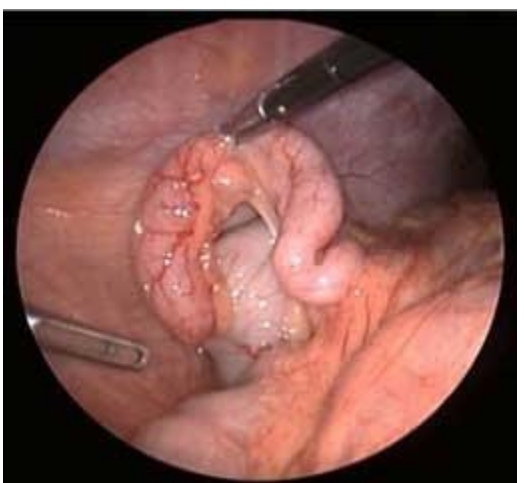
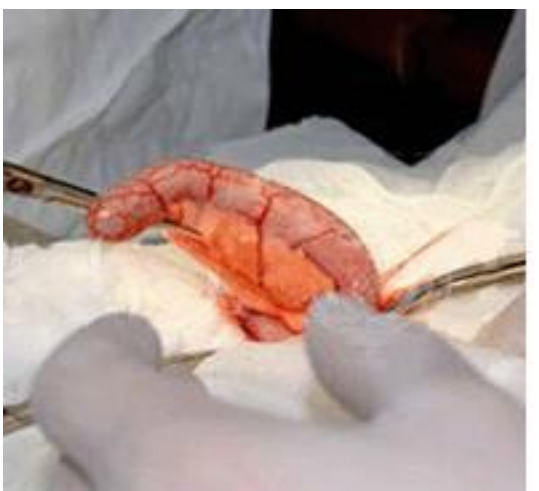
Acute appendicitis



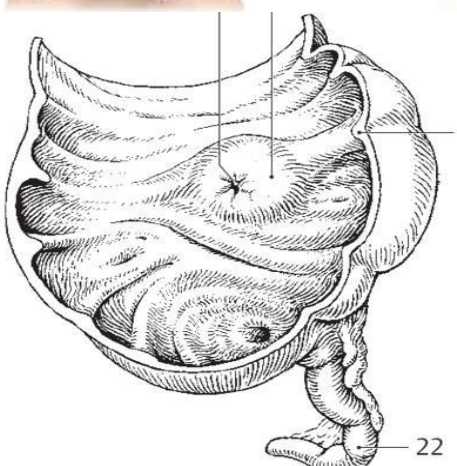


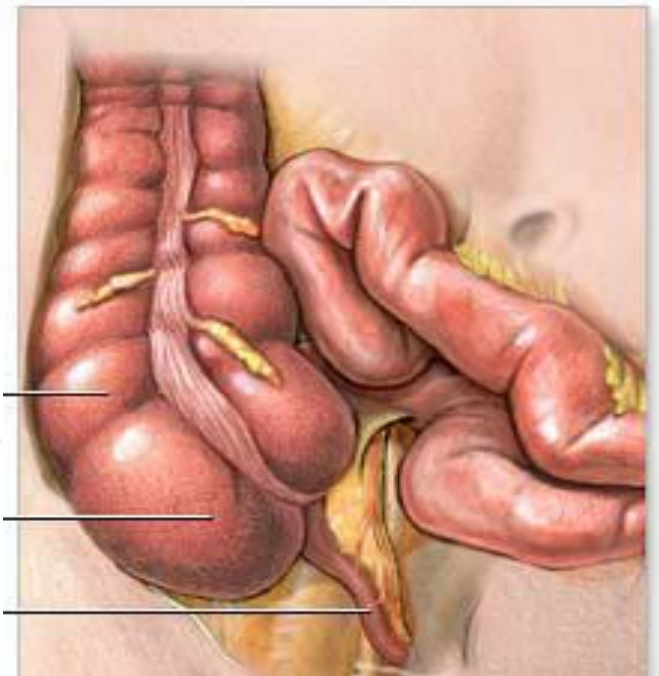
Appendicitis is defined as an inflammation of the inner lining of the vermiform appendix that spreads to its other parts.

Statistics

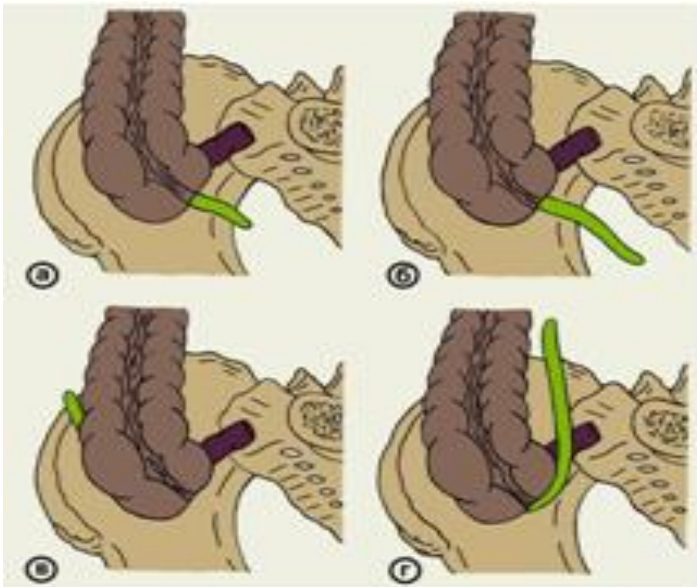
- The most frequent of the abdominal surgical pathologies.
- 4—5 cases out of 1000 persons a year.
- During the whole life 6% of the planet's population have an acute appendicitis.
- Lethality – 0,1% (1 person out of 1000 patients).
- At any age, more frequently at 10—30 years, man or woman.
- The most frequent cause of the generalized peritonitis

Anatomy





Anatomical variants



А – типичное (antecolica);

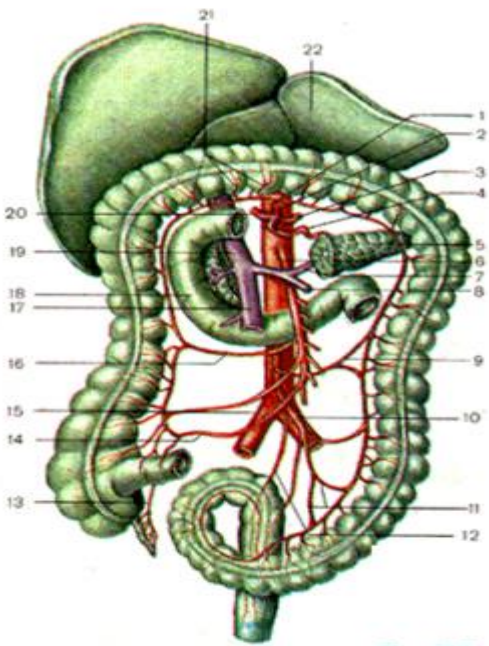
Б – тазовое;

В – ретроцекальное, ретроперитонеальное;

Г – мезоцекальное (медиальное)

NB! Localisation gives all the symptoms → appendicitis – «monkey» of all the diseases

Appendix vessels



NB! Venous flow:

v. appendicularis

↓

v. ileocolica

↓

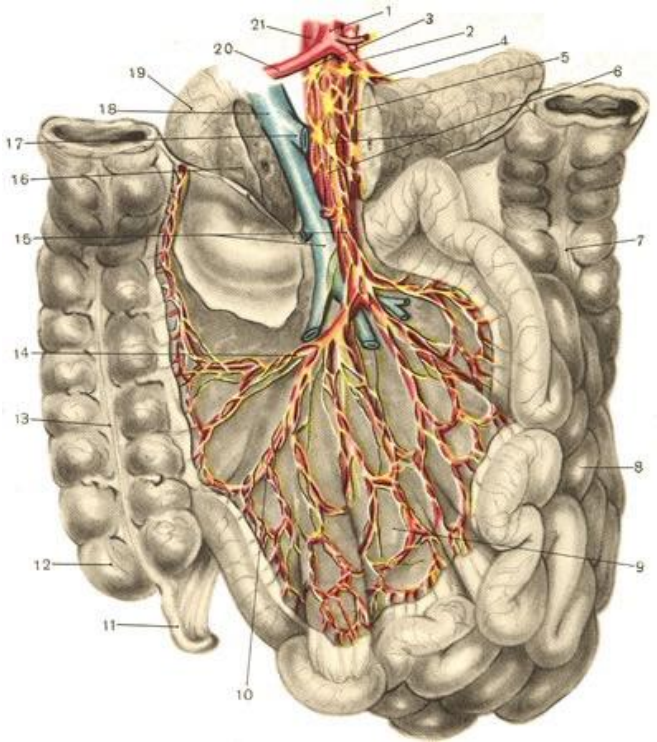
v. mesenterica superior

↓

v. portae

Portal way of the infection spread – **pilephlebitis** (fatal comlication of appendicitis)

Innervation



- sympathic system– celiac and upper mesenteric plexus
- Parasympathetic - fibers of the nervus vagus

- NB! Nociceptive (pain) afferent impulsation goes by the sympathetic fibers
- NB! Celiac plexus – server station of the sympathetic innervation of the abdominal cavity - frequently the pain begins in the epigastrium

Classification – on the stage of destructive changes

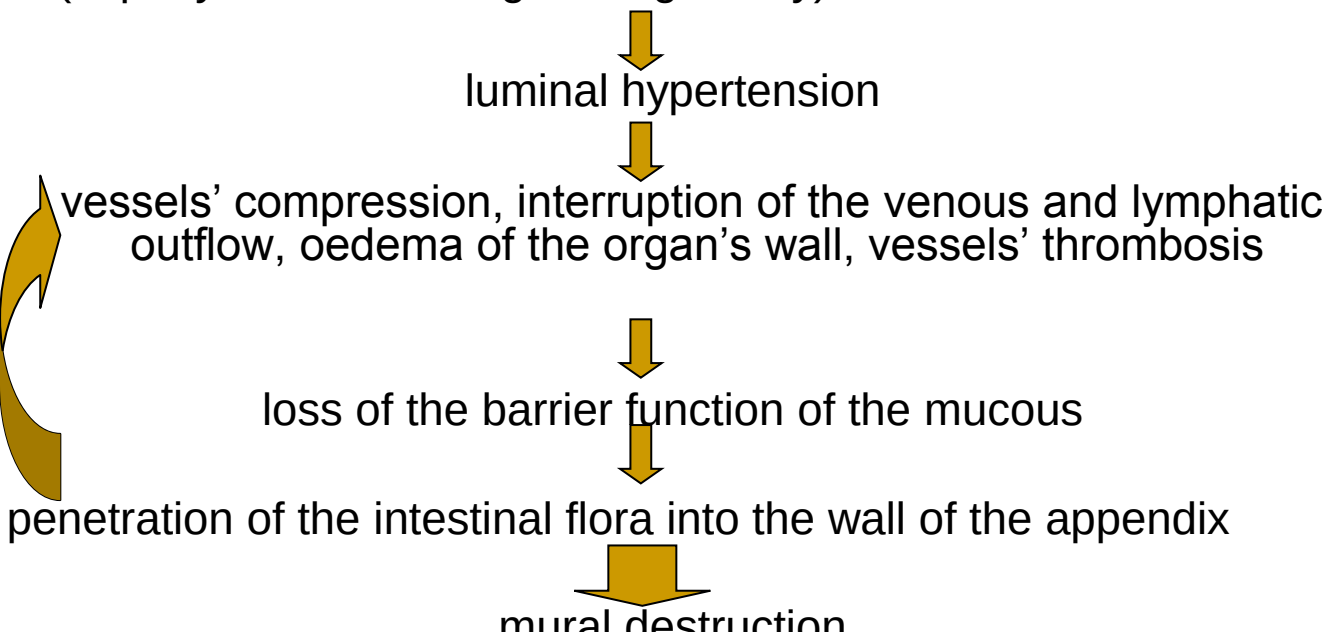
I. Acute appendicitis

1. Acute simple (catharral) appendicitis.
2. Acute destructive appendicitis:
   - Flegmonous;
   - Gangrenous;
   - Gangreno-perforative.
3. Complications of the acute appendicitis:
   - Peritonitis - localized, generalized;
   - Appendicular infiltrat;
   - Appendicular abscess;
   - Pilephlebitis;

II. **Chronic appendicitis** – result of the not operated resolved acute appendicitis.

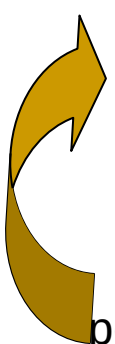
Etiology and pathogenesis

- **1. Mechanical reason** - obturation of the appendix lumen (coprolythiase, bending , foreign body)



Etiology and pathogenesis

- **2. Vascular reason**– interruption of the blood flow in the appendix' wall (appendix infarction)



Necrosis of the wall of the organ

loss of the mucous' barrier function

penetration of the intestinal flora into the appendix wall

Causes:

1. atherosclerosis, thrombosis of mesenteric vessels
2. emboly of the mesenteric vessels
3. systemic vasculitis

- NB! primitively-gangrenous (fulminant) appendicitis

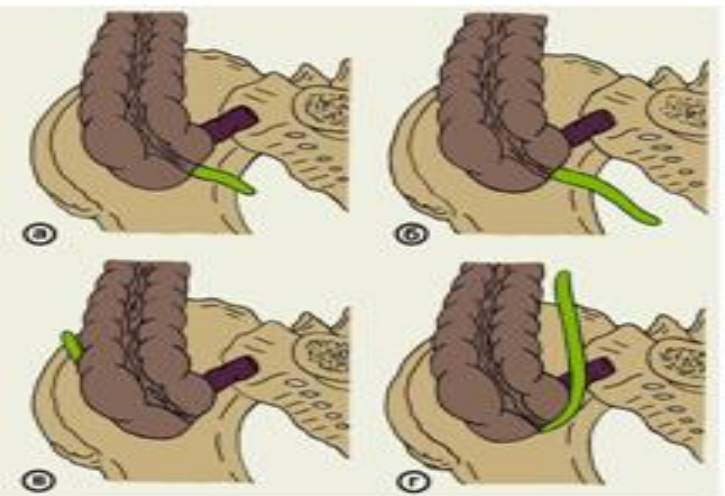
Etiology and pathogenesis

- **3. Infectious reason** – some infections (typhoid fever, yersiniosis, TB, parasite infections, amoebiase, salmonellosis) give acute appendicitis as their complications.

- **NB! In other causes (mechanical, vascular) infection is only secondary**

Symptoms

- Can vary a lot, considering anatomical variations of the appendix position



Symptoms

- **Abdominal pain** (100%) constant, moderately intensive.
- 40-50% **epigastric phase:** first pain in epigastric or ombilical region or more rarely all over the abdomen (in children), after a couple of hours the pain migrates to the right iliac region – symptom of pain migration **Kocher's-Wolkowitch's (only almost pathognomonic symptom of appendicitis)**.
- 50-60% pain right away in the right iliac region.

Symptoms

Pain irradiations

- into the perineum – if pelvic localisation;
- right lumbar region - if retroperitoneal localisation;
- right flank, right hypochondrium – if retrocecal localisation
- in mesogastrium - if median localisation

Symptoms

Anorexy 100%;

Nausea, vomitting (40-50%) 1-2 times, comes after pain, reflectory. can be absent;

NB! if nausea or vomitting before pain - not a appendicitis characteristic;

Tongue firstly wet, then dry.

NB! if dry tongue - sign of dehydration.

Клиника

Stool – no specific signs. But!

- can be liquid if pelvic (rectum's irritation) or retrocecal (right colon irritation) localisations.
- If generalized peritonitis, there is no stool because of the intestinal paralysis.

Urination is not disturbed. But!

If pelvic (irritation of the bladder) and retroperitoneal (irritation of right kidney and ureter) localisations frequent painful urination

Symptoms

Tachycardia (100%) и **hyperthermia** (≈ 40%) **-** inflammation process' consequence

- Catharral appendicitis ≈ up to 90 t ≈ 37,0 – 37,5
- Flegmonous ≈ до 110 t ≈ 37,5 – 38,5
- Gangrenous ≈ > 110 t ≈ 38,5 and >

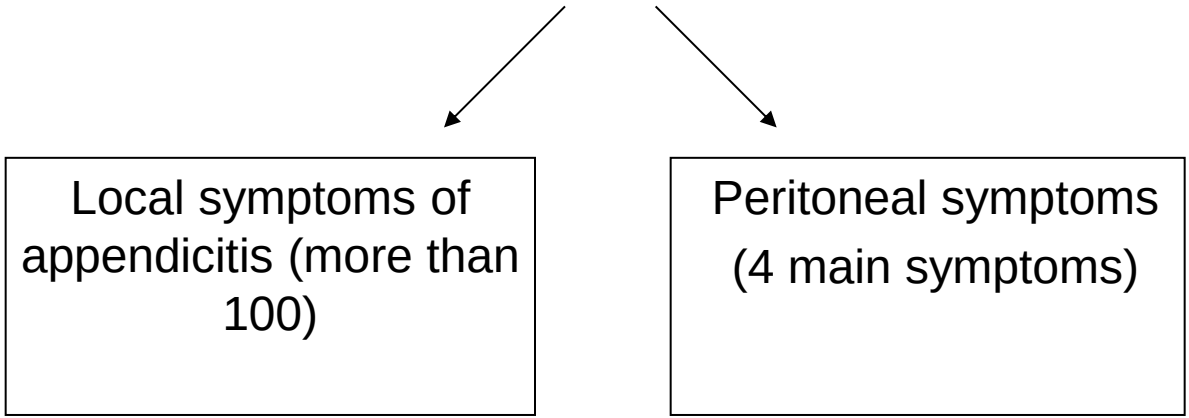
NB! Tachycardia – intoxication sign

NB! normally if 1 degree elevation, 10 heart beats elevation

Hyperthermia is not constant and can be absent in elderly patients

NB! if not adequation of heart rate and body temperature (tachycardia if normal t) – first toxic scissors

Symptoms:



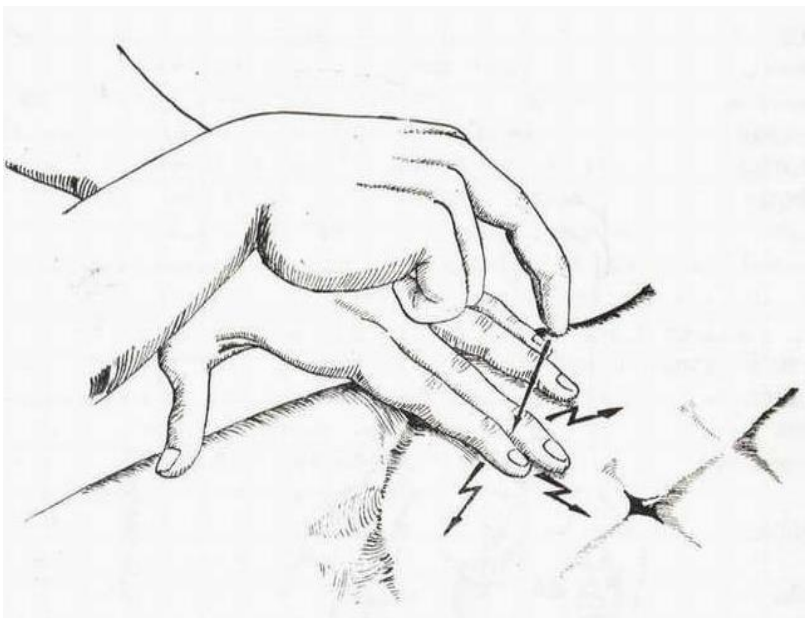
NB! Peritoneal symptoms – universal symptoms of peritoneal irritation.
There is a lesson about peritonitis .

Peritoneal symptoms

- 1. Woskresensky symptom – pain (skin hyperestesia) above the pathological source during fast sliding hand movements on the abdominal wall.
- Segmentary body innervation
- Lines of Gued

Peritoneal symptoms

2. Razdolsky's symptom – pain during percussion of the anterior abdominal wall



Peritoneal symptoms

3. Blumberg's symptom - The abdominal wall is compressed slowly and then rapidly released. A positive sign is indicated by presence of pain upon removal of pressure on the abdominal wall.

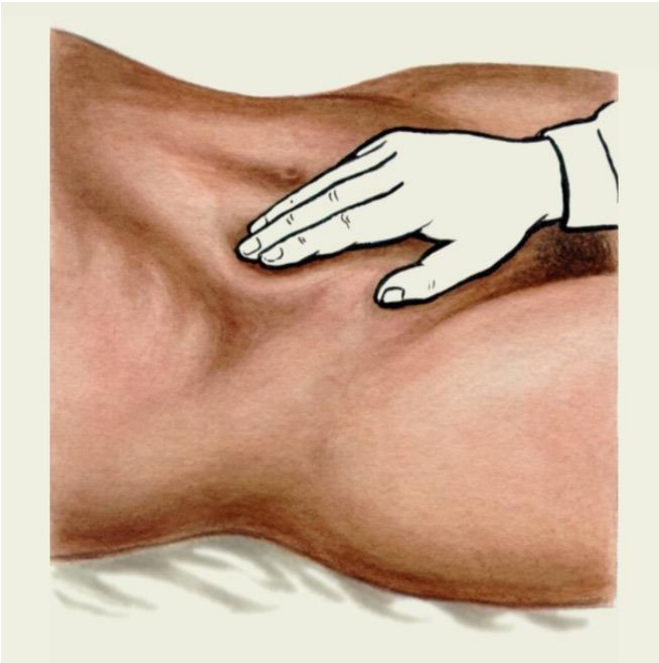
Peritoneal symptoms

4. Anterior abdominal wall's muscular guarding (defense musculaire)

The main peritoneal symptom

Maximal expression – desk-like abdomen

can be absent in multipares, in overwight, in elderly patients



Local symptoms

- NB! No pathognomonic signs

1. Kokher-Wolkowitch's sign – see before – **only one almost pathognomonic**.

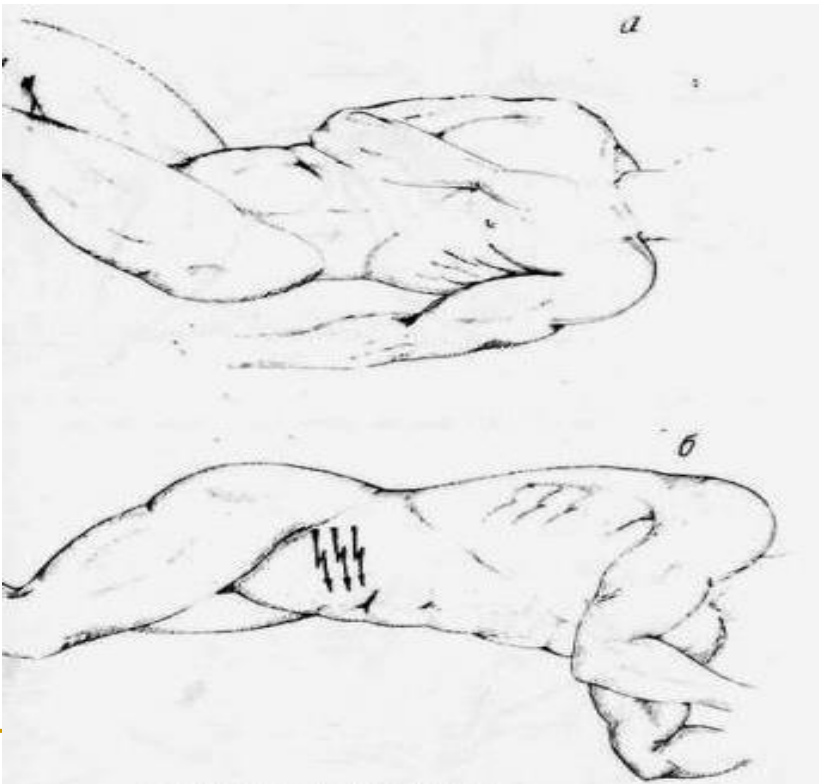
But! Can be simulated if perforative gastroduodenal ulcer

Local symptoms

2. Rovsing's symptom

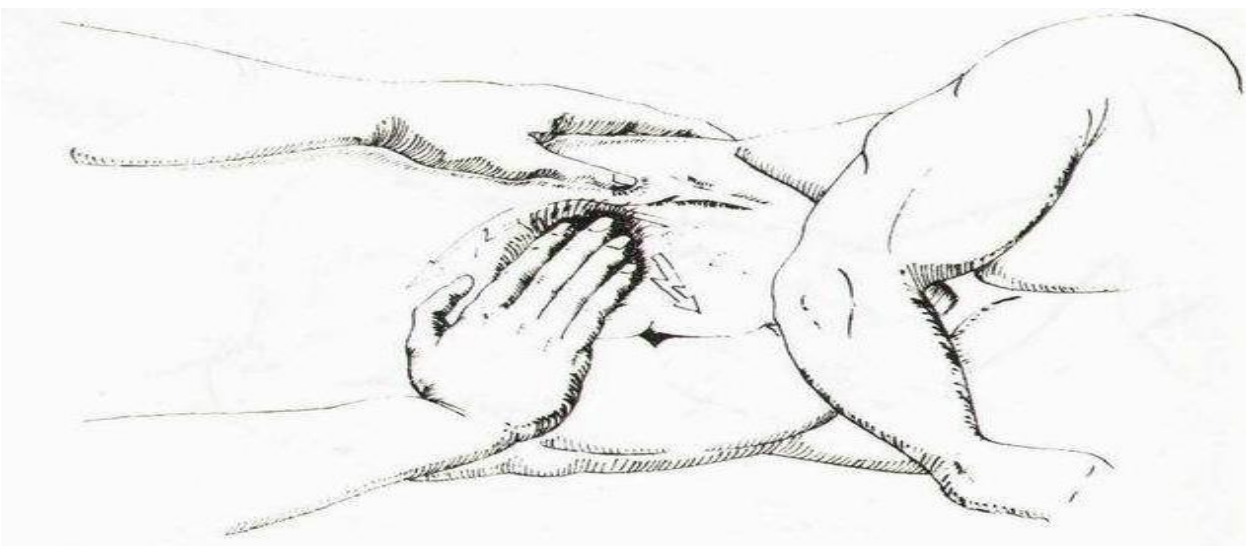
Local symptoms

3. Sitkowsky's symptom



Local symptoms

4. Bartomier-Mickelson symptom

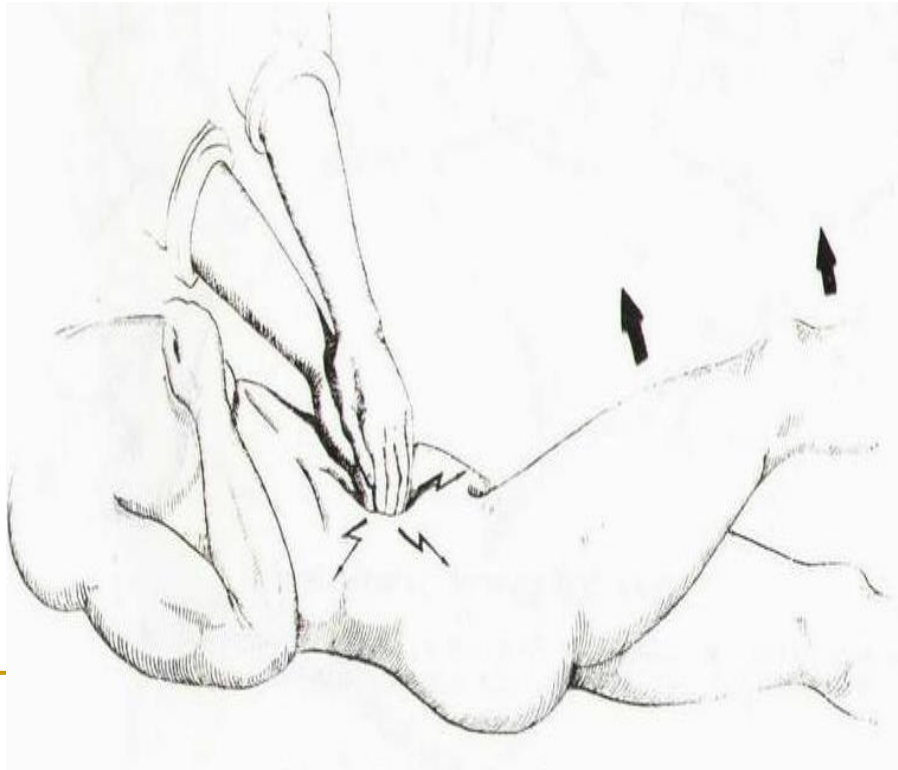


Local symptoms

- 5. Krymov's symptom– pain in right iliac region during finger examination of the external opening of the inguinal canal;
- 6. Dumbadze's symptom – pain if ombilical palpation.
- 7. Yaure-Rosanoff's symptom — pain if finger pression in the Petit's triangle (if retroperitoneal localisation of the appendix).
- 8. Gabay's symptom – positive Blumberg's symptom in the Petit's triangle (if retroperitoneal localisation).

Local psoas symptoms

9. Obrastsov's symptom – pain increasing during pressure on the caecum and in the same time raising straightened in the knee leg



Local psoas symptoms

10. Ostrovsky's symptom – the patient raises his straighned right leg. The surgeon quickly unbends it and puts it horizontally. Pain in the right iliac region.
11. Koul's symptom 1 – presence of pain in ileocecal region if unbending of right hip.
12. Koul's symptom 2 – increasing of the right iliac pain if right hip rotation (if pelvic localisation).

Laboratory diagnosis

- Leucocytosis with neutrophilic shift (PNN) increase.

Increases if process' progression

NB! Leucocytosis doesn't have its own meaning.

NB! normal or decreased leucocytes count with PNN – 2 toxic scissors (if hypoallergic immune response, inclusing elderly patients; if toxic and terminal stages of peritonitis)

Always look at the leucocytes formula

laboratory diagnosis

- Urine analysis – no specific changes But!

Important meaning:

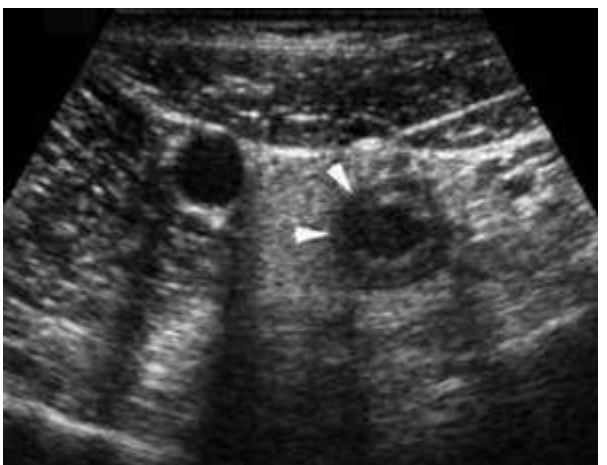
1. if retroperitoneal or pelvic localisation of appendix (hematurea, leucocyturea);
2. in differential diagnosis of the urinary tract pathology.

Instrumental diagnosis

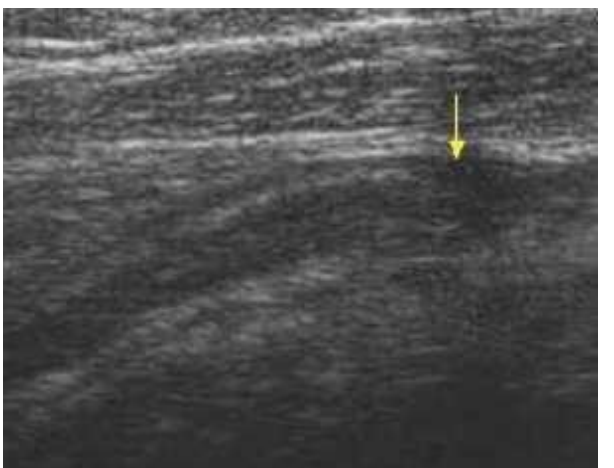
1. Palpation, percussion, auscutation.
2. PR if men PV if women – «Douglasses cry» (effusion), differential diagnosis with internal sexual organs pathology in women

Instrumental diagnosis

3. US – effective and not expensive method that doesn't have a big popularity in our region yet



local mural lesioins of the appendix (local loss of the sub-mucous echogenous layer), that shows the transmural lesion.

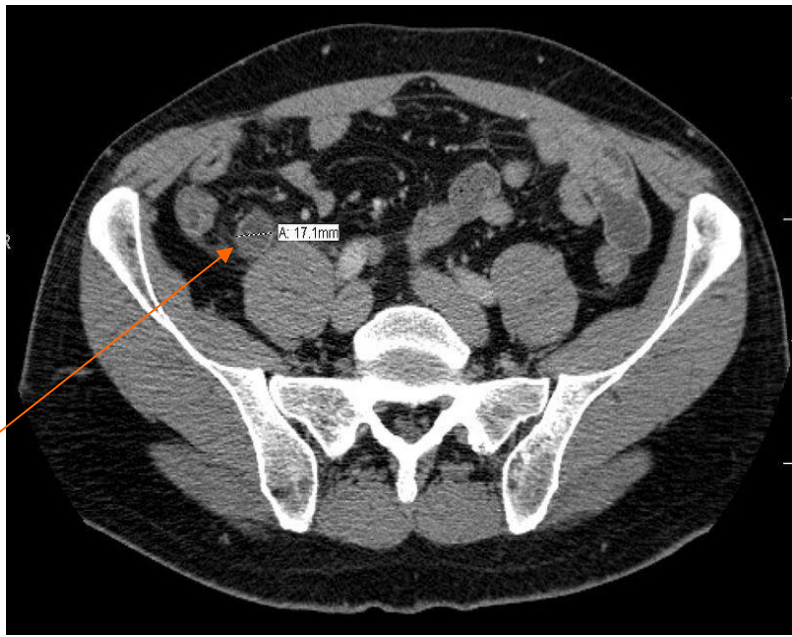


difficulty in determination of the top of the appendix (blurred contours and loss of echogenous sub-mucous layer

Instrumental diagnosis

4. Computer tomography - highly effective method, but expensive and though not highly popular in our region.

Thickened appendix



Instrumental diagnosis

5. Laparoscopy – invasive method, that allows to visualise the abdominal cavity, evaluate the appendix condition and to treat the appendicitis surgically.

Differential diagnosis

- Appendicitis – monkey of all diseases.

NB! Well constructed anamnesis – 50% of diagnosis.

1. pathology of right kidney and ureter;
2. intestinal infection;
3. genital pathology (in women);
4. acute pancreatitis;
5. covered gastroduodenal perforation;
6. Crohn's disease;
7. Meckel's diverticulitis;
8. Acute gastritis.

Differential diagnosis

Pathology of right kidney and ureter (kidney colic, pyelonephritis):

- pain in the right lumbar region with the irradiation to the right half of the abdomen;
- Sometimes nausea, vomiting;
- Changes in the urine: hematurie if kidney colic, leucocytes and bacteries if pyelonephritis;
- Intoxication in pyelonephritis;
- Not treated and not resolved kidney colic → obturated pyelonephritis.
- US!

Differential diagnosis

Intestinal infection (alimentary toxicoinfection):

- Flagrant onset;
- Multiple vomiting;
- Frequent liquid stool;
- Quickly intoxication (hyperthermia!) and dehydration;
- Pain, sometimes contractory (salmonellous triangle)
- Anamnesis!

Differential diagnosis

Genital pathology in women (very difficult):

1. Adnexitis – inflammatory signs, simulaiton of the appendicitis symptoms + vaginal discharge.
2. disturbed tubal pregnancy, ovary apoplexy (hemorragic form), broken ovary cyst – and also blood loss signs.
3. Ovary apoplexy (painful form) – middl of the cycle, only pain without blood loss signs.

NB! every woman with appendicitis suspicion should be seen by a gynecologist.

Differential diagnosis

Acute pancreatitis – strong, frequently belting pain in superior regions of the abdomen, multiple vomiting.

Sometimes epigastric phase of acute appendicitis is falsely taken for an acute pancreatitis

Covered gastroduodenal perforation – a little quantity of effusion in the superior regions give epigastric pain, then goes to the right iliac region – simulation of the Kokher-Wolkowitch symptom.

Differential diagnosis

Crohn's disease in its acute form is almost identical to the acute appendicitis symptomatology.

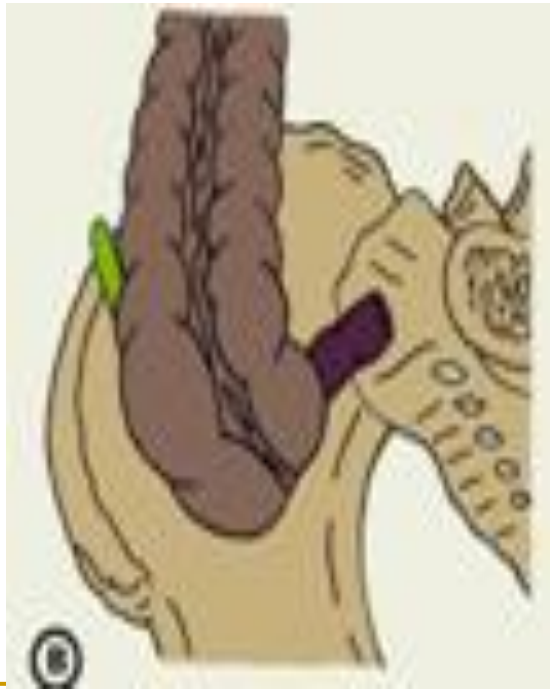
Meckel's diverticulitis – identical symptoms

Acute gastritis – can simulate the epigastric phase of acute appendicitis

NB! Epigastric phase's lenght - 2-3 hours, max 1 day.

Retrocecal (retroperitoneal) acute appendicitis (5-7%)

- Pain in the right lumbar region.
- Dysuria (irritation of the ureter, lidney).
- liquid stool (irritation of the caecum, right colon).
- Urine analysis – hematuria, leucocyturia.
- Blood analysis – lucocytosis with PNN increased
- Psoas-symptoms, s. of Gabay, s. Yaure-Rosanoff's

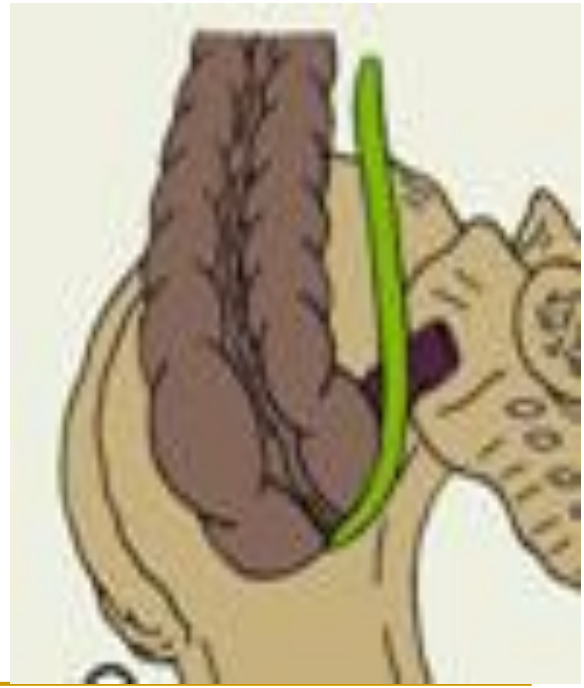


Pelvic acute appendicitis (16-30%)

- Pubic pain with perineum irradiation
- Dysuria (bladder's irritation)
- Liquid stool (rectum irritation)
- Urine analysis – hematuria, leucocyturia.
- Blood analysis – leucocytosis with PNN increase
- Koup's symptom 2, PR, PV

Sub hepatic localisation (rare)

- right hypochondrium pain simulating acute cholecystitis pain
- US



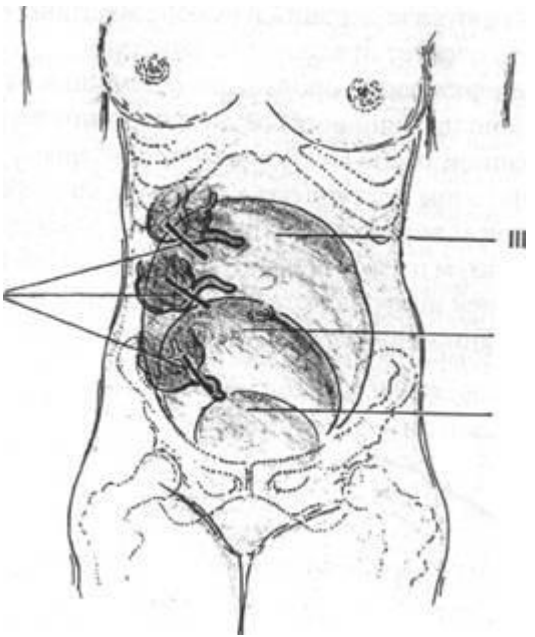
Left appendix localisation (rare)

1. situs viscerum inversus;
2. caecum mobile.

Acute appendicitis symptoms on the left side

Acute appendicitis in pregnant women (1%)

- pregnant uterus moves the caecum and appendix up;
- Pain is not expressed;
- no expression of local symptoms (uterus covers the caecum);
- No expression of the peritoneal symptoms (over extension of the anterior abdominal wall).



Acute appendicitis in pregnant women (1%)

- one of the difficult diagnostic problems:

1. Possibility of the physiological pain векcase of the ligament system of the uterus extension and its hypertonus;
2. possibility of the pregnancy dyspepsia (nausea, vomiting, stool problems);
3. possibility of the physiological luecocytosis;
4. atypical symptoms, especially during the second half of the pregnancy.
5. impossibility of the laparoscopy during late pregnancy period.
6. anamnesis, US, exclude pyelonephritis and the risk of the pregnancy interruption.

Acute appendicitis in children

- Particularities of children organism

1. Hyperergic response – fulminant symptoms;
2. Short big omentum – no limitations;
3. the child can not sometimes well relate the anamnesis.

Acute appendicitis in children

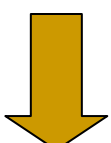
- Symptom's particularities

1. pain can be not localized, contraction-like;
2. Multiple vomiting;
3. Frequent stool;
4. Quickly febrile hyperthermia;
5. Quickly fast leucocytosis;
6. Symptom of the leg lifting;
7. Symptom of the surgeon's hand repulsion;

Acute appendicitis in elderly patients

- Particularities of the elderly patients' organism

1. Hypoergic response, reduced symptoms;
2. Atherosclerosis of the vessels – fast ischemia and necrosis (primarily-gangrenous appendicitis);
3. Diabetes mellitus – fast destruction.



Abundance of the complicated appendicitis forms

Acute appendicitis in elderly patients

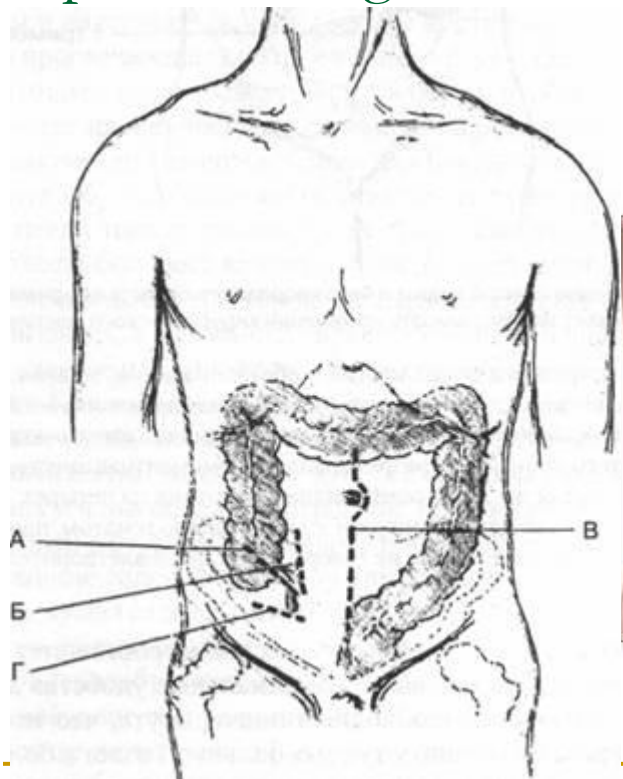
- Symptoms particularities

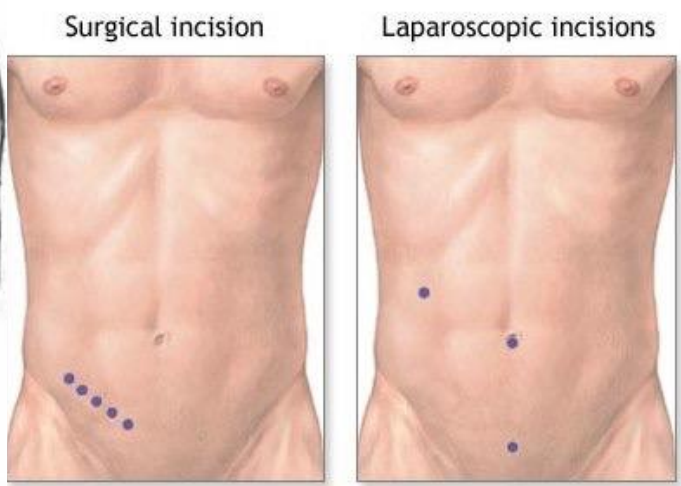
1. Reduced pain syndrom;
2. Reduces local and peritoneal symptoms;
3. First and second toxic scissors.

Treatment

- Hospitalisation in surgery department.
- If diagnosis not clear (table 0, IV, once intramuscular spasmolytic (но-шпа, папаверин).
- Without positive dynamics during 2 hours (laparoscopy or laparotomy).
- If diagnosis acute appendicitis is established, it is an absolute surgery indication.
- contraindication –agonic patient's condition.
- pain-killers – general anesthesia

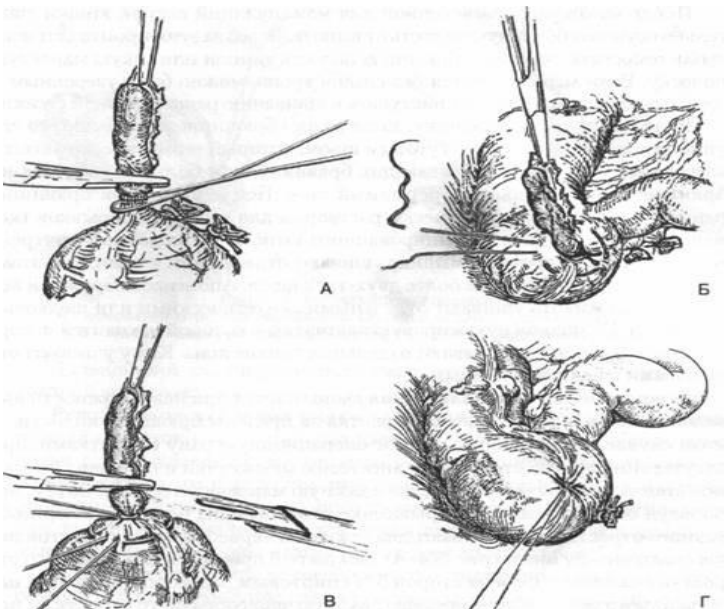
Operation stages



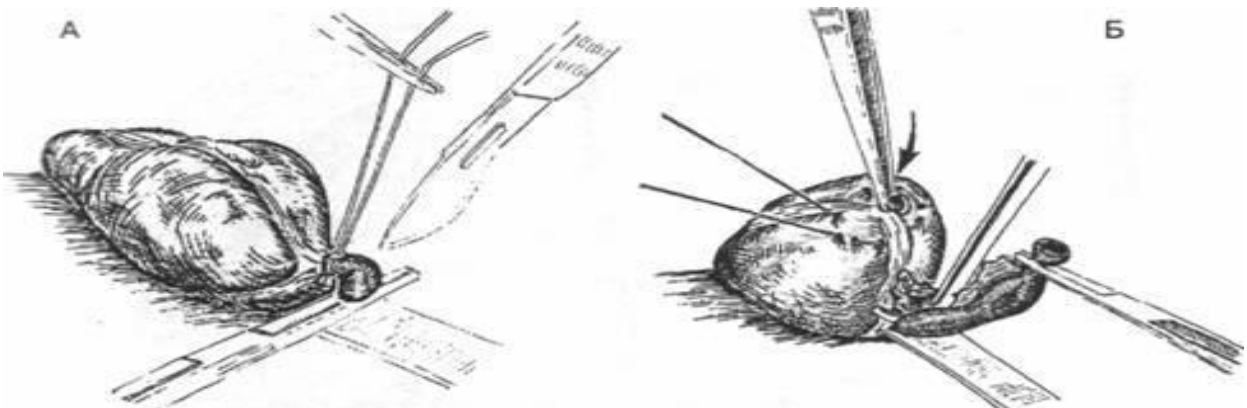


Operations stages

- Standard (anterograde) appendectomy



Operation stages



- Retrograde appendectomy

Operation features

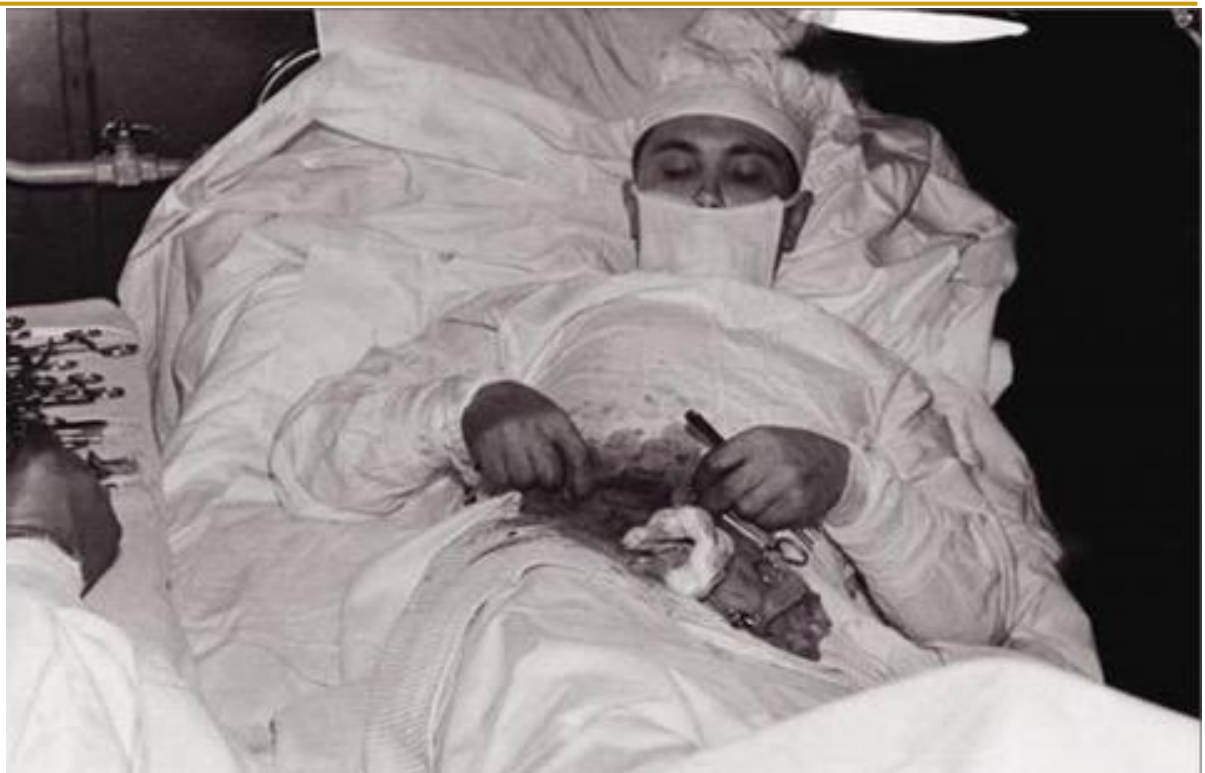
- In pregnant women - incision higher with the pregnancy length.
- In children– ligature method without purse-string and Z-stitches (thin wall of the caecum, riskof the ileocaecalis involvement in the stitches).
- If laparoscopy – only ligature method.

Open appendectomy

Laparoscopic appendectomy

- Conditions

1. Presence of necessary mechanisms (endosurgical stand);
2. Surgeon’s preparation;
3. Possibility of the laparoscopy (not in every case)



- Russian surgeon L.I. Rogozov have done an appendectomy on himself in Antarctic in 1961

Complications' classification

I. Early:

1. Before the operation:

- Appendicular infiltat;
- Appendicular abscess;
- Peritonitis - local, generalized;
- retroperitoneal flegmona (if retroperitoneal localisation)
- pylephlebitis.

2. Post-surgical complications:

- Intraperitoneal hemorrage;
- failure of the appendix stump;
- Local infiltrat and abscess of the peritoneal cavity;
- suoouration of the wound;
- post-surgical peritonitis (tertiary peritonitis);
- Intestinal paralysis;
- early adhesive intestinal blockage.

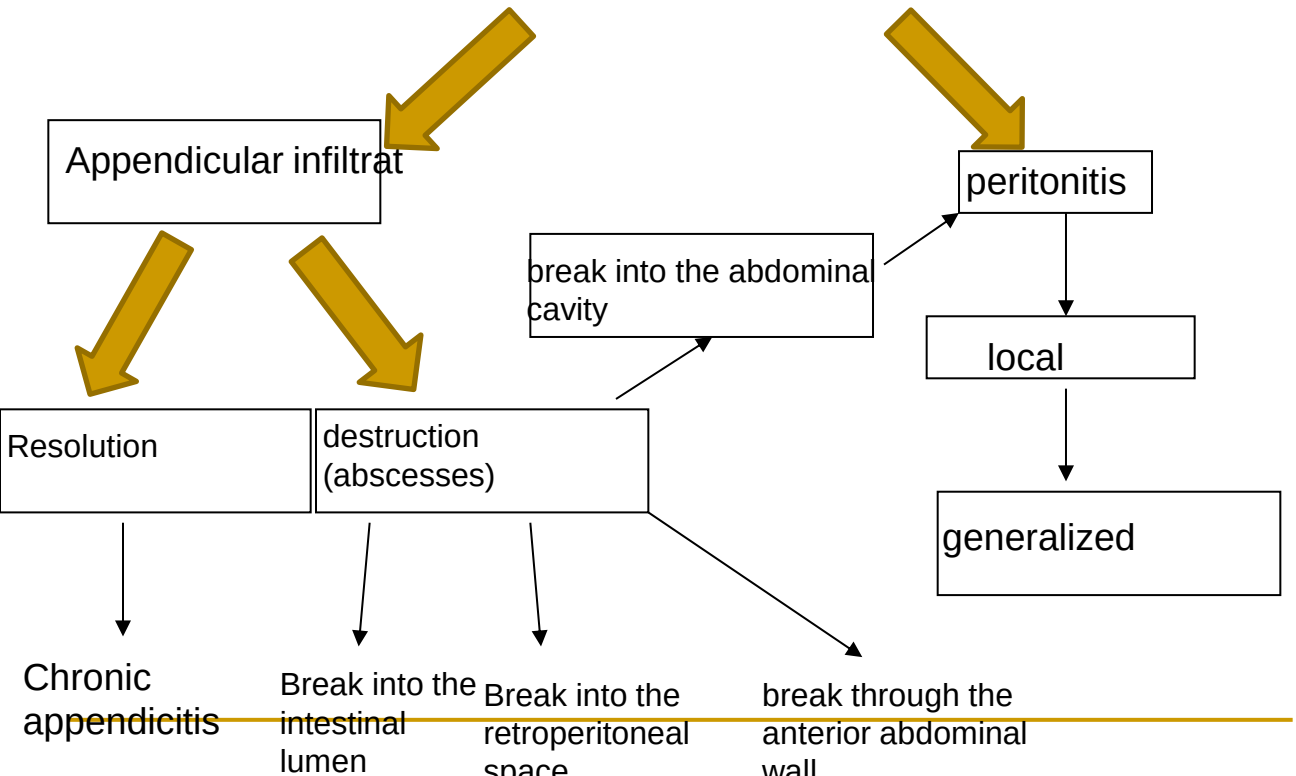
II. Late:

- Ligature fistulas;
- Adhesive intestinal blockage;
- Post-surgical ventral hernia.

III. Involving other systems and organs:

- Pneumonia, pleuritis, lung abscess;
- Myocardial infarction, acute failure of brain circulation.
- Thrombosis of the deep veines of the shin, lung emboly

Progression of not-operated appendicitis



Appendicular infiltrat (1-3%)

- Inflammatory tumor, Inflammatory tumor, conglomerate of losely fixed to one another tissues around the appendix with participation of parietal peritoneum, big omentum, caecum, small intestin.

- Infiltrat – limitation, protection reaction in order to limitate the inflammation

1. Formation (loose) of infiltrat – 3-4 days;
2. Formed (dense) infiltrat – after 5 days.

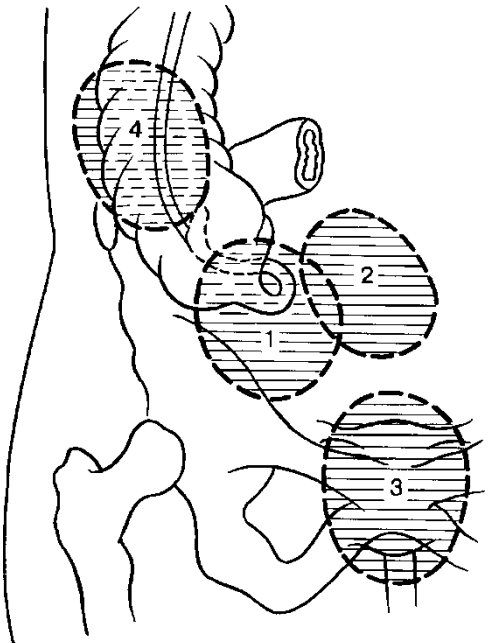
Appendicular infiltrat

Symptoms:

- Less abdominal pain;
- Better general patient's condition;
- Dense, not painful, fixed formation in the right iliac region,
- Infiltrate's size can vary a lot, can occupy all the right iliac region;
- There can be positive local symptoms and peritoneal symptoms - negative;
- Mild leucocytosis with PNN, sub febrile body temperature

Appendicular infiltrat

NB! it's localisaiton (abscess) depends on the initial appendix' localisation, it can be localized in the pelvis, in mesogastrium, in sub hepatic space.



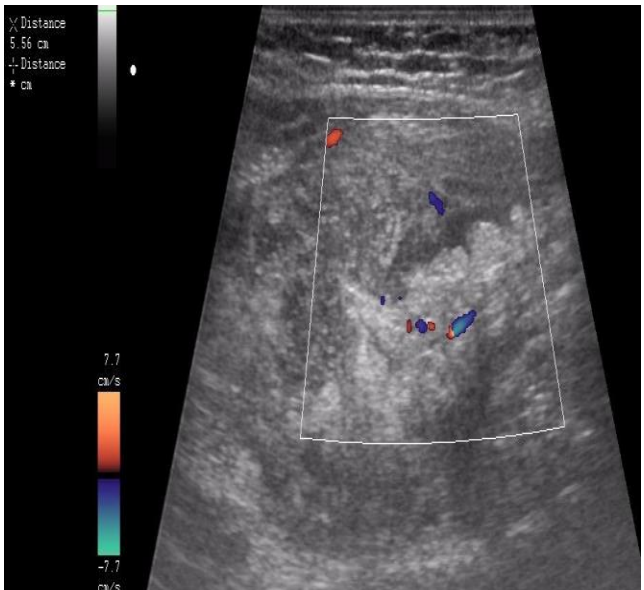
Appendicular infiltrat

Diagnosis:

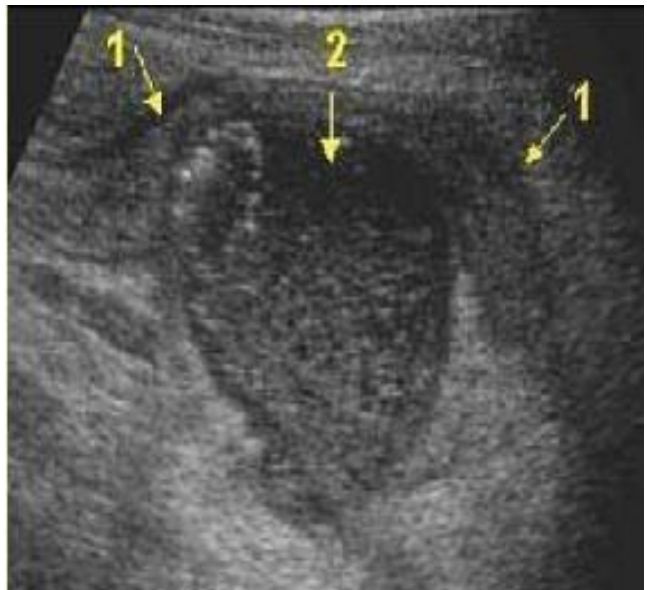
1. Disease's anamnesis (reduced symptoms in elderly);
2. US;
3. CT

Differential diagnosis: cecal tumor (especially in elderly)

US diagnosis



Appendicular infiltrat



Appendicular abscess

Appendicular infiltrat

Conservative treatment

1. Table 0 with IV infusions 30 ml/kg, then 1A;
2. Cold on abdomen;
3. Bed regimen;
4. Antibacterial therapy;
5. Physical treatment on the infiltrat region
6. No surgical indication (risk of organs participating in infiltrat damage)

Appendicular infiltrat

Results:

1. Resolution: pain decreases, infiltrat resorbs, temperature normalizes → discharge with planned hospitalisation in 3 month for a planned appendectomy
2. abscess → operation

Pain increase

Hyperthermia

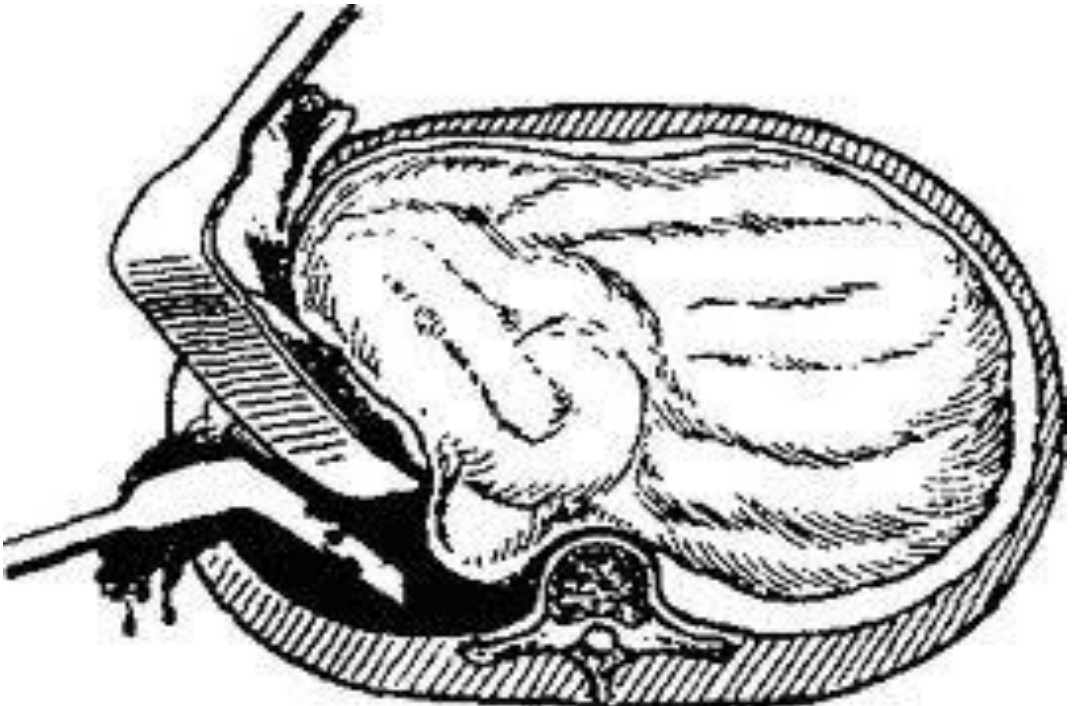
Leucocytosis

} even if one of these sign

Interventions variants

- Wolkowitch-Diakonov's Laparotomy
- Pirogov's method (extraperitoneal);
- Punction drainage under US control;
- Laparoscopy (risk!).
- No obligation of appendectomy, appendix can be removed if well visualised Risk of organ damage (organs that participate in the pyogenic capsule)

Pirogov's method



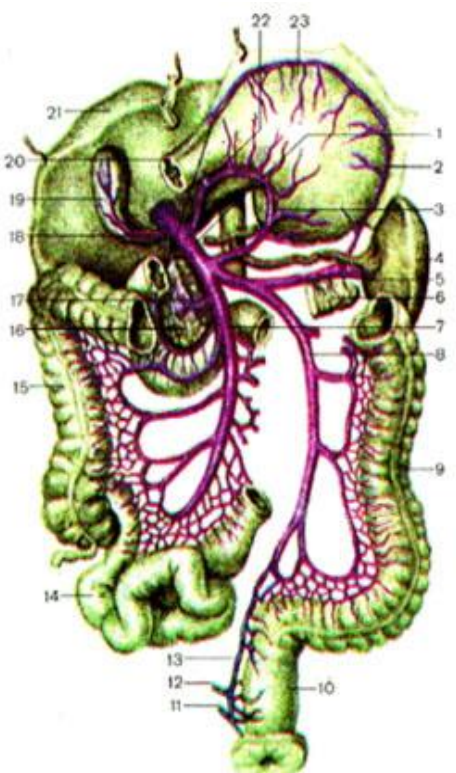
Laparoscopy

- video

Pilephlebitis

Septic thrombophlebitis of the portal veine – rare, but fatal.

- Necrotic prosess that invades appendix mesentery and its vessels.
- then invasion of the vessels of the ileocecal angle.
- in 2-3 days goes to the portal veine and hepatic veines
- then retrograde invasion of the splenic and other mesenteric veines.



Пилефлебит

Клиника:

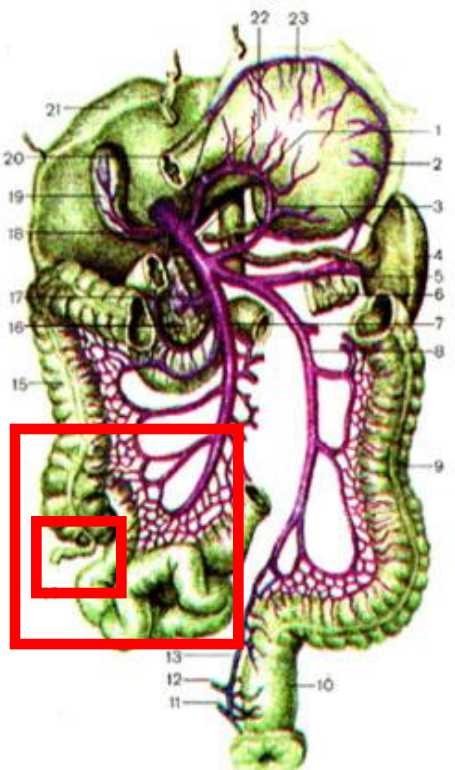
1. Бурно развивающаяся картина системной воспалительной реакции (фебрильная гипертермия);
2. Усиление боли в животе (правая половина);
3. Желтуха;
4. Гепатоспленомегалия;
5. Асцит;
6. Прогрессирующая печеночно-почечная недостаточность.

} портальная гипертензия

Pilephlebitis

- Treatment:

1. Maximal section of the appendix mesentery;
2. ligature v. ileocolica;
3. resection of the ileocecal angle;
4. Massive antibacterial therapy;
5. Masive infusion-detox therapy;



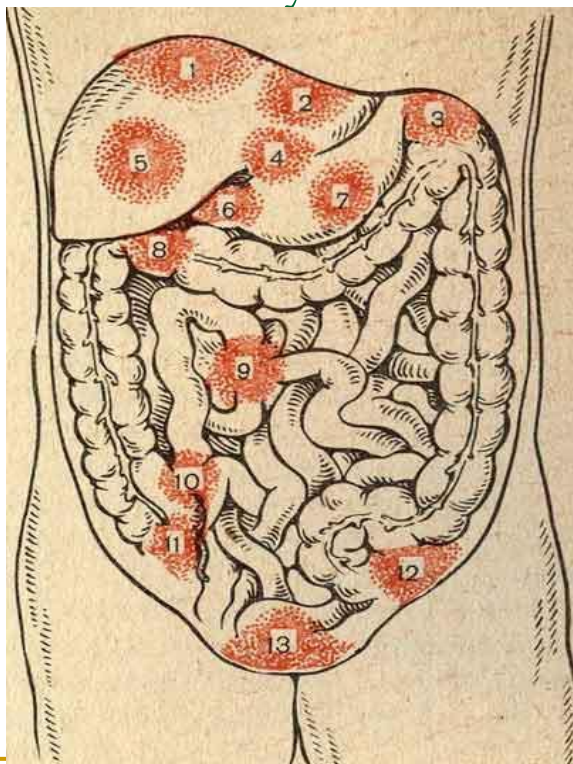
Abscesses of the abdominal cavity

- Appendicitis complication after surgery;
- Universal complication;
- Reasons:

1. Not adequate sanation of the abdominal cavity;
2. suppuration of hematomas after not adequate hemostasis;

- Typical localisation:

- pelvic (Douglass' space);
- iliac;
- between loops;
- sub hepatic;
- subphrenic.



General signs of the abdominal abscesses

- Clear laps of time – better general condition after operation then progressive symptoms with 7-8 day pic:

1. Growing hyperthermia

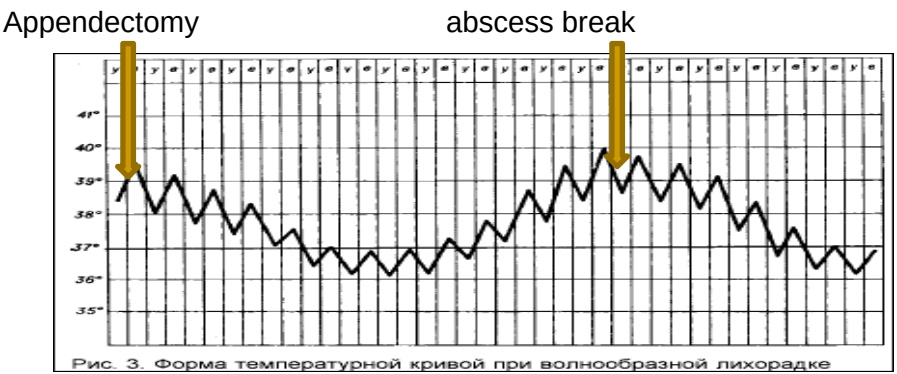


Рис. 3. Форма температурной кривой при волнообразной лихорадке

CCBP

SIRS

2. Progressive dehydration;
3. Leucocytosis with PNN growth;
4. Infiltrat's palpation (not always);
5. Local abscess symptoms.

Local clinic of the abdominal abscess

Douglass' abscess:

1. Pubic pain with perineum irradiation;
2. Dysuria (bladder's irritation);
3. tenesms (rectum's irritation).

Intestinal abscess:

1. pain in mesogastrium;
2. frequent liquid stool (small intestins irritation);

Subhepatic abscess:

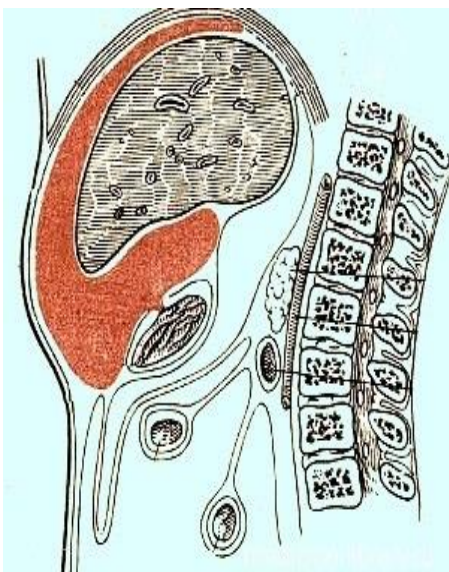
1. Pain in right hypochondrium;
2. Cholecystitis symptoms (Кера, Ортнера, Мерфи, Мюсси)
3. Frequent liquid stool (colon's irritation);

Local clinic of the abdominal abscess

Subhepatic abscess – the most difficult diagnostically and for the therapy

Classificaiton:

1. right-side, left-side, median;
2. one side, both side;
3. anterior, posterior;
4. superior, inferior.



Local symptoms of the abdominal abscess

Symptoms of the sb phrenic abscess

1. inferior thoracic region pain with shoulder irradiation (c. Мюсси, Элекера);
2. Senator's syndrom – body's rigidness;
3. thorax is late for the breathing;
4. pleural effusion signs;
5. inferior lobe pneumonia
6. Signs of SIRS (sometimes the only symptom).

One of the reasons – sucking action of the diaphragm.

Law: after operation the patient must be with raised head position (Fowler's position). Douglass' abscess is less difficult to treat than sub phrenic.

Retrouperitoneal flegmona

1. Right lumbar pain;
2. Irradiation to the right half of the abdomen;
3. Positive psoas symptoms;
4. softness of the tissues in the lumbar region (possible);
5. dysuria;
6. Changes in urine analysis;
7. Signs of SIRS – hyperthermy, leucocytosis, etc.

Diagnosis

- US – method of choice;
- CT – method of choice;
- X-rays (for sub phrenic abscess);
- PR! (Douglass);
- White blood (leucocytes elevation).

NB! abscess' localisation depends on the appendix localisation.

Surgical treatment

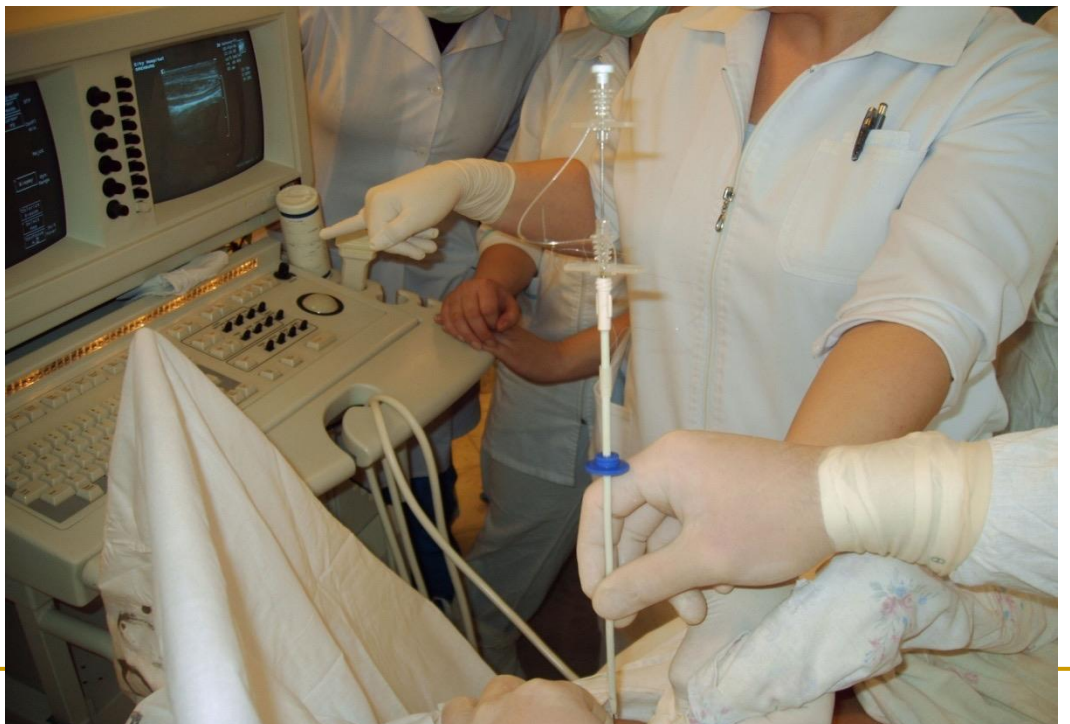
- Laparotomy;
- laparoscopy (risk);
- Punction drainage under US control (method of выбchoiceора);
- Pelvic abscess – transvaginally or transrectally;
- Sub phrenic abscess – Clermond's method; transthoracic acces (transpleural, extrapleural) – anachronism.

Punction drainage under US control

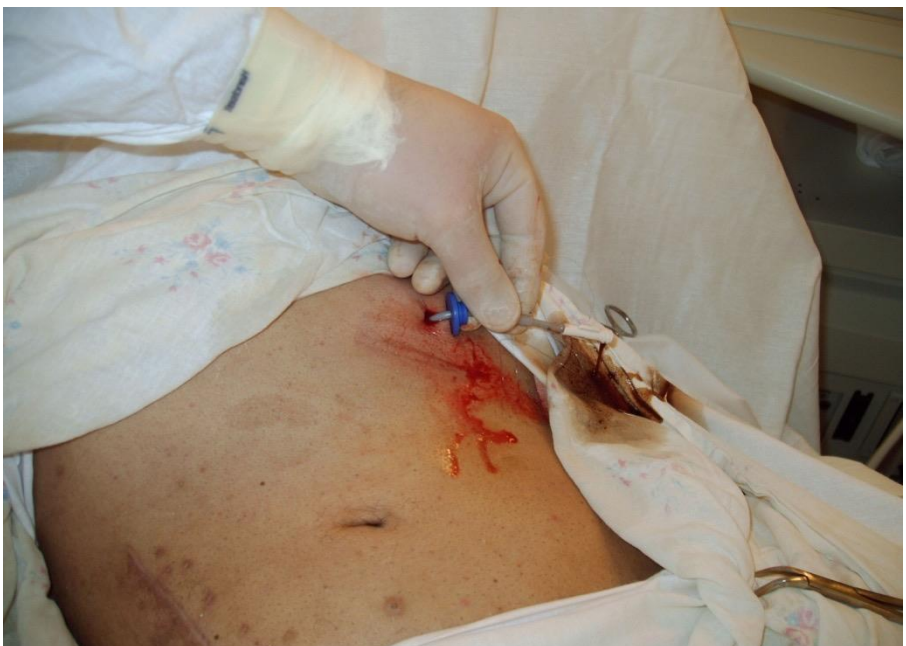
- Video
- Features:

1. Effectiveness 60-70%;
2. if no positive dynamics for 2-3 days laparotomy;
3. Risk of organs damage.

Punction drainage under US control



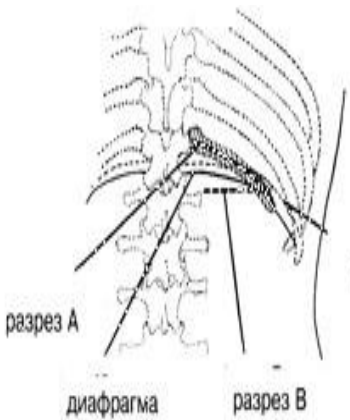
Punction drainage under US control

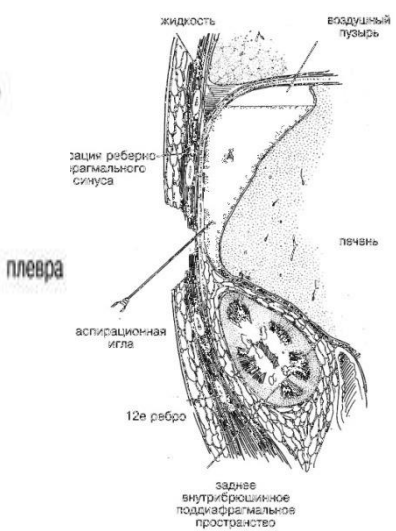


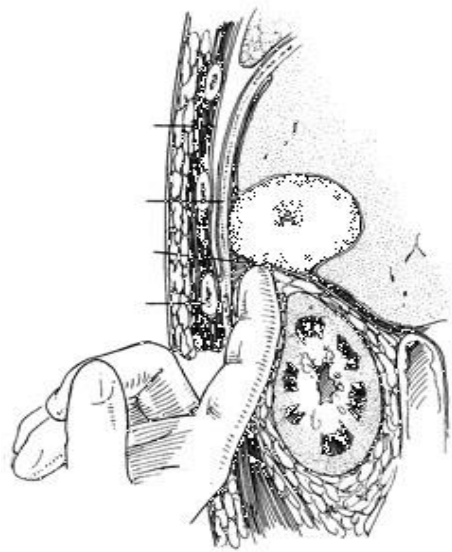
Clermond's method

Accessible for the anterior abscesses

Transthoracic methods







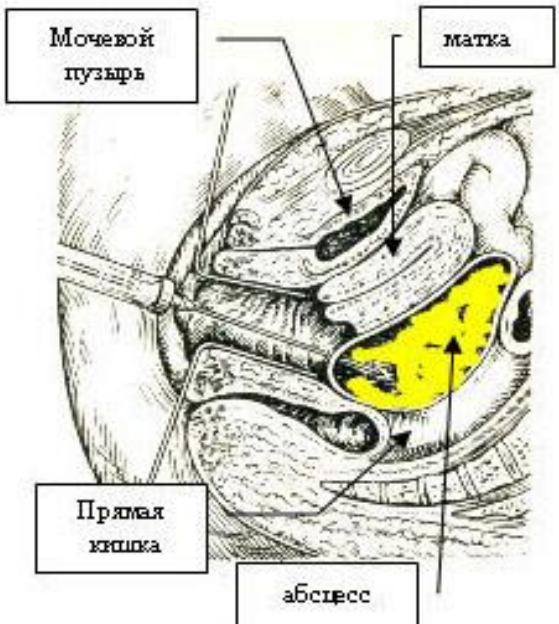
Variants

1.Transpleural acces in one or two times (VIII-IX costs);

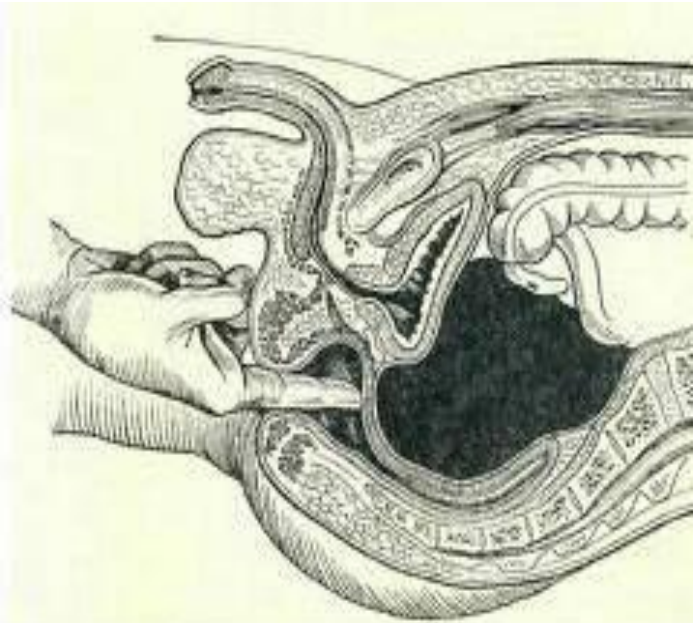
2.Extrapleural acces (X-XI cost).

Possible during posterior abscesses

Section of the pelvic abscess



vaginal access



rectal access

intraperitoneal hemorrage

- Causes:

1. ligature's slipping
2. abdominal organ's damage during revision (omentum, intestinal mesentery, liver, spleen).

- symptoms (during the first hours and depends on blood loss abundance):

1. General blood loss signs (skin palour, hypotony, tachycardia, diziness, weakness);
2. frequent signs of the intraabdominal hemorrage (increasing pain in the abdomen during palpation, c. Куленкампфа).

- Diagnosis:

1. Blood analysis – Hb decrease, Ht, erythrocytes;
2. US – free liquid in the abdominal cavity.

- Strategy – urgent median relaparotomy, blood loss stop.
- Prophylaxy – attentive hemostase and its control during the primary operation

Insufficiency of the appendix stump

- causes:

1. defects of the operative technique;
2. Tiphlitis (inflammation of the caecum's wall).

- Symptoms (from 3-4 days), process can be limited (abscess formaiton) and generalized (peritonitis):

1. Increasing pain and its generalization;
2. Peritoneal symptoms;
3. SIRS.

- Strategy – relaparotomy, punction drainage (if abscess).

Suppuration of the wound

- cause:

1. operation technique violation (trauma, unsufficient hemostase, pouches left): hematoma → suppuration.
cavity → then suppuration.
2. Appendectomy – «dirty» operation → risk of infection of operative wound.

Mechanical protection necessary (limitation of the wound, wound wash).

Perioperational antibiotherapy obligatory.

symptoms: (tumor, rubor, calor, dolor, functio laesa):

painful wound infiltrat, skin hyperhemia, SIRS.

NB! If source is very deep, local symptoms can be absent.

Treatment: revision and drainage of the wound.

- Peritonitis - theme of another lesson
- Intestinal peralysis and intestinal adhesive blockage - theme of another lesson.