Department of Faculty Surgery named after Professor Yu.M. Lubensky

Topic: Acute appendicitis. Features of acute appendicitis in children, the elderly, and pregnant women.

Lecture No. 5 for 4th year students studying in the specialty 05/31/01 General Medicine

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Lecture plan “Acute appendicitis”

1. Relevance of the topic
2. Anatomical and physiological information, etiology and pathogenesis of acute appendicitis
3. Pathological anatomy and clinical classification of acute appendicitis
4. Clinical picture and diagnosis of acute appendicitis
5. Surgical tactics for acute appendicitis
6. Conclusions

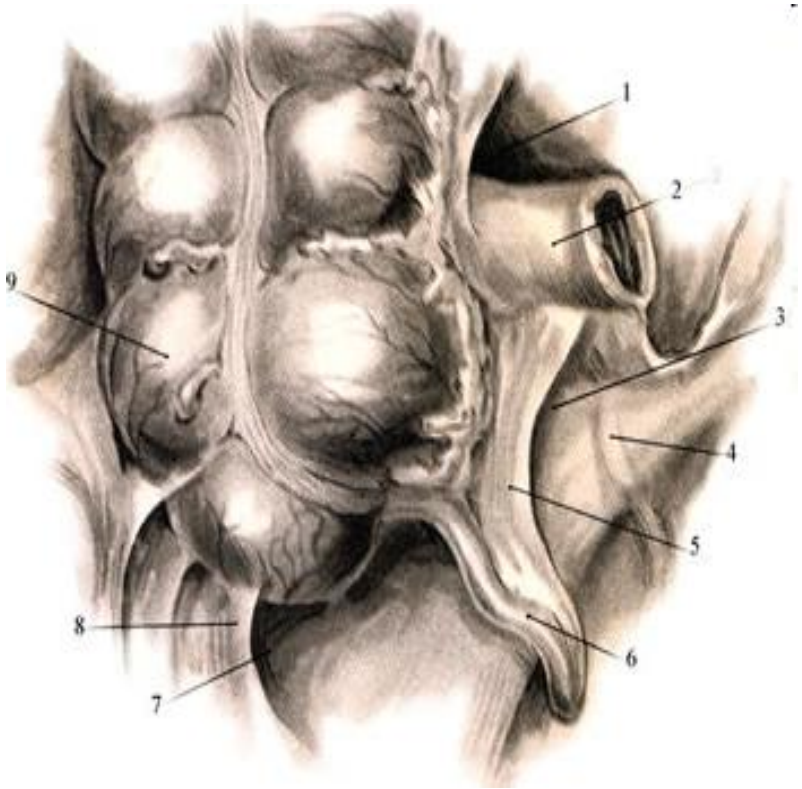
Acute appendicitis

- acute inflammation of the appendix of the cecum
- the incidence is 4-5 people per 1000 population
- most common between ages 15 and 40
- the ratio of men and women is 1.3-1.6:1 , respectively
- in 2017, 174,459 appendectomies were performed in Russia, in 2019 – 164,326
- mortality is 0.1-0.3 *% (2017 – 0.13%)*
- postoperative complications - 5-9%.

History of the issue

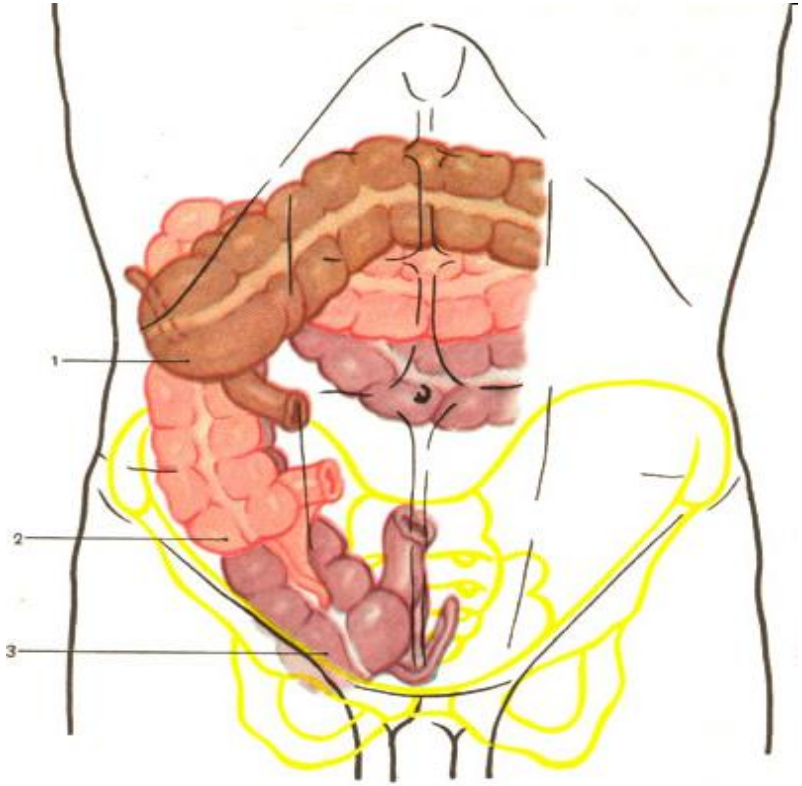
- 1884 - First appendectomy operation (Mahomed and Kronlein)
- 1890 - First successful appendectomy in Russia (A.A. Troyanov)
- In 1890, a special commission of American doctors adopted the name “appendicitis”, proposed in 1886 by R. Fitz
- In 1902, at a meeting of the Paris Surgical Society, it was decided that if a diagnosis of acute appendicitis was made, then surgery should be performed at any time from the onset of the disease.

Anatomical and physiological information



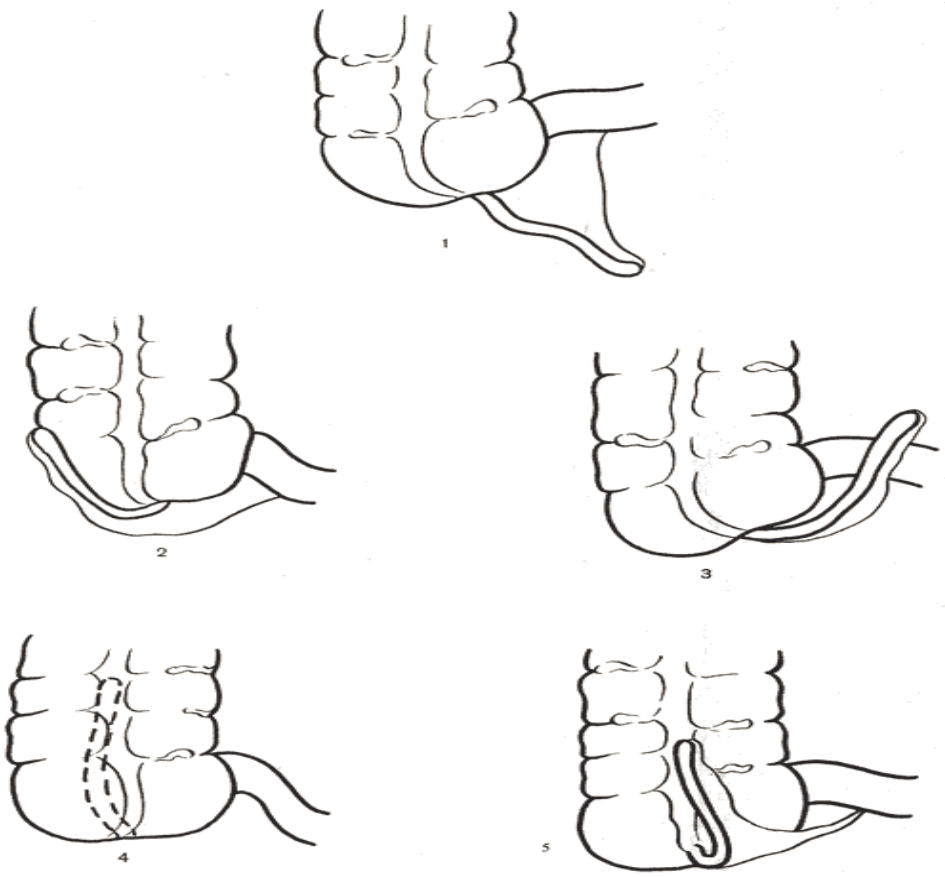
- Peritoneal pockets in the area of the cecum.
  1 - recessus ileocaecalis superior;
  2 - ileum (cut off);
  3 - recessus ileocaecalis inferior;
  4 - ureter dexter;
  5 — mesenteriolum appendicis vermiformis;
  6 - appendix vermiformis;
  7 - recessus retrocaecalis;
  8 - plica retrocaecalis;
  9 - caecum.

Anatomical and physiological information



- Variants of the position of the cecum.
  - 1 - subhepatic;
  - 2 - ileal;
  - 3 - pelvic.

Anatomical and physiological information

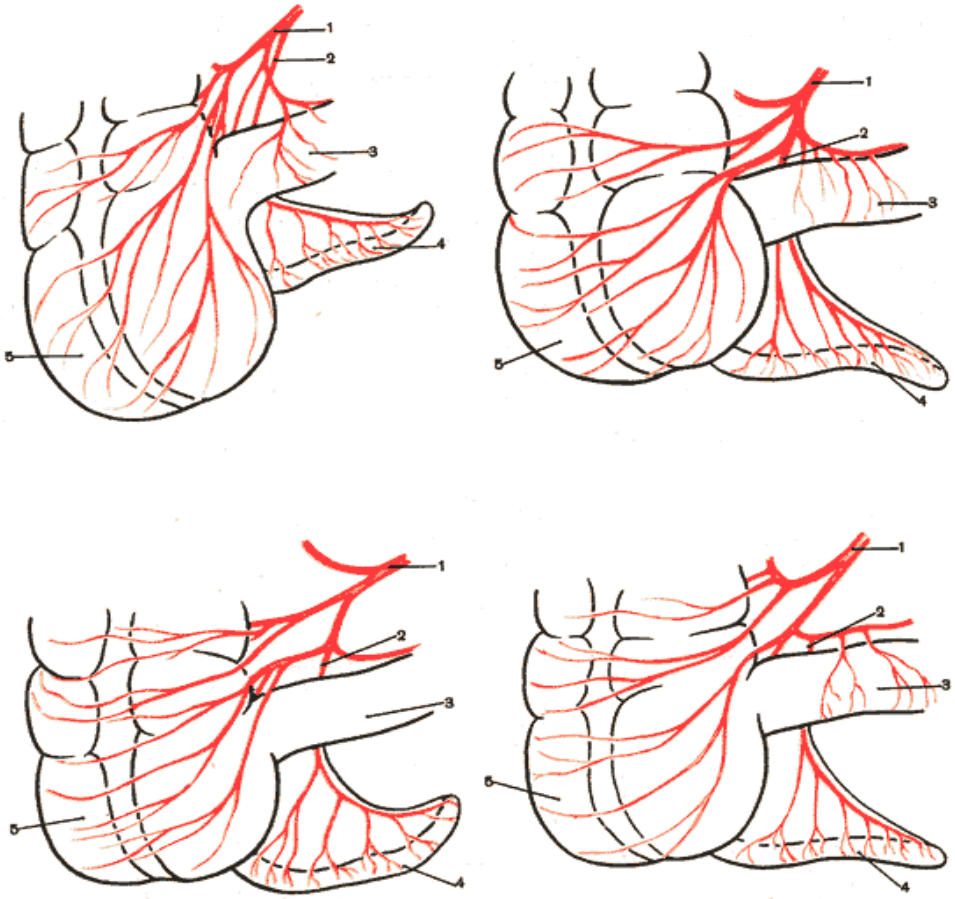


- Variants of the position of the appendix in relation to the cecum:
  - 1 - descending;
  - 2 - lateral;
  - 3 - internal (medial);
  - 4 - posterior (retrocecal, dorsal);
  - 5 - anterior (ventral)

Location of the appendix.

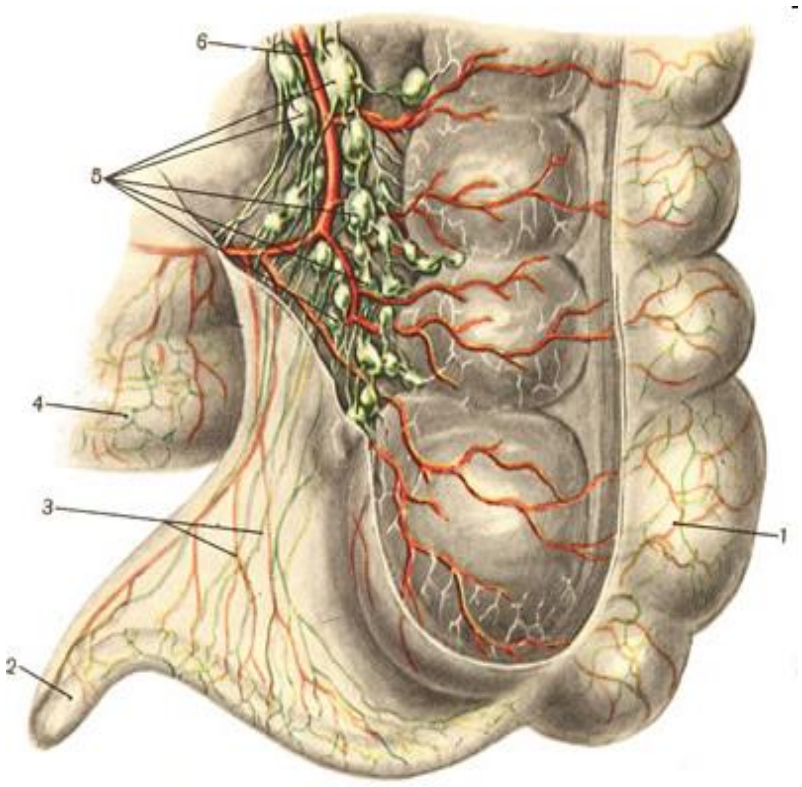
- typical (descending) location - 79.1% of patients,
- retrocecal – 5.6%;
- retroperitoneal (perinephric) – 1.4%;
- pelvic – 1.4%;
- left-sided – 0.1%;
- mesoperitoneal – 4.2%;
- subhepatic – 6.9%.

Anatomical and physiological information



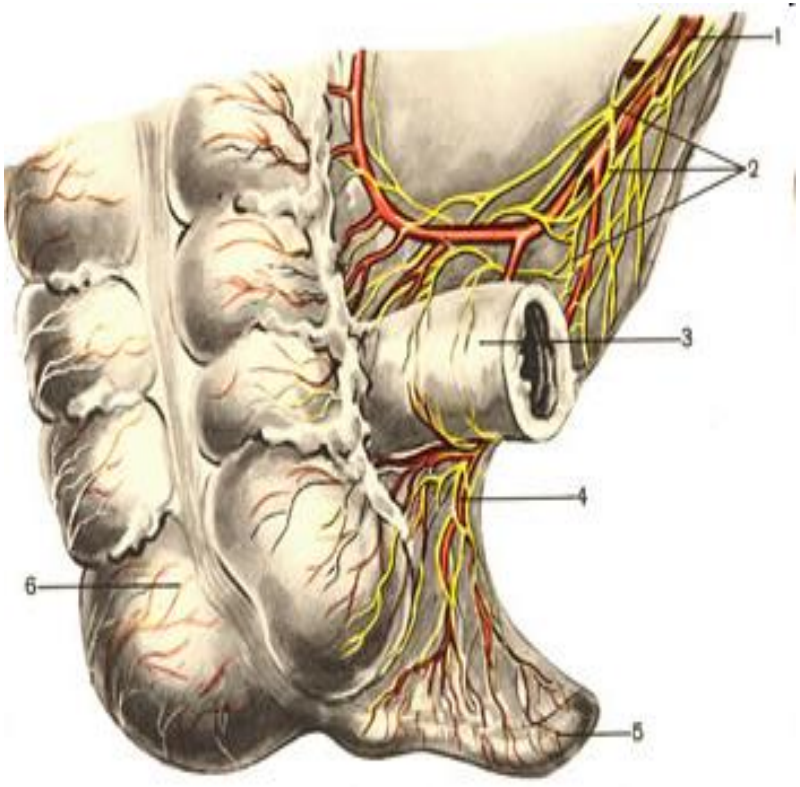
- Origin options of a. appendicis vermiformis.
  - 1 - a. ileocolica;
  - 2 - a. appendicis vermiformis;
  - 3 - ileum;
  - 4 - appendix vermiformis;
  - 5 - caecum.

Anatomical and physiological information



- Lymphatic vessels and nodes of the ileocecal angle (posterior view).
  - 1 - caecum;
  - 2 - appendix vermiformis;
  - 3 - lymphatic vessels of the mesentery of the appendix;
  - 4 - ileum;
  - 5 - ileocecal nodes;
  - 6 - a. ileocolica.

Anatomical and physiological information



- Innervation of the ileocecal angle.
- 1 - a. ileocolica;
- 2 - nerve branches of the plexus mesenterici superioris;
- 3 - ileum;
- 4 - a. appendicis vermiformis;
- 5 - appendix vermiformis;
- 6 - caecum.

Etiology and pathogenesis of acute appendicitis

The main reason for the development of OA is a violation of the passage of contents from the lumen of the appendix.

It may be due to:

- coprolites,
- helminthic infestation,
- food masses,
- lymphoid hypertrophy,
- neoplasms .

Etiology and pathogenesis of acute appendicitis

- Secretion of mucus under conditions of obstruction leads to increased pressure within the lumen of the appendix. The contents of the appendix, contaminated with pathogenic flora, serve as a favorable environment for the development of acute appendicitis.
- The most frequently isolated microflora are aerobic microorganisms, anaerobes and their associations.
- In elderly and senile patients, primary gangrenous appendicitis is possible, associated with thrombosis of the appendiceal artery, which does not have anastomoses.

Acute appendicitis. Classification

- by morphological changes:
  - catarrhal (simple, superficial);
  - phlegmonous (empyema of the appendix);
  - gangrenous;
  - secondary.

Simple (catarrhal) appendicitis

Moderate edema, hyperemia of the serous membrane and its mesentery.

The mucous membrane is swollen, hyperemic, loose, with areas of epithelial destruction. There may be a clear, odorless serous effusion (inflammatory exudate) periappendicularly.

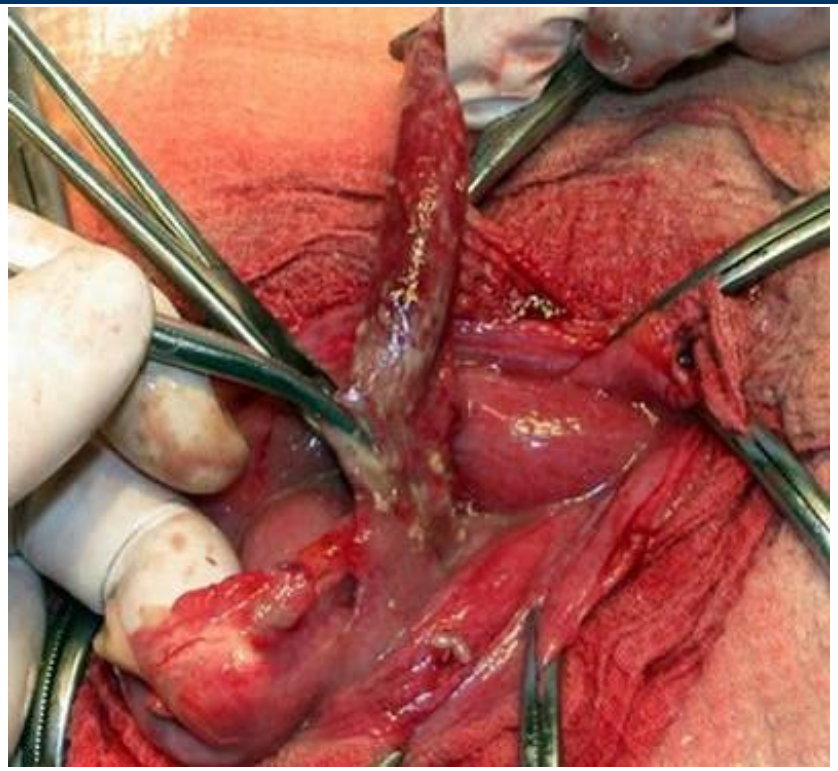
Phlegmonous appendicitis

The process is thickened, tense, its serous membrane is hyperemic and covered with fibrinous plaque. There is pus in the cavity of the appendix. There may be empyema of the process with flask-shaped expansion and sharp tension of the wall of the process. There is leukocyte infiltration of the walls of the appendix, and ulceration on the mucous membrane. Near the process there is serous/purulent exudate. The peritoneum next to the process is dull, with a coating of fibrin.

Gangrenous appendicitis

In the abdominal cavity there is a serous/purulent effusion with an unpleasant odor. The process is dirty gray in color, with areas of necrosis of the walls of the process. The peritoneum next to the process has hemorrhages and is covered with fibrin. Morphologically - ischemia of the mucous membrane, muscle layer, serous membrane, small abscesses, point necrosis, thrombosis of mesenteric vessels. In this form, perforation of the wall of the appendix and the occurrence of local peritonitis occur.

Perforated appendicitis



2-3 days after an attack of acute appendicitis, purulent melting of the wall of the appendix or necrosis of a section of the wall with its perforation may be observed, in which the contents of the appendix are poured into the abdominal cavity, which leads to local, diffuse or diffuse peritonitis.

Acute appendicitis. Classification

- depending on complications:
  - uncomplicated;
  - complicated:
    - perforation of the appendix;
    - appendicular infiltrate (preoperative detection);
    - appendicular infiltrate (intraoperative detection):
      - loose;
      - dense;
    - periappendicular abscess (preoperative detection);
    - periappendiceal abscess (intraoperative detection);
    - peritonitis;
    - pylephlebitis;
    - retroperitoneal phlegmon.

Acute appendicitis. Classification

- by clinical presentation:
  - with a typical clinical presentation (70-80% of AA cases);
  - erased clinical presentation;
  - atypical:
    a) with dysuria;
    b) with diarrhea;
    c) with a clinical presentation of acute cholecystitis;
    d) with signs of severe purulent intoxication.

Acute appendicitis. Clinical presentation.

- Pain
- Vomiting
- Lack of stool
- Urinary disorders
- Increased body temperature

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Acute appendicitis. Clinical presentation

- Assessment of general condition:
  - with AA, the general condition suffers slightly, but worsens when inflammation spreads to the peritoneum;
  - patients are usually in the fetal position (on the right side with the lower limbs bent and pulled towards the stomach);
  - upon examination, the shape of the abdomen is usually not changed;
  - at the beginning of the disease, the anterior abdominal wall is involved in the act of breathing; as the inflammatory process spreads, a lag in the breathing of its right half becomes

Acute appendicitis. Clinical presentation

- palpation tenderness in the right iliac region (at McBurney's point)
- abdominal guarding
- symptoms of peritoneal irritation

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Acute appendicitis. Clinical presentation

Signs of peritoneal irritation:

- **Shchetkin-Blumberg sing** - slow pressure on the right iliac region and quick removal of the hand. Increased pain when the hand is removed.
- **Voskresensky's sing** - through a shirt stretched downward, a sliding movement is made with light pressure from the epigastric region obliquely down to the right iliac region. There is a sharp increase in pain.

Acute appendicitis. Clinical presentation

- **Rovsing's sing** - with jerky pressure in the left iliac region, pain appears or intensifies in the right one.
- **Sitkovsky's sing** is the appearance or intensification of pain in the right iliac region when the patient turns on his left side.
- **Krymov's sing -** pain in the right inguinal canal during digital examination.
- **Razdolsky's sing** - increased pain upon percussion in the right iliac region.

Acute appendicitis. Clinical presentation

- **Bartomier-Michelson's sing** - pain on palpation of the right iliac region with the patient positioned on the left side.
- **Obraztsov's sing** - the examiner presses the abdominal wall in the right iliac region with his right hand; Gently lifting the straightened right lower limb causes a sensation of pain or increased pain in the right iliac fossa.
- **Cope's sing** - The patient is placed on his back and rotational movements are made with the right lower limb, bent at the knee and hip joints. In the presence of an inflammatory process and the pelvic location of the appendix, pain appears in the right iliac region.

Acute appendicitis. Diagnosis

- Clinical presentation.
- Laboratory research.
- Ultrasound
- CT, MRI
- Laparoscopy

Acute appendicitis. Diagnosis.

- Imaging of the abdominal cavity is clearly recommended only in patients with a low probability of AA in the absence of clinical improvements after hospitalization; in the case of an average or high probability of AA, the decision to perform abdominal imaging is recommended to be made individually, taking into account the characteristics of the clinical case.
- When choosing a method for abdominal imaging, it is recommended to maintain a balance of risk-benefit ratio - taking into account the patient's age and potential radiation exposure.

Acute appendicitis. Diagnosis.

- Computed tomography is recommended as a method for visualizing the abdominal cavity .
  - The main disadvantage of CT is the radiation exposure to the patient.
  - It has been proven that the routine use of computed tomography reduces the number of unnecessary appendectomies and increases the detection of abdominal diseases.

Acute appendicitis. Diagnosis.

- For pregnant patients, CT scanning of the abdominal cavity is not recommended; ultrasound examination of the abdominal cavity is recommended; in case of insufficient information from ultrasound, MRI of the abdominal cavity is recommended.
- If the clinical picture is unclear, as well as for the purpose of differential diagnosis with other acute diseases of the abdominal and pelvic organs, diagnostic video laparoscopy is recommended .

Acute appendicitis. Diagnosis.

- In patients with increasing or persistent pain in the right iliac fossa during follow-up and in the absence of possibility of diagnostic laparoscopy, open surgery is recommended

Acute appendicitis. Diagnosis.

Acute appendicitis. Diagnosis.

Differential diagnosis of acute appendicitis

- Perforated gastric ulcer.
- Acute cholecystitis.
- Acute pancreatitis.
- Crohn's disease, Meckel's diverticulum.
- Acute intestinal obstruction.
- Acute adnexitis.
- Interrupted ectopic pregnancy.
- Renal colic.
- Mesadenitis (inflammation of the lymph nodes of the mesentery of the small intestine)

Alvarado Score

SIGNS	
Tenderness in the right iliac fossa	+2
Elevated temperature >37.3°C	+1
Rebound tenderness	+1
SYMPTOMS	
Migration of pain to the right iliac region (Kocher's sign)	+1
Loss of appetite	+1
Nausea, vomiting	+1
LABORATORY DATA	
Leukocytosis > $10x10^{9}$ /l2	+2
Leukocyte left shift (shift of the leukocyte formula to the left) (neutrophils > 75%)	+1
Total	10

Data evaluation

LESS THAN 5 POINTS	**acute appendicitis is unlikely**
5-6 POINTS	acute appendicitis is possible and the patient needs observation
7-8 POINTS	acute appendicitis is probable
9-10 POINTS	there is acute appendicitis and the patient requires emergency surgery.

Protocols for organizing diagnosis and treatment care for acute appendicitis at the prehospital stage

- The presence of abdominal pain requires a targeted exclusion of the diagnosis of “acute appendicitis”, taking into account the variety of its atypical forms.
- Doubts about the diagnosis of acute appendicitis serve as the basis for referring the patient to a surgical hospital. In this case, if there is atypical clinical presentation, it is permissible to use the diagnosis of “acute abdomen”.
- If the diagnosis of acute appendicitis is not clear, the use of local heat (a heating pad) to the abdominal area, as well as the use of enemas and laxatives, is contraindicated.

Protocols for organizing diagnostic and treatment care for acute appendicitis at the prehospital stage

- If the patient categorically refuses hospitalization, he and his relatives must be warned about the possible consequences with a corresponding entry in the medical record.
- In case of a patient’s unauthorized departure from the emergency department of a surgical hospital before the diagnosis is determined, the doctor of the emergency department is obliged to report this to the outpatient clinic at the patient’s place of residence for an active examination by the surgeon of the clinic at home.

Acute appendicitis in childhood

- The smaller the child is, the more atypical the course of acute appendicitis is.
- Diffuse rather than limited peritonitis develops more often.

Acute appendicitis in childhood

- General symptoms and intoxication prevail.
- The child is restless due to severe abdominal pain.
- Repeated vomiting is observed.
- In some cases, at the beginning of the disease there is frequent loose stool.

Acute appendicitis in childhood

- The significance of specific signs typical for adults in children is extremely small.
- Questioning the mother about the onset and further course of the disease and the child's behavior.
- A skillful approach to the child, gaining his trust, diverting attention from the doctor's actions, patience during the examination.

Acute appendicitis in childhood

- If there is uncertainty about the diagnosis, it is necessary to re-examine the child, observe his behavior, and the position he takes in the ward.
- Palpation of the abdomen of a sleeping child, examination of the child in the arms of the mother.
- After a preliminary examination and palpation of the abdomen, do a small hypertensive enema.

Acute appendicitis in pregnant women

- More common in the II - III trimesters.
- Occurs in 0.7-1.2 % of cases, i.e. much more often than among the rest of the population.

Acute appendicitis in pregnant women

- Termination of pregnancy and fetal death occurs with appendicitis in pregnant women in 4-6% of cases.
- Mortality among pregnant women with acute appendicitis is 6-10 times higher than the annual average.

Acute appendicitis in pregnant women

- A number of signs characteristic of acute appendicitis (abdominal pain, vomiting, leukocytosis) are observed during the normal course of pregnancy, making its diagnosis difficult.
- The clinical course of acute appendicitis in the first half of pregnancy is almost no different from its course without pregnancy.
- Difficulties in diagnosis increase with increasing gestational age:
  - the enlarged uterus covers most of the abdomen for examination;
  - the abdominal wall is rigid due to tension by the enlarged uterus;

Acute appendicitis in pregnant women

- The sudden onset of the disease is characteristic.
- Unexpressed pain syndrome, so patients do not pay attention to it.
- Nausea and vomiting may be associated with pregnancy.
- Local pain in acute appendicitis in the second half of pregnancy will not be determined in the right iliac region, but much higher.

Acute appendicitis in pregnant women

- Due to the stretching of the abdominal wall by the enlarged uterus, local muscle guarding is weakly expressed.
- Symptoms of peritoneal tenderness (irritation) may be negative: Shchetkin-Blumberg, Voskresensky, etc.
- During this period, as a rule, Obraztsov's psoas sign, Sitkovsky's and Bartomier-Mikhelson's signs are well expressed.

Acute appendicitis in pregnant women

- The temperature reaction is less pronounced than without pregnancy.
- The number of leukocytes increases moderately. It must be taken into account that leukocytosis up to 12x109/l in pregnant women is a physiological phenomenon.

Acute appendicitis in old age

- occurs somewhat less frequently than in young and middle-aged people,
- the number of elderly and senile patients is about 10% of the total number of patients with acute appendicitis,
- in old and senile age destructive forms of appendicitis predominate:
  - decreased body reactivity,
  - atherosclerotic vascular lesions,

Acute appendicitis in old age

- Often, in the presence of destructive appendicitis, the general condition remains satisfactory.
- The temperature elevates slightly or may be normal.
- The pulse quickens and does not always correspond to the temperature.
- Specific signs of acute appendicitis are much less pronounced.

Acute appendicitis in old age

- General malaise.
- Disorder of physiological functions:
  - bloating,
  - slight nausea,
  - retention of stool and gases.
- Abdominal pain is moderate or mild, more often diffuse in nature and less often clearly localized in the right iliac region.

Acute appendicitis in old age

- Guarding of the abdominal wall muscles is not expressed in half of all cases; the abdomen seems soft and accessible to palpation.
- The pain on palpation is not sharp, but in complicated forms it is quite pronounced.
- Much more often accompanied by intestinal paresis and phenomena of dynamic intestinal obstruction.
- Symptoms of peritoneal irritation are less pronounced.

Acute appendicitis in old age

- appendicular infiltrate occurs much more often:
  - they often appear without a characteristic preceding acute attack,
  - their course is usually sluggish,
  - must be differentiated from a neoplasm of the cecum.

Treatment of acute appendicitis

- Patients with verified AA are recommended to undergo appendectomy (AE)
- In case of uncomplicated AA, it is possible to delay surgical treatment for up to 24 hours if the surgical team is busy, provided that the patient is in the hospital under the supervision of a surgeon, but this should be minimized as much as possible

Treatment of acute appendicitis

- Appendectomy is the standard treatment for AA and can be performed by open or laparoscopic access.
- Appendectomy is recommended as the method of choice for surgical treatment of AA. Laparoscopic access (LAE) in the presence of laparoscopic equipment and experience
- If it is not possible to perform LAE, it is recommended to perform AE using open access (at the McBurney point)

Perioperative antibiotic prophylaxis

- Preoperative antibiotic prophylaxis is recommended for all patients, regardless of the type of AA.
- 30 minutes before the incision, cefazolin is administered at a dose of 1.0 IV bolus. If the duration of the operation is more than 3 hours, the drug is administered again.

Preoperative prevention of thrombosis

- Recommended for patients at high risk of thrombotic complications:
  - age over 50 years,
  - excess body weight,
  - concomitant oncopathology,
  - cardiovascular diseases, including myocardial infarction, varicose veins,
  - postpartum period,
  - traumatic injuries,
  - taking hormonal contraceptives,
  - erythremia,
  - systemic lupus erythematosus,
  - genetic pathologies (deficiency antithrombin III, proteins C and S etc.)

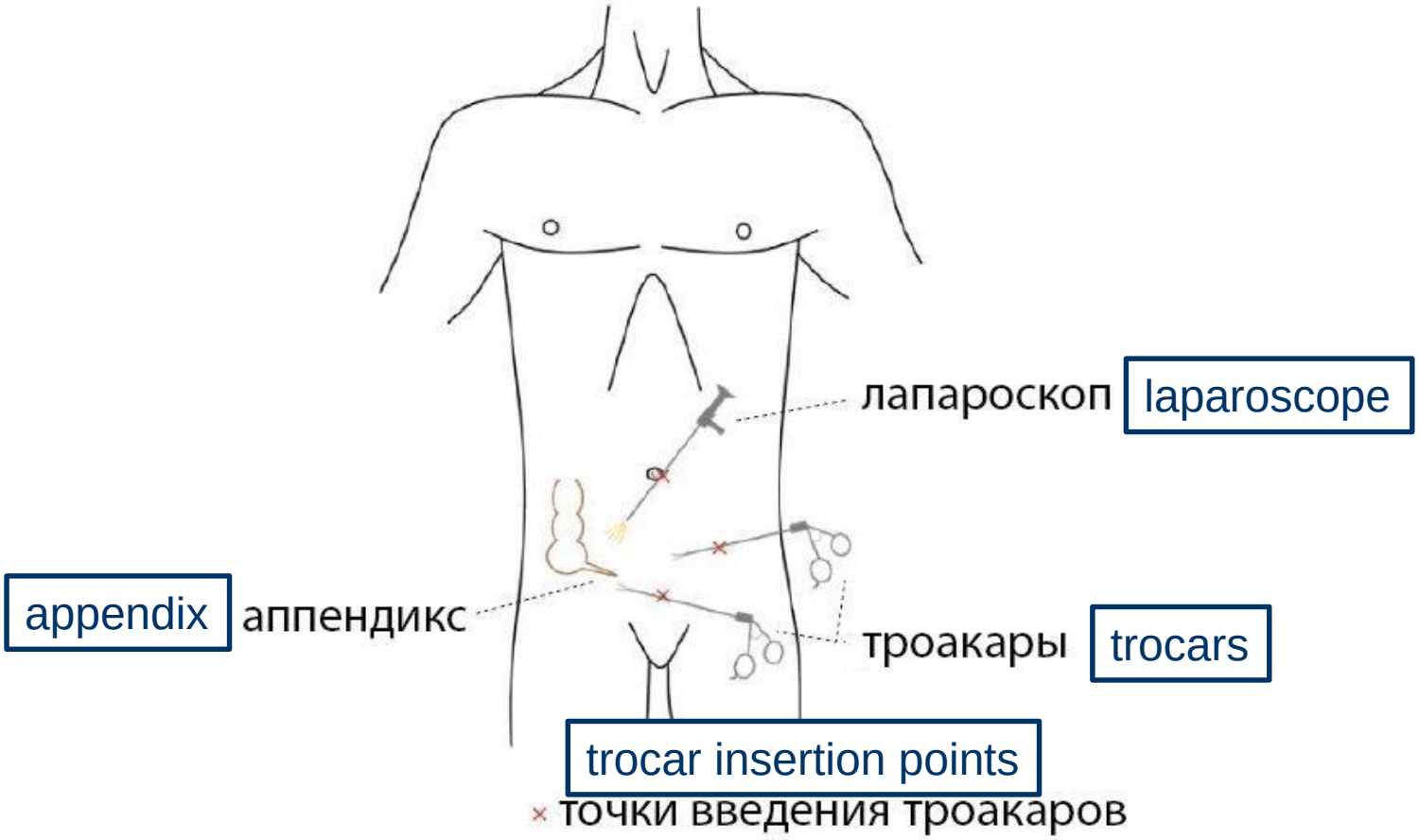
Appendectomy. Operating accesses.

- First choice surgery is laparoscopic appendectomy (LAE): gives better cosmetic results, reduces the patient's duration of hospitalization, and reduces the number of complications, including intra-abdominal abscesses and intestinal obstruction.
- Laparoscopy is safer than open AE, especially in the treatment of obese patients, elderly patients and patients with comorbidities.

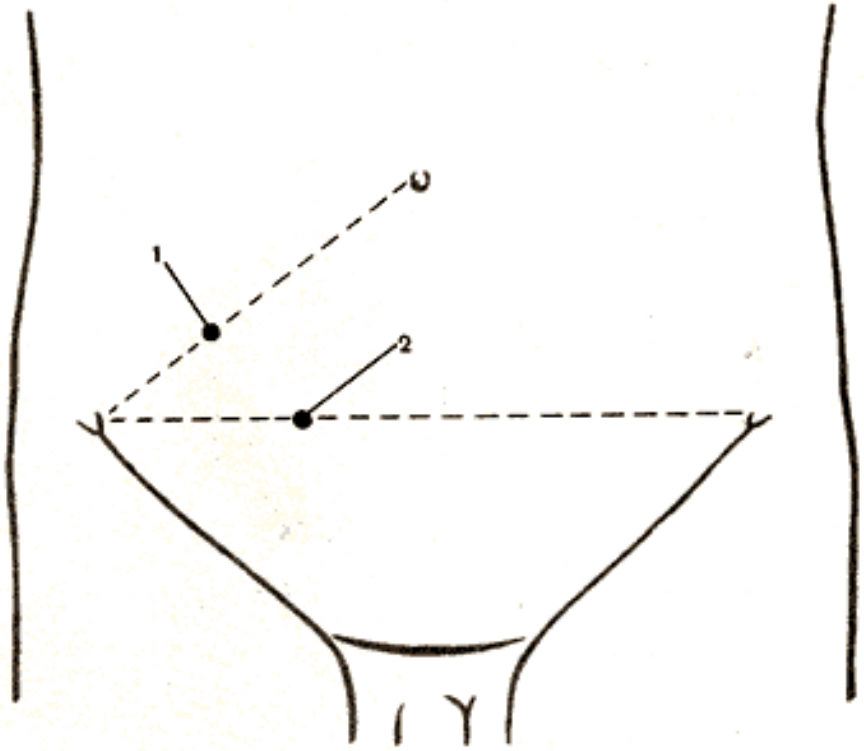
Appendectomy. Operating accesses.

- LAE is not recommended as the first choice method for surgical treatment of pregnant patients.
- Contraindicated:
  - For peritonitis with severe paresis of the gastrointestinal tract (presence of compartment syndrome with an increase in intra-abdominal pressure of more than 12 mm Hg).
  - Contraindications to carboxyperitoneum.

Laparoscopic appendectomy



Appendectomy



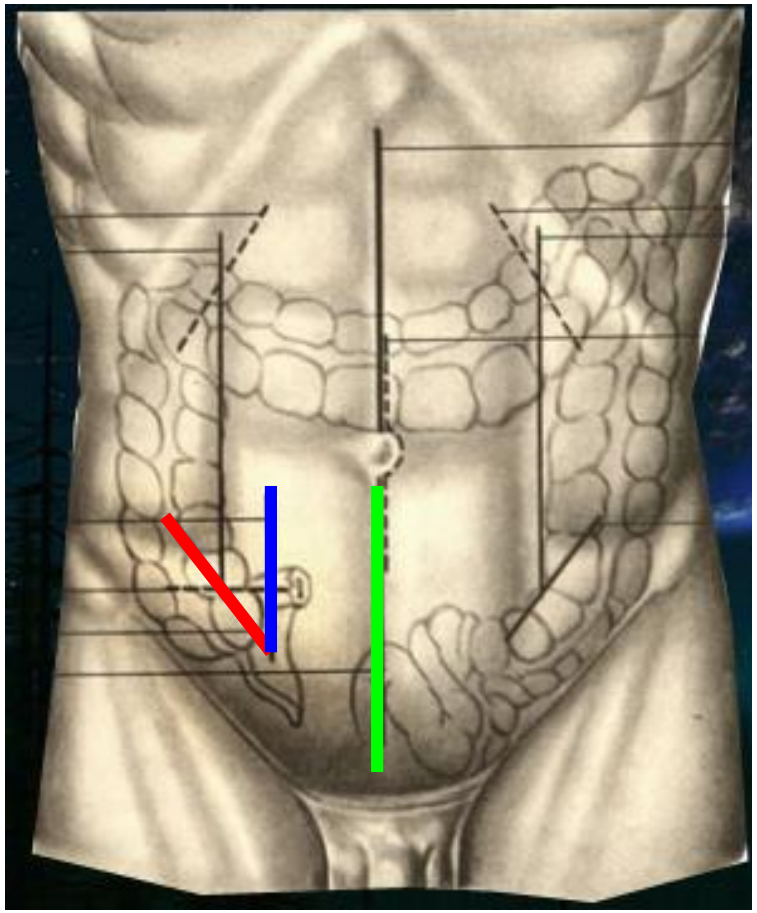
- 1 - McBurney point;
- 2 - Lanz point.

Appendectomy. Surgical accesses.

Volkovich - Dyakonov - Mack Burney incision

Lennander incision

Lower midline incision



Appendectomy

- Transection of the mesentery of the appendix is recommended using mono- or bipolar coagulation and an ultrasonic scalpel.
- During appendectomy with open access it is possible to transect and ligate the mesentery of the process using clamps

Appendectomy

- Ligation of the base of the appendix before its transection without peritonization of the stump is recommended for both open and LAE (ligature method).
- Peritonization of the process stump is not necessary, since the incidence of complications is the same, but it significantly increases the duration of the operation, especially with LAE
- After cutting off the process, any treatment of the mucous of the stump is not recommended.

Acute appendicitis in pregnant women. Surgical treatment.

- Surgical tactics for any form of appendicitis in pregnant women do not differ from the generally accepted principles of its treatment.
- The features of the surgical technique and methods of drainage of the abdominal cavity, adopted for various forms of acute appendicitis, fully retain their significance.
- Maximum caution must be taken when manipulating near an enlarged uterus, since trauma to it can be a direct cause of miscarriage or premature birth.

Acute appendicitis in pregnant women. Surgical treatment.

- For any form of acute appendicitis, general anesthesia should be preferred.
- Laparoscopy is used as surgical access in the first and second trimester; in the third trimester, the Volkovich-Dyakonov incision is used.
- In the second half of pregnancy, this access is modified according to the principle: the longer the gestation period, the higher the incision.

Acute appendicitis in pregnant women complicated by diffuse purulent peritonitis.

- The mortality rate for this complication is:
  - 23-55% for mother,
  - 40-92% for the fetus,
  - the highest mortality rate is observed in late pregnancy.

Acute appendicitis in pregnant women complicated by diffuse purulent peritonitis.

- **the question of the scope and nature of the intervention for destructive appendicitis with long gestation period should be decided together with an obstetrician-gynecologist**
- the principle of modern surgical tactics: *maximum activity in relation to peritonitis, maximum conservatism in relation to pregnancy.*

Acute appendicitis in pregnant women complicated by diffuse purulent peritonitis. Treatment.

- With diffuse appendiceal peritonitis in pregnant women:
  - Under general anesthesia, a median laparotomy is performed,
  - evacuation of pus with mandatory sampling for culture and antibiogram,
  - appendectomy,
  - toileting and abdominal drainage,
  - the surgical wound is closed tightly.

Acute appendicitis in pregnant women complicated by diffuse purulent peritonitis. Treatment.

- In full-term or almost full-term pregnancy (36-40 weeks) due to the inevitability of childbirth due to peritonitis:
  - the operation begins with a caesarean section,
  - then, after suturing the uterus and peritonization of the suture, an appendectomy is performed,
  - all further manipulations are related to the treatment of peritonitis.

Acute appendicitis during childbirth. Treatment.

- If childbirth proceeds normally with the clinical picture of catarrhal and phlegmonous appendicitis, then it is necessary to promote the fastest natural delivery and then perform an appendectomy.
- If, with the normal course of labor, there is clinical picture of gangrenous or perforated appendicitis, then it is necessary to temporarily stop the contractile activity of the uterus, perform an appendectomy and then again stimulate labor.
- In conditions of pathological childbirth, it is necessary to perform a simultaneous cesarean section and appendectomy for any clinical form of acute appendicitis.

Prevention of premature termination of pregnancy in the postoperative period.

- strict bed rest,
- administration of a 25% solution of magnesium sulfate, 5-10 ml 2 times a day intramuscularly,
- administration of tocopherol acetate at a dose of 100-150 mg per day,
- administration of proserin and hypertonic sodium chloride solution is strictly contraindicated
- Hypertensive enemas should not be used.

Acute appendicitis in old age

- preference for general anesthesia,
- laparoscopic access, Volkovich-Dyakonov incision, for peritonitis - median laparotomy,
- gentle treatment of tissues,
- Such patients should be operated on by experienced surgeons.
- In the postoperative period, dynamic monitoring of the functional state of the most important systems of the body should be carried out.

Acute appendicitis in old age

- Prevention of:
  - thrombosis and embolism,
  - cardiopulmonary failure (breathing exercises, elevated body position, early getting out of bed),
  - bedsores (pressure ulcers).

Period of temporary disability to work for acute appendicitis

Form of appendicitis	Period of temporary disability
Acute catarrhal appendicitis	16-18
Acute phlegmonous appendicitis	18-21
Acute purulent appendicitis	21-24
Acute appendicitis with perforation	26-30
Acute appendicitis with peritonitis	30-40
Chronic appendicitis (surgery)	18-20

Conclusion

- Acute appendicitis remains one of the most common surgical diseases with a mortality rate of 0.1-0.3%.
- Taking into account the anatomical features, the clinical picture of the disease can be varied.
- To make the diagnosis and carry out differential diagnosis, if necessary, all available methods should be used.
- Treatment of the disease is only surgical. The results of treatment and the outcome of the disease worsen with the progression of morphological changes in the appendix and the development of complications.

Literature

Main:

- **Surgical diseases. Textbook. In 2 volumes. Ed. Savelyeva V.S., Kirienko A.I. Moscow GEOTAR 2005**

Additional:

- **Algorithms for practical skills in general and private surgery, pediatric surgery, ophthalmology, neurosurgery, urology, oncology, otorhinolaryngology, traumatology, obstetrics. (algorithms for practical skills). / comp. A.V. Andreychikov and others - Krasnoyarsk: type. KrasSMU , 2010. - 230 p.**
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- **Belousov A.S. Diagnosis, differential diagnosis and treatment of diseases of the digestive system. Moscow, Medicine 2002**
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Thank you for your attention