TRALI-syndrome

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Definition

Transfusion-associated lung injury

(TRALI - transfusion-related acute lung injury) is

one of the serious problems of modern transfusiology. So, according to R.M. Korko [6], TRALI ranks third in deaths associated

with transfusion complications, after hemotransfusion shock and infectious complications, ranging from 10.5 to 14.1% of cases.

According to the US National Heart, Lung, and Blood Institute, TRALI is defined as “acute hypoxemia occurring within the first 6 hours after blood transfusion with the optional development of infiltrates in the lungs and the absence of left ventricular failureor other causes of pulmonary edema."

Medical history

- The first information that the lungs can be a target for the development of post-transfusion reactions began to appear in the scientific literature in the 1950s. under various names: "leukoagglutinin transfusion reactions", "pulmonary hypersensitivity reaction", "allergic pulmonary reactions". In 1957
- For the first time, a case of death in a patient with acute leukemia due to pulmonary edema, which developed immediately after blood transfusion and was associated with an immediate hypersensitivity reaction, was described for the first time.
- In subsequent years, similar cases were also described. In the 1970s a direct relationship was established between fatal changes in the lungs of recipientsand human leukocyte incompatibilityantigen (HLA - human leucocytes antigen) donorblood. In 1983 M.A. Popovsky et al. [8] described this phenomenon in detail and introduced the term TRALI

Epidemiology

- The incidence of TRALI per dose of transfused blood product is low and ranges from 0.02–0.09%. buttheir real number is probably higher, since this complication is not always diagnosed and regarded as circulatory disorders due tofluid overload. The risk of developing TRALI hasa place for transfusion of whole blood and all its components: erythrocyte mass, platelet mass, intravenous immunoglobulins, cryoprecipitate. But most often, transfusion of fresh frozen plasma leads to the development of TRALI. Not a single case of the development of TRALI during transfusion of drugs has been described albumin.

Pathogenesis

- There are two mechanisms of TRALI development: immune andnon-immune genesis. The development of TRALI of immune genesis is based on the immunological conflict “donor-recipient”: the production of antibodies to HLA or the presence of anti-leukocyte antibodies in transfusedblood products. Antibodies contained in plasma-containing blood products activate complement, which, in turn, causes neutrophil aggregation and sequestration in the microcirculation system. Activated complement neutrophils are a source of proteases and oxygen radicals that cause damage to the vascular endothelium, includingnumber of pulmonary capillaries, followed by an increase in vascular permeability, development of capillaryleakage and pulmonary edema.

Pathogenesis

- The donor's antibodies can make a reaction with lungs endothelium and activation of monocytes. Rare variants of immunological aggression is the interaction of the recipient's antibodies with leukocytesdonors or antibodies and leukocytes from different donors withmassive blood transfusions. Leukocyte antigensI and II classes are the main points of applicationtransfused antibodies. It should be noted thatHLA antibodies are more commonly found in women, multiple donors, and women with a history of two or more pregnancies. The development of TRALI has also been described after transfusion of blood products from mothers to children. M.J. Fontine et al. [5] described a case of TRALI development in 3 critically ill patients. When examining donors whose blood components were transfused to these patients, specific HLA classes I and II were detected in one donor.the other has nonspecific antileukocyte antibodies. According to M.A. Popovsky [9], greater valuewith TRALI has the presence in the donor blood of antibodies toneutrophils than to HLA, since antibodies to neutrophils were found in 41% of cases, and to HLA - in 28%

Pathogenesis

- It is assumed that during the development of TRALI of non-immune origin, the main role in triggering lung damagetwo independent factors play without the involvement of antibodies:q change in the reactivity of granulocytes and / or endothelium in patients who underwent blood transfusion against the background of critical conditions: sepsis, polytrauma, blood loss, major surgical interventions, leukemia, chemotherapy, etc.;q transfusion of canned blood components,containing lipids or cytokines, which lead to the activation of granulocytes.For example, during storage of prepared erythrocyte mass, degradation products of cell membranes containing biologically active lipids (in particular, lysophosphatidylcholine) accumulate, which contribute to the activation of neutrophils with the formation of proinflammatory mediators.

Pathomorphology

- At autopsy in the lungs of patients who died from TRALI,changes are found similar to those inearly stages of ARDS, in the form of diffuse leukocyte infiltration, capillary dilatation, interstitial and alveolar pulmonary edema.

DIAGNOSIS AND CLINICALFLOW

- The clinical symptoms of TRALI are dyspnoea,cough, foamy sputum, tachycardia, hypertension. Atall patients have diffuse infiltrateson a chest radiograph. But in contrast to ARDS, in most cases, against the background of intensive therapy is fast (less than 96 hours)positive dynamics of the x-ray picture.The diagnosis of TRALI is established on the basis of a decrease within 6 hours after blood transfusion of the oxygenation index PaO2/FiO2 less than 300 mmHg Art. or saturationblood (SaO2) less than 90% when breathing air, with the exclusion of other possible causes of the development of pulmonary edema. There is an early development and rapid progression of radiographic signs in the form of bilateral infiltration of the pulmonary fields. The diagnosis of TRALI is confirmed by the presence of antibodies to granulocytes in the presence of blood transfusion. Atdetection of antibodies, a cross-lymphocytotoxicity test is performed between donor and recipient plasma. If the TRALI test is positive, the diagnosis is confirmed; if it is negative, the diagnosis is assumed.

Diagnostic criteria

- Diagnostic criteria for TRALI (P. Toy et al. [9]):q acute onset, no clinical signsacute lung injury prior toblood transfusion;q hypoxemia, PaO2 < 300 mmHg Art., SaO2 < 90% when breathing air (FiO2 0.21);q bilateral pulmonary infiltration on a frontal chest x-ray;q no signs of left atrial hypertension(infusion overload), wedge pressure inpulmonary artery < 18 mm Hg. Art.An important provision is the registration of TRALI astransfusion complications, followed by examination of donors of transfused blood components.

Differencial diagnosis

- 1. Anaphylaxis: no pulmonary edema, no fever; respiratory failure against the background of laryngo- or bronchospasm, erythema, urticaria; hypotension is very characteristic.
- 2. Circulatory overload: tachypnea, cyanosis, tachycardia, hypertension, increased central venous pressure
- 3. Bacterial contamination: temperature increase, hypotension, vascular development of syndrome of disseminated intravascular coagulation

Prevention and treatment

- It should be emphasized that, unlike acute respiratory distress syndrome, which is characterized by a severe and prolonged course with a high mortality rate reaching 60%, the clinical course of TRALI is usually transient and less severe, well treatable, with a mortality rate of 5–13%.
- Features of intensive care in patients withestablished diagnosis of TRALI impermissibility of usage furosemide causing developmentsevere hypotension. It is advisable to carry out infusion therapy against the background of monitoring of central hemodynamic parameters and the implementation of respiratory support.

Prevention

- Based on international experience, a protocol has been introduced to prevent the development of TRALI in critically ill patients, primarily with polytrauma. Heincludes:q the use of leukocyte filters or microfilters in case of need for massive blood transfusions to preventHLA allosensitization and immunosuppression, as well as non-hemolytic post-transfusion reactions;q the use of washed red blood cells and leukocyte-free red blood cells in patients with highthe risk of developing TRALI;q use of donor blood components with a short shelf life (erythrocyte mass - up to 14 days of storage);q after withdrawal from traumatic shock, at stagestreatment of traumatic disease - a reasonable restriction on the use of donor blood components (restrictive approach to the use of plasma-containing blood products) with the inclusion of drugs that stimulate hematopoiesis in therapy.

Clinical case

- Patient S., aged 85, was admitted to the hospital with chronic anemia (Hg – 72 g/l, RBC – 2*10*12, Ht – 0, 2 %.
- Due to anemia not corrected by iron preparations, blood transfusion of an erythrocyte suspension with a removed leukocyte thrombus layer in a resuspending solution was shown 310 ml. He behaved well, the temperature did not rise, the pulse and pressure were within the normal range, diuresis was sufficient.
- After transfusion the datas changed slightly: Hg – 75 g/l, RBC – 2,3*10*12, Ht – 0, 2 %. And was prescribed second transfusion of erythrocytes in volume of 270 ml. Compatibility was without peculiarity. In 2 hours – acrocyanosis, orthopnoe, oliguria, tachicardia 120/min, edema of lungs.
- Therapy: dexamethasone 8 mg per 100,0 0.9% NaCl, furosemide 40 mg i/v, isoket 5,0 0.1% per 100,0 0.9% NaCl i/v. , sydnopharm 1 mg per os.

Conclusion

- Taking into account the development of complications after blood transfusion, the patient's absence of signs of left ventricularinsufficiency that could lead to pulmonary edema, andrapid resolution of the pulmonary edema clinic, TRALI syndrome was diagnosed

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