

**MINISTRY OF HEALTH OF UKRAINE  
POLTAVA STATE MEDICAL UNIVERSITY**

Department of general surgery

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

<b>Study discipline</b>	<b>General surgery</b>
<b>Module №1</b>	<b>INTRODUCTION TO SURGERY. SURGICAL EMERGENCY CONDITIONS. FUNDAMENTALS OF ANESTHESIOLOGY AND INTENSIVE CARE</b>
<i>Content module 2.</i>	<i>Bleeding, blood loss. Bases of blood transfusion</i>
<i>Lesson theme №7</i>	Blood transfusion. Determination of blood groups according to ABO and Rh-factor. Test for individual compatibility according to ABO and Rh-factor systems, biological test.
<b>Years of study</b>	<b><i>III</i></b>
<b>Faculty</b>	<b>International</b>

**Poltava**

<b>Content module 2.</b>	<b>Bleeding, blood loss. Basics of haemotransfusiology.</b>
<i>Lesson theme №7</i>	Blood transfusion. Determination of blood groups according to ABO and Rh-factor. Test for individual compatibility according to ABO and Rh-factor systems, biological test..

### 1. Relevance of the topic:

A number of diseases and traumatic injuries that are accompanied by a large loss of blood and the development of hemorrhagic shock, need for blood transfusion. Therefore, the determination of blood groups, compatibility tests on blood donor and the recipient, the knowledge of the indications and contra-indications for blood transfusion, complications of blood transfusion can increase the level of theoretical and practical knowledge of students.

### 2. Learning Objectives:

1. Know the history of the doctrine of blood.
2. The doctrine of the blood groups.
3. To be able to determine the blood group of the standard serum.
4. Determine the blood group of Colyclons.
5. Determine the blood group of the standard red blood cells.
6. Determine the Rh-factor express method serum anti-Rhesus D
7. Determine the Rh-factor Colyclons anty-Rh "D" super.
8. Define a group compatibility.
9. Determine the Rh-compatibility.
10. Prove biological sample.

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

The names of the preceding disciplines	The skills
normal physiology	Determine blood group, to carry out tests for compatibility. Know the features of the functioning of the hematopoietic and cardiovascular system. Know the normal parameters of a general analysis of blood, urine
normal anatomy	Determine the type of vessels. Know the structure of the main types of vessels
Propedeutics Internal Medicine	To demonstrate the method of examination of patients, medical history, conducting the inspection, palpation, percussion and auscultation, reading radiographs
pathophysiology	Know the pathogenesis of blood transfusion and anaphylactic shock

biochemistry	Have knowledge of normal blood chemistry
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**The student must have an idea :**

- about the history of Transfusion .
- The composition of the blood.
- About the physiology of the blood ( blood group , Rh- factor , etc.).
- About the indications and contraindications for transfusion .

**The student should know:**

- the definition of the standard blood groups ABO serum , Colyclons A and B standard erythrocytes.
- Determination of Rh- factor for standard sera antirezus D and D monoclonal Colyclons super .
- Test for compatibility before transfusion :
- ABO compatibility ;
- Rh- compatible with 10 % gelatin ;
- biological sample .

**The student should be able to:**

- be able to determine the blood group of the standard serum .
- Be able to determine the blood group of Colyclons .
- Be able to determine the blood group of the standard red blood cells .
- Be able to determine the Rh- factor express method serum anti - Rh .
- Be able to determine the Rh- factor Colyclons anti - Rh " D" super .
- Be able to define a group compatibility.
- Be able to determine the Rh- compatibility.
- biological test .

**Mastering the skills of students:**

- determination of blood groups on the standard red blood cells .
- Determination of blood groups using Colyclons .
- Conduct tests on individual compatibility .
- Conducting a biological sample .

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

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

term	definition
transfused	blood-transfusion
agglutination	-antigen-antibody reaction to form a precipitate hlopepodobnogo
agglutinin	antibody (to eritrotsitar antigens)
agglutininogen	antigen (erythrocyte membrane)
coliclon	Standard monoclonal antibody (to eritrotsitarnim antigens) of anti-A and anti-B

#### **4.2 . Theoretical questions for the class :**

1. Stages of the history of blood transfusion
- 2 . Methods for determination of a group of accessories for blood groups ABO
- 3 . Possible errors in the determination of a group of accessories for the blood group ABO system
- 4 . Methods for determining the Rh factor of
5. Test for individual compatibility
6. Tests for ABO compatibility of the system
7. Test for biocompatibility

#### **4.3. Practicall tasks that are used in class:**

1. Determination of blood group on the standard red blood cells
- 2 . Determination of blood groups using Colyclons
- 3 . Conducting tests on individual compatibility

#### **5 . The content of the topic.**

##### **BLOOD TRANSFUSION**

The treatment of blood disorders and the management of bleeding during surgery have traditionally relied upon therapies involving the transfusion of donor blood and blood products.

Blood is fluid substance of organism, which executes the most important functions. On this you are acquaint in the course of physiology. However with this tissues in the clinic you will be meet several on especial, because with old - and on today it presents a riddle, but attempts its use for the treatment stay tempting, because in number of events are magic efficient.

Considered that blood is a source of life, exactly a soul inheres in it and so under bleeding leaves a soul. Many researchers linked an action of blood with the nature of person, power, and its physical abilities. That is why in ancient Egypt recommended use blood baths, but in Rome - to drink a blood of died gladiators.

The idea of replacement of lost blood appeared in XIV-XV century. But, as Harvey described the anatomy-physiological bases of circulation only in 1728, therefore transfusion of blood could not be carried out before this time.

In 1666, Richard Lower published the results of experiments on transfusion of blood to animals. These results were so convincing that Deni and Emerez in 16<sup>th</sup> repeated Lower's experiments on dogs and poured blood from lamb to a seriously ill patient. Despite the imperfect technique, the patient recovered.

In 1697 Merklin and in 1682 Attenmuller reported the results of the observation, according to which at mixing blood of two individuals agglutination sometimes occurred. That specifies incompatibility of blood. Despite of obscurity of this phenomenon, in 1820, Blandel (England) successfully carried out transfusion of blood from man to man.

A large obstacle to blood transfusion was its fast coagulation. Therefore, in 1835 Bishoff offered to pour difibrinated blood. However, after transfusion of such blood there were a lot of complications, therefore the method was not widely used.

However, agglutination and coagulation of blood prevented the application of blood transfusion. After opening blood groups by K.Landsteiner and Y.Yansky (1901-1907) these obstacles were eliminated. Hustin in Brussels carried out the first successful use of sodium citrate as an anticoagulant for stored blood in 1914 at St. Jean Hospital. Thus, the elements were in place for the development of blood bank, anticoagulation, cold storage, and the addition of sugar to prolong the life of the red cell.

Blood transfusion has become a common operation, but to prevent grave complications and produce good results it requires strict observance of certain rules. These include sterility in preparing the apparatus, precision in determining the blood groups, Proper preservation of the sera and observance of other rules which at times seem «trifling»(S.I.Shevchenko).

From a moment of blood transfusions and before our days hemotransfusiology passed complex, time tragic, way. This is stipulated by an absence of knowledge on that length of time-knowledge in anatomy, physiology, knowledges about the role of blood in the organism of person.

Before Garvey's period physicians transfused blood in emergency situations, in! spite of forbid and punishments. In 1820 in England Blandel, and in 1832 in Russia Volf and in 1848 Filomalfiyskiy successfully had transfused a blood from the person to the person, trying explaining a mechanism of its action. Beginning of current age was signified by the opening of blood types in 1901 by Landshteiner (three groups) and 1907 Yanskiy (fourth group). Studied mechanisms of action transfuse blood (Filomalfiyskiy), condition of its keeping (1914 Yurevich and Rozengard - had offered a citrate of Na), sources of getting blood (1919 Shamov- a putrid blood).

Created system of organizations of blood's service (in 1926 by the efforts of Bogdanov in Moscow for the first time in the world was opened an institute of blood transfusion).

And today lasts a work on studying specificity of blood, on use it or separate components.

Clinical practice under settle a problem on hemotransfusion comes from number of blood's particularities, which had been opened us today the immunologists we always must remember that this is liquid fabrics and transfusion of it is nothing else than transplantation tissues, in which is discovered more than 300 different antigens, forming number of systems. But clinic takes into account not all, but only system defining blood type and rh-factor.

**Blood type** - is genetic stipulate sign and showing by the combination of antigens, which basing in forming elements and plasma of blood. As far back as 1901 years Lanshteyn - a Viennese physician had opened such phenomena as agglutination, having separated people on 3 groups, he had installed that under the first blood type a serum agglutinating with erythrocytes of II and III groups. In II blood type a serum is agglutinating erythrocytes of III groups, but III group agglutinating erythrocytes of II group. Later Yanskiy had opened IV<sup>th</sup> group. Such a phenomena was explained by existence of system ABO, in other words - a kit of agglutinogens and agglutinins within one individual.

On statistical Europe data 42-44% people have a second blood type; 38-39% first; 12-14% - third; 4-6% - fourth.

Each blood type define a combination an agglutinins and agglutinogens. So, in the first group there are agglutinins a and P and agglutininogen 0; in second accordingly - A and P; in third- B and a; and in fourth AB<sub>Q</sub>.

Indication of blood type is accepted on presence of agglutininogen: 0(I); A(II); B(III); AB(IV).

Agglutinogens A and B - are termolabile organic substance. They base on erythrocytes and cause a formation an antibody. These antigens appear beside 3-h month intrauterine growth already and are not changed the whole life. Earlier considered that in the first group of antigen no, therefore have mark its 0; however is today proved, as in the first group is an antigen, but it does not give reactions of agglutination, so its indication have leave 0 and do not settle accounts with the blood transfusion. Agglutinins  $\alpha$  and  $\beta$  are termolabile globulins. They base in the plasma, also in liquid tissue. Accumulation them in the plasma go gradually, reaching that level (titre) when they are able to cause a reaction of agglutination. Beside newborn their titre is low, but it gradually growing, reaching maximum to 10-12 years. Titre of agglutinins  $\alpha$  is usually composed in adult from 1:32 to 1:128;  $\beta$  — 1:16, 1:64. Than is above titre, that is big possibility for reaction of agglutination under meeting of the same agglutinogens of erythrocytes.

Otenberg's rules were held under hemotransfusion. These rules stated that during blood transfusion agglutinating introduced erythrocytes (agglutinogens) because the incorporated plasma (agglutinins) are diluting in general volume of liquid and their titre becomes to be insufficient for agglutination of patient's erythrocytes. Truth, clinicians forewarned that in events an edge of anemia, attempt of quick indemnity of bleeding by the donor's blood of first group was observe agglutination of patient's erythrocytes because was saved high concentration introduced agglutinins -named else "inverse agglutination". So, it is recommended don't transfuse the greater amounts compatible blood, add in the system a liquid. Manifestations of agglutination steel observe in the clinic and at the transfusion a same group, particularly second blood type.

Studies of immunologists and hemotransfusiologists of last years allow consider reasons of these manifestations.

Render that there are several subgroups of agglutinogens. So A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub>; A<sub>O</sub>, A<sub>h</sub>, A<sub>z</sub> and others are discovered. The most strong antigen - A<sub>1</sub>, it is meet approximately beside 88% people with the second blood type. It causes a quick reaction of agglutination. Several more weak actions A<sub>2</sub>, it is meet approximately in 12% people with the second blood type. The rest subgroups of antigen A are weak and practically in the clinic are not taking into account.

Agglutininogen B also has several subgroups (B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>), but their titre and antigen action are small, so in the clinic there do not take into consideration.

Antigens A<sub>1</sub> and A<sub>2</sub> are capable to work out against it antibodies, they have name extraagglutinins a<sub>1</sub> and a<sub>2</sub>. Their combination and reactions at the blood transfusion can be unpredictable within one (second) blood types. So, if beside the patient has the blood type A<sub>1</sub>(II)b<sub>a2</sub>, but beside the donor A<sub>2</sub>(II)b can approach hemolysis of erythrocytes.

When in the process of life antigen A, B to fall into the organism (beside the pregnant women, if embryo its has, during autohemotherapy, during the transfusion of other group blood) are forming immune agglutinins a and b they enlarge titre of natural agglu-

tinins by the time before 1:512 and then no possibility its weaken a dilution in liquids of organism, that can bring about agglutination.

That is why, rules of Ottenberge losed in the practice their power (value) and we transfused only the some group blood. Beside the children this already become a law.

At the blood transfusion is take into account not only system ABO, but and system of that Rhesus factor.

#### **Rhesus factor.** What is it?

At 1940 years Landshtein and Vinner, entering erythrocytes of manlike monkeys to he rabbit had found that beside it is worked out antibodies, capable to agglutinate erythrocytes. Render that in blood of human in erythrocytes, but at last years and in fluid its part, inheres a factor, capable to cause antibodies, and named rh factor. Before the el a structure of this antigen is not reveal, consider that this polimucoproteid compound. The blood of 85% of the people contains an antigenic **Rhesus factor** (a rh-positive). About 15% of the people are rh-negative.

Consequently, transfusing blood, always we had a danger a rh-conflict, or under the recurrent transfusion a rh-negative patient the rh-positive blood, or during the transfusion a rh-negative blood, containing antibodies, rh-positive sick. Such simple system in modern medicine not exact because its render that there are beside the person 6 system antigens Rh-Hz (D, C, E, d, c, e). The first three antigens are a variety an rh of factor D (Rho), C (rh'), E (rh''), the most antigenety is D, very weak - E. So it is taking in« account (Rho) the presence of antigen D. In 2-3% rh-negative donors contain antigens C(rh'), E(rh''), but recipients must be considered a rh-negative only, when it does not be kept an antigen D. Thereby, in blood of person can be one type of the rh-factor or combination several types, moreover to each of they are worked out specific antibodies. In erythrocytes exist system antigens H2 - H20; h2', h2'', but their antigens characteristics weak. Together with that, at presence them in blood of rh-negative sick donor at the transfusion to rh-positive recipients this can cause postransfusional reaction. That is why in the clinic follows remember on these particularities of immune systems and at the transfusion necessary to define a rh attribute and to carry out a test on the rh-compatibility, but in general better transfuse the one type and one name on the rh factor a blood (B.I.Dmitriev).

#### **Determination of blood type:**

Exists several ways of determination of blood type:

- 1) with the help of standard serums (known agglutinin);
- 2) with the help of the standard erythrocytes (known agglutininogen);
- 3) and modern method, which falls into the life, using monoclonal antibodies anti-A and anti-B.

At the determination of blood types with the help of standard serums value their fitness - serum must be transparent, not to contain additional including, correspond to the shelf time. Determination realized in conditions of temperature of surround ambience 17-20°C, on Petry's cup or special plates. As rule, serums of first, second and third I groups are taken. Serum of fourth group is used seldom. Always use serums of two titres, so to the cup inflict on two dripped standard whey, each of three groups. The testing blood is adding there, moreover it's taken in 5-10 once less; serums mix and take an answer account into reactions of agglutination. If testing blood of first group, agglutination absent.

If second - there is agglutination in the whey of first and third group. If third - there is agglutination present with first and second serums. And if agglutination is in all three wheys - this is fourth group.

At the determination of blood types by this method, either as the others with the help of the standard erythrocytes is possible get an unauthentic result.

Using the standard erythrocytes are conducting, as a rule, on stations of blood transfusion, because they're keeping and moving is labored. Follows to remember that we know agglutinogens, so to the drop of standard erythrocytes we must add testing serum which is gets by defending, or centrifuging patient's blood.

Accounts of results are made after 5 minutes of mixes of whey and standard erythrocytes. If there is agglutination with erythrocytes of second and third groups - this is first group. If erythrocytes agglutinate only third group, so this patient second group; if agglutination is in the second group, this is testing third group. When agglutination is absent in all erythrocytes - this is the fourth group.

At the account of reactions possible to find agglutination where it practically is absent and reason to this phenomena (pseudoagglutination) are:

1. low temperature indoors, this below 15° C;
2. account to reactions later 5 minutes;
3. eating of erythrocytes (momental columns), their easy find of staggering of plate;
4. concentrate (is sub narrow) standard whey;
5. at presence infesting blood the immune antibody, if patient suffers a sepsis, system disease of blood.

Sometimes agglutination is impossible to notice, this can be at number of conditions:

1. Determination of blood types is lead at temperature over 25-30°C;
2. If it is take reaction less than 5 minutes into account;
3. If low titre of agglutinins (below 1:32), in other words, you define blood type by one series of serum;
4. Unless it is keep correlation a whey-blood and last much (B.I.Dmitriev).

The most reliable method of determination of blood types is a using Coliclons anti-A and anti-B. They are a product of gibridome cellar lines, getting in a result of mergings of mousy antibodyproducing B-lymphocits with ceils of mousy myelome. Coliclons are not the products of human's cells, this is ascetical divorced liquid of mousses - carriers corresponding gibridome, in which are kept in specific immunoglobulins class M, which are directed against antigens A or B of the person. Coliclons anti-A and anti-B are releasing like liquids in vials or ampules on 20, 50, 100 and 200 doses. Liquid keep a preservative 0,1% acid sodium, is tinted in the blue color anti-B and rose anti-A. Vials are keeping near two years in the refrigerator at the temperature +2 - +8°C.

Determination of blood type is conducting in native form, blood with the preservative and without it, best result can be with high concentration erythrocytes.

On the tablet or plate, in conditions of temperature indoors +15 - +25°C, inflict on one drop (0,1 ml) coliclons anti-A and B, then inflict testing blood (drop its must be in 10 once less), mix 3 minutes, observe a reaction.



If there is no agglutination in both coliclons - a first group; if agglutination with coliclons anti-A - second; if with anti-B -third and, if agglutination in both coliclons -a fourth group.

### **Determination of rh- factor**

Several methods are exists to install the presence rh-factor in blood of human. In emergency situations can be used an express-method. The investigated blood are adding to the standard anti-rh serum (containing antibodies) on cups Petry, and take a reaction account into 3-5 minutes. Presence of agglutination means presence of rh-factd This method is possible in specifically emergency situations, but is hereinafter require determination by laboratory methods. There are two methods: on Petry's cups and in test tubes.

On Petry's cups is inflicting two times (different titre) three dripped whey's a anti-rh, then add 50% suspension of testing erythrocytes, but in two other times add a standard rh-positive and negative 50% suspension of testing erythrocytes for checking the conditions of experience. During 10 minutes cup is placed on the water bath at the temperature 42-46°C. On reactions of agglutination mean the presence of rh-factor.

Other laboratory method allows more clearly see agglutination because it can be not clear. Its take into account in weight or gelatines, or polyglucin. In two times on J test tubes infuse standard whey of anti-rh (0,1 ml), there add testing and standard erythrocytes and dissolve gelatines. Test tubes are put in the thermostats for one hour at the temperature 37°C. After that stir up a test tube stir up for definition of agglutination. At keeping conditions take into account presence or absence of agglutination in a test tube. If we observe agglutination, the blood consist rh-factor.

### **The Sources of getting blood:**

Main source of blood is sound **people - donors**. Rarefied to take a blood beside persons, reached adult, which didn't suffer from tuberculosis, syphilis, malaria, aren't base in a period of recovery after carrying infectious diseases, virus hepatitis.

To take a blood beside the people with exhausting, breaking an exchange of materials, oncological patient, also suffering suppurating diseases is inadmissible. The single dose taken blood must not exceed 450 ml. Break between delivery of blood must be 2 months.

Attitude to donors in different countries are different. So in Italics donors are interpreted as a deal "Christian mercy, love and brotherhoods", but donor, gave blood, gets in the manner of setting free sin compensations. In Holland a person, gave 10 once its blood, gets a medal of Landshteyner. In our country the donorship can be payed, when donor gets a material compensation, as well as free, when people will once a year deliver a blood.

Blood, which were taken from the donor, must be preserved at particular conditions. History of preservations of blood begins from 1865, when physician V.Sutugin had offered to defibrinate blood and keeps at the temperature 0 degrees. At 1867 Rautenberg had offered a blood to mix with solution of sodium carbonate. This prevented it from the coagulation. At 1914 Yurevich and Rozengard had offered to use a citrate of sodium in the correlation 1:10 for warning of coagulation. At present, blood is preserving by the solution of glucidicir (sodium of hydroquotings, glucose and distillate water) from the calculation 25

ml on 100 ml of blood. Earlier were used preservatives of different composition COLIPK — 7<sup>b</sup>-12 and the others, which included except the preservative glucose and levomecitin. Blood, prepared by such method, is keeping in sterile vials at the temperature +4 - +6 degrees in the refrigerator. Shelf times before 10-11 days, but optimum term is 7 days (B.I.Dmitriev).

By accompaniments 50-60 mg of geparins on 1 litre blood is possible to preserve. This blood is used in cases of artificial circulation of the blood; shelf time 24 hours.

Is claims attention the preservation of blood under low (-196°C) temperatures. Such blood ready for the transfusion from 2 before 10 years. However complex standart specifications of its keeping did not allow spreading this method broadly.

#### Exist and other sources of getting blood:

1. Utilate Blood - a blood, which is received at the phlebotomy on the cause of number of diseases, not render influences upon the composition of blood. This hypertonic crisis, uremias.

2. Autoblood - a fence of blood is realized beside patient or on the eve of operations, or during operations; when blood is pour out in cavities as a result of container breakup. This blood must not contain some admixtures (bile, intestine and gastric contents; urine).

3. Professor Malinovskiy had offered to use an umbilical cord-placental blood. It is kept an increased amount of fermentive elements, squirrel, and hormones- folliculine. Amount this blood varies from 100 to 400 ml. Today it use broadly for preparing the components of blood.

4. The Shamov's work had shown that after 10-12 hours after the death a blood saves their own qualities. So it had offered to store up a blood beside dead bodies, understandable, this are to be people, died as a result of sudden, more often traumatic damages. Blood must be stored up in sterile conditions not later 6-8 hours after the death.

Thereby, all foregoing shows that using blood has do a way from purely clinical before scientifically-motivated methods of stocking up, keeping and use it as a powerful treatment factor. Pack stocking up system, keeping and using it. In large hospitals there are points of blood's fence, but the main are: departments and institutes of blood transfusion. What source of blood fence was not use, follows to remember that blood of donor is necessary subject to studies, to not vaccinated sick number of diseases.

As acts a transfuse blood, after all this in the end total and defines the showing to hemotransfusion.

### **Mechanism of transfused blood action**

The effect of transfused blood depends on amounts, method, velocities of transfusion. Incorporated blood renders replacing and haemostatic action, intensifies an exchange of materials, possesses by immunobyological, desintoxical and nourishing action.

In the surgical practice the most significant is a replacement action, when is necessary fill a lost blood under bleeding because this threatens patient's life. Substituting must be conduct rationally, it is impossible tend on 100% change of bleeding. Usually transfuse before 1/3 loss blood, then enter saline dissolve and newly transfuse a blood. Transfuse blood, irritating promote to tonus of vascular system enlarges a volume of circulating of

blood, respiratory surface of erythrocytes, influences upon organs own circulation of blood. Hemostatic effect is due to entering the factors of blood coagulation, platelets thrombocytes). Particularly this is showing at the transfusion fresh blood (direct or after 1-3 day after preservations). Together with donor blood are entering antibodies, globulins, which take place in immune correcting of patient's organism. Incorporated °°d substitutes squirrels, carbohydrates and fat, rendering hereunder feeding sick. Entered blood replace proteins, carbohydrates, and fats, rendering the nourishment c sick. Except this, proteins of blood absorb the bad materials (poisons, bacterial toxins Intensify the exchanging oxidation processes, producting of urine, hereunder turns 01 to be desintoxicating action.

### ***The indications and contraindications to the blood transfusion***

Coming from the mechanism of action transfuse blood, are determined absolute and relative contraindications to haemotransfusion. At first, no contraindications to the account do not undertake when we talking about the blood transfusion (bleeding) under the evident threat life of sick.

#### ***The indication to haemotransfusion:***

1. The commonest indication for blood transfusion is profuse haemorrhage, either external or internal;
2. It is indicated during certain major operations, where a large amount of blood loss is inevitable, e.g. radical mastectomy, abdominoperineal resection, etc.;
3. In case of deep burns blood transfusion is indicated besides initial fluid plasma administration, as there is considerable haemolysis;
4. Preoperatively blood transfusion is required when the patient is already anemic and there is no adequate time for Iron Replacement Therapy before operation. This is 1 particularly needed before operations for malignant diseases;
5. In postoperative cases blood transfusion is required when the patient has become considerably anemic and debilitated, either due to excessive bleeding during opera- j tion, or as a result of infection or septicemia;
6. In anemic patients, particularly when the hemoglobin level is below 100g/l, blood transfusion is often indicated to treat of anemia. It must be remembered that in chronic 1 anemia, it is better to tranfuse packed cells rather than whole blood to reduce more J burden to the already burdened heart due to hypervolemia
7. In severe malnutrition and hypoproteinaemia, blood transfusion is, indicated before any type of surgery.
8. In certain coagulation disorders like hemophilia, thrombocytopenic purpura, leukemia, aplastic anemia whole blood transfusion is required.
9. In treating cases of erythroblastosis foetalis due to Rh incompatibility, exchange transfusion is often performed through umbilical vein of the newborn.
10. During chemotherapy for malignant diseases, blood transfusion is often indicated if the routine blood examination considerable diminution of RBC level.

#### ***Contraindications to hemotransfusion are:***

1. Sharp violaton a function livers, kidneys, heart;
2. Inflammatory diseases of vessels (tromboflebits, phlebitis, embolisms);
3. Allergic conditions;
4. Active tuberculoses process, also inflammation disease pulmonary tissues.

As was it already says above, all these contraindications become relative, when the question is edge poor blood. Certainly, risk increases, so possible use separate components of blood, fractional transfusion, follow to adjust a velocity and amount introduced blood.

### ***Methods and technology of blood transfusion***

Distinguish direct, indirect, inverse, exchanged and extracorporeal methods of blood transfusion.

Direct transfusion - a direct using donor's blood, which is take now and immeditely transfused to recipient, avoiding stage of preservations, and such blood is the most valuable. However it hides in itself danger of infecting sick beside disease, which can suffer a donor, time not being aware of this.

For the direct transfusion use a number of devices "Beca", "Jubalio", as well as syringe method. Blood is distilled from the donor to recipient. All this procedures is conduct in sterile conditions.

Indirect method. Blood withdrew from the donor, mix with the preservative, and is kept under certain conditions and, after 5-10 days, possible use for the transfusion.

Disposable systems for the indirect transfusion are used. Co cost from the kit a tubes and filters.

When blood is entering intraarterially, we used bladder and manometer in the system, which allows creating a pressure in the system. Pressure in the system must be within 180-200 mm Hg.

The following researches are necessary for carrying out before a hemotransfusion:

- definition of blood group of the donor;
- definition of blood group of the recipient;
- determination of group compatibility of donor and recipient;
- determination of rhesus compatibility of donor and recipient;
- biological test .

### ***Exchange transfusion or reinfusion***

This using of blood, pour out in the cavity, on essences of deal this autotransfusion. This blood in the event of the absence of clots, different admixtures, is then and there bringing back into the patient's circulatory system. In the process of reinfusion blood is filtered through filters and sterile bandage lying; small quantity of heparine is adding in it. Technically this is realized as an indirect transfusion. Exchanging transfusion is using during acute poisoning (arsenic, mushrooms, carbon monoxide, lead, quicksilver and other poisons). In cases of phlebotomy sometimes take equivalent amount of donor's blood.

Thereby we have pack with you approach system to hemotransfusion and previously than its produce, physician must execute a number of actions:

1. Install the showing to hemotransfusion - with what aim you will enter a blood.
2. Take account of possible contraindications and with provision for this define the ways of introduction the blood, amount, velocity of introduction.
- 3- Define a blood type and rh-factor of recipient and donor (see appendix 9).
- 4- Put (deliver) a direct test on compatibility, beforehand having value fitness of blood to the transfusion (see appendix 8).
- <sup>5</sup>- Making a test on the rh compatibility.

6. Check biological compatibility by a way of fractional introduction 15-20 ml of blood with intervals 3 minutes.

Arrange special documentation or special protocol of blood. For checking the possible complications first two hours are take measurements temperatures of sick, as well as urinalysis during the first day (B.I.Dmitriev).

Coming from different a showing possible to use the following ways of introduction the blood:

1. Intravenous;
2. Intraarterious;
3. Intrabones;
4. Intramuscular;
5. Subdermal;
6. Through mouth;
7. Through rectum;
8. Through corpus cavernosus.

Structural and logic threads

term	definition
1. blood group	Blood - genetically based biological characteristic that is characterized by a set of antigens , which are contained in the formed elements of the blood ( red blood cells , white blood cells , platelets ) and plasma proteins of the individual.
	This is a strong antigen that is inherited and is in the red blood cells , white blood cells and platelets of different bodies in fluids , amniotic fluid .
2. Rh factor	Specific antibodies which may be formed when Rh - positive blood factor falls person with Rh negative blood , for example in rhesus negative pregnant specific antibodies are formed from Rh positive fetus . It is proved that about 85 % of people Rh- positive , the remaining 15 % - Rh - negative .
antirH agglutinins	To 0.1 ml of serum of the recipient (the blood in the tube was centrifuged ) was added 10 times less blood . The reaction was read after 5 min. As the reaction has not occurred , the blood together .
3. Test for group compatibility	The patient was transfused three times with 15 ml . blood transfusion, with intervals for 3 min. At this time, there was not observed in the patient's symptoms of transfusion of incompatible blood . With no signs of an incompatible transfusion procedure is continued .
4. Test for Rh compatibility	Methodological techniques such as when determining the compatibility group only after mixing with blood serum mixture was put in a water bath at a temperature of 42-48 ° C and observed 10 min . With the emergence of

	agglutination blood transfusions can not .
5. Test biological	Donors with 0 ( I ) blood group is often called the " universal donor " blood agglutinin bred in the blood of the recipient and not able to agglutinate his red blood cells , red blood cells only last agglutinated transfused blood , and not the recipient. This circumstance allowed at a single-group blood transfused blood serum of another group that does not agglutinate red blood cells of the recipient.
6. Universal donor	Recipients with AB ( IV ) by a group - called "universal recipients ."
7. universal recipient	Blood transfusion is done directly from the donor to the recipient. Indications: afibrinemia , after a hard postpartum bleeding , impaired blood coagulation system .
8. direct transfusion	Use canned , stabilized blood.
9. indirect transfusion	Harvesting autologous culture and plasma by plasmapheresis
10. autotransfusion	The transfusion of his blood to the patient , which resulted in serous cavities ( thoracic , abdominal ) .
11. refusion	Performed in cases of poisoning . Available in some of the blood and blood poured at the same time with some excess capacity.
Exsanguinotransfusion	Individual fractions are derived from whole blood that are specific indications to its use.
6. Component of blood	Physically homogeneous transfusion means a whole line of action on the body, which has the ability to replace the specific function of blood.
7. blood substitutes	Saline solutions are preferably used to supplement blood loss to stabilize the bcc for regulating water , salt and acid -base status . They also take part in the elimination of toxins . Isotonic sodium chloride solution ( 0.9 % ) , Ringer - Locke, solvent as close to the salt content of the plasma ( laktosol ) .
Kristalloide solutions	It is most often low -( reopoliglukin ) and srednomolekulyarnye ( polyglukin ) dextrans that after intravenous administration increase blood pressure in the long term , increase the tone of blood vessels. Zhelatinol (8 % gelatin solution ) polivinol (2.5% polyvinyl alcohol) . The indications for their use is traumatic , burn and operating shocks , acute blood loss , severe hemodynamic instability , peritonitis , intestinal obstruction
Blood substitutes geodynamic action	Used in various intoxications , sepsis, burns difficult . These drugs promote diuresis . The leading role played by small molecule drugs polyvinylpyrrolidone ( gemodez , periston , neokompensan ) and polyvinyl alcohol ( polidez )

	. This group includes drugs such as reopoliglujukin , reoglyuman .
Detoxicston drugs	Drugs that are used to replenish gipoproteinemii under difficult burns, purulent diseases. In particular, it albumin, synthetic amino acids , hydrolysis , aminopeptid , aminozol . The widespread use of parenteral protein nutrition to get a balanced amino acid mixture , which are included in the free amino acids ( polyamine mariamin , levamin , Aminona , alvezin ) .
Preparations parenteral nutrition	Antigens ( aglyutinogen A and B antigen is 0 , which is a weak antigen and of erythrocytes and agglutination does not ) organic compounds are thermolabile . They are found in the erythrocytes , as in all other tissues of the body other than the brain . Practical values are aglyutinogen located on the surface of blood cells , they cause isoimmunization and having them join the antibody , causing agglutination and hemolysis.
Aglyutinogen	Agglutinin ( R and ? ) - Labile plasma globulins and they are in such a lymph exudate and transudate . Group agglutinins blood represent gamma globulin molecules that differ from other globulins ability to connect with the same specific antigen blood.

## 6. Materials for self-control.

1. To show methods for the determination of blood group and Rh factor .
2. To show determination of compatibility tests for blood donor and recipient.
3. Familiarise with a history of transfusion .
4. Explain necessity and method of sampling for compatibility.
5. Explain clinical presentation of complications and how to provide first aid and treatment for complications of blood transfusion .

### 6.1. Tasks for self-control .

#### Question:

1. Stages of the history of blood transfusion
- 2 . Methods for determination of a group of accessories for blood groups ABO
- 3 . Possible errors in the determination of a group of accessories for the blood group ABO system
- 4 . Methods for determining the Rh factor of
5. Test for individual compatibility
6. Tests for ABO compatibility of the system
7. Test for biocompatibility

#### Problem:

- 1 . Determination of blood group on the standard red blood cells
- 2 . Determination of blood groups using Colyclons
- 3 . conducting tests on individual compatibility .

## 6.2 . Situational problems .

Task 1 . During the determination of the blood group ABO system of agglutination of red blood cells

study determined the standard blood serum of I and II and did not cause - III group. What aglyutinogeny contained in these red blood cells ? A. A and B. A SV D. E. C , and C

Task 2 . During the surgery, the need arose massive blood transfusions. Blood victim - In ( III ) Rh +. Donor with any blood type should I choose? A. AB ( IU ) Rh- B 0 (I) Rh- A C. (II) Rh + D. VIII ) Rh + E. VIII ) Rh-

Task 3 . In the study of blood groups in two series of standard serum test result was evaluated by a doctor 10 minutes. Agglutination occurred in the sera of O ( I ) , A ( II ) , B ( III ) . The result was interpreted as a fourth group of blood. Is the study conducted ?

Task 4 . In carrying out tests on a group ABO compatibility mix serum donor red blood cells of the recipient. The result of the study assessed after 5 min of agglutination were not identified. Does this mean that the blood of the donor and recipient together by the ABO system ?

Task 5 . In conducting tests on rhesus compatibility tube placed one drop donor erythrocytes that have previously washed with saline , was added 2 drops of 10% gelatin solution and 2-3 drops of serum of the recipient. Contents of the tube were mixed . Output samples evaluated over 10 min, was added to the tube 5-8 ml of isotonic solution. Agglutination in vitro have been identified. Or is it that the blood is Rh- joint on the Factor ?

Task 6. A patient with a stab wound to the stomach and bleeding before surgery blood was determined in two series of standard sera with antibody titers 1:32, with a string of pridatnosti that ended one month ago. In assessing the agglutination were found in the sera ON ( I ) AND ( II ) , B ( III ) blood groups. Or is it that the first patient in the blood ?

### Test problems in the volume of "Step 1" and "Step 2" .

Test number 1 Specify the contents aglyutinogenov erItrotsitah in a patient with blood group A ( II )

- a) Red blood cells instead of aglyutinogen In
- b) Red blood cells instead of aglyutinogen A
- c) Erythrocytes aglyutinogeni together A and B
- d) Red blood cells are not together aglyutinogeniv
- d ) Red blood cells contain about aglyutinogen

Test number 2 Specify the contents aglyutinogeniv in red blood cells in a patient with blood group 0 ( I ):

- a) Red blood cells instead of aglyutinogen In
- b) Red blood cells instead of aglyutinogen A
- c) Erythrocytes aglyutinogeni together A and B
- d) Red blood cells are not together aglyutinogeniv
- d ) Red blood cells contain aglyutinogen Rh

Test number 3 Specify the contents of the agglutinins in the serum of patients with blood group AB ( IV )



- a) A serum will contain agglutinin
- b) The serum will contain agglutinin in
- c) Serum accommodate agglutinin and B
- g ) Serum not accommodate agglutinin
- e) serum contains cold agglutinins

Test number 4 Determine the correct written blood group B ( III ) of the system and the ABO ) A. \* b) O. \*\* ) In \* g ) A B 0 d ) A B \*

Test number 5 Determine the correct written blood group AB ( IV ) for the ABO system a) A \* B ) O \*\* ) In \* g ) A B 0 d ) A B \*

### 6.3 Tests for self-control (basic knowledge )

Test number 1. When it is necessary to evaluate the suitability of stored blood transfusion ?

- a) After shaking b ) To agitation c) After 3 min . after shaking g ) After 5 minutes. after shaking d ) After 10min. after shaking

Test number 2 . Specify image determination of the biocompatibility of blood :

- a) After the transfusion of 20 ml. blood. b) Two-time after the transfusion of 15-20 ml . blood at intervals of 3 min in ) twice after the transfusion of 15-20 ml . Blood 5min intervals . d) three times after the transfusion of 15-20 ml . blood at intervals of 3 min d ) three times after the transfusion of 15-20 ml . Blood 5min intervals .

Test number three . ABO system is so named due to:

- a) agglutinin b) Rh factor in ) aglyutinogenam g ) mikroagregantam e) the components of the clotting

Test number 4 . What percentage of people in the world have the blood group II

- a) 25-30 % b) 42-44 % c) 60-79 % d) 5-10% d ) 10-20%

### Tests and testing task source of knowledge .

1. Rhesus (Rh) was opened in 1940

- a) Landsteiner and Wiener b) B. Moss in Jansky ) Otenbergom g ) of Moher e) Spasokukotskim

2 . The most common blood type in the world is:

- a) A ( II ) b) 0 ( I ) ) In ( III ) d) AB ( IV ) d ) are equally common

3 . Who is to transfuse blood to the patient during the surgery ?

- a) The surgeon b) in anesthetist ) surgeon or anesthetist who participate in operation d) the surgeon or anesthetist who do not take part in the operation d ) Nurse

4. 30 old pathient ailing with A ( II ) blood group blood loss was 800 ml . Blood is needed in the hospital group is absent . That tactic doctor is correct in this case .

- a) pour 500 ml of 0 ( I ) Rh ( + ) blood b) pour 500 ml of 0 ( I ) Rh ( - ) blood c) refuse transfusions and blood products used to supplement the bcc g ) , transfuse to 50 mL in ( III ) Rh ( + ) d ) to pour in 500 ml ( III ) Rh ( + )

5 . When certain groups of two series of standard blood serum 0 \*\* ( I ) , A \* ( II ) , V \* ( III ) came agglutination of red blood cells . What blood type in a patient?

a) 0 \*\* ( I ) b) AB ( IV ) c) determination of blood groups to continue g ) blood group should be repeated e) AB

6. When certain groups of two series of standard blood serum I, II, III groups , no not cause agglutination of red blood cells. What blood type in a patient \*

a) \*\* ( I ) b) AVO ( IV ) c) determination of blood groups to continue d) determination of blood groups must be repeated e) AB

### **Case studies for the source of knowledge**

1. In the surgical ward enrolled patients with peptic ulcer disease 12 Palo intestine, complicated by bleeding. BCC deficit is 35%. In order to restore blood loss, blood transfusions are indicated . What is the minimum required sampling and laboratory studies , without which the blood transfusion impossible ?

2 . Under the supervision of a physician in the manipulation room two nurses determine the blood group of four patients. To do this, they are on white porcelain plate with appropriate notes struck by two series of standard sera. Investigated the blood is well mixed with drops of standard sera. The plates shook and left for 1-2 minutes , then again shook . Not earlier than 3 minutes , the place where the agglutination have arisen 1 drop of isotonic sodium chloride solution. After 5 minutes of the start of the study physician assessed the results be recorded in history. To which the doctor did not pay attention , thus violating the requirements of the "Instructions for determining blood groups ABO "?

3 . A patient with massive internal bleeding on life hits taken to the operating room . Under endotracheal anesthesia is performed surgical intervention aimed at the final stop bleeding. In order to restore blood loss during surgery arose the need for blood transfusions . How to conduct a biological sample for compatibility patient who is under anesthesia ?

4 . When conducting tests on the compatibility of the resulting group agglutination . What do I need to do , and that indicates that reaction ?

5 . In the recipient Rh factor was determined by rapid method . When conducting tests on rhesus compatibility resulting agglutination . In this reaction indicates that it is necessary to perform , and ?

6. Patient with massive bleeding gastric (Hb 48 g / l erythrocytes  $1.8 \cdot 10^{12} / L$  , Ht 20) shown transfusion eritrotsitarnoy mass. Single-group odnorezusna eritrotsitarna mass delivered to the station of blood transfusion . During the test for compatibility on the ABO system emerged agglutination . As indicated by this reaction ? What should the doctor do ?

7. The patient is being prepared for surgery for gastrointestinal bleeding , the nurse identified a group of blood sera of one series and showed the doctor. agglutination emerged

Serum from the first and third groups . What blood type in a patient and made a mistake or a nurse ?

8. Blood group standard sera was carried out in the planchette at 14 a. When determining the agglutination observed with all sera . How can one interpret the result of the study?

9. Blood group standard sera was carried out in the planchette at 35 a. When determining the agglutination in the serum is not emerged . Or can be interpreted as the first result of the study of blood ?

10 . In patients with intra-abdominal bleeding nurse determines the blood group by Colyclons . Agglutination emerged from Colyclons Antes Antes A and B , or can be interpreted as the result of blood group AB ( IV ) ? .

11. In the study of blood groups in two series of standard serum agglutination not emerged after 3 minutes. The result was interpreted physician as the first group of blood. Is it true interpretation of results

### Tests III level of complexity

Test number 1. In man , 45 years old , 3 years after removal of the stomach contents of red blood cells in the blood is  $2.0 \cdot 10^{12} / L$ , Hb - 85 g / l, color index -1.27 . Malabsorption of vitamin caused any changes eritropoezu ?

A. With B. B12 SA D.R E.V6

Test number 2 . During the determination of the blood group ABO system for using standard sera were obtained the following results: serum agglutination took place in groups I and II did not take place in the serum of Group III . Which group is the study of blood ?

A. AB ( IU ) B. A ( II ) C. ( III ) D. 0 ( I )

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### General:

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### **8. The distribution points are awarded to students:**

At mastering topic number 7 to substantial module 2 for training activities for students rated a 4-point scale (traditional) scale, which is then converted into points as follows:

<b>rating</b>	<b>Points</b>
5 (excellent)	5
4 (good)	4
3 (satisfactory)	3
2 (poor)	0

Guidelines prepared

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