



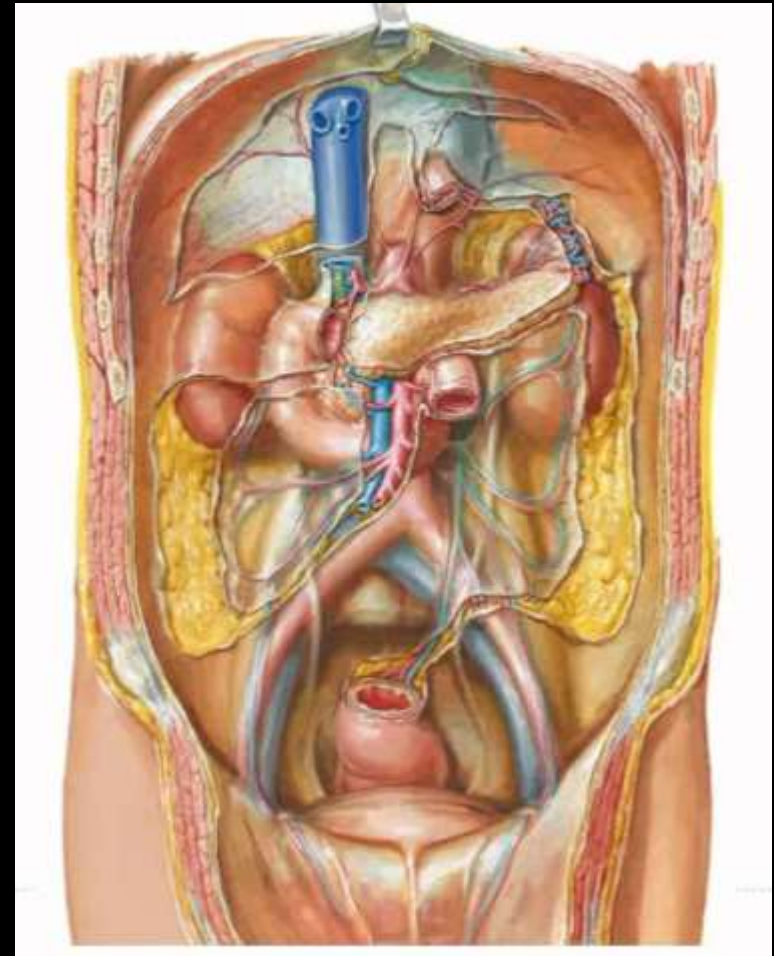
Pirogov's Russian National Research Medical University
Department of General Surgery and Radiology

Peritonitis

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Anatomy and Physiology

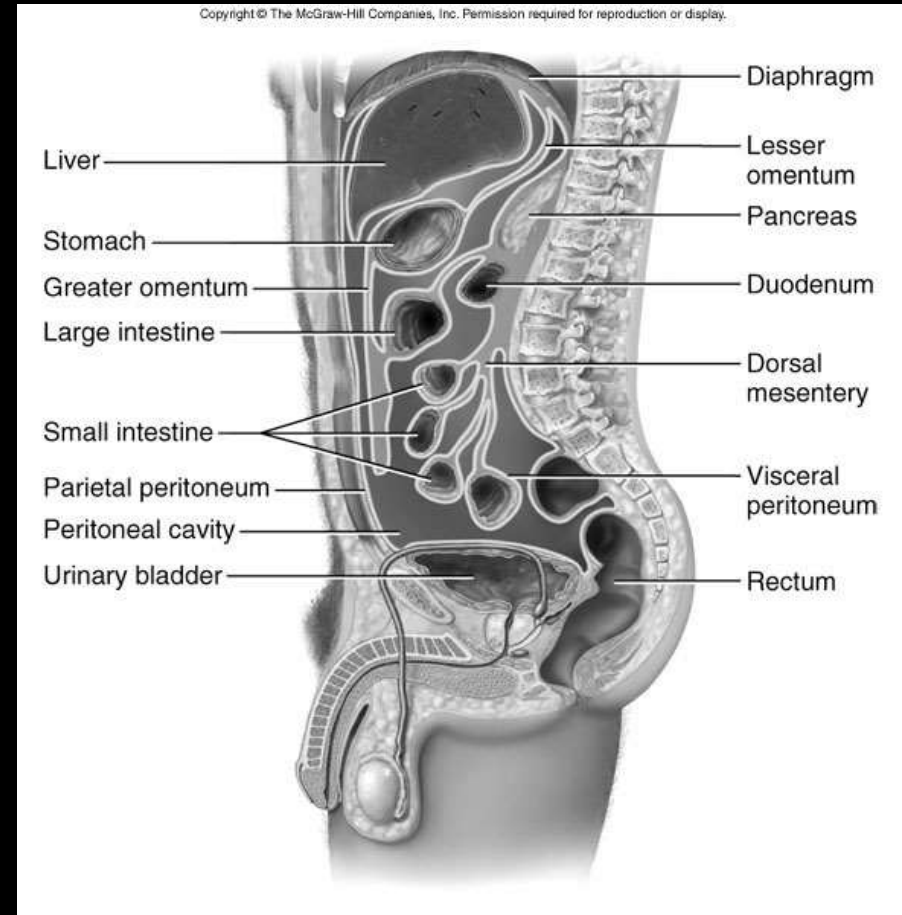
- The peritoneum is a thin, double layer of serous membrane in the abdominal cavity
- The area of the peritoneum is around 2 square meters



Anatomy and Physiology

All organs are divided on 3 groups:

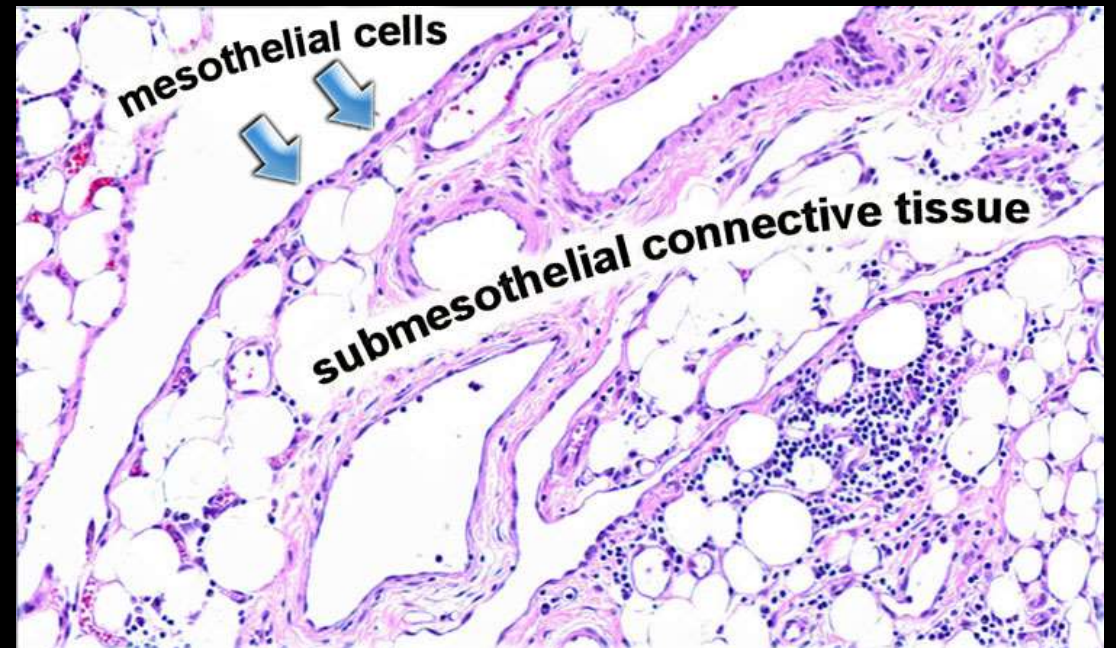
- 1) Intraperitoneal
- 2) Mesoperitoneal
- 3) Extraperitoneal



Anatomy and Physiology

Peritoneum tissue

- is a typical connective tissue;
- is covered by polygonal mesothelium;
- has very good plastic peculiarities;
- has a very good blood supply;
- Extremely high absorption capacity



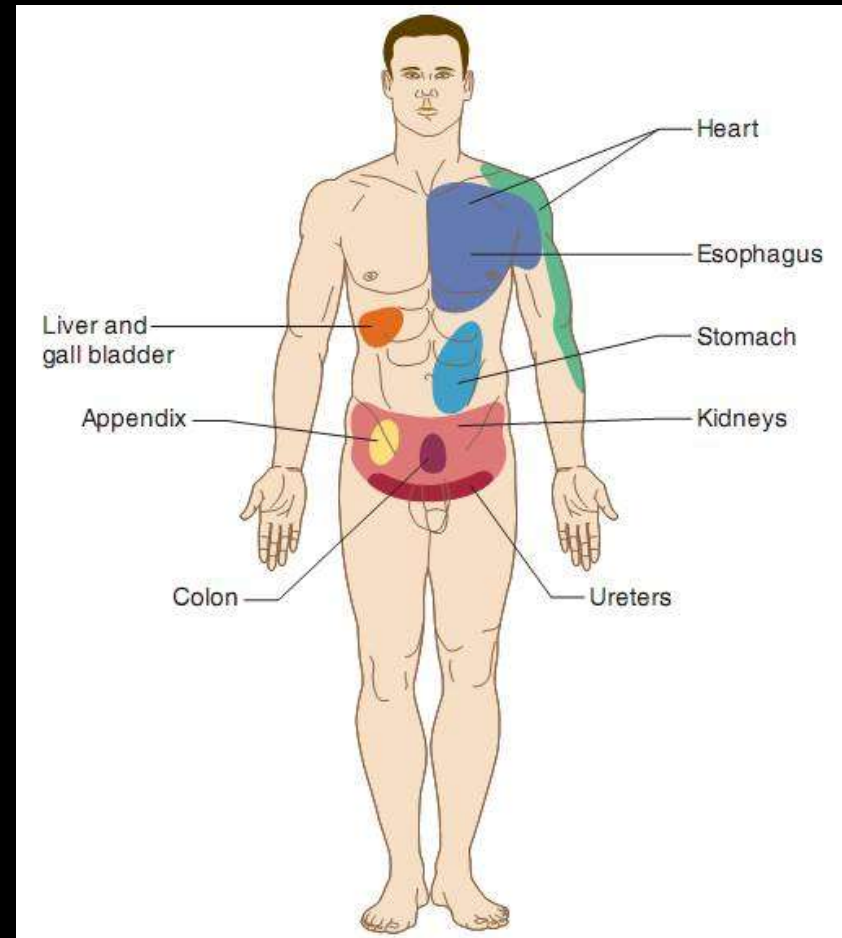
Anatomy and Physiology

- The parietal peritoneum is innervated by the sensitive somatic nerves
- The pain as a result of the parietal peritoneum irritation is localized (somatic pain)
- The pelvic peritoneum has no somatic innervations



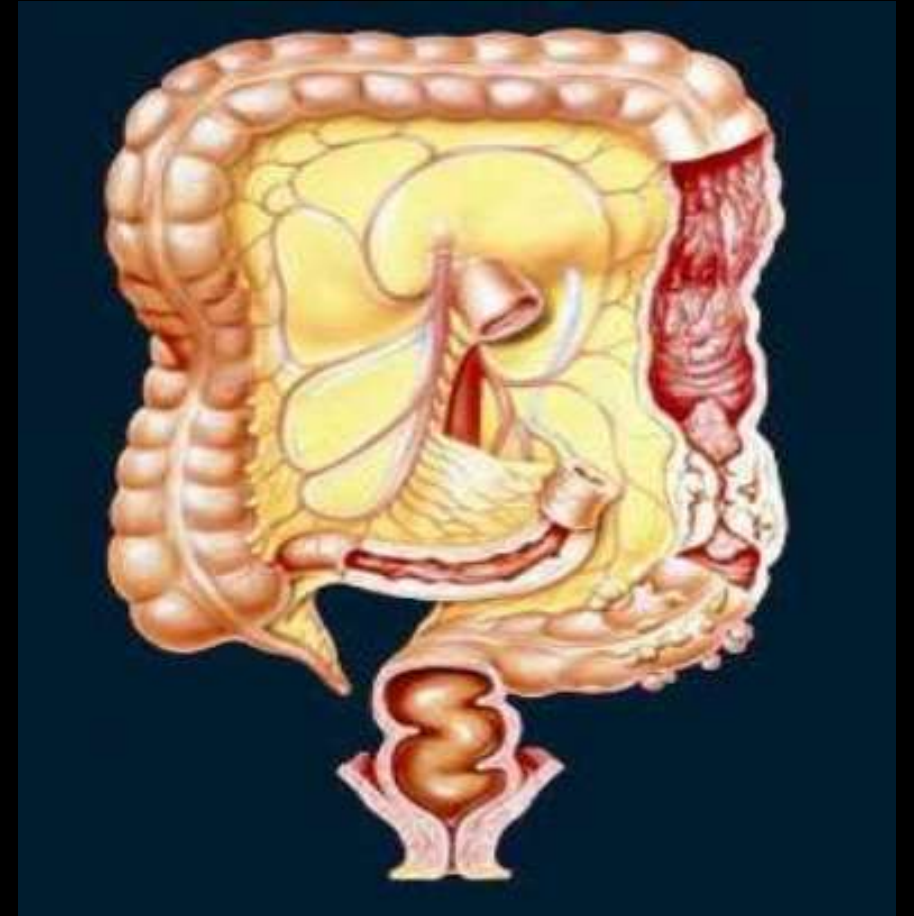
Anatomy and Physiology

- The visceral peritoneum has vegetative (parasympathetic and sympathetic) innervations
- The pain as a result of the visceral peritoneum irritation is not localized

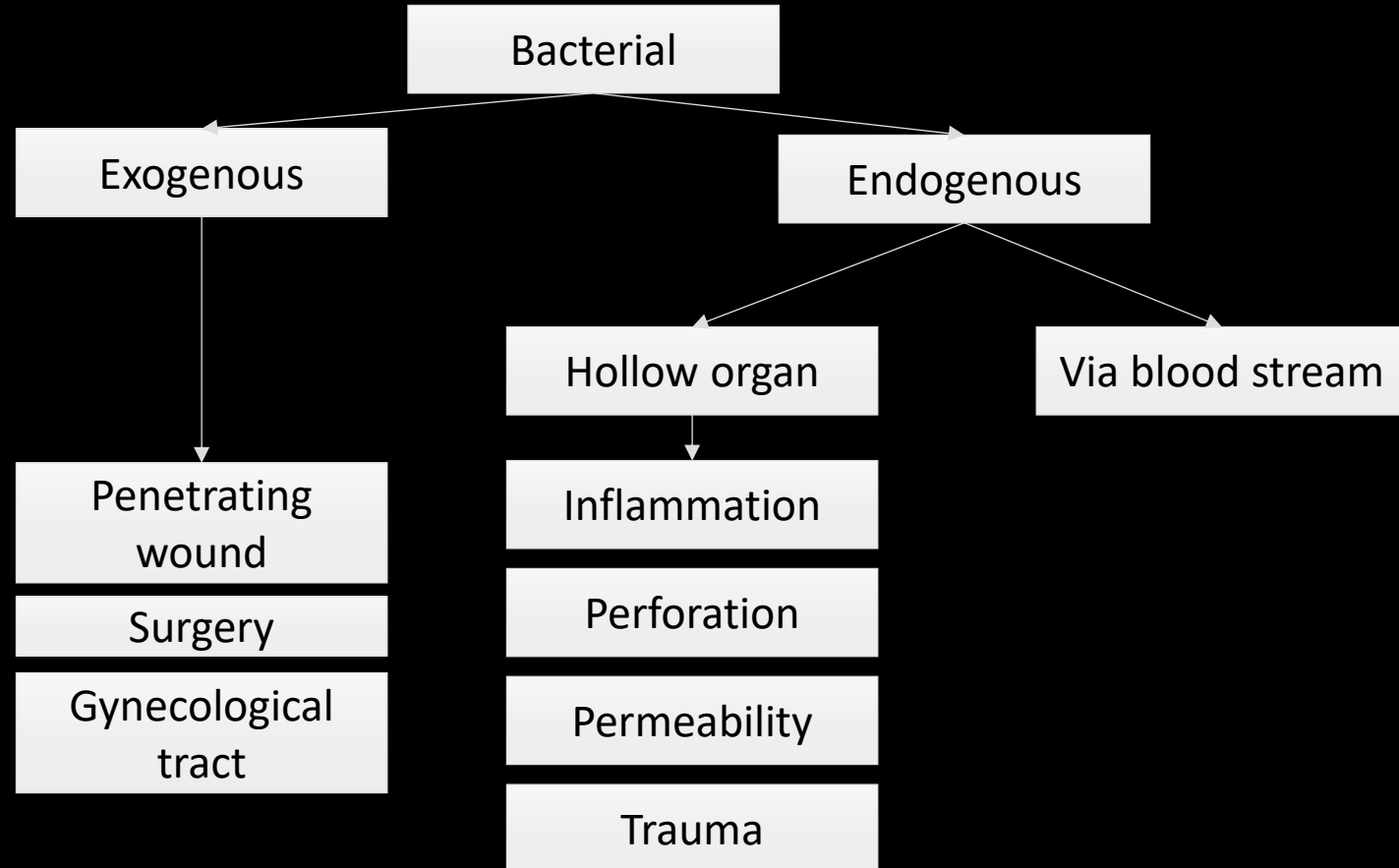
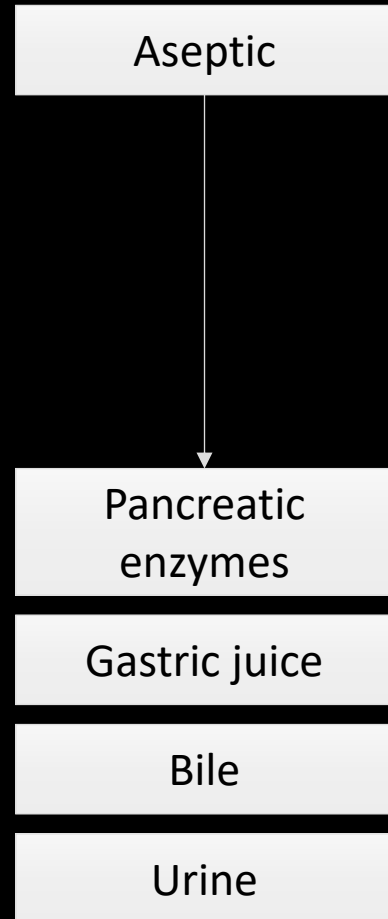


Definition

- Peritonitis is an inflammation of the peritoneum
- Characterized by typical clinical stages
- Leads to the SEPSIS and organ dysfunction

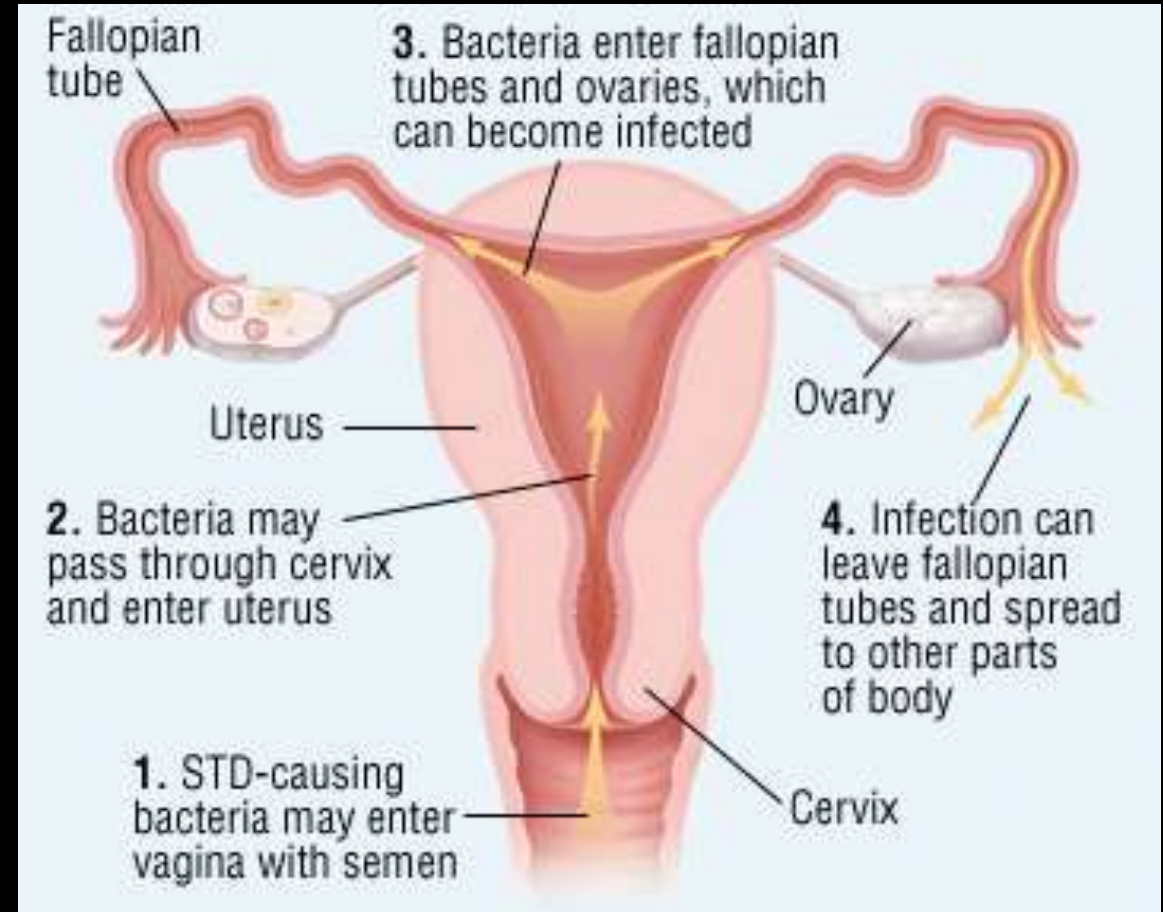


Etiology



Pelvic infection disease

- Cervicitis
- Endometritis
- Salpingitis, salpingooforitis, tubo-ovarian abscess
- Peritonitis



Etiology

I Bacterial peritonitis

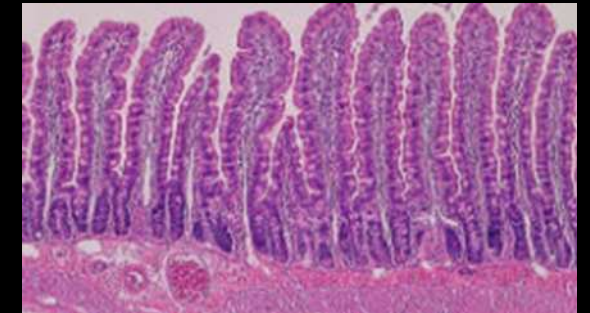
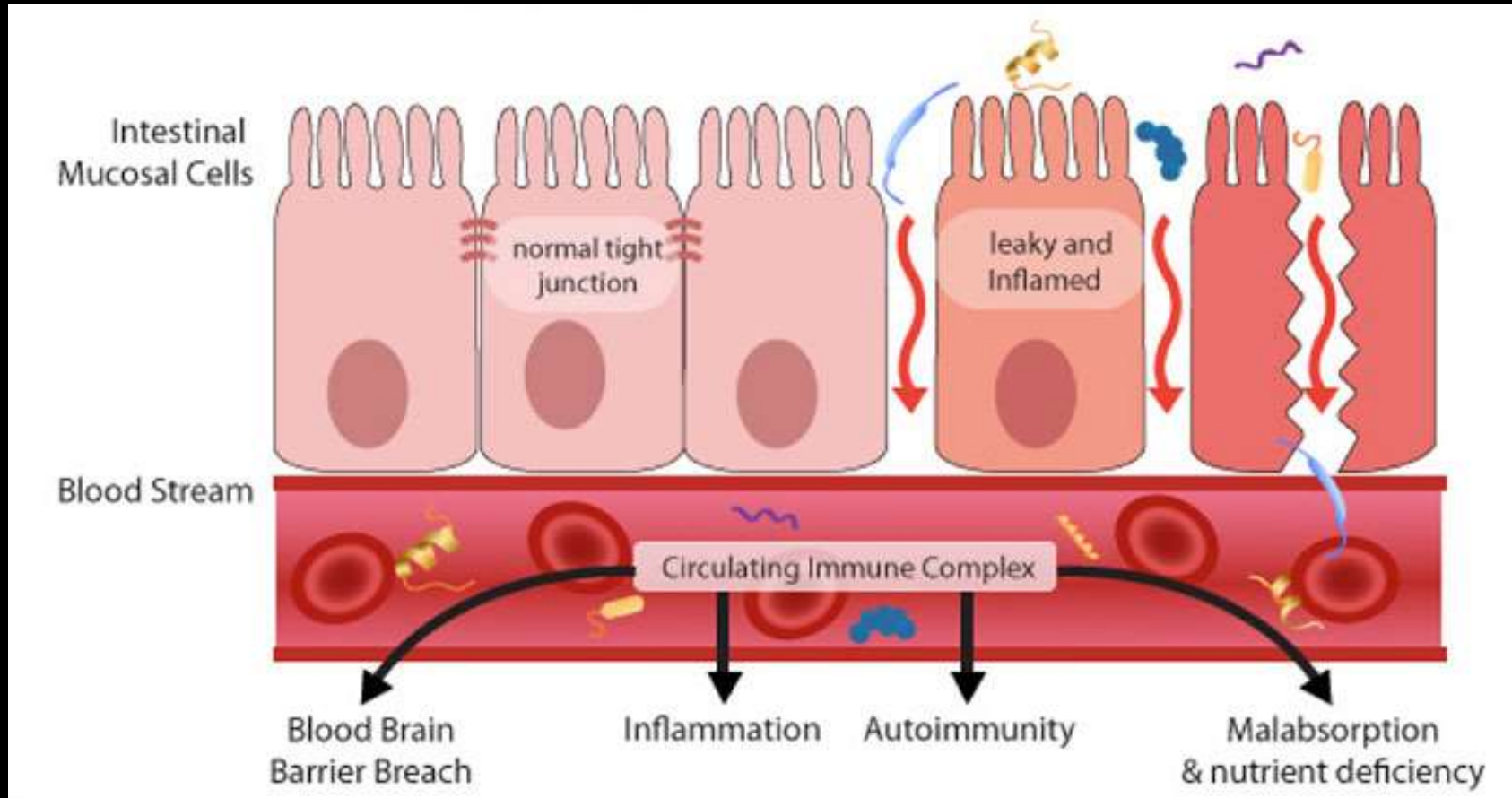
- a) staphylococcus
- b) streptococcus
- c) proteus
- d) enterococcus

II Sterile peritonitis

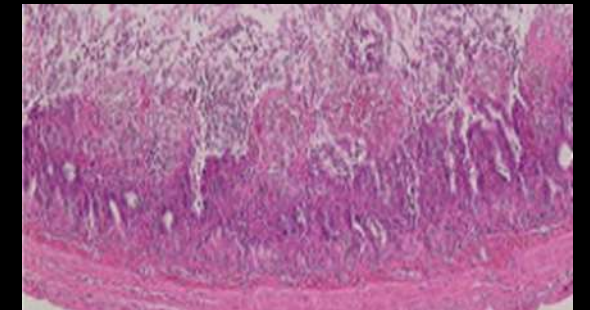
- a) caused by bile
- b) caused by pancreatic enzymes

- After first 3 days of infection – mixed flora from intestine:
 - Enterobacteriaceae
 - Bacteroides, fusobacteria, peptococcus, peptostreptococcus
- Secondary contamination due to increased intestine permeability
- Disruption of intestine barrier function at the background of intestine paralysis
- Intestinal bacteria translocation

Intestinal bacteria translocation

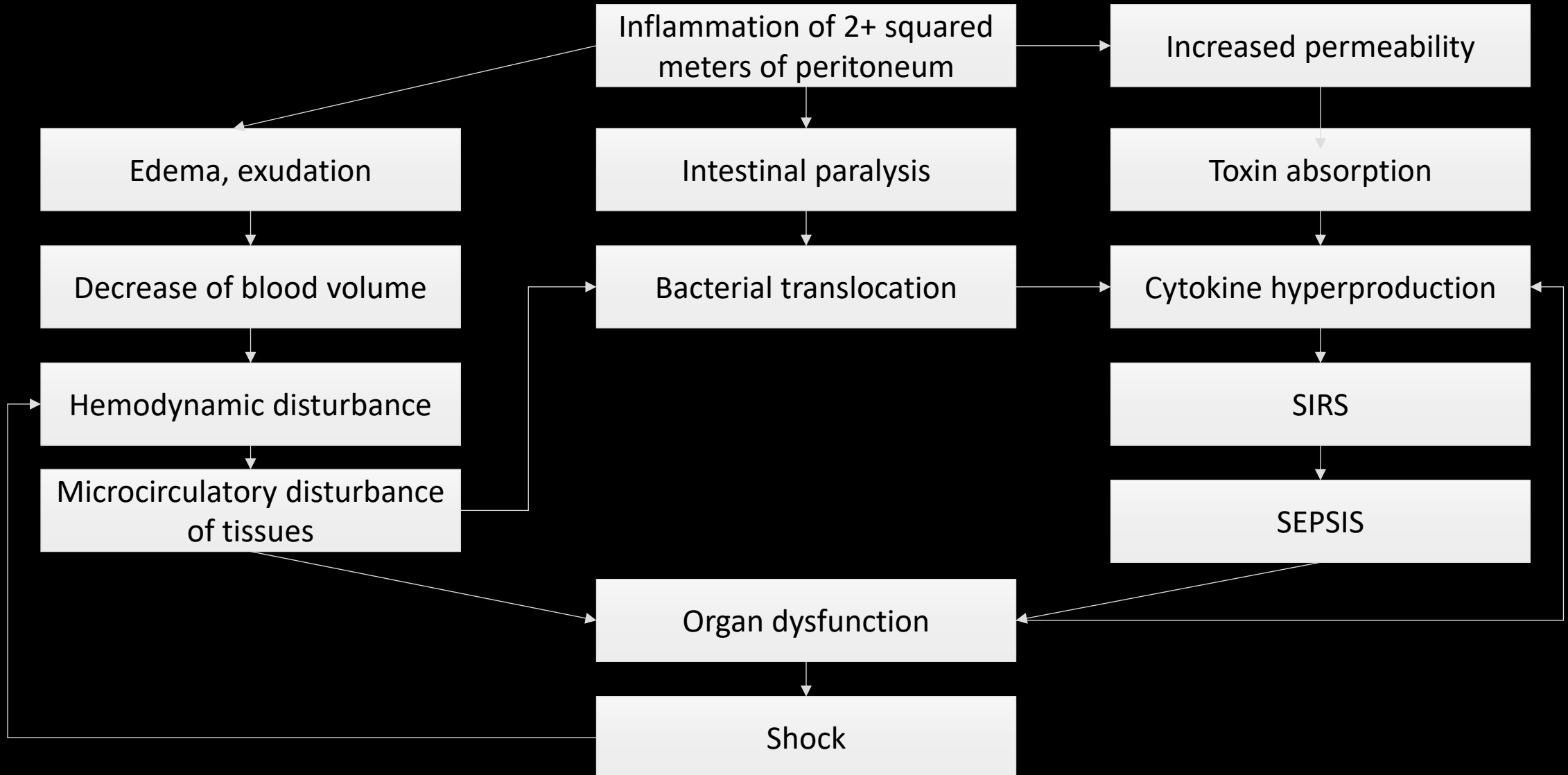


Normal mucosa



Damaged mucosa

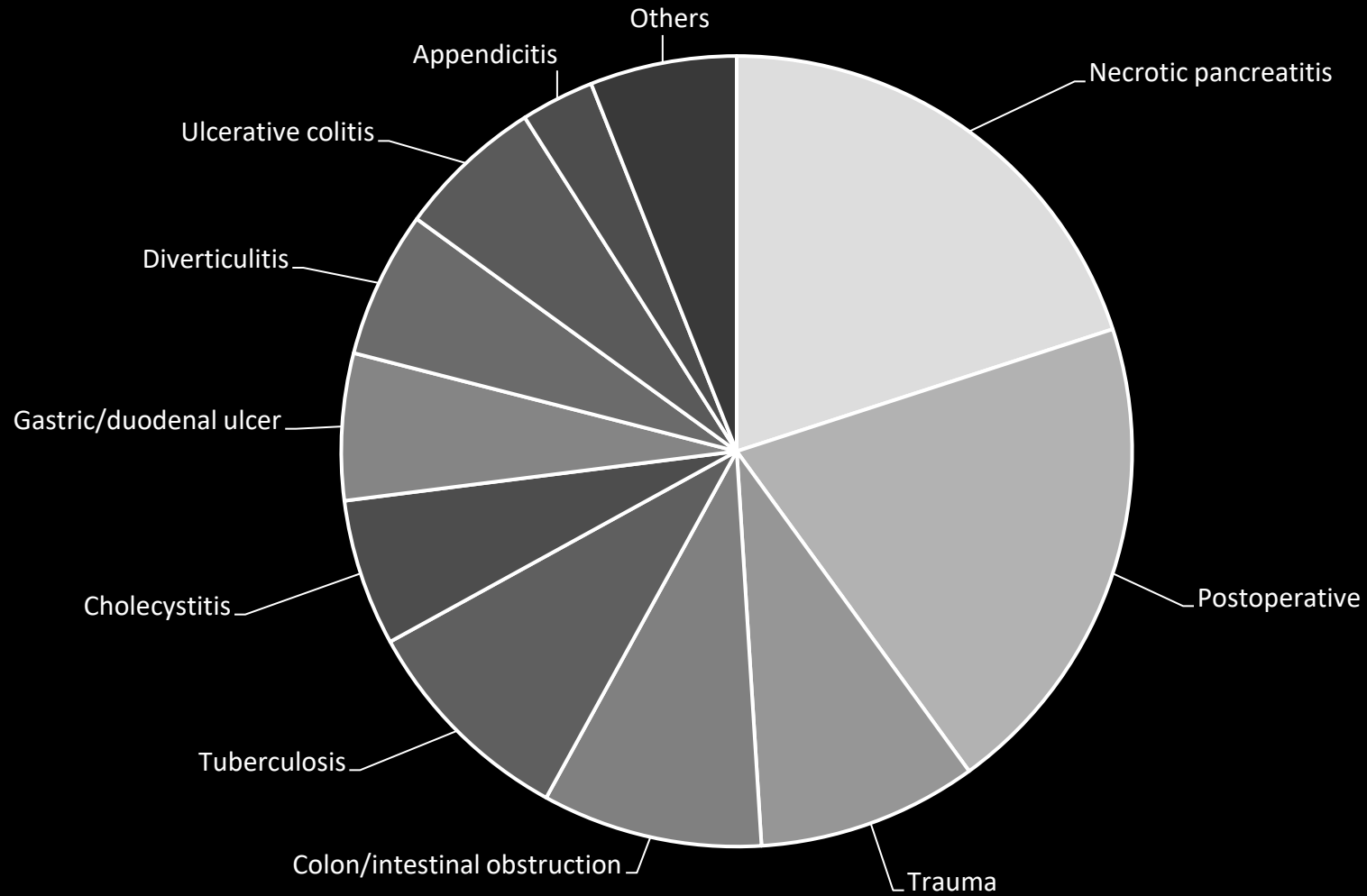
Simple pathogenesis



Classification

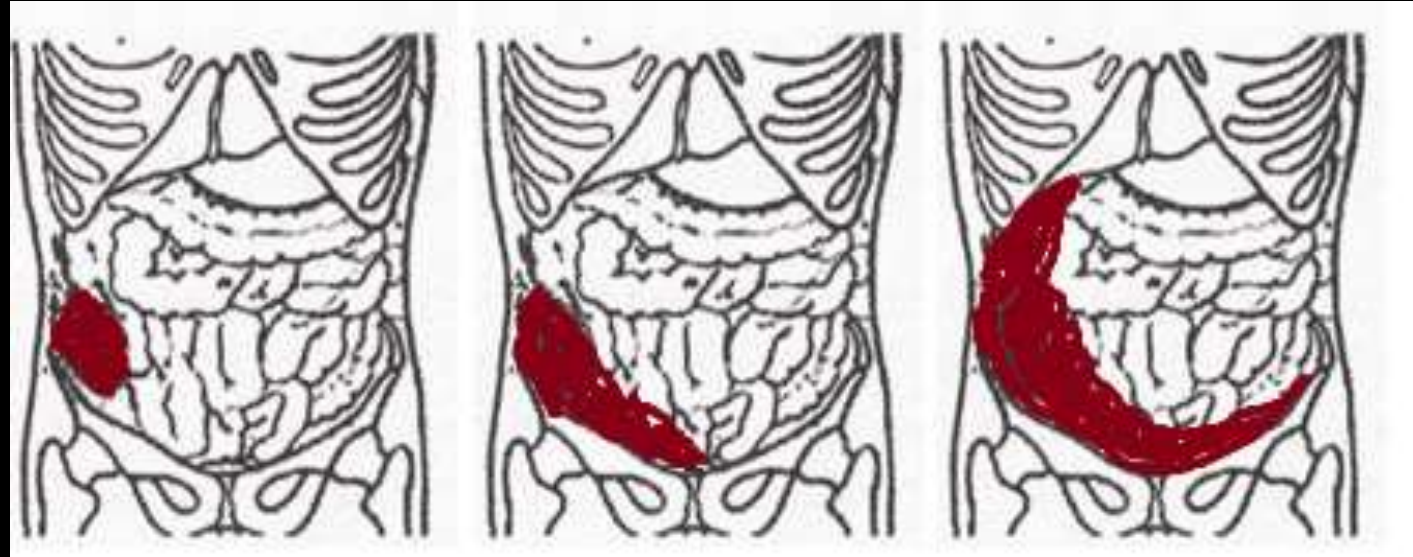
1. **Primary peritonitis:** no primary source of infection, caused by bacterial spread via blood stream (ascites-peritonitis)
2. **Secondary peritonitis** – primary source of infection:
 1. Abdominal organ perforation/inflammation
 2. Trauma: open penetrating/closed with rupture of hollow organs
 3. Post-operative
3. **Tertiary peritonitis:** after unsuccessful treatment of primary/secondary, peritoneum – the source of infection

Secondary peritonitis



Classification

- I. Local peritonitis
 - a) encapsulated (abscess)
 - b) non-encapsulated
- II. General peritonitis
 - a) Diffuse
 - b) Total



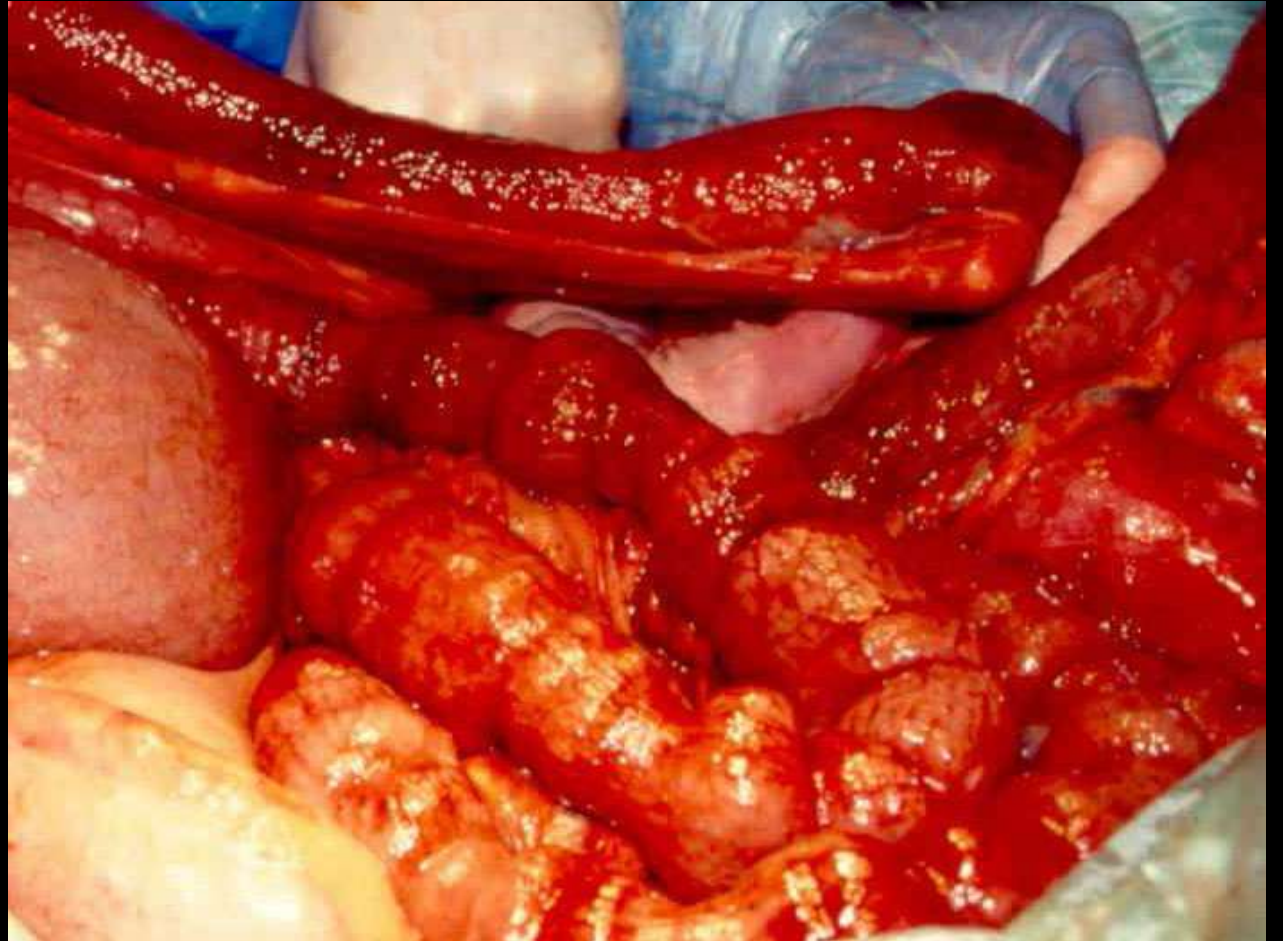
Local – one
anatomical region

Diffuse – 1-2
neighbored regions

Total – 3+
neighbored regions
or any non-
neighbored regions

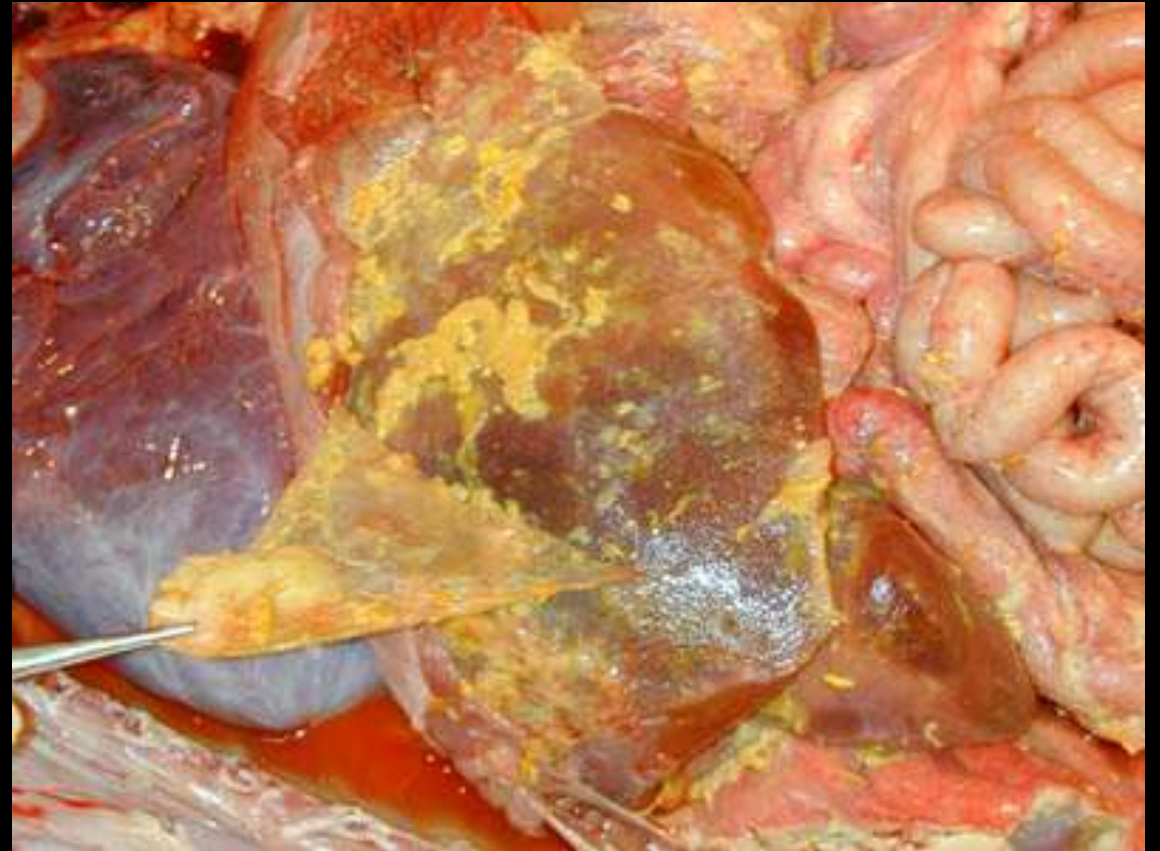
Classification

- Serous peritonitis
- Fibrinous peritonitis
- Fibrinous-purulent peritonitis
- Purulent peritonitis
- Hemorrhagic peritonitis
- Putrid peritonitis



Fibrin fibers and films

- Separation of the purulent source from other abdominal cavity (abdominal infiltration, abscess)
- Separation of bacteria from immune response (tertiary peritonitis)
- Adhesion lesions (intestinal obstruction, gangrene)



“Old” clinical Classification

Stages of Peritonitis

1. Initial (reactive) stage (up to 24 hours)
2. Toxic stage (24- 72 hours)
3. Terminal stage (after 72 hours)

“New” clinical Classification

1. Peritonitis without SIRS
2. Peritonitis with SIRS without organ dysfunction
3. Peritonitis with SIRS + organ dysfunction
4. Peritonitis with SIRS + shock

Criteria of SIRS

Fever of more than 38°C (100.4°F) or less than 36°C (96.8°F)

Heart rate of more than 90 beats per minute

Respiratory rate of more than 20 breaths per minute or arterial carbon dioxide tension (PaCO₂) of less than 32 mm Hg

Abnormal white blood cell count (>12,000/μL or < 4,000/μL or >10% immature [band] forms)

**≥2 criteria
= SIRS**

Stages of sepsis

Peritonitis + septic shock

Hypotension refractory
to intravenous fluids

Peritonitis + SEPSIS

Organ dysfunction

Peritonitis + SIRS

Systemic inflammatory response: ≥ 2 criteria of SIRS

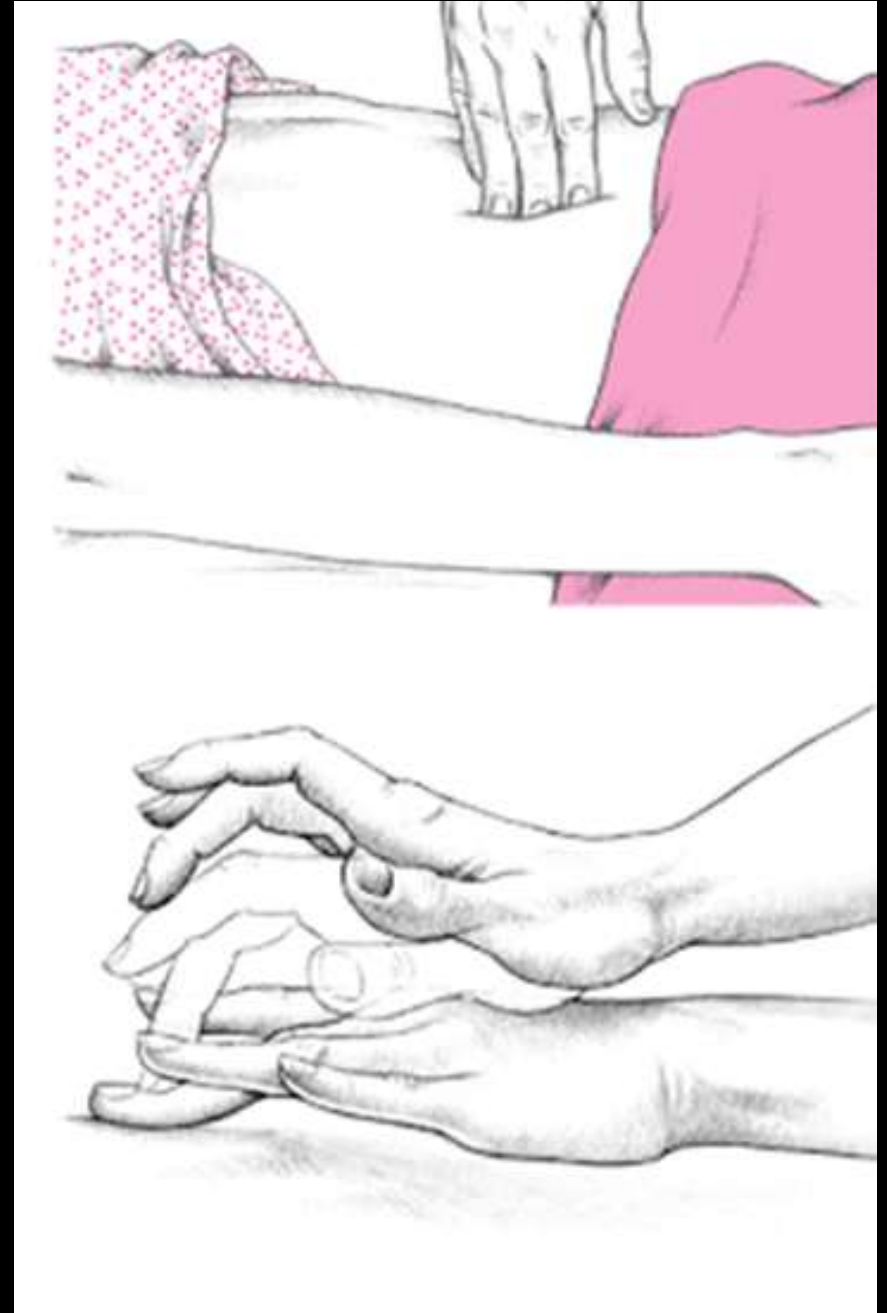
Peritonitis

Local inflammatory response

Diagnostics

- Local signs:
 - Abdominal pain
 - Limited movement of abdominal wall
 - Abdominal distention
 - Muscle defence (guarding)
 - Peritoneal irritation
 - Low or absent peristalsis
 - Signs of abdominal fluid accumulation (dull percussion sound)
- General signs of inflammation and intoxication:
 - Nausea and vomiting
 - Fever
 - Headache, lethargy, weakness
- Signs of organ dysfunction:
 - Hypotension
 - Oliguria
 - Jaundice
 - Respiratory failure
 - Dehydration (dry tongue, mucosa, skin)
 - Loss of consciousness, disorientation, coma

Abdominal irritation



Abdominal guarding



- Muscle tenderness + peritoneal irritation = **Schetkin's-Blumberg's sign** = peritonitis
- Peritoneal irritation without abdominal guarding = **Kulenkampf sign** = no peritonitis (exudation, blood)

Nausea and vomiting

- Refractory:
 - 1-2 times with relief
 - With food
- Toxic:
 - Multiple without relief
 - With food and stagnant contents
- Paralytic:
 - Multiple, unstoppable, consumptive,
 - With stagnant contents



Paralytic ileus

Progressive stages of peritonitis

Abdominal distension

Loss of muscle defence

Absence of peristalsis

No feces and gases

Dilated intestine on X-Ray



Old clinical Classification

Stages of Peritonitis

1. Initial (reactive) stage (up to 24 hours)
 1. Prevalence of local symptoms (pain, irritation, defance)
 2. Intoxication not severe
 3. Reflex vomiting
 4. Local intestinal paralysis
 5. No organ dysfunction
2. Toxic stage (24- 72 hours)
3. Terminal stage (after 72 hours)

Old clinical Classification

Stages of Peritonitis

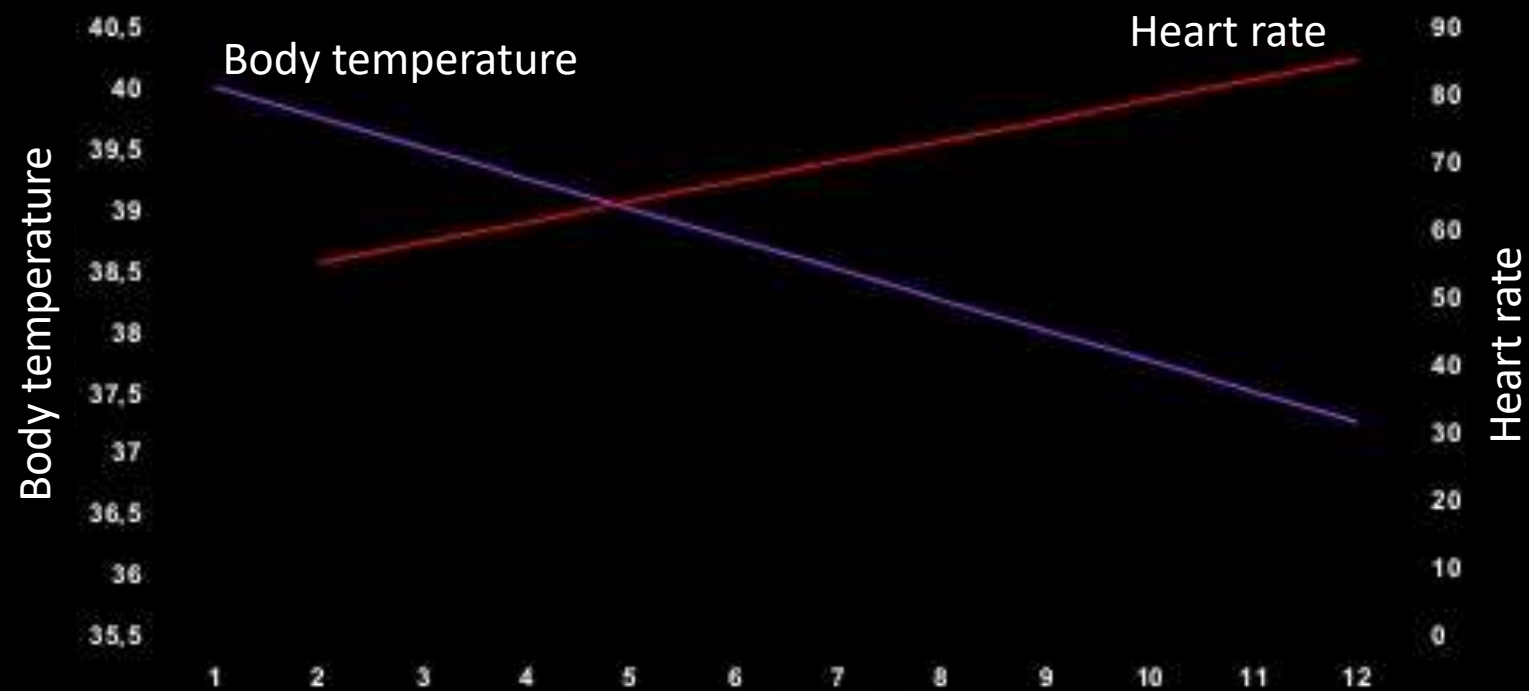
1. Initial (reactive) stage (up to 24 hours)
2. Toxic stage (24- 72 hours)
 1. Domination of intoxication
 2. Decrease of local signs (pain, defance)
 3. Toxic vomiting
 4. Increase of intestinal paralysis
 5. Increase of organ dysfunction
3. Terminal stage (after 72 hours)

Old clinical Classification

Stages of Peritonitis

1. Initial (reactive) stage (up to 24 hours)
2. Toxic stage (24- 72 hours)
3. Terminal stage (after 72 hours)
 1. Domination of intestinal paralysis over local signs
 2. Paralytic vomiting
 3. Severe intoxication
 4. Multiple organ dysfunction with hemodynamic disturbance

“Toxic scissors” sign



Hippocratic face

- Deathly pale with a bluish dry tint facial skin,
- Fallen eyes,
- Dull cornea
- Pointed nose



Laboratory diagnostics

- Increased WBC ($>9 \times 10^9$)
- Increased immature [band] forms ($>10\%$)
- Increased ESR
- Positive procalcitonin test (if infected)
- Signs of organ dysfunction:
 - Anemia
 - Thrombocytopenia
 - Increased bilirubin, creatinine
 - Coagulation abnormalities
 - etc

Instrumental diagnostics

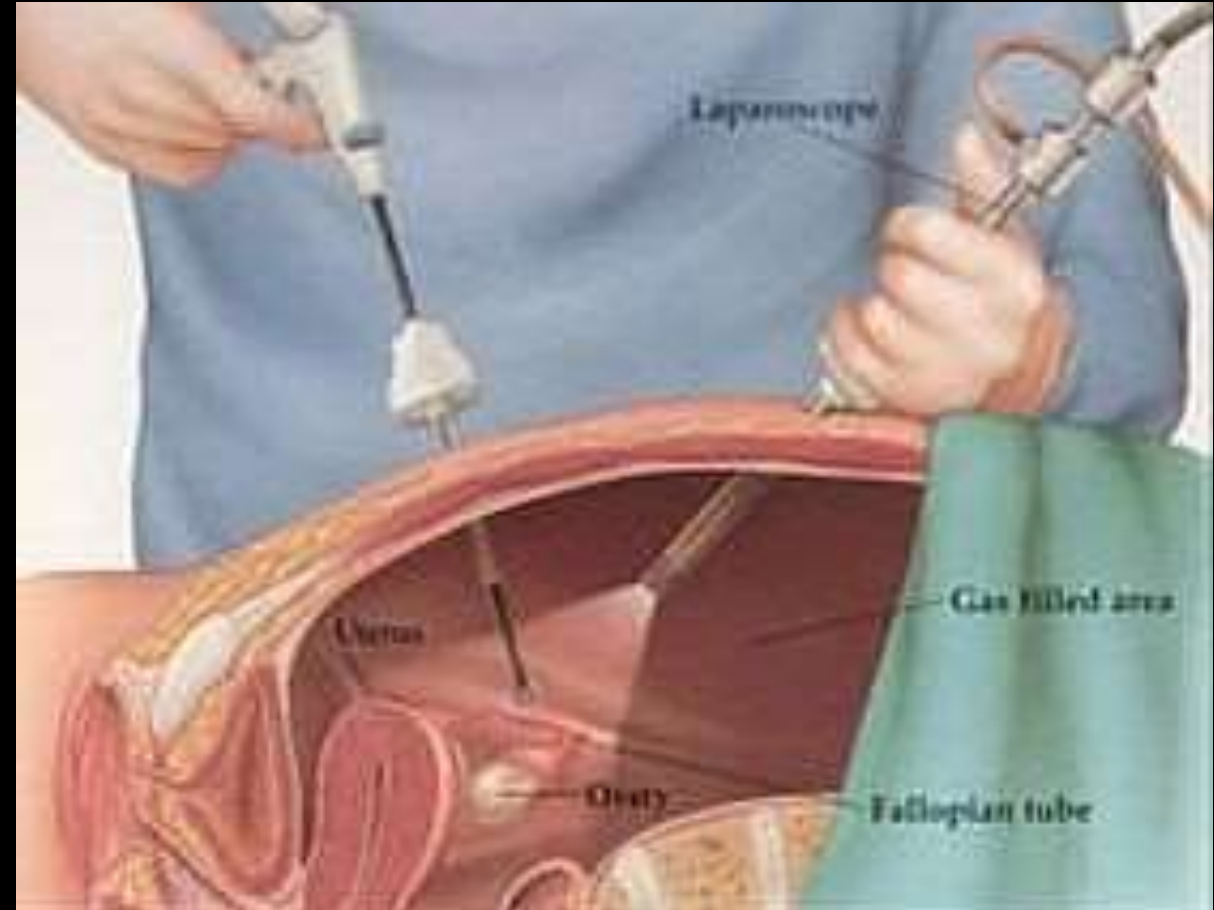
- Ultrasound:
 - Non-specific
 - Abdominal fluid
 - Intestinal paralysis
 - Source-specific:
 - Cholecystitis
 - Appendicitis
 - Pancreatitis
 - Abdominal abscess
- X-Ray:
 - Non-specific
 - Intestinal paralysis
 - Source-specific:
 - Hollow organ perforation
- CT scan
- MRI scan

Diagnostic laparoscopy

- Confirm diagnosis in case of any doubts
- Look for the source of infection
- Evaluation of involvement of peritoneal cavity (local, diffuse, total)



Plan the operation!



Mannheim Peritonitis Index (MPI)

- Organ Failure: 7
- Diffuse peritonitis: 6
- Age older than 50 years old: 5
- Female gender: 5
- Malignancy: 4
- Non-colonic Sepsis origin: 4
- Preoperative duration of peritonitis: 4
- Exudate
 - Fecal: 12
 - Cloudy or purulent: 6
 - Clear: 0
- Score 0-5: 0% Mortality
- Score 6-13: 2% Mortality
- Score 14-21: 13% Mortality
- Score 22-29: 26% Mortality
- Score 30-39: 64% Mortality

Treatment

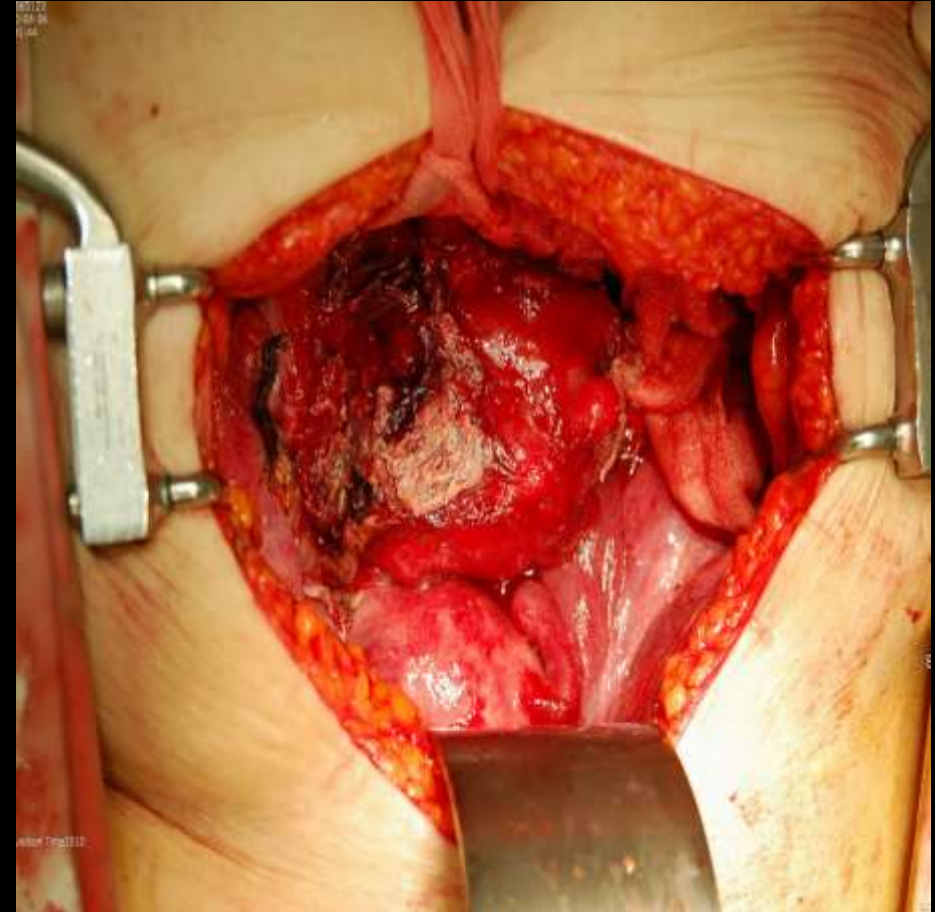
- Peritonitis = emergency surgery at vital indications
- Preoperative treatment for 1-2 hours available in severe condition of patient
- Short preoperative preparation:
 - Shaving of abdomen
 - Venous access
 - Urinary catheter
 - Stomach drainage
 - No enema if no colon obstruction!

Surgery

1. Operative access
2. Revision of abdominal cavity, confirming the primary source of infection
3. Removing the primary source of infection
4. Washing abdominal cavity with antiseptic solutions
5. Intestinal drainage
6. Abdominal drainage
7. Close laparotomy wound

Surgery

1. Operative access
 1. Only laparotomy!



Surgery

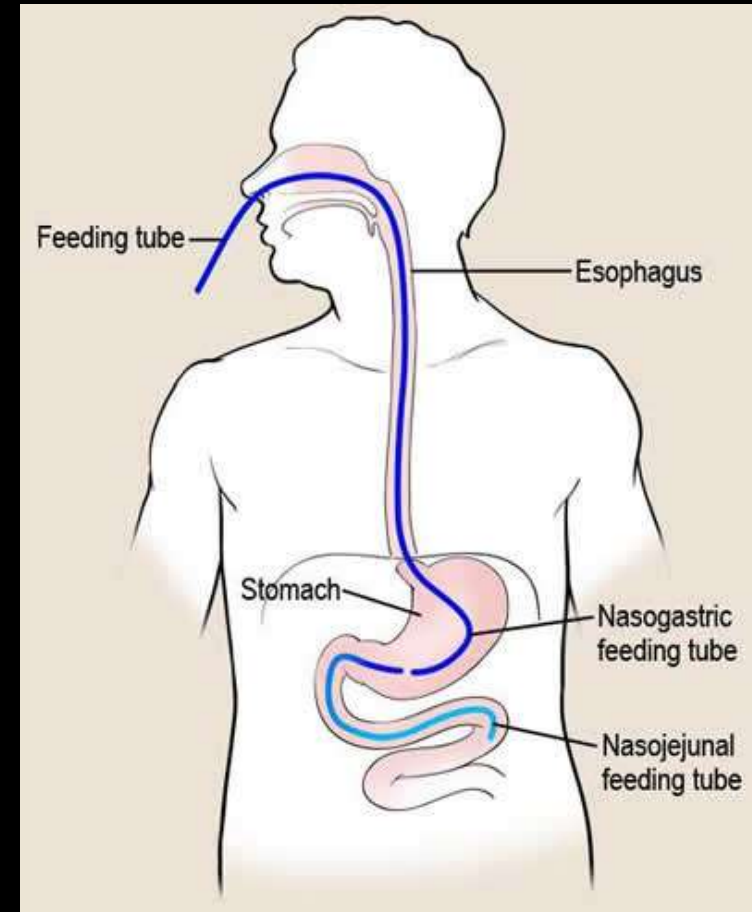
1. Operative access
2. Revision of abdominal cavity, confirming the primary source of infection
3. Removing the primary source of infection
 1. Appendectomy
 2. Cholecystectomy
 3. Suturing of ruptured or perforated organs
 4. Resection of dead organs
 5. etc

Surgery

1. Operative access
2. Revision of abdominal cavity, confirming the primary source of infection
3. Removing the primary source of infection
4. Washing abdominal cavity with antiseptic solutions
 1. Big amount of fluids
 2. Remove as much fibrin as possible

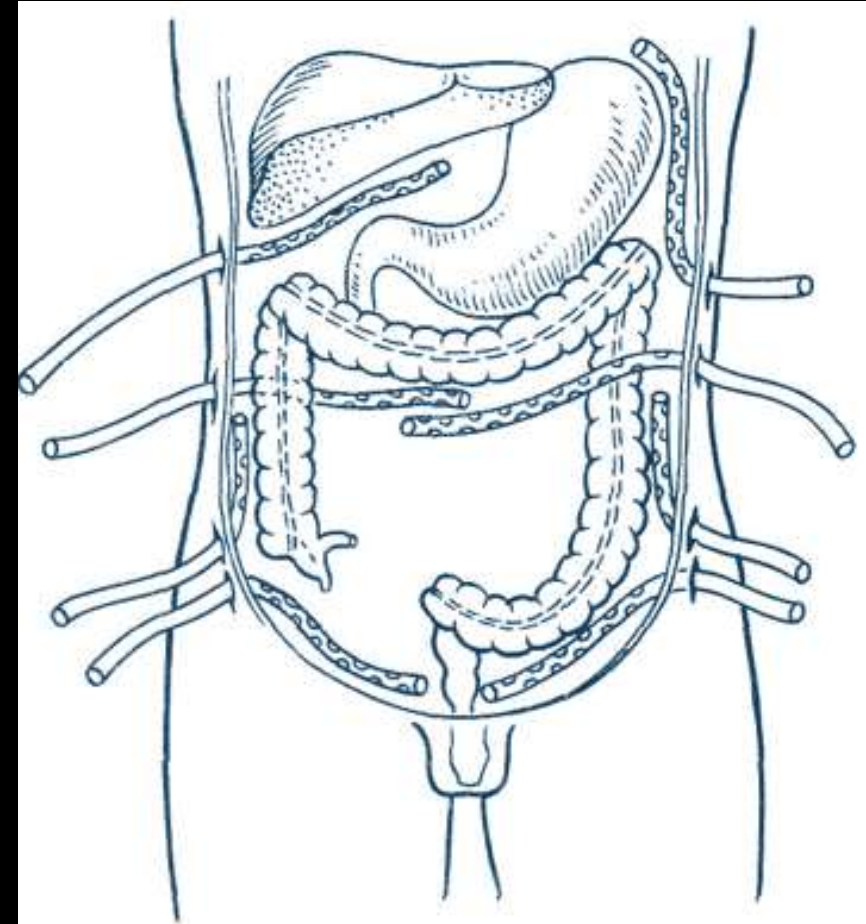
5. Intestinal drainage

- Intestinal decompression
- Selective decontamination
- Enteral nutrition
- Prophylaxis of adhesion lesions



6. Abdominal drainage

- More spreading of inflammation – more tubes!
- All zones of fluid accumulation should be drainage
- Aims:
 - Remove exudation
 - Control insensitivity and characteristics of inflammation



7. Close laparotomy wound

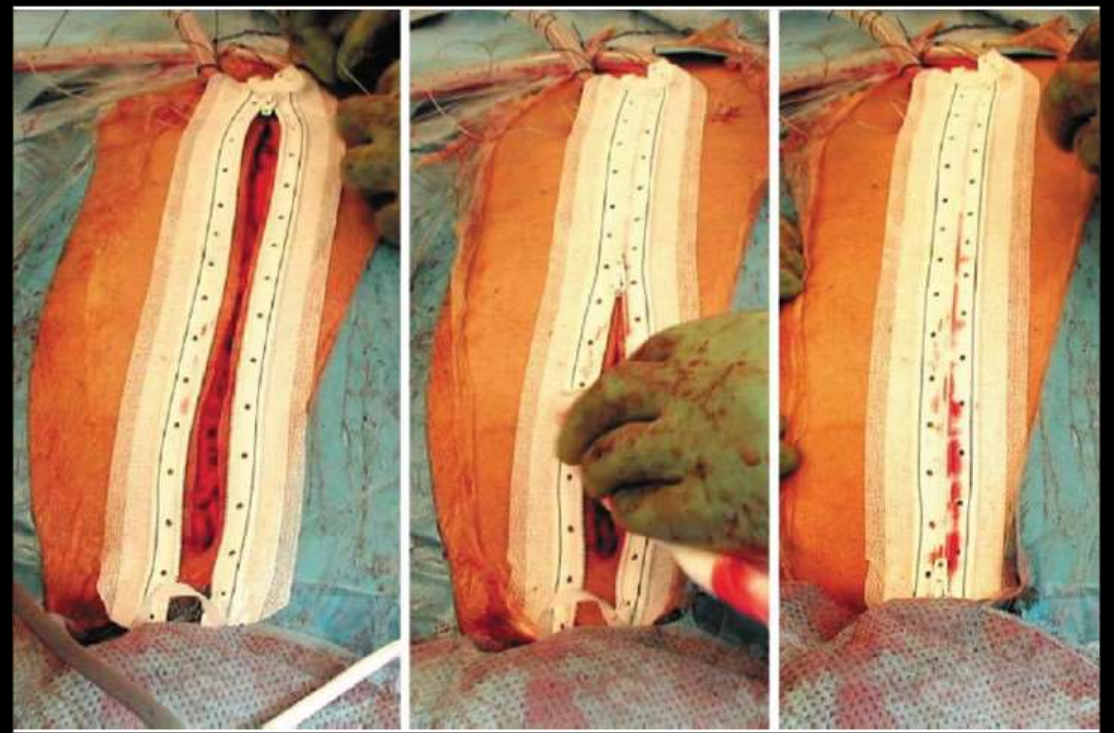
- Closed
 - Suturing of all layers
 - Skin suturing (prophylaxis and treatment of intraabdominal hypertension)
 - Temporary sutures, including zipper (programmed re-laparotomy)
 - Temporary cover by films (abdominal hypertension + programmed re-laparotomy)
- Open
 - Laparostomy (anaerobic infection)



Skin sutures



Temporary sutures and zipper



Covering by films



Laparostomy



Additional treatment

- Systemic antibiotics
- Detoxication, including extracorporal
- Infusion therapy
- Correction of enteral dysfunction
- Parenteral and enteral nutrition
- Hemodynamic support
- Respiratory support
- Correction of coagulation abnormalities and VTE prophylaxis