



**MEDICAL UNIVERSITY – PLEVEN**  
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**DEPARTMENT OF INFECTIOUS DISEASES, EPIDEMIOLOGY,  
PARASITOLOGY AND TROPICAL MEDICINE**

**Lecture № 13**

**TREATMENT OF  
INFECTIOUS DISEASES –  
ETIOLOGIC AND SUPPORTIVE**

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# Etiologic treatment of infectious diseases

- **Aim** – destruction of bacterial cells or breaking of their multiplying.
- This leads to breaking of the infectious process.
- The etiologic treatment is with a greatest importance.

# Etiologic treatment of infectious diseases

- Three groups antimicrobials:
- Antibiotics
- Chemotherapeutic drugs
- Immune-therapeutic drugs

# Antibiotics

- Natural, semi-synthetic or synthetic macromolecules with bactericidal or bacteriostatic effect upon the pathogens.

# Principles of the etiologic treatment

1. The etiologic treatment should begin earliest. Obligatory taking of biologic materials for isolation of the agent – before the onset of etiologic treatment.
2. The choice of antibiotic must be according to the diagnosis or hypothetical agent.

# Principles of the etiologic treatment

**3. The dose** estimates according to the diagnosis and severity.

In the onset the dose is maximal.

**4. The course** depends of the diagnosis and the patient's condition.

# Principles of the etiologic treatment

5. A change of antibiotic needs if after 3-4 days treatment has not clinical and laboratory improvement and especially at worsened condition.
6. Mono- or combined therapy – according to the diagnosis.

# Principles of the etiologic treatment

- **Monotherapy** – when the agent is clear.
- **Combined therapy** – when the etiology is not clear or the patient's condition is severe.
- **It is not recommended a combination of bactericidal and bacteriostatic antibiotics.**

# Principles of the etiologic treatment

- Most frequently used antibiotic combinations, active against Gram (+) and Gram (-) agents:
- Penicilins and aminoglycosides
- Cephalosporins and aminoglycosides
- Carbapenems and aminoglycosides
- Rifampicins and cephalosporins.

# Principles of the etiologic treatment

7. The administration of the antibiotics should be according to their pharmacokinetics.
8. Administration of antibiotic at viral infections is controversial but at risk groups it should be given from the onset to prevent bacterial complications.

# Principles of the etiologic treatment

9. To kept in mind the adverse effects of antibiotics – allergy, hepato-, nephro- and neurotoxic effects; dysbacteriosis, avitaminosis, mycosis. At neutropenic patients use of myelotoxic antibiotics is contraindicative.

# Classification of the antibiotics

## 1. Beta-lactam antibiotics – 4 groups:

- Penicillins
- Cephalosporins
- Carbapenems
- Monobactams.

# Classification of the antibiotics

- **Penicillins** – derivatives of 6-aminopenicillan acid. They have **bactericidal activity** – inhibit the synthesis of the cell wall and cause an osmotic bacteriolysis.
- *Penicillins with narrow spectrum* – benzylpenicillin (penicillin G), phenoximethylpenicillin, benzacillin compositum – against Gram (+) and Gram (-) cocci, spirochetes.

# Classification of the antibiotics

- *Penicillinazo-resistant, semi-synthetic (anti-staphylococcal) penicillins* – cloxacillin, oxacillin, methycillin.
- *Broad-spectrum penicillins:*
  - *Aminopenicillins* – ampicillin, amoxicillin – against Gram (+) and Gram (-) bacteria. High bacterial resistance exists.

# Classification of the antibiotics

- *Carboxypenicillins* – carbenicillin, tycarcillin – against Pseudomonas, Proteus.
- *Combined* – amoxiclav, unazin, tazocin.

# Classification of the antibiotics

- **Cephalosporins** – semi-synthetic derivatives of 7-aminocephalosporanic acid. Bactericidal – destroy the synthesis of the bacterial cell wall. Broad spectrum. Excretion by the urine, cephazolin, cephalexin and ceftriaxone by the liver.
- **Five generations cephalosporins.**

# Classification of the antibiotics

- ***Cephalosporins 1<sup>st</sup> generation*** – cephalexin, cephalothin, cephazolin, cefacetrile, cefadroxyl, cephalixin, cephaloglycin, cephalonium, cephaloradine, cephalothin, cephapirin, cephasolin, cephradine.
- ***Cephalosporins 2<sup>nd</sup> generation*** – cephamandol, cefuroxim, cefaclor, cefprozil, cefuroxime, cefuzonam. Second generation cephalosporins with antianaerobe activity: cefmetazole, cefotetan, cefoxitin.  
The following cephems are also sometimes grouped with second-generation cephalosporins: Carbacephems: loracarbef; Cephamycins: cefbuperazone, cefmetazole, cefminox, cefotetan, cefoxitin.
- ***Cephalosporins 3<sup>rd</sup> generation*** – ceftriaxon, cefotaxime, ceftazidime, cefperazone, ceftibuten, Cefcapene, Cefdaloxime, Cefdinir, Cefditoren, Cefetamet, Cefixime, Cefmenoxime, Cefodizime, Cefotaxime, Cefovecin, Cefpimizole, Cefpodoxime, Cefteram, Ceftibuten, Ceftiofur, Ceftiolene, Ceftizoxime, Ceftriaxone. Third-generation cephalosporins with antipseudomonal activity: Cefoperazone, Ceftazidime. The following cephems are also sometimes grouped with third-generation cephalosporins: Oxacephems: latamoxef.
- ***Cephalosporins 4<sup>th</sup> generation*** – cefepime, cefpime, cefluprenam. The following cephems are also sometimes grouped with fourth-generation cephalosporins: Oxacephems: flomoxef
- ***Cephalosporins 5<sup>th</sup> generation*** – Ceftobiprole, Ceftaroline – Ceftobiprole has been described as "fifth-generation" cephalosporin, though acceptance for this terminology is not universal. Ceftobiprole are on the FDA fast-track. Ceftobiprole has powerful antipseudomonal characteristics and *appears* to be less susceptible to development of resistance. Ceftaroline has also been described as "fifth-generation" cephalosporin, but does not have the anti-pseudomonal or VRE coverage of ceftobiprole.

# Classification of the antibiotics

- *Carbapenems* – the most potent broad-spectrum antibiotics – tienam, meropenem, ertapenem.
- *They do not penetrate through blood-brain barriere (not appropriate for a treatment of CNS-infections).*

# Classification of the antibiotics

- 2. Aminoglycosides** – with bactericidal effect by destroying of the bacterial protein synthesis. Active against Gram (-) bacteria and Staphylococci. Excretion by the urine. Synergistic with beta-lactams.
  - ❖ Gentamycin, amikacin, tobramycin.

# Classification of the antibiotics

3. **Tetracyclines** – bacteriostatic (in high doses – and bactericidal) effect by blockage of the bacterial protein synthesis. Good tissue- and intracellular penetration. Excretion by the urine and the liver. Broad spectrum against Gram (+) and Gram (-) agents.

❖ Doxycyclin, metacyclin, tetracycline, tetracycline.

# Classification of the antibiotics

- 4. Macrolides** – bacteriostatic effect by suppression on the protein synthesis of the pathogens. Against Gram (+) bacteria including staphylococci.
  - ❖ Erythromycin, spiramycin, oleandomycin, macropen, clarythromycin, azithromycin

# Classification of the antibiotics

- 5. **Amphenicols** – bacteriostatic by blockage of the protein synthesis. Broad spectrum against Gram (+) and Gram (-) bacteria.
  - ❖ Chloramphenicol.

# Classification of the antibiotics

**6. Rifampicins** – against Gram (+), mycobacteria and some Gram (-) agents.

❖ Rifampicin

**7. Lincosamides** – bacteriostatic effect, very good penetration into the bones and the soft tissues.

❖ Lincomycin, Clindamycin.

**8. Glycopeptides** – bactericidal effect.

❖ Vancomycin, teikoplanin.

# Classification of the antibiotics

**9. Polypeptides** – against Gram (-) bacteria.

❖ Polymyxin B, colistin.

**10. Antifungal** – nystatin, amphotericin, griseofulvin.

# **SUPPORTIVE TREATMENT OF INFECTIOUS DISEASES**

# Supportive treatment of infectious diseases

- **Aim** – a restoration of the functional disorders, especially life-threatening.
- Prompt administration, especially in the severe forms of the infectious diseases.

# Restoration of watery-electrolytic homeostasis and alkaline-acid balance

- **Three tasks:**

- ❖ A restoration of the body fluids
- ❖ A restoration of the saline contain of the fluids
- ❖ A normalizing of the alkaline-acid balance.

# I. Restoration of water content of the body' fluids:

- By that increases the volume of the circulated blood, eliminates the peripheral vassal spasm, increases heart systolic intake, improves the circulation, eliminates the hypoxia.
- Required volume of fluids is a sum of 3 parameters:
  - ❖ Previous deficit of fluids
  - ❖ Daily needs of fluids
  - ❖ Pathologic losses of fluids.

## Previously deficit of fluids:

- Estimates by two modes:
  - ❖ the difference of the patient's body weight before and after the clinical onset of the disease;
  - ❖ by the grade of dehydration
- 1<sup>st</sup> degree of dehydration (a loss of body weight to 5%):
  - ❖ Reduced skin turgor
  - ❖ Dry tongue
  - ❖ Increased heart frequency, decreasing of the blood pressure less than 100 mm Hg
  - ❖ The consciousness is normal.

- **1<sup>st</sup> degree of dehydration (a loss of body weight to 5%):**

- ❖ Slightly reduced skin turgor

- ❖ Dry tongue

- ❖ Increased heart frequency, decreasing of the blood pressure less than 100 mm Hg

- ❖ The consciousness is normal.

- **2<sup>nd</sup> degree of dehydration (loss of body weight to 10%):**
  - ❖ Central neural system: in adults – the patient is anxious and nervous; in children – the weight loss leads to somnolence and later to stupor.
  - ❖ Skin and mucosa – dry, turgor – very reduced
  - ❖ The fontanel in infants is slightly hollowed.
  - ❖ Cardiovascular system – tachycardia, soft pulse, blood pressure under 80 mm Hg, without shock.
  - ❖ Oliguria.

- **Third degree of dehydration – loss of body weight more than 10% is equivalent to hypovolemic shock:**
  - ❖ Central neural system – comma.
  - ❖ In all patients: the mucosa is dry and red, the cornea is seared, the skin is dry, wrinkled, without turgor.
  - ❖ In infants: the fontanel is greatly hollowed.
  - ❖ Cardiovascular system – a sharp fall down of the blood pressure.
  - ❖ Tachypnea, cyanosis, anuria.

# *Cholera – 3<sup>rd</sup> degree of dehydration*



**Figure 2: A child, lying on a cholera cot, showing typical signs of severe dehydration from cholera**

The patient has sunken eyes, lethargic appearance, and poor skin turgor, but within 2 h was sitting up, alert, and eating normally.

# Aims of the management

- **Supportive treatment:**
  - ❖ Recovery of volume of the fluids.
  - ❖ Recovery of electrolytes' balance.
  - ❖ Correction of metabolic acidosis.
- **Etiological treatment.**

- **In cases with second and third degree of dehydration a metabolite acidosis is observed,**
- Intracellular water loss and electrolyte deficiency
- Disturbed function of the kidney, liver, cardiovascular system and adrenal glands.
- In adults: Endotoxic shock is observed in Gram-negative bacteria.
- In children: it is expressed by toxicosis.

# **Restoration of normovolemia (rehydration)**

- **Restoration of previously fluids' losses:**
- **Lost fluids recover themselves within first six hours as follows:**
  - 50 % within first two hours and
  - 50 % during the next four hours.

# Restoration of normovolemia (rehydration)

- Daily needs:
- Little children:
  - ❖ first trimester x 150 ml/kg body weight/ 24 h;
  - ❖ second trimester x 120 ml/kg body weight/ 24 h;
  - ❖ third trimester x 100 ml/kg body weight/ 24 h.
- Adolescents x 60 ml/kg body weight/ 24 h.
- Adults x 40-50 ml/kg body weight/ 24 h.

# Restoration of normovolemia (rehydration)

- **Current losses:**

- ❖ Current losses caused **by vomiting and diarrhea** x 20ml/kg body weight/ 24 h.
- ❖ **For perspiration** x 30ml/kg body weight/24 h.
- ❖ **For supporting of urine output** x 30ml/kg body weight/ 24 h.
- ❖ **For each temperature degree over 38° C** x 10 ml/kg body weight/ 24 h.

# *Ward for cholera*



## Formula for correction of fluids

$T$  (body weight)  $\times 4 \times (Ht_{\text{patient}} - Ht_{\text{norm}}) =$   
fluids for 24 h.

# Criteria for severity of hypovolemia

pulse

- $C \text{ (coefficient)} = \frac{\text{pulse}}{\text{systolic RR}} = 0.5 \text{ norm}$

- At  $C = 1.0$  – There is a danger of hypovolemic shock.
- At  $C$  more than 1.5 – There is hypovolemic shock.
- At decreasing of  $C$  under 1.0 – An active and effective resuscitation is necessary.

# Solutions for rehydration depending of the type of dehydration

- **HYPOTONIC DEHYDRATION –**  
2/3 saline solutions - 1/3 glucose solutions.
- **HYPERTONIC DEHYDRATION –**  
2/3 glucose solutions - 1/3 saline solutions.
- **ISOTONIC DEHYDRATION – EQUAL PARTS**  
of saline and glucose solutions.
  - 80 % – parenterally,
  - 20 % – orally.

# Recovery of electrolytes' balance

- Daily needs:

- ❖  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^+$  – 1-2 meqv/kg body weight/ 24 h

- ❖ Ca – 1-2 meqv/kg body weight/24 h

- Hypernatremia over 150 mmol/l leads to brain stroke – because of subarachnoid and subdural bleeding.

# Recovery of electrolytes' balance

- Current losses:
- At 100 g body weight loss, definite quantities of electrolytes expressed in mmol/l are lost because of:

	Na	Cl	K
• <u>vomiting</u>	10	10	2
• <u>diarrhea</u>	6	6	6
• <u>vomiting and diarrhea</u>	8	8	4
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mean	8	8	4

## Formula for correction of SODIUM expressed in mmol/l

$$T \times 0,3 \times (145_{\text{norm}} - \text{Sodium}_{\text{ionogram}})$$

- Sodium and chlorine / Na and Cl – not more than 10 meqv/kg body weight/24 h.

- **Formula for correction of POTASSIUM expressed in mmol/l**

$$T \times 0,3 \times (5_{\text{norm}} - \text{Potassium ionogram})$$

- No more than 2 –3 mmol/l in 100 ml fluids,
- No more than 4 meqv/kg body weight/24 h.
- **Never potassium fastly intravenously!!!**
- **Never potassium at anuria!!!**
- **Administration – in slow infusion!!!**

# Correction of metabolic acidosis

- **Formula of Astrup:**

$T \times 0,3 \times BE = \text{Sodium bicarbonate}$   
8.4%/ml

**Administration – 2/3 of estimated!!!**

# Other supportive measures

- Human albumin 5% and 20% – 10 ml/kg body weight/24 h
- Blood – 10-20 ml/kg body weight/24 h
- Methylprednisolone – 1-2 mg/kg body weight/24 h

# Other supportive measures

- In cases of cholera is applied **Phillips'**  
**solution:**
- Sodium chloride – 5.0
- Sodium bicarbonate – 4.0
- Potassium chloride – 1.0
- Distilled water – 1000 ml.
- It contains: Sodium – 135 mmol/l, chlorides – 15 mmol/l, and bicarbonates – 40 mmol/l.

# Other supportive measures

- **WHO solution for oral rehydration:**
- Sodium chloride – 3.5 g.
- Sodium bicarbonate – 2.5g.
- Potassium chloride – 1.5 g.
- Glucose – 20.0 g.
- Distilled water – 1000 ml.

# Treatment of watery-saline homeostasis:

- Appears at acute renal failure (ARF) at leptospirosis, HFRS or at hyperhydration.
- To prevent hyperhydration at ARF the fluid intake is sum of diuresis + 1000 ml.
- When manifestations of hyperhydration appear (such as lung and brain edema, swelling of the eyelids, scrotum) intravenous infusions stop and furosemide administers (at adults 200-400 mg, at children 3-5mg/kg body weight). In lack of effect – dialysis performs.

# Treatment of the intoxication

- Intravenous infusion of glucose, saline or both fluids, plasma, blood in volumes according to the age, needs and the patient's condition – for adults to 2000 ml, for infants to 100 ml/kg body weight.
- Corticoids –i.m. or iv. In dose 2-3 mg/kg body weight in short course (4-5 days).
- Vitamins – vitamin C and group B.
- Oxygenation – with nasal catheter – 3-5 L/minute.

# Treatment of the brain edema

- Intravenously Mannitol 10% – 1-2 g/kg divided in 2-3 equal intervals. Contraindicated in lung edema, acute renal failure.
- Corticoids in gradually decreasing dose:
  - ❖ Methylprednisolone 3-5 mg/kg /day intravenously twice or trice daily 5 to 7 days or
  - ❖ Dexamethazone 0,2-0,5 mg/kg/day intravenously twice or trice daily 5 to 7 days.
- Salidiuretics – furosemide 2-3 mg/kg for infants and 20-40 mg twice or trice daily for adults.
- At severe brain edema Mannitol + Furosemide.
- Human albumin 20% 5 ml/kg BW, plasma 15-20 ml/kg.
- Oxygenation – with nasal catheter – 3-5 L/minute.

- Anticonvulsants:

- ❖ Diazepam – 10-20 mg i.m. or i.v. At i.v. administration – danger from breath arrest!!! For infants – 0,25-0,50 mg/kg i.m.
- ❖ Phenobarbital i.m.– for adults 100-200 mg, for infants 5 mg/kg/day.

# Treatment of the endotoxic shock

- Restoration of the circulating volume – by intensive infusion of glucose and saline solutions, Ringer, Hartmann, Human albumin, plasma etc. The volume of intakes depends of the diuresis, central venous pressure, arterial pressure, hematocrite, grade of dehydration, electrolytes' levels. At adults totally 3-4 L, at infants and children – 100-200 ml/kg/day.
- Corticoids – methylprednisolone 5-10 mg/kg – first administers the half of total dose and after then the remaind divided in three equal parts. The initial total dose – 2-3 days and after then – gradually decreasing. Total course – 7-8 days.
- Vasopressors – dopamin perfusion 5-10-15  $\mu\text{g}/\text{kg}/\text{minute}$ .
- Central cardiotonics – intravenously digoxin in initial dose 400-600  $\mu\text{g}/\text{day}$ , after 1-2 days to 400 or 200  $\mu\text{g}$  daily. At infants and children 15-30  $\mu\text{g}/\text{kg}/\text{day}$ , after 1-2 days – the half of this dose.
- Treatment of the hypoxia – oxygenation by nasal catheter 3-5 L/minute.
- Restoration of the alkaline-acid balance.

# Treatment of the allergic shock

- Epinefrin – **immediately i.m. or i.v. 1 amp (1 mg) for adults, 10 µg/kg for infants.**
- Corticoids i.v. or i.m. – methyprednisolone 5-10 mg/kg and if needs the same dose after 2-3 hours.
- Antihistamines – i.m. or i.v.
- Solutions i.v. – for adults 1-2 l within 2-3 hours, for infants 100-150 ml/kg in equal parts glucose and saline solutions.
- Oxygenation by nasal catheter 3-5 L/minute.
- Central cardiotonics – intravenously digoxin in initial dose 400-600 µg/day, after 1-2 days to 400 or 200 µg daily. At infants and children 15-30 µg/kg/day, after 1-2 days – the half of this dose.
- Vasopressors – dopamin perfusion 5-10-15 µg/kg/minute.

# Treatment of haemorrhagic shock

- Restoration of the circulating volume.
- Immediately transfusion of isogroup blood – for adults some envelopes, for children 20-40 ml/kg.
- Haemostatic drugs – Ca gluconicum, vitamin C, Pamba, decinone, antihaemophylic plasma, platelet concentrate.
- Oxygenation by nasal catheter 3-5 L/minute.
- Central cardiotonics – intravenously digoxin in initial dose 400-600 µg/day, after 1-2 days to 400 or 200 µg daily. At infants and children 15-30 µg/kg/day, after 1-2 days – the half of this dose.
- Vasopressors – dopamin perfusion 5-10-15 µg/kg/minute.

# Treatment of cardiogenic shock

- Vasopressors – dopamine perfusion 5-10-15  $\mu\text{g}/\text{kg}/\text{minute}$ .
- Restoration of the circulating volume.
- Corticoids intravenously methylprednisolone 2-3 mg/kg/day.
- Oxygenation by nasal catheter 3-5 L/minute.
- Central cardiotonics – intravenously digoxin in initial dose 400-600  $\mu\text{g}/\text{day}$ , after 1-2 days to 400 or 200  $\mu\text{g}$  daily. At infants and children 15-30  $\mu\text{g}/\text{kg}/\text{day}$ , after 1-2 days – the half of this dose.

# Treatment of haemostatic disorders and haemorrhagic syndrome

- Appear at liver dysfunction, damage of the vassal, bone marrow, DIC, or combined.
- The treatment depends of the reasons:
- **At liver dysfunction:**
  - ❖ Transfusion of fresh blood or antihemophilic plasma – no less than 20 ml/kg.
  - ❖ Corticoids – methylprednisolone 3-5 mg/kg/day, at acute liver failure no less than 5 mg/kg/day.
  - ❖ Hepatoprotective drugs – vitamins B, vitamin C, silymarin, L-ornithine, ademetionine, glucose and levulose solutions.

- **At endothelial damage:**

- ❖ Stabilizing the vassal walls drugs – Ca gluconicum, vitamin C, ruthin, peflavit, rutascorbin.

- ❖ Corticoids – methylprednizolone 3-5 mg/kg/day

- ❖ Haemostatic drugs – Ca gluconicum, vitamin C, Pamba, decinone, antihaemophylic plasma, platelet concentrate.

- **At myeloid disorders with thrombocytopenia:**

- ❖ Corticoids – methylprednizolone 2-3 mg/kg/day

- ❖ Vitamins B, vitamin C.

- **At DIC:**

- ❖ In the 1<sup>st</sup> phase (of hypercoagulation) –
  - Heparin 200-300 E/kg/day for children and 20-30 000 E/kg/day for adults in permanent intravenous infusion or divided fourthly. The course is 2-3 days.
  - Antiagregants – acetysal, antistenocardin, indomethacine
  - Corticoids – methylprednizolone 5-10 mg/kg – first administers the half of total dose and after then the remaind divided in three equal parts. The initial total dose – 2-3 days and after then – gradually decreasing. Total course – 7-8 days.
  - Intravenous infusions of solutions improving the blood' reology – low-moleculle-weight dextrans (haemodex, reodex), Ringer, human albumin, plasma.

❖ In the 2<sup>nd</sup> and 3<sup>rd</sup> phase (hypo- and acoagulation):

- Transfusion of fresh blood, antihaemophilic plasma together with heparin (to prevent an increasing of the coagulation due to transfusion of new haemostatic factors).
- Antifibrinolytics – Pamba 3-4 amp daily for adults, 5-10 mg/kg for children), EAC (1 amp i.v. each 6 hours).

# Treatment of acute renal failure (ARF)

- **In the oliguric phase:**
  - ❖ High doses furosemide for adults 400 and more mg/kg/day in 3-4 infusions. Begins with lower doses and gradually increase. If to 600 mg diuresis is not appeared, a dialysis performs. For children the dose is 3-5-7 mg/kg/day.
  - ❖ A maintenance of adequate water-saline homeostasis – see above. At hyperkalaemia – Ca gluconicum (to 100 ml/day) and concentrated glucose (20% 1000 ml) with adequate insulin.
  - ❖ Calorie intake – for adults 2000 cal, for children 50-80 cal.
  - ❖ Corection of the acidosis – see above.
- **In the poliuric phase:**
  - ❖ Increased fluid infusions (diuresis plus daily needs) and electrolytes.

# Treatment of acute liver failure

- Intravenous infusions of glucose and levulose 1500 to 2000 ml/day, 5% or 10% glucose with 6 E Insulin and 500 to 1000 ml 5% laevulose/day in permanent infusion.
- Corticoids – methylprednisolone 4-6 mg/kg/day, in 3-4 equal doses. The first dose could be the half of daily dose. If an improvement appears the daily dose decreases. Famotidine gastroprotection is needed and antibiotic protection also.
- Treatment of the brain edema – mannitol 10%, human albumin (see above).

- Drugs for decreasing of the hyperamoniaemia – glutamat, L-ornitine, low protein intake by feeding, deep enema, lactulosis, antibiotics for supression of the intestinal bacterial flora orally or by nasogastral tube (aminoglycosides, polymyxin M, cephalosporins)
- Vitamins – vitamins B, vitamin C, vitamin K
- Corection of the alkaline-acid balance – in the onset alkalosis appears (correction by dehydratin), in later stages – acidosis (correction by sodiun hydrogencarbonate 8,4% to formula of Astrup – see above)
- A maintainence of adequate water-saline homeostasis – see above.
- Sedatives – diazepam 10-20 mg every 3-4 hours together with treatment of brain edema (dexamethazone, mannitol, human albumin)
- Neurostimmulators – at coma pyramem 4-6 g i.v. in 2 parts.

- Treatment of the haemorrhagic syndrome (see above).
- Prevention of secondary bacterial infection – antibiotics against the intestinal bacterial flora, immune drugs (Immunovenin)
- Hyperbarr oxygenation
- Liver transplantation.

# Treatment of acute respiratory failure

- Appears at central or peripheral paresis or paralysis of the breathing, an obstruction of airways, destroyed gas-exchange in the alveoli.
- **At paresis or paralysis of the breathing:**
  - ❖ Ambu or mechanic ventilation
  - ❖ Oxygenation by nasal catheter 3-5 L/minute.
  - ❖ Immediately intubation, if needs – mechanic ventilation.
  - ❖ Treatment of brain edema.
  - ❖ Improving of neurotransmission – nivalin, neostigmine, prostigmine, vitamins B1, B12
  - ❖ Prompt intensive treatment of the leading disease.

- **At obstruction of the airways:**
  - ❖ Aspiration, intubation, tracheostomy
  - ❖ Oxygenation by nasal catheter 3-5 L/minute.
  - ❖ Prompt intensive treatment of the leading disease.
- **At destroyed gas-exchange in the alveoli:**
  - ❖ Oxygenation by nasal catheter 3-5 L/minute.
  - ❖ Immediately intubation and mechanic ventilation.
  - ❖ At lung edema – mechanic ventilation, diuretics (furosemide), methylprednisolone 3-4 mg/kg, phlebotomy
  - ❖ At cardiac failure – central cardionics
  - ❖ At inflammation – intensive treatment of the inflammatory process
  - ❖ At pneumothorax – pleural puncture and permanent aspiration (in Surgery Ward).

**THANK YOU  
FOR THE ATTENTION !**