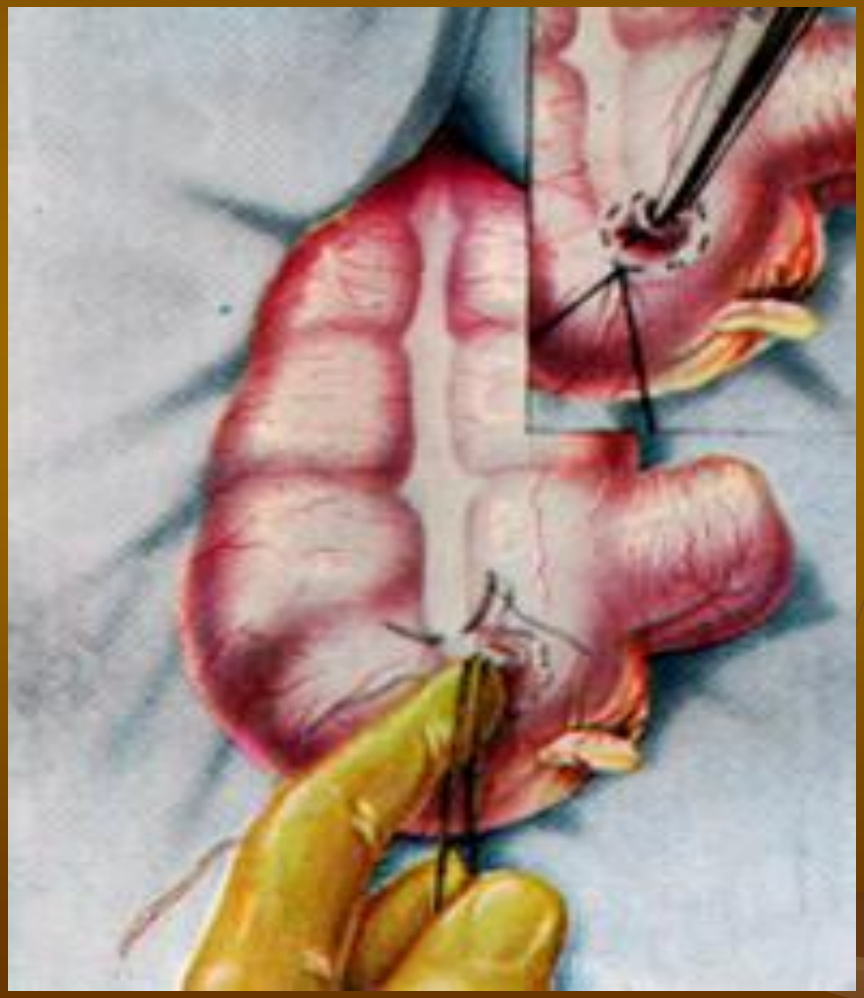
The appendix is clamped proximally about 5 mm above the cecum to avoid contamination of the peritoneal cavity and is

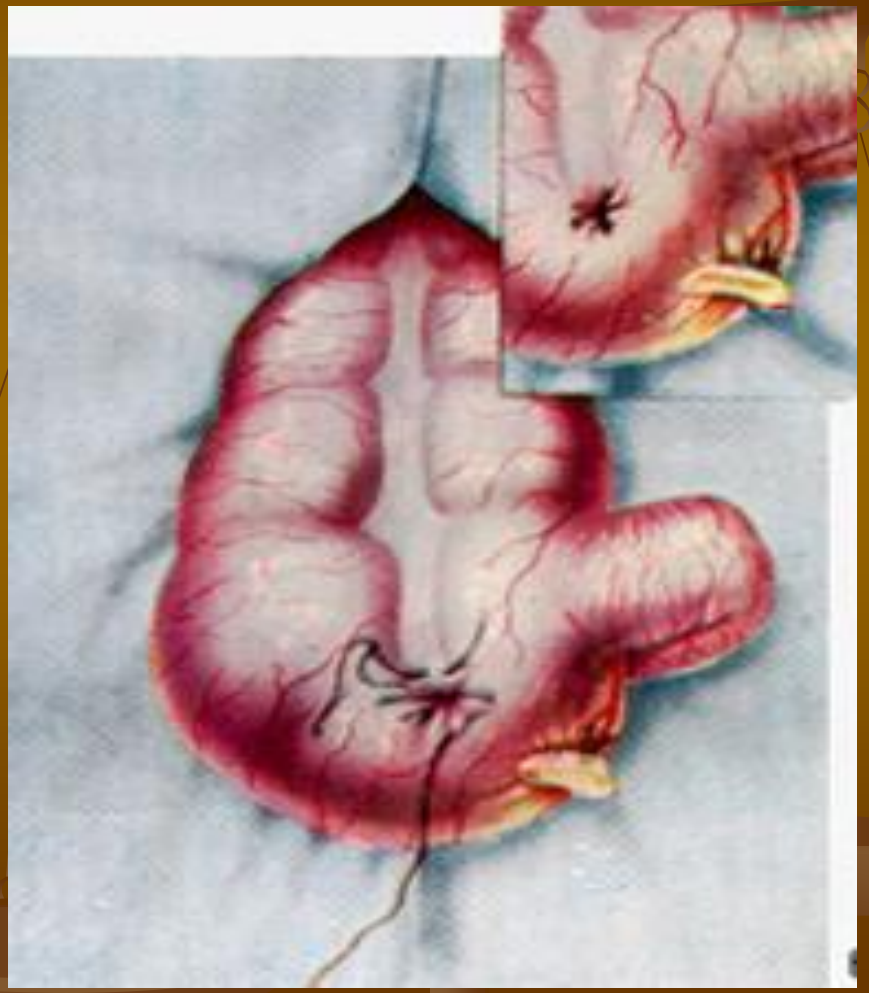
cut above the clamp by a scalpel

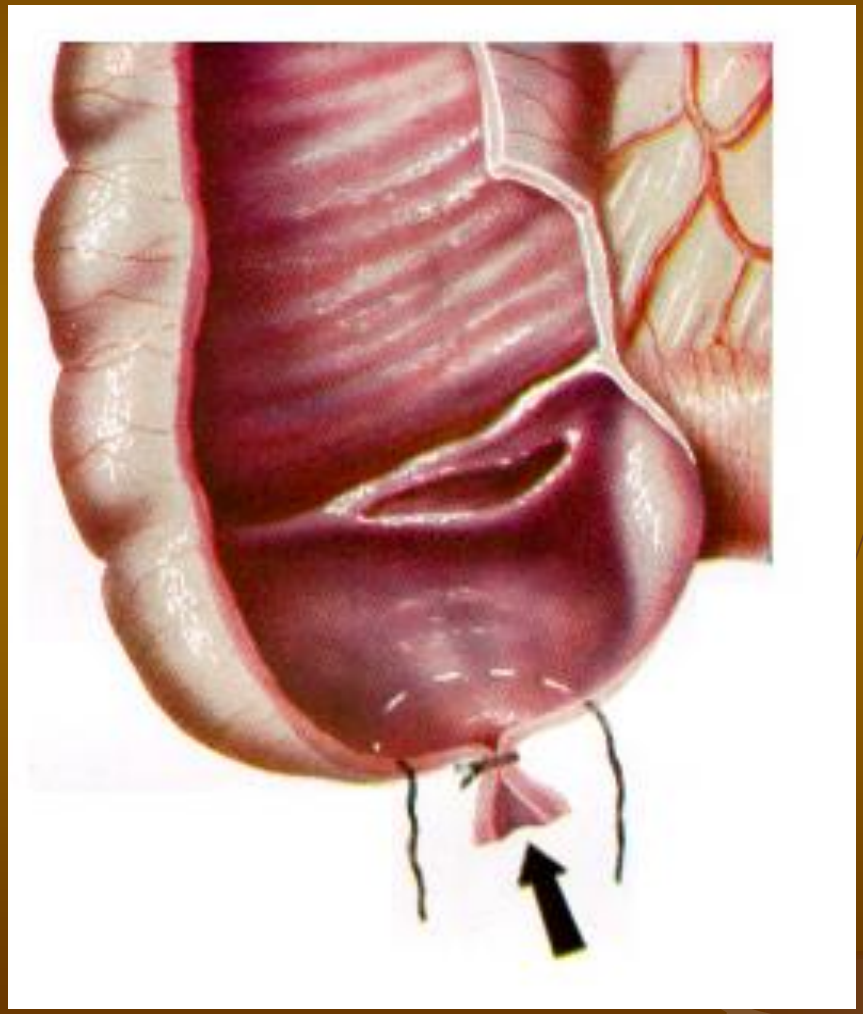


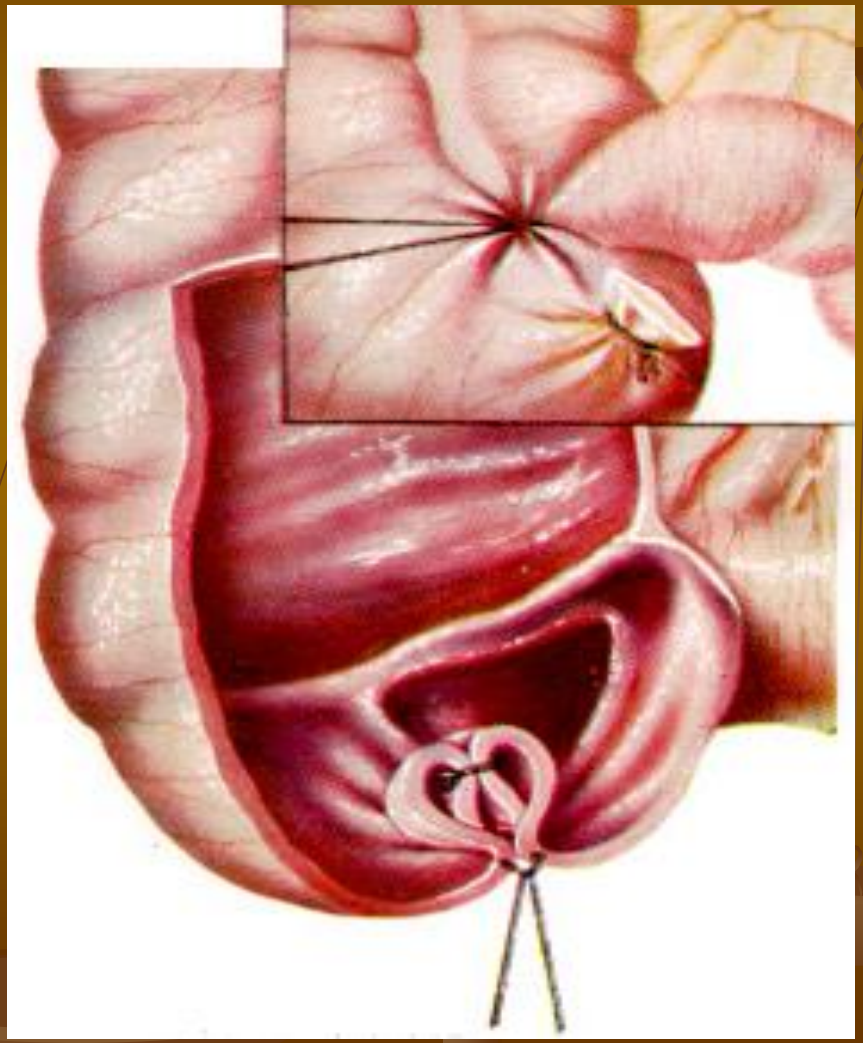


The appendix may be inverted into the cecum with the use of a pursestring suture









- 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:

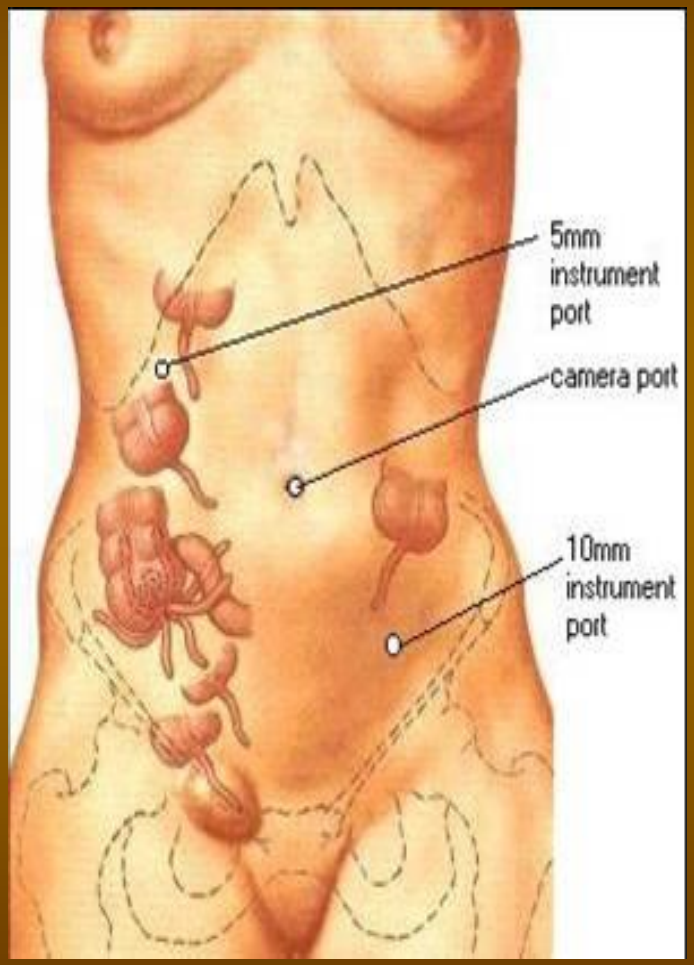
Laparoscopic appendectomy	Open appendectomy
Female of reproductive age group	Complicated appendicitis
Female of pre-menopausal group	COPD or Cardiac disease
Suspected appendicitis	Generalized peritonitis
High working class	Previous lower abdominal surgery
Obese patients	Hypercoagulable sates
Disease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

Further Inpatient Care:

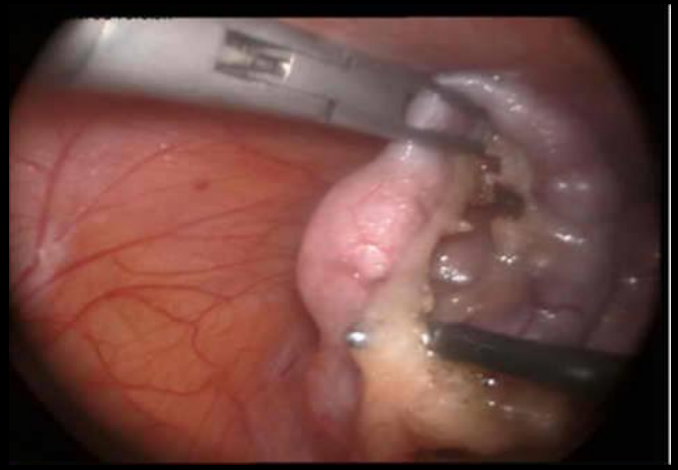
- Laparoscopic appendectomy seems to be a safe alternative for the treatment of complicated appendicitis in children.
  - Potential advantages of laparoscopic appendectomy include reduced postoperative pain and lower wound infection rate.
  - Pediatric laparoscopic patients have fewer wound problems 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



Widow 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

Meckel's diverticulum is the most common form of incomplete bile duct obliteration, occurring in about 2% of the human population

Classification of appendicular peritonitis in children (V.P. Krasovska, 1982)

I.By dissemination.

1.Local: limited (appendicular infiltrate, appendicular abscess); unlimited.
2.Widespread:

diffuse (occupies 2-4 anatomical areas of the abdominal cavity out of 9); spilled (occupies 5-6 anatomical areas of the abdominal cavity out of 9); general (occupies all areas of the abdominal cavity).

II. By the nature of the exudate: serous, purulent, purulent-fibrinous.
III. By clinical course: reactive phase (without intestinal paresis, up to 24 hours ; toxic phase (with intestinal paresis, 1 to 3 days); terminal phase (with complications, more than 3 days old).

IV. By the type of pathogen: colibacillus, proteus, purulent, staphylococcus, associative.

Primary peritonitis (diplococcal, peritonitis of girls)

- Occurs in girls aged 3 to 7 years
- Infection enters the abdominal cavity through the vagina with the development of endosalpingitis
- Forms: simple and toxic

Acquired intestinal obstruction

Plan of the lecture

1. Classification of intestinal obstruction in children
2. The main causes of spastic and paralytic intestinal obstruction.
3. Classification, pathogenesis, and prevention of postoperative mesenteric intestinal obstruction.
4. Principles of treatment of mesenteric intestinal obstruction.
5. Etiology, pathogenesis, clinic, diagnosis of idiopathic intussusception in children.
6. Indications for conservative and surgical treatment.

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* (is more violent, with water-electrolyte and haemodynamic disorders) and *low* (it proceeds more slowly, intoxication symptoms prevail).**

The border between high and low intestinal obstruction is the border between ileum and jejunum

- **Due to clinical course: partial, complete (acute, subacute, chronic, recurrent)**
- **By the mechanism of origin :** mechanical, dynamic.

Mechanical: obturative (without impaired blood supply)

strangulated (with impaired blood supply)

mixed (intussusception)

Dynamic obstruction: paralytic, spastic.

Paralytic intestinal obstruction

develops against the background of other severe pathological conditions - severe trauma, pneumonia, sepsis, intestinal infections, in the postoperative period during operations on the abdominal and thoracic cavities

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

Adhesive obstruction:

- early (paretic, delayed),
- late (after one month from the date of the surgery).

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

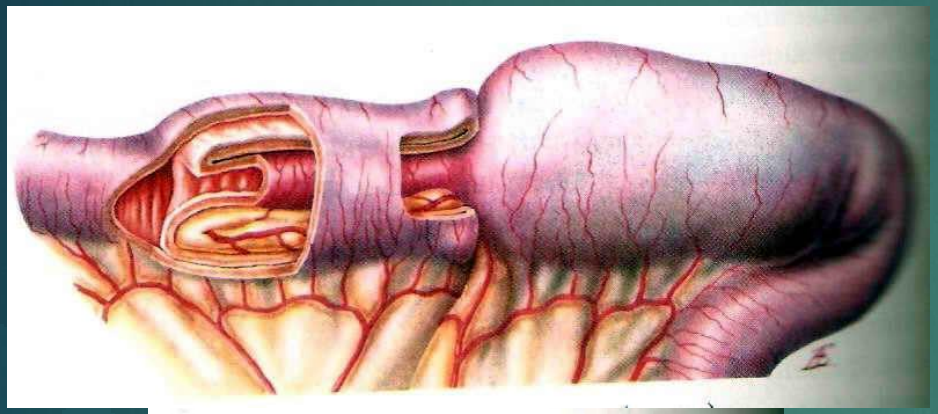
The components of the intussusception:

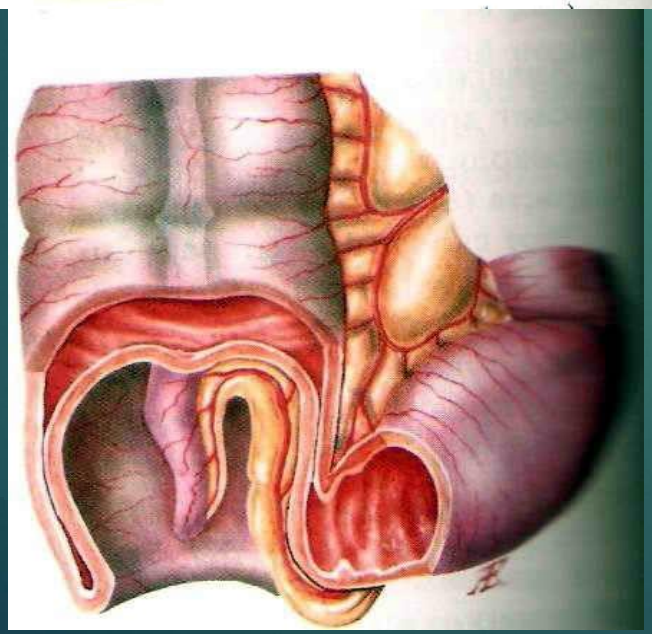
- **deferent part of the intestine,**
- **a head of the intussusceptum,**
- **outer cylinder of the intussusceptum,**
- **neck of the intussusceptum,**
- **adducent part of the intestine.**

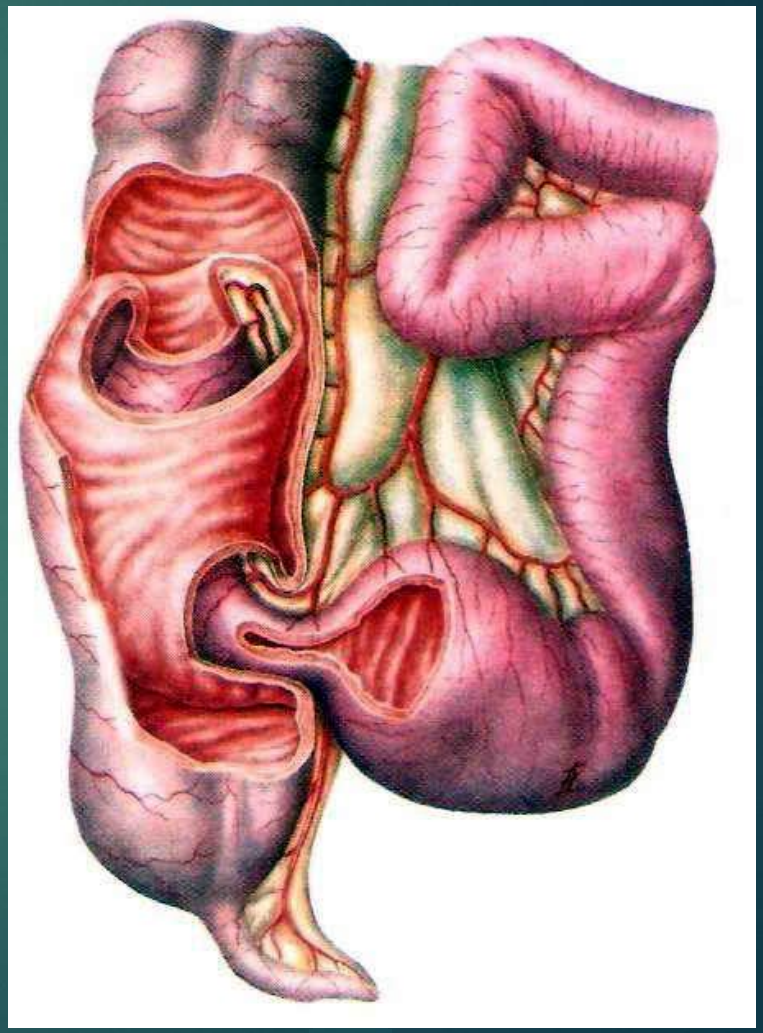
A loop of bowel which was stacked in two cylinders (external and internal) is named an intussusceptum.

Classification.

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







Intussusception - a mixed form of intestinal obstruction: obturative and strangulative.
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 of raspberry jelly consistance and 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.

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 "raspberry 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

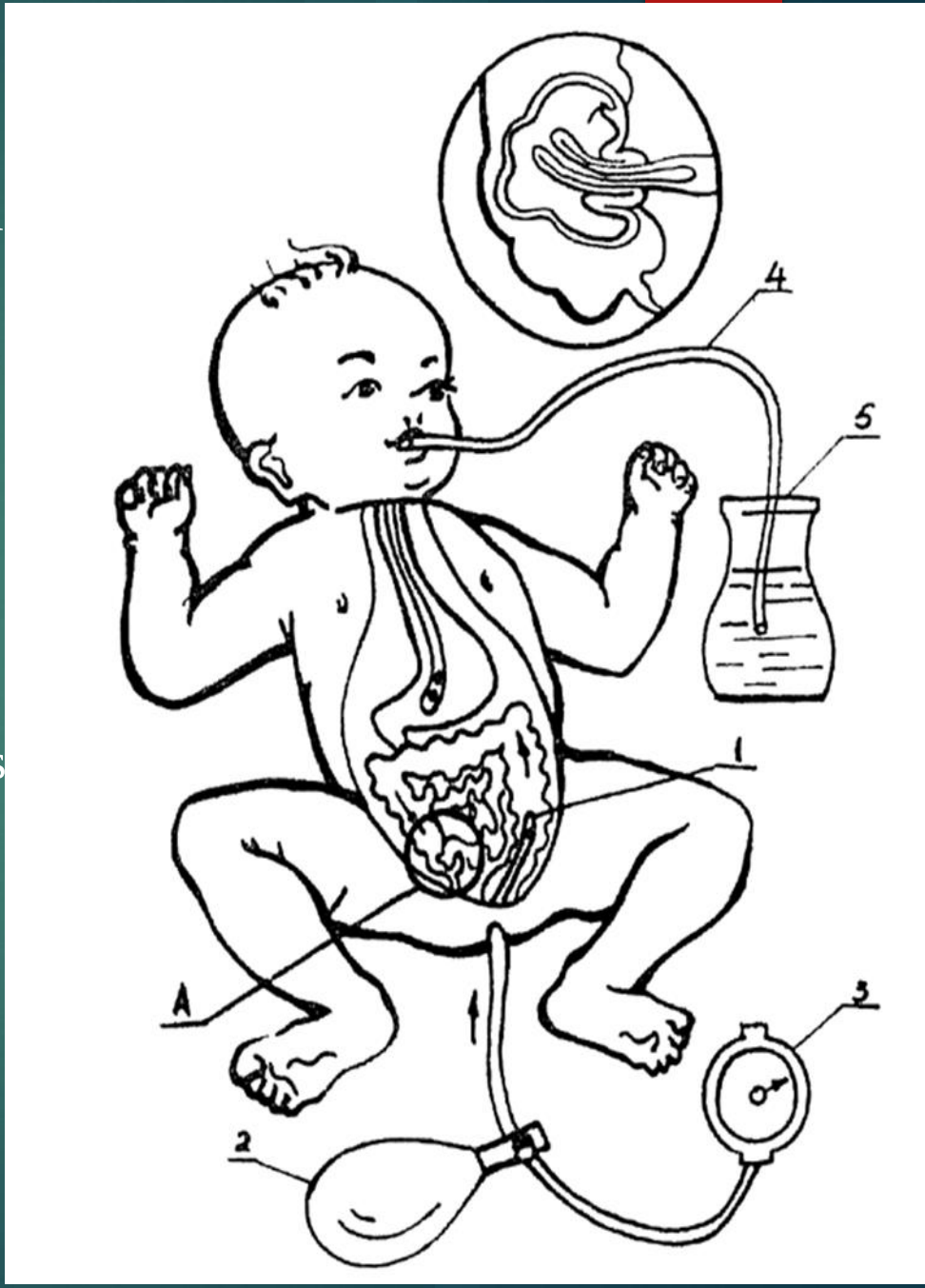
-rectal prolapse.

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 cases return 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 gently by forceps.




Thanks for your attention!