MINISTRY OF HEATH OF UKRAINE

POLTAVA STATE MEDICAL UNIVERSITY

Department of general surgery

METHODICAL INSTRUCTIONS
FOR STUDENT SELF-DIRECTED WORK WHEN PREPARING FOR AND DURING PRACTICAL CLASS

Study discipline	**General surgery**
Module №1	**INTRODUCTION TO SURGERY. SURGICAL EMERGENCY CONDITIONS. FUNDAMENTALS OF ANESTHESIOLOGY AND INTENSIVE CARE**
Content module 2.	**Bleeding, blood loss. Bases of blood transfusion**
Lesson theme №9	Complications of blood transfusion and their prevention. Prevention of the transmission of infectious diseases during the transfusion of blood components. Blood substitutes: classification, mechanism of action, indications and methods of application.
Years of study	***III***
Faculty	**International**

Poltava

Content module 2.	**Bleeding, blood loss. Basics of haemotransfusiology.**
Lesson theme №9	Complications of blood transfusion and their prevention. Prevention of the transmission of infectious diseases during the transfusion of blood components. Blood substitutes: classification, mechanism of action, indications and methods of application.

1. Relevance of the topic:

The transfusion of blood - is the most common operation for tissue transplantation from a healthy patient with a medical purpose . Blood transfusions can be applied in different circles of medicine: surgery , internal medicine , obstetrics and gynecology , etc. Therefore, blood transfusion equipment must possess a doctor . The ability to correctly identify screenings for transfusion , to determine the blood group and Rh affiliation , to test for compatibility of blood, which is poured - is vitally important to the patient.

For mistakes made by blood transfusion , responsible doctor who received a blood transfusion . Therefore, the sample for compatibility , availability of blood and serum should be able to control every doctor . These are the main requirements of prevention of the most dangerous complications and post-transfusion reactions that snevozmogayut tragic consequences.

2 . Learning Objectives :

1. Know the blood products .
2. Know the pathological effects of blood transfused .
3. Know a complication of transfusion of blood and blood products and their treatment Know the reaction transfusion of blood and blood products and their treatment .
4. Know the classification of blood substitutes .
5. Know screenings to blood transfusion .
6. Know the reaction and treatment in the application of blood substitutes .
7. Complications at a transfusion of components of blood.
8. Clinic, diagnostics and treatment of haemo transfusion shock.
9. Prevention of complications at a hemotransfusion.

3 . Basic knowledge and skills necessary for studying the topic (inter-disciplinary integration)

The names of the preceding disciplines	The skills
normal physiology	Know the features of the functioning of the hematopoietic and cardiovascular system. Know the normal parameters of a general analysis of blood and urine tests.

normal anatomy	Determine the type of vessel. Know the structure of the main types of vessels.
Physical and Colloid Chemistry	Know the concept of osmotic and oncotic pressure.
Propedeutics Internal Medicine	To demonstrate the method of examination of patients, collecting medical history, conduct inspection, palpation, percussion and auscultation, reading radiographs.
pathophysiology	Know the pathogenesis of hypovolemic shock, blood disorders, DIC, to be able to diagnose shock.
Biochemistry	To treat blood biochemistry.
pathological anatomy	Histopathological signs of bleeding

The student must have an idea :

- The indications and contraindications for transfusion of blood and blood components , assimilate methods of blood transfusion .
- A blood transfusion and monitoring of patients during its execution .
- Groups of substitutes .
- The possible errors and complications with blood transfusion .

The student should know :

1. Preparations of blood components.
2. Group substitutes .
3. Possible errors and complications of transfusion of blood and blood components ,
4. Classification of complications of blood transfusion ,
5. Pathogenesis of complications of blood transfusion,
6. Clinical features of complications of blood transfusion .
7. Complications at a transfusion of components of blood.
8. Clinic, diagnostics and treatment of haemo transfusion shock.
9. Prevention of complications at a hemotransfusion.

The student should be able to:

1. Be able to define the indications and contraindications for transfusion of blood and blood components , blood transfusion techniques to learn .

2 . Organize a blood transfusion and monitoring of patients during its execution .

3 . To categorize groups of substitutes .

4 . Classify errors and complications of blood transfusion .

5 . Master the prevention and treatment interventions for complications of blood transfusion .

Mastering the skills of students:

1. Macroscopic determination of the quality of blood.

2 . Observation of the patient during the transfusion , documentation.

3 . Determination of blood groups and conduct tests for compatibility.

4. Tasks for self-study in preparation for the lesson .

4.1. The list of basic terms , parameters, characteristics that must learn student in preparation for the class:

Term	**definition**
autohemotransfusion	The transfusion of his own blood.
refusion	Direct transfusion of fresh his own blood from the site of bleeding.
hemostasis	Stop the bleeding.
coagulation	Blood clotting.
coagulopathy	Disruption in the blood coagulation system.

4.2 . Theoretical questions for the class :

1. Indications and contraindications for transfusion .
2. Ways and methods of blood transfusion .
3. The mechanism of action of transfused blood and blood components.
4. Preparations of blood components.
5. Group substitutes .
6. Possible errors and complications of transfusion of blood and blood components , classification , pathogenesis , clinical features .
7. Prevention of complications of blood transfusion .

4.3.Praticall scill (tasks) used in class:

1. Macroscopic determination of the quality of blood.
2. Observation of the patient during the transfusion , documentation.
3. Determination of blood groups and conduct tests for compatibility.
4. Determination of mechanical complications
5. Determination of reactive complications
6. Determination of Infectious complications

5 . The content of the topic.

COMPLICATIONS OF BLOOD TRANSFUSION

Blood transfusion is considered to be a safe method of treatment if all the rules and regulations are carefully followed. Violation of the regulations, underestimation of contraindications, and technical errors can lead to serious post-transfusion reactions and complications.

It is know many different classification of posthemotransfusion complications. Best full they are in classification by A.N.Filatov:

Classification of posthemotransfusion complications by A.N.Filatov

1. Mechanical
2. Reactive
3. Infectious

I. Mechanical complications

1. Acute cardiac dilatation - there are acute circulatory impairment, acute

cardiovascular insufficiency. Cause this complications are overload of heart by big volume of fast transfused blood into venous system. There are especially dangerous for elderly patients and patients with accompanying pathology of cardio-vascular system

The clinical picture includes dyspnoea, cyanosis, right hypochondriac pain, fast weak arrhythmic pulse, arterial hypotension with venous hypertension.

When there are signs of cardiac overload, transfusion should be stopped, cardiac drugs (strophanthin, corglucon), vasoconstrictors and 10 ml of 10% calcium chloride is given.

2. Air embolism – there are very rare but very severe complication. It appears when little quantity air with transfused substance gets into vascular system (Air embolism may result from an instant entry of as much as 2-3 cm^3 to the vein). Air with blood flow get in right parts of heart, than into pulmonary artery and embolised the main tube (column) and small branches. Result is mechanical obstruction for blood circulation

Clinical signs of air embolism of the pulmonary artery are severe chest pain, dyspnoea, cough, cyanosis of the upper trunk, fast weak pulse and hypotension. The outcome is often unfavorable. With the early signs of embolism, transfusion must be stopped and resuscitation started: artificial ventilation of lungs, cardiovascular drug therapy.

3. Thrombosis and embolism. Immediate cause is blood clots (thrombus) different size. This clot form in consequence of uncorrected blood conservation, mistakes in method of hemotransfusion, transfusion big doses conserved blood with long term of keeping (after 7 days keeping, e.i., number of aggregate exceed 150000 in 1 ml)

The clinical features of this complication are similar to those of air embolism. Small thrombi obstruct smaller branches of the pulmonary artery causing lung infarction, whose clinical signs being as follows: sudden chest pain, cough (progressing from being dry to that with bloody sputum), sharp breathlessness, sometimes hemoptosis (blood spitting), fever, pale skin, shown cyanosis. Chest x-rays show signs of focal pneumonia.

With the early signs of thromboembolism transfusion must be stopped and cardiovascular drugs, oxygen, activator of fibrinolisis (streptocinasa, urocinasa), fibrinolysin, streptokinase and heparin given.

4. Impairment blood circulation into extremity after intraarterial transfusions

It is very rare complication. Arterial vall thromboses and gets to thromboses or embolism of peripheral artery by blood clot

II. Reactive complications

There are best severe, dangerous and frequent posthemotransfusion complications

1. Hemotransfusion reaction
2. Hemotransfusion complications

1. Hemotransfusion reaction

1) According gravity of clinical course:

I level - mild (easy) reaction - body temperature increases by 1°C and the patient complains of headache and muscle pain, chill

II level - moderate reaction - involves rigors, body temperature increase by 1,5-2°C, tachycardia, breathlessness, chills; sometimes skin rash (eruption) and dyspnoea.

III level - severe reactions - characterized by rigors, body temperature rise by more than 2°C to as high as 40 °C, severe headaches, pains in the muscles and bones, tachycardia, labial cyanosis and dyspnoea, urticaria, chills, Quincke's edema.

2)According cause reactions are reveal:

a) Pyrogenic,
b) Antigenic (non-hemolytic)
c) Allergic

a) Pyrogenic reactions

The pyrogenic reactions are mediated by the products of plasma protein decay into donor's blood, products of microbial activity.

Clinic: body temperature increases, headaches, tachycardia,

Treatment: During pyrogenic reaction, the patient should be covered with warm clothing and hot water bottles applied to the feet; he/she should be given hot drinks as well as paracetamol. If it is a mild or moderate reaction, these measures may suffice. In severe reactions, apart from the above-mentioned measures, the patient is given promedol, analgin in injections, 5-10 ml of 10% calcium chloride and solutions of glucose are given intravenously.

To prevent pyrogenic reactions: abide by rules of blood conservation; in patients with severe anaemia, washed and frozen red blood cells should be transfused.

b) Antigenic (non-hemolytic) reactions: causes by sensibilisation by lejkocytaris, thrombocytaris and plasma proteins antibodies as result from previous transfusions and pregnancies.

Clinic reveals after 20-30' after stopped of hemotransfusion: chills, body temperature increases, headache, bradycardia, pain in the small of the back (lumbar pains)

Treatment: antigistamins, cardiovascular, narcotic analgetic, detocsication, anthyshok solutions

c)Allergic reactions cause by human body (recipient's) sensibilisation to different immunoglobulins. This antybody formed after blood, plasma and krioprecipitat repeated transfusions. Sometimes this antybodyes are form before the born.

Clinica: gravity of allergic reactions may be different – from easy till development of anaphylactic shock with accordance clinical picture. Manifestations of anaphylaxis include rigors, fever, malaise, urticaria, dyspnoea, suffocation, nausea, vomiting.

Treatment: Antihistamines and desensitising agents (dimedrol, suprastin, calcium chloride, corticosteroids) are used, in case of vascular insufficiency vasopressors are administered.

2. Hemotransfusion complications.

If blood incompatible mainly by the ABO group and Rh systems is transfused, the patient develops blood transfusion shock resulting from rapid intravascular haemolysis of the transfused blood. The main reasons of incompatibility of blood are technical errors.

1) Hemotransfusion shock - complication for blood transfusion, wich incompatibility by ABO system.

The three degrees of **shock** are identified:

degee 1 - a fall in systolic blood pressure to 90 mm Hg,

degee 2 - a fall in systolic blood pressure to 8070 mm Hg,

degee 3 - a fall in systolic blood pressure below than 70 mm Hg.

The following periods are identified in the course of blood transfusion shock:

1) blood transfusion shock per se;

oliguria and anuria;

restoration of diuresis;

recovery.

Clinical symptoms and signs of shock can occur at the beginning of the procedure following transfusion of only 10-30 ml of blood, at the end of transfusion or immediately after transfusion. These usually involve restlessness, pain and a sensation of retrosternal uneasiness, lumbar or muscle pain, and sometimes rigors; the patient is dyspnoeic, tachycardic and hypotensive, his/her face being hyperaemic, sometimes pale or cyanotic. The may also experience nausea, vomiting, enuresis or even encopresis. Fulminant development of these manifestations may be fatal.

If incompatible blood is transfused to a surgical patient under general anesthesia during operation these signs of shock may manifest mildly, if at all absent. In such cases incompatibility is identified by the increase or decrease in blood pressure, cyanosis of the skin and visible mucus layer, an increase sometimes very pronounced bleeding tendencies of tissues in the operation wound. When the patient recovers consciousness, they may have tachycardia, hypotension, and acute respiratory arrest.

During recovery from blood transfusion shock, they can develop **acute renal failure.** Oliguria, hyposthenuria and progressing uraemia may be evident in the first few days. Progression of acute renal failure can lead to a cessation of urine production, or *anuria.* The levels of products of protein degradation, urea and bilirubin start to increase in the blood. In severe cases the period can last for 8-30 days. In favourable situations, the signs of renal failure subside, diuresis is gradually restored and the patient enters the recovery period. If uraemia sets in, death usually occurs within 3-15 days.

Treatment. With the early signs of blood transfusion shock, transfusion must be stopped and intensive therapy started.

1. Cardiovascular agents like strophanthin, corglucon (in cardiovascular failure), norepinephrine (in hypotension), dimedrol, suprastin or diprazin are used as antihistamines, corticosteroids (50-150 mg of prednisolone or 250 mg of hydrocortisone) are given to stimulate vascular tone and inhibit the antigen - antibody reaction.

2. To accelerate the restoration of circulation rheopolyglukin and saline solutions are given.

3. To remove the products of haemolysis hydrocarbonate and sodium lactate are given.

4. To support diuresis haemodes, lasix and mannitol are given.

5. To reduce spasm of the renal vessels an emergency bilateral paranephric novocain (procaine) blockage is done.

6. Oxygen therapy is given and in respiratory failure artificial ventilation of the lung is provided.

7. Ineffective drug therapy of acute renal failure and progressing uraemia is an indication for haemodialysis or haemabsorption.

2) Complication for blood transfusion, wich incompatibility by Rh-factor system.

Clinical manifestations of blood transfusion shock after transfusing Rh incompatible blood occur after 30-40 minutes, and occasionally several hours after transfusion.

This complication may occur when patient with Rh-negative blood are injected Rh-positive blood. And this patient was sensebilized by previous transfusions (or in vomen – Rh-positive foetus)

3) Syndrome massive hemotransfusion Transfusing an amount of donor's blood above 40-50% of the circulating blood volume (i.e. about 2-3 l) within a short period (up to 24 hours) is referred to as *massive blood transfusion.* In transfusing such an amount of blood (especially after long storage) from different donors there is a risk of *massive blood transfusion syndrome.* The factors that contribute to its development are as follows:

- exposure of blood to cold (refrigerator);
- administration of excessive amounts of sodium citrate and products of blood decay (e.g. potassium, ammonia), which accumulate in plasma during its storage;
- administration of excessive amounts of fluid that enters the blood stream and overloads the cardiovascular system.

Citrate intoxication Massive transfusion may cause *citrate intoxication.* The toxic dose of sodium citrate is considered to be as much as 0,3 *g/kg.* Sodium citrate interacts with calcium ions in the recipient's blood and causes hypocalcaemia, which, combined with accumulation of citrate in the blood, leads to severe intoxication.

The signs of the latter are as follows: tremor, twitching, fast pulse, hypotension, arrhythmia. In severe cases dilation of the pupils, cerebral and pulmonary oedema can be evident.

To prevent citrate intoxication, it is required that following transfusion of each 500 ml of preserved blood 5 ml of 10% calcium chloride be given.

Treatment: to neutralise sodium, citrate solutions of calcium gluconate and calcium chloride are administered.

K^+-intoxication The transfusion of blood that has been stored for a long period (more than 10 days) can be followed by severe potassium intoxication that leads to ventricular fibrillations and further to cardiac arrest.

Clinically, hyperkalaemia involves bradycardia, arrhythmia, myocardial atony.

Prevention of potassium intoxication consists in transfusion of blood that has been stored for a short time (maximum 3-5 days) or the use of washed and frozen red blood cells.

Treatment: 10% calcium chloride, normal saline, 40% glucose with insulin as well as cardiac preparations are given.

7) Homological blood syndrome. In massive blood transfusions when compatible blood of the same group and Rh, obtained from different donors is transfused, individual incompatibility of plasma proteins can cause the development of a serious complication known as *homological blood syndrome.* Clinical signs of the syndrome include skin pallor with bluish discoloration, dyspnoea, anxiety, cool skin on touch, fast and weak pulse,

arterial hypotension with venous hypertension. Multiple bronchi are audible on auscultation of the lungs. Haematocrit falls and the circulating blood volume dramatically decreases, although sufficient blood has already been transfused; the blood clotting time slows down. A microcirculatory defect, red cell stasis, microthrombosis and deposition of blood all contribute to the pathogenesis of this syndrome.

Prevention of the syndrome of homological blood involves replacement of blood loss depending on the circulating blood volume and its components. It is important to combine donor's blood with antishock solutions (polyglukin, rheopolyglukin) that improve the rheologic properties of blood (fluidity) because of dilution of blood, reduction of its viscosity and acceleration of microcirculation.

In massive transfusion it is not necessary to fully replace the concentration of haemoglobin. To maintain the transport function of blood haemoglobin blood levels of at least 75-80 g/l will suffice. To replace the deficit in the circulating blood volume, solutions must be used. Of great importance in prevention of the syndrome of homological blood is autotransfusion of blood and plasma, i.e. the transfusion of absolutely compatible transfusion solutions as well as washed and frozen red blood cells.

3. Infectious complications.

Prevention of such complications involves thorough choice of donors, education of donors, proper management of the blood banks' and blood stations' work.

1) Transmission of acute infectious diseases (e.g. influenza, measles, typhoid, brucellosis, toxoplasmosis).

2) Transmission diseases, which spread of serum way serum (e.g. hepatitis **B, C, HIV,** cytomegalovirus infection, malaria)

3) Development banal surgical infection.

Bacterial - toxic shock only rarely occurs. It is caused by contamination of the blood during its preparation or storage. Complications occur either during transfusion or within 30-60 minutes. Rigors occur suddenly, fever, anxiety, semi-consciousness, fast and thready pulse, marked hypotension, enuresis and encopresis.

Bacteriological investigation of the blood left after transfusion plays a major role in confirmation of the diagnosis.

Treatment is by means of immediate antishock transfusion, detoxication and antibacterial substances, analgesic and vasoconstrictors (norepinephrine), solutions with rheologic and desintoxicating properties (rheopolyglukin, haemodes), electrolyte solutions, anticoagulants, broad-spectrum antibiotics (aminoglycosides, cephalosporins).

Most effective is the complex therapy with exchange blood transfusion.

IMMEDIATE AND LONG-TERM COMPLICATIONS

Complication of blood transfusions can develop both during and shortly after transfusion (immediate complications) , and through a long period of time - a few months, and after repeated transfusions - and years (long-term complications) . The main types of complications are presented in Table . 3 .

Table 3. Complication of transfusion of blood and blood components

Type of complications	Couse

The immediate immune	
1. acute hemolysis	Incompatibility of red blood cells of donor and recipient for AB0
2. Hyperthermic response negemoleticheskaya	Donor granulocytes in the overflow environment
3. anaphylactic shock	Class antibodies Ig A
4. urticaria	Antibodies to plasma proteins
5. Non-cardiogenic pulmonary edema	Antibodies to leukocyte or complement activation
Immediate not immune	
1. acute hemolysis	The destruction of donor red blood cells because of a violation of temperature and storage time, mixing with a hypotonic solution
2. bacterial shock	Bacterial infection of the transfused environment
3. Acute cardiovascular insufficiency	volemic overload
The long-term immune	
1. hemolysis	Repeated transfusions to form antibodies to erythrocyte antigens
2. The reaction of a "graft-versus-host"	The transfusion of non-irradiated stem cells
3. Post-transfusion purple	The development of anti-platelet antibodies
4. Alloimmunization antigen erythrocytes, leukocytes, platelets or plasma proteins	Action antigens of the donor origin
Long-term non-immune	
1. The overload of iron – Hemosiderosis	Multiple transfusions of red blood cells
2. Hepatitis C - often, at least - in very rare – A	Infection with hepatitis viruses transfused medium C, B, A
3. AIDS	Infection with the human immunodeficiency virus protection
4. parasitic infections	malaria

Blood substitutes

Blood substitutes are medicines which apply to transfusion therapy of various pathological states and at intravenous administration in an organism in defined steps can replace to the donor blood.

Blood has various biological and medical impact on an organism, and it cannot be replaced with any other remedies entirely.

The term "blood substitutes" arose because now medicines which on a number of indicators own in comparison with effect of blood therapeutic effect are developed.

There are 2 classifications of blood substitutes at which as a basis taken:

1. Structure and physical and chemical characteristic of solution (F_latov.A.N.-1975).

2. Functional properties of medicines).

Blood substitutes have to perform the main medical functions:

1. Fillings of the blood course, BVC providing restoration to normal level, and supports of the joint-stock company broken as a result of hemorrhagic shock.

2. Releases of an organism from toxins at poisoning with toxic substances.

3. Ensuring delivery nutritious nitrogenous, fatty to both hydrocarbon all bodies of substances and body tissues.

4. Oxygen transfer to body tissues.

Blood substitutes are subdivided INTO 6 groups:

I. Gemodinamichn_ (antishock) - for treatment of shock of different origin and restoration of violations of haemo dynamics, including microcirculation and for a gemodilyution.

II. Disintoxication - for treatment of intoxications of different origin (poisoning, toxicoses, a burn disease, radiation damages, dysentery, a hemolytic disease of newborns, diseases of a liver and kidneys, etc.)

III. Nitrogenous, fatty, hydrocarbons medicines for parenteral food which are applied to treatment of metabolic disorders that develop at a different serious illness and in the postoperative period.

IV. Water regulators - salt and acid the main balances - different salt solutions and osmodiuretic substances which have dehydrational properties and also carry out correction of composition of blood, solutions of polyatomic alcohols - the MANNITOL, d sorbite.

V. The modeling respiratory functions of blood - carriers of gases of blood.

VI. Complex Multifunctional blood substitutes which have the expanded range of action.

The general requirements to blood substitutes:

1. Their physical and chemical properties have to be close to blood plasma indicators (viscosity, osmolarity, etc.).

2. Have to quite it is brought out of an organism, fabrics and not to break function of bodies, or metabolesed in fermental systems.

3. Not to be anafilactogenic and not to cause an organism sensitisation to compound

4. Have to be not toxic, not pirogenic, maintain sterilization by autoclaving.

5. To be steady at preservation not less than 2 years.

Blood substitutes haemodynamic actions for restoration of the joint-stock company and its support at the normal level, have to is in the blood course since day. During this period plasma-proteins gradually fill and together with blood substitutes support colloid-osmotic pressure at the stable level. Optimum molecular weight for

antishock blood substitutes on the basis of partially hydrolyzed dextran is considered 30 000 - 70 000, and osmotic pressure within 400 - 600 mm. water column.

For blood substitutes haemodynamic an oxiyetilkrokhmal range admissible molecular weight is actions on a basis 200 000 - 450 000.

For a **desinoxication blood substitutes** important short-term circulation in the blood course, active interaction with toxins and fast their conclusion in the form of neutralized a complex with urine or a stake.

Medicines for parenteral food (nitrogenous medicines, fatty emulsions, glucose solutions, d- sorbite, to a mannit) Of course have small the molecular weight (MW) - from several hundred to several thousand Dalton. Their appointment - to join in exchange processes and to provide energy resources of an organism.

Blood substitutes haemodynamic actions are intended for normalization of indicators of the central and peripheral haemodynamics that are broken at blood loss, a mechanical injury, burn shock, various surgical diseases of internals (peritonitis, acute intestinal impassability, acute cholecystitis, acute pancreatitis), exogenous and endogenous intoxications.

Have the high molecular weight and osmotic properties expressed colloidal, long time circulate in the vascular course and attract intercellular liquid to the course, considerably increasing BVC(volemich effect). Besides the main action haemo dynamic blood substitutes have disintoxication action, improve microcirculation and rheological properties of blood.

To antishock blood substitutes carry are developed on the basis of a dextran

- oksiyetilkrokhmat
- gelatin
- polyethyleneglycol

I. dextran derivatives.

DEXTRAN - water-soluble high-molecular polymer of glucose which is waste product of bacteria. The native dextran is partially hydrolyzed, allocate a medium molecular fraction, cleaned and on its basis make a dosage form. Depending on molecular weight solutions of this group divide into two:

- medium molecular _ (poliglyucinum, polifer, rondeks, makrodex, nitradex, dextran, plasmodex, hemodex, oncovertin),
- low-molecular (reopoliglycinum, reoglyuman, reomacrodex, lomodex, dextran 40, gemodeks). The main medium molecular medicine of a dextran is poliglyucin, low-molecular - reopoliglyucin.

Poliglyucinum - 6% the district of partially hydrolysed dextran, (MM 60 10 x 103 in 0.9% the district of sodium of chloride). Medicine sterile, non-toxic, apirogeic. Poliglycin hidril polysaccharide which can connect water. Each gram occludes it 25 ml of water. At intravenous administration - increases BVC, raises and steadily maintains arterial blood pressure:

- increases the volume of the circulating liquid
- strengthens oxidation-reduction processes in an organism and fabric utilization of oxygen by us

- raises a vascular tone at stream introduction

- has disagregated influence on platelets and erythrocytes, improves microcirculation.

In an organism 3 - 7 days circulate, in the first day 45 - 55% of medicine are removed.

Indications - pour at shock:

1) develops as a result of a trauma, acute blood loss, intoxications, sepsis and others to the reasons (to acute circular insufficiency at different diseases),

2) surgery,

3) burn.

At shock which develops drug is injected intravenously stream on one introduction of 400 - 1200 ml, adult and 10 - 25 ml/kg - to the child. If necessary the dose is increased to 2000 ml for the adult and 35 - 40 ml/kg for the child. At critical condition (stage IV shock, an agony) poliglyucinum there is an input intraarterial (250 - 500 ml) with the subsequent transition to intravenous to injection.

side effect - at some people (less than 0,001%) allergic reaction is observed. For prevention - to carry out biological test. After infusion of the first 10 drops and the subsequent 30 drops it is necessary a break for 2 - 3 min. (observation). At development of reactions - the solution of calcium of chloride of 10% - 10.0 in/in

- the solution of glucose of 40% - 20.0

- cardiacs

- antihistaminic.

Contraindications:

- there are no absolute,

- Considering a possibility of increasing blood pressure after injection, it should not be changed at 2 MT (with increase in intra cranial pressure),

- at proceeding internal bleedings, except for heavy violations of haemodynamics (falling of the blood pressure is lower than 60 mm Hg). Release form: on 50, 100, 200, 400 ml in glass bottles and in polyethylene capacities on 250 and 500 ml. Preservation: - 10 - 20 C.

REOPOLYGLUCINUM

- 10% solution of a low-molecular dextran with average MM 35 000 - 5000 in 0.9% solution of sodium of chloride and 5% the district of glucose.

Medicine sterile, non-toxic, apirogenic.

Pharmacological action. Reopolyglucinum is hypertensive colloidal solution and at to in introduction considerably increases OTsK. Each 10 ml of a Reopolyglucinum attract to the blood course from adjacent fabric 10 - 15 more ml of liquid. There is a fast growth of the blood pressure, disaggregation of erythrocytes, is prevented to a thrombogenesis, decreases stasis of blood, there is a gemodilution, the viscosity of blood decreases rheological properties and microcirculation improve. Reopolyglucinum circulates in an organism of 2 - 3 days, 70% of medicine are removed in the first day.

Indications to application:

- it is lowered capillary blood circulation,

- State of shock of different origin,
- disorders of arterial and venous blood circulation,
- tromboembolic complications,
- Improvement of local blood circulation and decrease in a tendency to formation of thromboses in transplantat during plastic surgeries, on vessels, open heart,
- posttransfusion complications, prevention of a acute renal failure.

At violations of capillary blood circulation (different types of shock) medicine are entered to into by drop infusion from 400 to 1000 ml within 30 - 60 min., if necessary increase a dose to 1500 ml, to children of 5-10 ml/kg, if necessary up to 15 ml/kg.

Side effects are the allergic reactions connected with a sensitisation. Necessary to do of biological test.

Contraindications: Constant control of the blood pressure and W (heart failure, an anury) is necessary. At pathology of kidneys - appoint Reopolyglucinum with glucose.

Release form - on 50, 100, 200, 400 ml in glass bottles and polyethylene capacities on 250 and 500 ml. Keep from 10 to 25 Pages.

Dextran with MM of 1000 for prevention of allergic reactions.

2. Medicines on a basis to an hydroxyethyl starch.

In recent years in the USA, Germany, Japan solutions of hydroxyethyl starch - plasmosterin, plasmotonin, volex began to be applied, NAES - refortan, stabisol. In the CIS are issued oxipamat also to volekma. Structurally these solutions are close to a glycogen of animal fabrics and are capable to be split in the blood course amilolitic by enzymes.

VOLEKAM - 6% solution of hydroxyethyl starch _ am_lowpectinal starch, in 0.9% isotonic solution of sodium of chloride. MM - 170 000. Medicine sterile, non-toxic, apirogenic.

Pharmacological action: colloid- osmotic plasma substitute dynamic actions. Causes replacement with medicine of blood loss and holds for a long time liquid in the blood course. Has rheological, antitrombotic properties, improves blood circulation in a system macro - and microcirculation.

The main quantity of a volekam (90%) is brought out of the blood course in 14 days, and that that remained (10%) - in 24 days.

Indications are injuries, burns, sharp blood loss, the operating room shock, sepsis, violation of haemodynamic at different pathological processes, a preoperative isovolemic a gemodilyution, venous thrombosis. Are entered in / in stream or by drop infusion after conducting biological test.

At the developed shock which is followed by blood loss are entered to into stream 500 ml - 1500 ml, the general dose of a volekam - 1500 ml a day, depends on indicators of haemo dynamics and the general condition of the patient.

Side-effects are allergic reactions (an itch, rashes, Quincke's edema, etc.), acceleration of pulse, decrease of the blood pressure, temperature increase of a body, a headache, nausea, vomiting, hyperamilasemia.

Contraindications: skull injuries (at increase in intra cranial pressure), at the high joint-stock company, heart failure of stagnant character, dysfunction of kidneys (oligo--, an anury), organism dehydration, tendency to bleeding owing to hipofibrinogenic or trombopenic.

Release form on 50, 100, 200, 400 ml in glass bottles.

Preservation at 10 - 20 Pages.

REFORTAN - a plasma substitutes with MM in 20 000:

STABIZOL - MM - 450 000.

Are applied to filling of the absent blood volume in vessels at states with an insufficient volume of the circulating blood, prevention of hipovolemic shock in connection with burns, injuries, operations, gemodilution.

3. Medicines on the basis of gelatin.

Solution of gelatin was the first substitute of blood offered for treatment of shock and blood loss.

GELATIN - the denatured protein, is emitted from collagen of different animals. The ancestor of group and the most widespread medicine is gelatinol - 8% the solution which is partially hydrolyzed food gelatin in 0.9% the district of sodium of chloride (MM - 15 000 - 25 000). Abroad are issued: plasmogel, gelofuzin, gemogel, gelofuzin, modegel (M. M. 34 000 - 40 000).

Gelatinol is protein that contains a number of amino acids: Glycine, protein, etc. medical action it is connected with the osmotic pressure high colloidal which provides fast intake of tissues liquid in vascular neurology the course. In the conditions of acute blood loss, at adequately entered volume, quite renews BVC and the blood pressure. Quickly, in 2 hours - the course gets in vascular neurology and it is distributed in extracellular space.

Indications: hemorrhagic in the operating theater, traumatic shock of the I-II stage, when training patients for operation, at burns, intoxications.

The dose of medicine depends on a state of the patient. It can be at the same time poured to 2 l of solution.

Side-effects - has weak antygene properties.

There is no contraindication - absolute,

relative - acute or chronic nefritis and the same that for medicines of a dextran or hydroxyethyl starch.

Release form - on 450 ml in glass bottles, preservation at a temperature of 4- 22 degree

4. Medicines on the basis of polyethyleneglycol.

Polyethyleneglycol - monodisperse polymer, MM - 20 000.

On its basis the aganistshok blood substitutesk polyoxidin is created.

POLIOXIDIN - 1.5% solution polyetilenglicol - 20 000 in 0.9% isotonic solution of sodium of chloride. Medicine sterile, non-toxic, apirogenic. Polyoxidin has ability to attract a intratissu fluid to the blood course, at massive blood loss transfuion to a polyoxidin in volume of the lost blood is followed by sustainable recovery of system haemo dynamics, BVC. Against the background of restoration of BVC and the blood

pressure, blood volume grows approximately twice. There is a gemodilyution, the viscosity of blood and disaggregation of erythrocytes decreases that leads to normalization of capillary blood circulation. The Acid and main state is normalized.

Indications - hypovolemic state as a result of acute blood loss, posttraumatic and postoperative shock at adults.

Enter intravenously, doses and speed depends on indications and a state of the patient. A solution dose that is entered, makes 400 - 1200 ml a day (to 20 ml/kg)

Contraindications - cranial a trauma with increase in intra cranial pressure at which diseases it is contraindicated in / in introduction of high doses of liquid.

Release form - on 100, 200, 400 ml in glass bottles. Preservation from - 10 to - 30 C.

II. Blood substitutes of disintoxication actions.

It is a lot of diseases and pathological states are followed by organism intoxication (poisoning with various poisons, infectious diseases, burn and radiation sickness, sharp nirkovo a liver failure, etc.) blood substitutes disintoxication actions provide an organism detoxication by binding, neutralization and a conclusion of toxic substances.

Blood substitutes on the basis of polyvinylpirrolidone purposefully and effectively carry out desintoxication of an organism hydrophily and stimulation of a diuresis, quickly wash away an organism from toxins and products of metabolism. Medicines - a haemodes, a neohaemdes, reosorbilact, sorbilact, polides .

Reosorbilact

Mechanisms of detoxication action

With the administration of Reosorbilact into the vascular bed due to hyperosmolarity the fluid inflow occurs from intercellular space into the general bloodstream, «washingout» metabolites and toxins from the damaged cells, tissue, organ and improving perfusion in them.

• This is accompanied by increase in CBV (due to administered volume and intercellular fluid), which ensures hemodilution effect, thanks to that the concentration of toxins and metabolites in plasma is reduced.

• Due to the diuretic action toxins and metabolites are excreted from the organism. • The liver – the main organ of detoxication. Improving the microcirculation of organ, as well as replenishing glycogen depots, Reosorbilact ® normalizes the functional state of hepatocytes and enhances physiological detoxication.

Composition: active components: 100 ml of the solution contains 6 g sorbitol, 1.9 g sodium lactate, 0.6 g sodium chloride, 0.01 g calcium chloride, 0.03 g potassium chloride, 0.02 g magnesium chloride; auxiliary components: injection water.

Pharmaceutical form. Infusion solution.

Pharmacotherapeutic group. Auxiliary solutions for intravenous administration. Electrolytes combined with other drugs. ATC code B05X A31.

Pharmacologic properties.

Pharmacodynamics. Reosorbilact® has rheological, antishock, detoxification, alkalizing and stimulating effect on intestinal peristaltic. The main pharmacologically active components of the drug are sorbitol and sodium lactate. Sorbitol is metabolized in

the liver, originally into fructose that is subsequently transformed into glucose and then glycogen. Part of the sorbitol is used for the urgent energy needs, and the rest is deposited as glycogen. An isotonic sorbitol solution has a deaggregation effect, thus improving microcirculation and tissue perfusion. Unlike in the case of bicarbonate solution, metabolic acidosis correction by sodium lactate takes place more slowly as it is being included in the metabolism, without rapid pH fluctuations. The effect of sodium lactate is observed 20-30 minutes after administration. Sodium chloride has a rehydrating effect and replenishes the deficit of sodium and chlorine ions in various pathological conditions.

Calcium chloride replenishes the deficit of calcium ions. Calcium ions are required to enable transmission of nervous impulses, contraction of skeletal and unstriated muscles, myocardium functioning, formation of bone tissue and blood coagulation. It decreases cell and vascular wall penetrability, prevents inflammation and increases the body's infection resistance. Potassium chloride restores the water-electrolyte balance. It has a negative chrono- and bathmotropic effect; in high doses – a negative inoand dromotopic effect, and a moderate diuretic effect. It takes part in nervous impulse transmission. Increases the acetylcholine content and stimulates the sympathetic part of the autonomic division of the nervous system. Improves skeletal muscle contraction in case of myodystrophy and myasthenia.

Pharmacokinetics. Sorbitol is quickly included into the general metabolism; 80-90% is utilized in the liver and accumulated in form of glycogen, 5% deposited in the brain tissue, heart muscle and skeletal muscle, 6-12% eliminated with urine. After being administered into the bloodstream, sodium lactate is broken down into sodium CO2 and H2O, which create sodium bicarbonate that increases the blood alkali reserve. Only half of the administered sodium lactate (L isomer) is considered active, while the other half (D isomer) is not metabolized and then eliminated with urine. Sodium chloride is eliminated from the bloodstream, increasing the circulating blood amount only temporarily. It also increases diuresis.

Pharmaceutical characteristics: Main physical and chemical properties: translucent colorless liquid; nominal osmolarity – 900 mOsm/l; pH 6.0-7.6; ion composition: 1 ml of the drug contains Na+ - 5.395 mg, Ca++ - 0.036 mg, K+ - 0.157 mg, Mg++ - 0.051 mg, Cl- - 3.995 mg, CH3CH(OH)COO- - 15.635 mg.

Incompatibilities. Reosorbilact® may not be combined with phosphate- and carbonatecontaining solutions. Shelf life. 2 years. Storage conditions. Store at temperatures of 25°C or below. Keep out of reach of children. Do not freeze. Packaging. 200 ml and 400 ml bottles, 1 bottle in a cardboard box; 200 ml and 400 bottles; 250 ml and 500 ml containers.

Clinical profile.

Indications. Improving capillary circulation for prophylaxis and treatment of traumatic, operative, hemolytic, toxic and burn shock, in cases of acute blood loss, burn disease; contagious diseases accompanied by intoxication, aggravation of chronic hepatitis; sepsis; for pre-operative preparation and in the post-operative period; for improving arterial and venous circulation to prevent thrombosis, thrombophlebitis, endarteritis, Raynaud syndrome.

Contraindications. Individual heightened sensitivity to any of the drug components. Reosorbilact® is not used in the presence of alkalosis and in cases when infusion of large amounts of liquid is contraindicated (cerebral haemorrhage, thromboembolia, cardiovascular decompensation, grade III arterial hypertension, terminal renal insufficiency); dehydration.

Administration and doses. In adults, Reosorbilact® is administered by drop infusion, at a rate of 40-60 drops/minute. If necessary, stream infusion is allowed, with prior testing by drop infusion at 30 drops/minute. After 15 drops of the drug has been administered, the infusion is stopped; after 3 minutes, if no reaction is observed, Reosorbilact® is administered by stream infusion.

For cases of traumatic, burn, post-operative and hemolytic shock in adults, 600-1000 ml (10-15 ml/kg of patient's body mass) is administered in a single dose; subsequent doses of 600-1000 ml (10-15 ml/kg of patient's body mass) are administered by stream infusion at first, then by drop infusion. For cases of chronic hepatitis in adults, 400 ml (6-7 ml/ kg of patient's body mass) is administered by drop infusion. For cases of acute blood loss in adults, 1500-1800 ml (up to 25 ml/kg of body mass) is administered. In this case, infusion of Reosorbilact® is recommended at the pre-hospital stage, in a specialized first aid vehicle.

At the pre-operative stage and after various surgical treatments – a dose of 400 ml (6-7 ml/kg of body mass) by drop infusion, during 3-5 days. For cases of thrombo-obliterating vessel diseases – doses of 8-10 ml/kg of body weight, repeated every other day, up to 10 infusions per treatment course.

Side effects. Immune system disruptions: anaphylactoid reactions, angioedema, hyperthermia. Cardiovascular system disruptions: increase or decrease of arterial pressure, tachycardia, shortness of breath, acrocyanosis. Neurological disruptions: tremor, headache, faintness, general weakness. Changes in skin and hypoderm: cutaneous eruptions, hives, itching.

Overdosing. Alkalosis conditions that are swiftly alleviated after immediate cessation of the drug therapy; occasionally – collapses, dehydration (due to increased diuresis). If the administration rate is exceeded – tachycardia, increased arterial pressure, shortness of breath, headaches, chest pains or stomach pains are possible. The above symptoms are swiftly alleviated after the solution administration is ceased or slowed down significantly.

POLIDEZ - 3% solution of polyvinyl alcohol in isotonic chloride sodium solution (mm 10 000 - 12 000). It is removed by kidneys within 24 hours.

Apply intravenosly by drop infusion to treatment of intoxication caused by peritonitis, intestinal impassability, acute pancreatitis, cholecystitis, a sharp purulent infection, an burn disease, damages of a liver, etc.

Adult - 200 - 500 ml a day, to children of 5 - 10 ml/kg.

Side-effects - at fast introduction are possible dizzinesses and nausea.

III. Medicines FOR of PARENTERAL food.

Any trauma (wounds, bone fractures, burns, radiation defeat, surgical interventions) promote an exit in blood of corticosteroids and adrenaline. These substances break a homeostasis, causing a hyperglycemia, acidosis, hypercoagulyatinu, g_peramon i є m_yu, hyperkaliyemiya, hyponatriemia. Therefore inevitably there occurs strengthening of the main exchange. Activation of the main exchange strengthens disintegration of carbohydrates and proteins. It is promoted releases under the influence of sour products of lytic enzymes and also by utilization of proteins on energy needs. So there is a catabolic orientation of exchange that proceeds in the form of four consecutive phases:

The I phase - damages or an adrenocorticoid, lasting 2 - 4 days that is characterized by the expressed catabolism,

The II phase - hormonal stabilisation (or a turn point), is characterized by improvement of a state and disappearance of hormonal shifts (from 7 days),

The III phase - muscular force with advantage steroids and positive nitro balance, lasting 2 - 5 weeks,

The IV phase - accumulation to fat, proceeds several months.

It is established that there lasts reserve of carbohydrates in the conditions of hunger for 13 hours, and proteins and amino acids - only 4-6 hours. So, after this period the organism of the victim passes to consumption of own proteins and fats.

So in the first 3 - 5 hours of a state of shock the victim can lose up to 100 g of fabric protein, and at deep large burns is every day spent for a covering of nitrogenous and power expenses up to 500 g of m "muscular tissue and 250 g to fat. Daily losses of nitrogen will be at shock 80 - 128 g, at burns - 20 g, at an abdominal cavity operations - 12 - 18 g after a stomach resection, patients in the first days lose - 106 g of protein or 425 g of m "muscular tissue. It should be taken into account that temperature increase of a body With increases exchange for 13% by I.

Big losses of protein are negatively shown on healing of wounds, the resilience of an organism and promote emergence of complications. In such cases there is a need for parenteral food (PF).

Indications to PF - if the patient cannot whether should not wants to eat through a mouth.

The main components of food is proteins, carbohydrates, fats, also electrolytes, minerals, vitamins, stimulators of digestion of food are necessary. For the strengthened PH it is important to have imagination about daily requirement. At the same time it is necessary to adhere to the following conditions:

I) previously to eliminate hemodynamic frustration and to fill intra vascular deficiency plasma and globular volume,

2) to liquidate rough disorders of water salt exchange and an acid alkaline state,

3) to restore functions of vitals systems.

PF can be full when into an organism or the injured patient enter all feeding substances, incomplete when use only the main feeding substances (proteins, or proteins and carbohydrates), or food through a mouth is not enough and it needs to be added with separate substances.

POLIAMIN - 8% solution of mix 13 L - amino acids in 5% solution d sorbite. Caloric content in / in solutions of 600 kcal.

Indications: means for parenteral protein food at Hypoproteinemic,

- at impossibility of meal in the regular way,
- to and in the postoperative period,
- large deep burns, exhaustion, injuries, changes,
- putulent processes,
- functional insufficiency of a liver, etc.

The method of application - is entered intravenously by drop infusion by 10 - 35 drops a minute (100 ml an hour), on 400 - 1200 ml a day. Pol_am_n it is worth uniting with simultaneous injection 10-20% of solution of glucose with insulin (on 4 g of glucose - the I piece of insulin)

Side-effects - when speeding introduction hyperaemia the person, heat, a headache, nausea, vomiting is possible. It is necessary to interrupt to injection and to inject desensibilased drugs. A release form - on 100, 200, 400 ml in glass bottles, T - 10 - 20 degree.

2. Additives of minerals or vitamins at parenteral food:

a) addamel H - solution which holds electrolytes and minerals,

b) soluvit H - dry mix of water-soluble vitamins.

3. Nitrogenous medicines on the basis of hydrolysates:

- solution hydrolisin, hydrolysate of protein of casein, aminocrovin, amikin, infuzamin, hydramin.

Sources of receiving protein hydrolysates is casein, proteins of blood of cattle, m "muscle proteins and also erythrocytes and clots of donor blood.

When receiving proteinaceous hydrolysates initial raw materials are exposed enzymatic or acid hydrolysis.

Proteinaceous hydrolysates enter by drop infusion slowly - with a speed of 10 - 30 thaws a minute, different ways: intravenously, via the probe in a stomach or in a duodenum. Volume can reach 1.5 - 2 l/days.

Contraindications:

- Acute violation of haemo dynamics (shock, massive blood loss),
- decompensation of warm activity,
- hemorrhage in a brain,
- renal and liver failure,
- tromboembolitic complications.

At transfusion of proteins medicines it is necessary to carry out biological test.

Medicines of power providing,

Osmotic diuretics

For ensuring processes of synthesis and functioning of bodies and the systems of an organism at parenteral food as power sources use:

- carbohydrates (glucose, fructose),
- polyatomic alcohols, (sorbite, KSILOL, MANNITOL),

- fatty emulsions (lipovenos, intralipid, etc.).

The minimum need for carbohydrates - 100 g/day.

Fats provide an organism not only with energy, but also irreplaceable fatty acids (linoleic, linolenic, arakhidonovy), fat-soluble vitamins (And, To, E), phospholipids, etc.

Caloric content of a power component (carbohydrates) at patients in a postoperative period has to be 35 kcal/kg (for the patient weighing 65 kg - 2275 kcal). For ensuring such energy demand only with glucose it should be entered: 5% - 11.5 l, 10% - 5.75 l, 20% - 2.9 l. the volume of 20% of solution of glucose which is entered up to 2.1 l allows to reduce additions (1.25 ml/kg) of ethyl alcohol. an important source of additional introduction of energy is enteral probe food. At gullet, stomach operations and 12 Paly to a gut the probe is carried out to a small intestine 15 - 20 cm lower than an anastomosis and by drop infusion enter a power component.

Hydrocarbons solutions for infusions.

Most of all distribution was gained by glucose solutions - 5%, 10%, 20%, 40%. Solutions of glucose enter intravenously by drop infusion:

- 5% - are minimum to 150 drops in min. (500 ml / X), the maximum daily dose for adults - 2000 ml,

- 10% solution - as much as possible up to 60 drops a minute (3 ml/kg of body weight of input-output) the maximum daily dose for adults - 2000 ml (30 ml/kg).

- 20% solution, as much as possible up to 30 - 40 drops a minute (150 ml/kg), the maximum daily dose for adult 500 ml.

- 40% - up to 30 drops a minute (1.5 ml/kg an hour) the maximum daily dose for the adult - 1000 ml (15mg/kg).

From other carbohydrates use fructose, a dextrose, glyucostarit 10% and 20%.

Contraindications to use of solutions of glucose - violation of its exchange (diabetes).

Osmotic diuretics.

MANNITOL - mighty osmotic diuretic - prepare in two medicinal Faure a move:

I) solution to a mann_t of 15%,

2) Liofilisated MANNITOL.

The MANNITOL - strong diuretic means that promotes fast removal of liquid from the vascular course, increases kidney blood circulation, reduces a hypoxia of fabrics. Its introduction strengthens exfusio of sodium chlorine together with liquid.

Indications: camps, followed by a liquid delay in an organism:

- Local extracellular overhydratation (brain hypostasis),

- acute kidney or kidney- liver failure with fallen the filter ability of kidneys,

- posttransfusion the complications caused by introduction of incompatible blood

- for prevention and treatment of violations of aque - salt balances, resulted superfluous input of the fluid in an organism,

- at operations with extracorporal blood circulation.

MANNITOL **inefficien**t at an azotemiya, cirrhosis with ascites.

Method of application. The Liofilised MANNITOL (the maintenance of a bottle of 30 g) before the use is dissolved in water for or solution of 5% of glucose. Prepare: 10%, 15% and 20% solutions, enter only intravenously. With the preventive purpose apply in a

single dose 0.5 g/kg of body weight, from medical - at the rate of 1 - 1.5 g/kg. The daily dose should not exceed 140 - 180. Repeatedly it is worth entering under control of indications of water salt balance.

Side-effects. At excess input of the fluid possible symptoms of dehydration (hallucinations, the dispepsic phenomena).

Introduction can lead a mannit at an anury which is caused by changes in kidneys to development of a pulmonary edema.

Contraindications:

- damage of kidneys with filtration process violation
- heart failure with sharply expressed anasarka
- camps ekstratselyulyarno ï g_perg_drats i ï.

Release form - on 30 m in the lyophilized look in bottles - 500 ml and 15% on 200 and 400 ml in bottles.

Sorbite - is power means (4 kcal/g), a source of carbohydrates which, turning into fructose, is quite acquired by an organism, resupplies a liver glycogen. Has osmodiuretic properties, eliminates paresis intestines, promotes an elimination of gases, has bile-expelling effect, reduces a spasm of a sphincter of Oddi. Solution of sorbite improves rheological properties of blood (reduces viscosity and gematokrit blood, prevents aggregation of platelets, contributes to the development of collateral blood circulation in endings and to reduction of a fabric hypoxia), normalizes a hemostasis.

Method of application. Solution of sorbite of 20% is entered intravenously in a dosage of 0.5 - 2 g/kg of body weight, if necessary repeated in 6 - 12 hours.

Solution of sorbite of 20% for DR "injections - power, osmodiureticnand disintoxication means.

Release form - on 250, 500 ml in the soldered capacities from polyethylene or in glass ampoules on 20 ml.

Fatty emulsions FOR infusions

In clinical practice apply fatty emulsions (the emulsified fats do not cause a fatty embolism)

Most of all distribution was gained: intrelipid, lipifizian, infuzolinol, lipofundin, lipomul, infonutrol, fatgen, venolipid, emulsan.

VENOLiPiD - high-calorific means for parenteral food. Is a source of nonsaturated fatty acids. Promotes the best digestion of amino acids, slows down catabolic processes in an organism.

It is shown for parenteral food of patients:

- In before - and the postoperative period,
- sharp and chronic gastrointestinal diseases,
- tuberculosis of lungs,
- burns, injuries, lack of consciousness.

Method of application - 500 ml in / in by drop infusion within 3 hours and more than 1 time a day. A dose no more than 20 ml of medicine on 1 kg of body weight,

Side-effects - pain on the introduction course, phlebitis, hypersensibility to medicine.

Contraindications are thromboses, dysfunction of a liver that provides to the blood curtailing properties, a hyperlipidemiya, diabetes with ketoacidosis, prematurity at children.

Form of release 200, 500 ml in bottles. Medicine costs input warmed up to room temperature, not to allow freezing.

VITALIPID - special additive to a intralipid which contains vitamins for parenteral food.

IV. Regulators of water salt exchange and acid alkaline state (electrolytic solutions).

Salt crystalloid solutions play an important role at treatment dehydration of an organism and acute blood loss. Intravenous injection of electrolytic solutions is promoted filling of volume of the circulating plasma, by microcirculation normalization, prevent development of desiminate intra vascular fibrillation and education mycrotromosis. Crystalloid solutions get through walls of capillaries therefore the output pressure of interstitial liquid and kupu¾tsya development of violations of water and electrolytic exchange in fabrics is reached. There is a filling of deficiency of extracellular liquid, compensation of metabolic acidosis and a detoxication, there is some haemo dynamic effect which consists in correction of a hypovolemiya and stabilization of arterial blood pressure. Therefore at initial filling with elektrolit solutions of blood loss their volume has to exceed blood loss by 3 - 4 times.

Crystalloid solutions most of which often use:

- physiological solution - 0.9% the district of sodium of chloride
- Region of Ringera
- Region of Ringera Lokka
- laktasol.

In clinical practice the specified solutions apply to correction water - salt balances, they contain the most adequate composition of blood a set of Ions. Solutions like Ringer Locke and a laktasol contain and antyacidotic components in the form of bicarbonate or a lactate of sodium.

Crystalloid solutions:

- (Germany), cvintasol, sodium chlorate (Poland), the district of Disol for DR "injections ionosterit (Russia),
- the district of Laktasol - means for correction of violations of water salt balance and compensation of metabolic acidosis (Russia).
- the district of Mafusol is Russia
- triamin - buffer means that raises Ph blood.

Pharmacological action. It is injected intravenously drug reduces concentration of ions of hydrogen in blood, that is raises it Ph, eliminates acidosis. The maximum dose of 1.5 g/kg (50 ml/kg) in 24 hours. Is issued on 250 ml (Russia). For correction of acidosis do intravenous injection of 4-5% of solution of a hydrocarbonate of sodium.

Polyionic solutions quickly enough leave by vascular systenm. In this regard expediently combined use of crystalloid and colloidal solutions.

Crystalloid together with gemodinamic colloidal blood substitutes is included in complex therapy of traumatic and hemorrhagic shock, it is purulent - septic diseases and also apply to prevention and correction of violations of water salt balance and acid-base balance at large operations and in the postoperative period.

II. Transferics of oxygen

Creation of the blood substitutes performing the main function of blood - oxygen transfer to body tissues, so-called artificial blood is important, but very hard task.

Artificial blood has to meet a number of requirements:

1. It is not worse to provide oxygen transport to natural blood.
2. To be non-toxic.
3. To guarantee absolute impossibility of infection with any infectious diseases.
4. To be steadier at preservation, than natural blood.

Among artificial blood substitutes with oxygen transfer function most the Persian were pectiv for clinical practice perftororganic connections (PFOS).

In 1978. Under the leadership of the prof. F.F. Beloyartsev, the first experiments on perfusion in heart and kidneys perfortributilamin, and in 1982 were made. The multifunctional blood substitutes with gas transmission function is created.

6. Materials for self-control.

1. Causes of posttransfusion complications (Group)
3 . liquid plasma substitutes
4 . The principles of transfusion therapy in various states of the organism
5 . Taking and preservation of blood and blood components

6.1. Tascs for self-control .

questions :

- Methods and storage time stored blood , its components ;
- The route of administration of blood ;
- Equipment for the PC ;
- The method of drip and jet PC ;
- Clinic reactions and complications after the PC , first aid , prevention of tick ;

be able to:

- To determine the blood group ;
- Macro- spending life blood for transfusion ;
- Mount system for your PC, fill it out ;
- To determine the projection of the main veins on the skin, to be able to puncture them ;
- Provide individual sample and the sample on the Rh- compatibility, a biological sample ;

- Transfuse blood bolus and infusion ;
- Provide first aid for a vocational school ;
- Fill in the "Protocol BT ."

objectives:

1. Ti do transfusion and monitoring of patients during its procedure .
2. Classified of blood substitutes .
3. Classified errors and complications of blood transfusion .
4. To do prevention and treatment interventions for complications of blood transfusion .

6.2 . Situational problems .

1. The doctor found that the patient within 12 hours lost 400 ml of blood. Having determined the blood group to the patient and the vial of blood , Rh- , and, after trial on the individual and Rh compatibility, poured 400 ml of blood. After 5 min. after a blood transfusion in the patient developed chest pain and back pain, shortness of breath , cold sweat , and tachycardia. As with the patient and the doctor 's mistake ?

A: The early post-transfusion reaction . Do not carry out biological sample . The loss of 400 ml of blood are not evidence for a transfusion .

2 . In the emergency room surgical hospital delivered injured in a traffic accident in an unconscious state with marked pallor , blood pressure is not detected , the pulse thready , ill considered . Blood loss by Phillips 2.5 liters. Another doctor determined the blood group , blood is sent to a laboratory to determine the Rh factor and waited for an answer. After 25 min. the patient died . Is the doctor did ? What should be the tactical ka ?

Answer: False . To obtain a response from the lab to begin urgently needed to transfuse blood products hemodynamic effect , Rh- negative red cell mass.

3 . In the acceptance department delivered surgical hospital patients with extensive multiple wounds in a state of shock. The patient pale , cold sweat, confused mind , thready pulse, blood pressure 80/50 mm Hg What transfusion therapy you assign to the patient ?

Tests in the volume " Step1 " and " Step2 " .

Test number 1. Blood samples for determination of compatibility system AB0 and Rh factor is carried out :

A) of the finger on the slide ;
B) veins in the blend ;
In) of the finger on the slide with the addition of sodium citrate ;
D) veins in a dry test tube ;
D) veins in a test tube with isotonic sodium chloride solution;

Test number 2 . Transfusion of blood :

A) is checked before the first transfusion ;
B) is checked before each transfusion ;
B) does not check the data in the passport ;
D) is not checked , it is enough data in the medical record ;

D) does not check the data history ;

Test number three . Blood transfusion in patients who are in a state of anesthesia :
A) test for compatibility conducted in full;
B) does not meet the biological sample ;
B) is carried out only biological sample ;
R) is determined only by the compatibility AB0 system ;
D) is determined only by the compatibility of Rh ;

Test number 4 . Transfusion and obstetric history before blood transfusions can:
A) to prevent potential transfusion complication ;
B) rushed to pick up donated blood ;
B) determine the Rh blood group affiliation and patient;
T) determine hereditary disease;
D) to make medical history ;

Test number 5 . In preparing patients for blood transfusion is necessary:
A) make a general analysis of urine;
B) do a complete blood count ;
B) collect blood transfusion history ;
D) collect obstetric history ;
D) do all of the above ;

Test number 6. Specify the allowable methods of blood transfusion :
A), intravenous, intraarterial , intraosseous ;
B) subcutaneous, intraarterial , intraosseous ;
B) intravenous, epidural , enteral ;
D) intravenous, subcutaneous, endolymphatic ;
D) intra-arterial , intraosseous , endotracheal ;

Test number 7. How to proceed with the bottle , which was released after the transfusion of blood and its components of :
A) it washed and hand over to the lab ;
B) throw ;
B) 10-15 ml of blood was left in the vial and stored for two days ;
D) 10-15 ml of blood is left in the vial and stored 30 days;
D) leave 10-15 ml of blood in a vial and stored until patient discharge ;

6.3 Tests for self-control (basic knowledge)

1. In patient M. , 37 years old with abdominal trauma and intra-abdominal bleeding , damage to the hollow bodies have been identified. In auditing the abdomen revealed no 2L blood clots . How to compensate for BCC ?

A) reinfusion of blood from the abdominal cavity B) single-group transfusion of stored blood ;

C) svezhetsitratnoy blood transfusion ; D) transfusion of donated blood ;
E) via blood .

2 . In the patient K. , 35 years old, in thrombocytopenia occurred gastric bleeding . What is the component of blood transfusion to the patient appropriate ?

A) red blood cell mass , and c) platelet mass , C) albumin ; D) native plasma ;
E) A dry plasma.

3 . During a blood transfusion during a biological sample in a patient came chills, sore covered with cold sweat , said flashing before his eyes, a slight pain in the lumbar area . What state has evolved into a patient?

A) transfusion reaction , B) pyrogenic reaction , C) bacterial and toxic shock ; D) citrate shock, E) attack of renal colic.

4 . The patient, 27 years old , delivered with a knife wound abdomen 4 hours after injury. A serious condition . Pulse - 120/min . , Weak , BP - 70/40 mm Hg laparotomy was performed . In many liquid abdominal blood. Assigned bleeding vessels folds small intestine. The bleeding stopped. Damage hollow bodies have been identified. How best to restore blood loss ?

A) pour red cell mass , and c) to autologous blood reinfusion , C) pour the washed red blood cells ; D) pour fresh frozen plasma , and E) pour reopoiglyukin .

5 . The patient , 40 years old, with blood group A (II) was performed for the indication of native plasma transfusion of blood group A (P). 20 minutes after the transfusion the patient noted a strong fever, fever up to 40 ° C, headache and pain in muscles, bones , shortness of breath. On examination - cyanosis of the lips . Pulse - 106/min . BP - 103 /90 Which type of transfusion complications is this state ?

A) pyrogenic reaction , B) an allergic reaction , C) transfusion shock ; D) transfusion reaction , and E) hemotransfusion complication .

6. The patient , aged 50, as a result of erroneous transfusion of incompatible blood transfusion suffered a shock II severity, after which the output of a patient after 1.5 weeks developed uremia . What period blood transfusion shock meets this condition ?

A) acute intestinal failure; B) own blood transfusion shock , C) oliguria and anuria ;
D) restoration of urine output , and E) recovery.

7. In order to quickly replenish the patient transfused blood loss of 1050 mL of serologically - compatible donor blood preserved with sodium citrate . At the end of gemoranefusion patient anxiety arose , pale skin , anxiety , tachycardia, blood pressure dropped to 60/40 mm . Hg, there were muscle cramps . What complication occurred in a patient ?

A) transfusion shock, B) pulmonary embolism , C) citrate shock ; D) anaphylactic shock, E) pyrogenic reaction .

8. The patient, 48 years old , enrolled in 5 hours after injury with fracture of two ribs on the left , left-hand gemopnevmotorax . Against the background of infusion therapy , 4 minutes after the start of transfusion of plasma single-group became restless , felt a sharp stuffiness . Systolic blood pressure decreased from 90 to 60 mm Hg diastolic is not defined on the skin urticaria phenomenon . What is a complication ?

A) anaphylactic shock, B) traumatic shock , and C) transfusion shock ; D) plevropulmonary shock, E) pulmonary embolism .

9. The patient, 40 years old , delivered to the hospital emergency room with symptoms of gastro -intestinal bleeding, severe anemia with a deficit of BCC - more than 30%. The patient need a blood transfusion . What sequence of actions of the doctor , who must pour the blood?

A) Identify the blood group and Rh factor of the patient and conduct tests on the compatibility of the recipient's blood , B) Determine the Rh- host by antirhesus sera , C) Determine the suitability of the transfusion of blood and its group membership ; D) Identify the individual and rhesus compatibility of the donor and the patient's blood , and E) Conduct a biological sample .

Tests and testing task source of knowledge .

1. For whole blood characteristic is:
   a) the protein content in the serum concentration in a conventional
   b) increased the content of coagulation factors
   c) increase in the number of leucocytes and thrombocytes
   d) reduced content of potassium
   d) reduced content of sodium

2 . So -called universal donor blood is considered :
   a) any blood group 0 (I)
   b) the blood 0 (I) Rh (-) with a titer of 1:64 agglutinin
   c) the blood 0 (I) Rh (-) with a titer of 1:64 over agglutinin
   g) blood 0 (I) Rh (-)
   d) blood 0 (I) Rh (+)

3 . What is not a complication of massive blood transfusion :
   a) hypercalcemia
   b) hemolysis
   c) hyperkalemia
   g) acidosis
   e) alkalosis

4 . What are the responsibilities of donors :
   a) Comply with the interval between the delivery of blood
   b) report the skin and venereal diseases

c) accept the surrender of the full dose
g) to require the satisfaction of benefits for donors
d) comply with a healthy lifestyle

5 . Why should observe the principle of harvesting and the use of blood , " one donor - one patient ":
a) reduces the possibility of the disease due to the development of infection in the bottle
b) reduces the possibility of transmission of viral and infectious diseases from the donor
c) to reduce the possibility of sensitization of the recipient by foreign agents
d) reduces the possibility of complications and reactions
d) do not conduct a test on individual compatibility

6. What amount of antigen in human erythrocytes ?
a) 3
b) 5
c) 30
g) 106
d) 250

7. At that indicates detection of serum antibodies to Rh system ?
a) the patient received a blood transfusion of Rh - positive
b) the patient is not given antigen , the patient is Rh negative
c) increased patient reactivity
d) the woman had to Rh factor in pregnancy
d) the patient can be transfused only Rh- negative blood

8. How many individual tests for compatibility required when blood transfusion ?
a) one
b) three
c) Two
d) five
d) six

9. How important is the distribution on the Rh -negative and Rh- positive people ?
a) The same person may be Rh- positive and Rh - negative
b) Rh-negative person is , if it has no D antigen , but there are C, E and other
c) A antigen most active and frequent
d) person is Rh- negative if it does not have antigens A , C, E
e) pour Rh- negative recipient can only Rh- negative blood donors

10 . Shelf life eritrotsitarnoi mass at t o 4 Co on preservative glyugitsir :
a) 21 days
b) 7 days
c) 14 days

d) 25 days
d) 30 days

11. The shelf life of frozen red blood cells, which are suitable for transfusion :
a) 5-10 days
b) 1 year
c) 1 month
g) 3 years
d) 5 years

12. What is the maximum period of storage of washed red blood cells :
a) 24 h
b) 72 h
c) 2 days
g) 6 hours
d) 4 days

13. What are the reasons for the limited indications for the use of direct blood transfusion ?
a) blood is examined for hepatitis B and AIDS
b) blood does not provide for the use of filters during transfusion
c) the difficulty of the previous survey of donors
g) lack of advantages in comparison with the transfusion of fresh cooked "warm" blood
d) the technical difficulties of applying

14. At that , first of all , you need to pay attention to when the macroscopic evaluation of the quality of preserved blood ?
a) bacterial contamination , the presence of clots , hemolysis
b) blood chylous
c) compliance certification
d) sealing packaging
d) compliance with conservation

15. What amount of blood, packed red blood cells or plasma are administered when the biological sample ?
a) 10-15 ml 3 times
b) 20-25 ml 3 times
c) 2-5 mL 4 times
d) 30-40 ml of 1
d) 10-15 ml, 2 times

16. What are the initial clinical symptoms of complications associated with transfusion of incompatible blood for the AB0 system ?

a) drop in blood pressure , the appearance of red urine
b) fever or burning sensation
a) abdominal pain, muscle head
d) the acceleration of heart rate , breathing , paleness
e) anuriya
e) hemorrhagic syndrome

17. What is the main advantage of the transfusion of washed red blood cells ?

a) they are areaktogennoy transfusion medium lacking because leukocyte antigens and proteins

b) does not cause reactions in patients who have been sensitized to the antigens of the HLA system

c) have no toxic effects and metabolic products citrate cellular components
d) have a lower risk of contracting hepatitis and cytomegalovirus
e) transfusion Wednesday rheological actions

18. What blood transfusion safety?

a) autologous blood transfusion
b) reinfusion of blood
c) thawed washed red blood cells
g) packed red blood cells
e) Whole Blood

19. Basic prevention of hepatitis B infection and retroviruses in transfusion :

a) transfused red cell mass and blood products when they are badly needed
b) draw blood relatives
c) use autokrov
g) Use the reinfusion
e) The mandatory testing of blood donations
e) Use a disposable system

20. What is the old blood, which resulted in a body cavity can be used for reinfusion ?

a) up to 12 hours
b) up to 24 h
c) up to 48 hours
d) up to 72 hours
d) up to 2 hours

21. Select salt for the prevention and treatment of citrate intoxication.

a) Nacl
b) Cacl2 or calcium gluconate
a) Kcl
g) Mgcl2

d) Fecl2

22. The optimal way of blood transfusion :
a) intravenous
b) the intra-
a) Intra-
g) in the cancellous bone
e) exchange transfusion

Case studies for the source of knowledge

1. In the surgical department to urgently delivered a patient with gastroduodenal ulcer hemorrhage etiology that lasts a long time . Displaying a blood transfusion to this patient ? For what purpose ? To what extent ?

2 . During the month, in a surgical hospital treated a patient with deep burns of 15 % and is preparing for cutaneous dermatomal autoplasty . Clinically, it is set hypoproteinemia , anemia, mild , sometimes "unhealthy " granulation burn surface . Is there evidence of a blood transfusion in this patient? For what purpose ? To what extent ? The predominant route of administration.

3 . If you recorded a blood transfusion pyrogenic reactions of moderate severity. Which, in your opinion, may be the cause of her ? Your treatment and prevention measures?

4 . 2 hours after intravenous transfusion 250.0 mL of blood in the single-group patients had post-transfusion shock you to the transfusion of Rh- incompatible blood . Your arguments and curative measures .

5 . As a result of the massive intravenous transfusion to the patient 68 years old, who admitted to the hospital with profuse bleeding ulcers , came a sharp expansion of the heart . Ba -shi tactical and therapeutic measures .

6. The patient was transfused intravenously 250.0 mL single-group levels. The next day, he noted yellowness of the skin, sclera icterus , urine -saturated red. Determining the causes of post-transfusion complications found : measurement of body temperature after transfusion, the patient was not spent , the first portion of urine , and the next morning urine

Day of macro- and microscopically was not investigated ; bottle from which flowed the blood of pain - Nome , has been washed immediately after transfusion.

What are the errors in the monitoring of patients after blood transfusion and re - organization of blood transfusion ? Measures to prevent them.

7. As a result of improper filling system for blood transfusions in the venous bed patient got a few air bubbles. What complications can develop ? The clinical picture and prevention.

Tests III level of complexity

1. Which recipients are categorized as hazardous because of the possibility of hemo-transfusion complications :

A) those who have had a blood transfusion ;

B) those who have had an infectious disease ;

B) those suffering malignant diseases;
D) those suffering blood diseases ;
D) there is no such category ;

2 . Test for individual compatibility of blood made between :
A) plasma or serum of the patient and the blood of the donor;
B) and blood plasma donor patient;
B) formed elements of the patient's blood and the blood of the donor;
D) formed elements of the blood donor and the blood of the patient;
D) a complete blood donor and holistic patient's blood ;

3 . Indications for blood transfusion is determined by:
A) an allergic condition of the patient ;
B) as a shock ;
B) the presence of hepatic and renal failure;
D) the need to fill the loss of blood ;
D) the presence of the patient beriberi ;

4 . Which of the following pathological conditions can receive blood that is suitable for reinfusion :
A) an ectopic pregnancy ;
B) enterorrhexis ;
B) splenic rupture ;
D) rupture of an aortic aneurysm ;
D) rupture of the gallbladder ;

5. Indication for intra-arterial blood transfusion are:
A) severe shock ;
B) preagonale condition resulting from acute blood loss ;
B) clinical death ;
D) preoperative ;
D) surgery ;

6. Intraosseous blood transfusion is carried out :
A) club crest bone;
B) of the femoral shaft ;
c) the calcaneus ;
D) sternum ;
f) metaphysis of the tibia ;
Select the right combination of :
A) 1,2,3 B) 2,3,4 , B) 1,3,4 , D) 1,3,5 , D) 1,2,5 .

7. The optimum storage temperature of stored blood :
A) from 0 to 200C ;

B) from 4 to 600C ;
B) from 8 to 1000C ;
D) -100C ;
D) 200C ;

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8. The distribution points are awarded to students:

At mastering topic number 9 to content module 2 for training activities for students rated a 4-point scale (traditional) scale, which is then converted into points as follows:

rating	Points
5 (excellent)	5
4 (good)	4
3 (satisfactory)	3
2 (poor)	0

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