Erythrocyte concentrate (pediatrics)

General Information

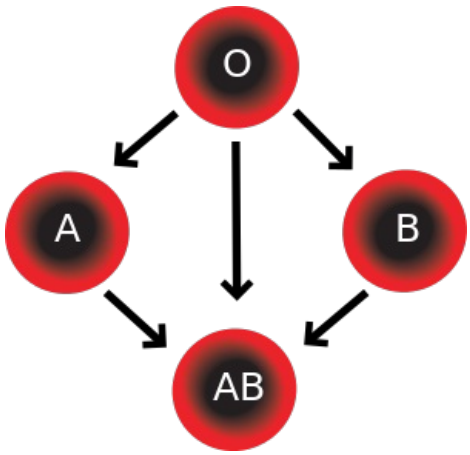
Hematocrit erythrocyte concentration is usually 0.50–0.70, depending on the type of preparation, the volume of the *transfusion unit* (TU) is approximately 250 ml.

The erythrocyte concentrate must be of the same group in both the AB0 and Rh systems. The universal donor is group 0. In acute, life-threatening conditions, erythrocytes of group 0, Rh-negative can be administered. The universal recipient is group AB.

Applications

- for the application of erythrocytes, the universal donor is a blood group 0 donor, the universal recipient is a patient of blood group AB.
- sick 0 -> can 0,
- sick A -> can A or 0,
- sick B -> can B or 0,
- sick AB -> can AB or B or A or 0.

Side effects of erythrocyte concentrate



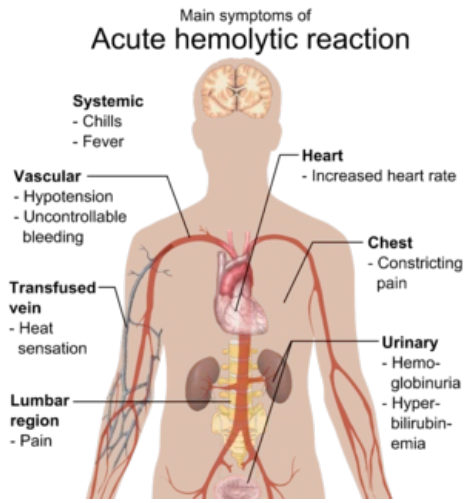
AB0 compatobility

Immediate complications

- **Circulatory overload:** symptoms are dry cough, feeling of heaviness in the chest, cyanosis, dyspnea. On examination, we find an increased filling of the jugular veins and symptoms of pulmonary edema.
- **Haemolytic post-transfusion reaction** (incompatibility, erythrocyte damage): the most common cause is intravascular destruction of erythrocytes by transfusion recipient antibodies. Symptoms include severe chest and/or back pain, dyspnea, restlessness, febrile illness, chills, vomiting. This is followed by hypotension, only with the development of the shock state. If the patient survives the shock, jaundice, renal failure, DIC symptoms appear within 24 hours. Even 50 ml of incompatible blood is sufficient to induce this reaction.
- **Leukocyte and platelet antibody response:** repeated transfusions may induce the production of antibodies to leukocyte and platelet antigens. About 1/3 of patients with these antibodies may develop fever chills, chills, headache, erythema, cough, and chest pain 30 to 180 minutes after blood transfusion.
- **Non-haemolytic reactions:** chills, fever (caused by donor granulocytes), sepsis (in case of bacterial contamination), hyperkalemia (in case of massive transfusion), hypocalcemia, anaphylaxis in the presence of anti- IgA antibodies). The symptomology is urticaria, laryngospasm.
- **Post-transfusion purpura, ARDS, pulmonary edema** (in the presence of anti-leukocyte antibodies, in complement activation).

Late complications

- alloimmunization against HLA and erythrocyte antigens (caused by contact with donor antigens)
- late hemolysis (caused by anamnestic antibody response to erythrocyte antigens)
- post-transfusion GVHD = graft versus host disease (caused by proliferation of transfused functional lymphocytes)
- transmission of syphilis
- virus transmission hepatitis, CMV, HIV
- transmission of parasites: malaria
- Overload of iron in polytransfusion



Main symptoms of Acute hemolytic reaction

Preventing adverse effects

- examination of urine, temperature, blood pressure, SF before and after transfusion
- patient monitoring during transfusion
- accurate documentation
- when the reaction is recorded, we immediately interrupt the transfusion, but we also leave access
- the rest of the product is left for 24 hours at T 4 ° C

- the post-transfusion reaction is reported

Application procedure

If blood from the vital indication is not required, erythrocyte concentrate is ordered from the transfusion station according to the patient's blood group according to the AB0 and Rh system. Prior to each scheduled transfusion, the laboratory requires a so-called **"cross experiment"** (this is the reaction of the recipient's serum/plasma and the blood cells of the product segment). After receiving the blood, we perform this "cross-experiment", i.e. an orientation examination of the blood group in the AB0 system at the patient's bedside just before the transfusion. During the start of the transfusion, we perform a so-called **"bioassay"**. We perform it at the beginning of each transfusion to detect an incompatibility or any other reactions early. In the case of unconsciousness, general anesthesia, in a newborn a biological test is not clearly indicated.

Fatal post-transfusion reactions are almost always an administrative mistake!

Indications

The decision to transfuse should not be based on hemoglobin alone. The indications are as follows:

- Hb < 40 g/l (HCT < 0.12) in any patient condition
- Hb 40 to 60 g/l (HCT 0,12–0,18) with concomitant hypoxia, acidosis, dyspnea, impaired consciousness
- Hb < 70 g/l (HCT < 0.21) in clinical anemia intolerance
- Hb < 80 g/l (HCT < 0.24) in simple operations
- Hb < 90 g/l (HCT < 0.27) in cardiopulmonary or cerebrovascular disease
- Hb < 100 g/l (HCT < 0.30) in planned cardiac surgery

The above values are fixed, they do not take into account, for example, the possibility of further progression of anemia (eg in hemolytic anemias, bleeding conditions). Here, the requirement for transfusion would come even at higher Hb values. In intensive care patients, the criteria for erymass transfusion are completely different. The optimal possibility of oxygen transfer is taken into account here. It is recommended that a hematocrit of 0.25 to 0.35 be maintained in these patients. Values below 0.25 already represent a low transport capacity for oxygen, while values above 0.40 already worsen the rheological properties of the blood. In patients in intensive care, but in a stable state, a "restrained" policy is preferred today, transfusion is recommended only with a decrease in Hb <70 g / l.

Applications transfusion of red cell products in children

- Total volume 10-15 ml / kg
- Recommended speed 4-8 ml / kg / hour
- 4 ml of the product / kg body weight assumes an increase in Hb of 10 g / l

Types of blood products containing erythrocytes

Bedside test

Whole Blood

Whole blood comes from one donor, where we usually take 450 ml of blood into the anticoagulant solution. It serves primarily as a raw material for the preparation of other transfusion products. Whole blood is practically no longer used for transfusion. The hematocrit is usually > 0.30. After collection, it is cooled and centrifuged. Resuspension solution is added to the separated erymase. As a result, we obtain 3 types of transfusion products:

- plasma
- thrombocytes from the buffy coat (= buffy coat platelets + leukocytes)
- resuspended erythrocytes without buffy coat

Pure erymass (erythrocyte concentrate = plasma-depleted blood) represents about 150 to 200 ml of erythrocytes, from which most of the plasma has been removed.

The following products are used in practice far more often than whole blood.

Erythrocytes without buffy coat resuspended

Erythrocytes without buffy coat resuspended (EBR) represent the most common form of erymass for transfusion in adult patients without specific burden (polytransfused patients, hematooncological problems, requirement for CMV negativity). They have a low leukocyte content (leu <1.2 x 10/9) and a minimal, residual amount of plasma. The resuspension is performed in a solution of NaCl, glucose, mannitol, adenine, guanosine etc. The resuspended eryconcentrate contains an insignificant amount of plasma. HCT is in the range of 0.55-0.65.

Erythrocytes without buffy coat resuspended and deleucotized

Eryconcentrate corresponds to the previous type, in addition, **leukodepletion** is performed. Leukocyte removal takes place at various stages (during production, before release from the transfusion department or at the bedside via a single-purpose filter). The number of leukocytes is significantly reduced (<1 x 10/6), HCT is usually in the range of 0.55 to 0.65. This preparation is an alternative to the CMV negative erythrocyte preparation. It is suitable for the positivity of antibodies against leukocytes, in polytransfused patients (hematooncology, young children).

Washed Erythrocytes

Washed erythrocytes are obtained from whole blood by centrifugation and washed with isotonic solution, resulting in removal of plasma, platelets and leukocytes. HCT ranges up to 0.65-0.75. The indication is patients with proven antibodies against plasma proteins, eg. in IgA deficiency, in hemolytic anemia with complement activation (eg. paroxysmal nocturnal haemoglobinuria), in severe transfusion reactions.

Eryconcentrate must be administered as soon as possible, i.e. no later than 24 hours after preparation.

The disadvantage of this preparation is the risk of contamination and the impossibility of storage when opening a closed system, as well as damage to the cells by washing.

Cryopreserved erythrocytes

These are erythrocytes frozen at −80 ° C. They do not contain protein, granulocytes and platelets. The indications are rare blood types and as an alternative to CMV negative erythrocyte preparation.

Erythrocytes irradiated

Irradiation of erymass eliminates T-lymphocytes. **Irradiated erythrocytes** have special indications:

- patients before and after TKD
- hereditary immunodeficiency syndromes
- intrauterine transfusion
- hematooncological diseases
- oncology patients on chemotherapy and radiotherapy
- polytransfused patient

From today's point of view, irradiated, deleukotized and resuspended eryconcentrate without buffy coat is the safest variant of erythrocyte transfusion for young children. This type of eryconcentrate should certainly be used in premature babies and newborns, preferably also in children under 6 years of age.

Disadvantages of irradiation include a negative effect on the stability of the erythrocyte membrane (increased value of pottasium and Hb during storage), preparations with erythrocytes can be irradiated within 14 days after collection. Irradiation is recommended just before application, storage is only possible within 24 hours.

Links

Related Articles

- Hemotherapy (pediatrics)
- Blood
- Hemostasis

Source

- HAVRÁNEK, Jiří: Hemotherapy . (modified)