Transfusion medicine

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Transfusion medicine introduction

- management of collection, transport, processing and distribution of blood products
- good laboratory practise
- good manufacturing practise
- medicine control agency
- blood safety
- effective use of blood and blood products

Blood donor-donation of blood

- volunteer donors
- age :18- 65 years
- health history :diseases of heart,liver,lungs,kidney, cancer,abnormal bleeding etc….contraindication)
- interval from last donation at least 56 days (whole blood)

Blood donor-donation of blood: no donation

- exposure to HIV group
- risk group for viruses: drug abuse,male sex with another male, female prostitutes..
- other exposure to blood-borne pathogens(contaminated with blood..)
- received blood transfusion or tissue transplant in past 12 months
- history of syfilis

Blood donor-no donation of blood

- malaria
- Creutzfeldt-Jakob disease
- recent immunizations and vaccinations
- history of babesiosis or Chagas disease

Blood donor-no donation (relative-short time) of blood

- pregnancy, lactation
- hypotense
- body weight under 50 kg
- surgical intervention
- endoscopy
- extraction of teeth

Blood donor-donation of blood

- physical examination
- laboratory tests (Hb, Ery, WBC, Plt, urine, liver tests)
- testing of infectious disease (HIV1,2 Ab+Ag24, HCV- Ab, HBsAg,Syfilis-serological tests)
- donation of whole blood in men 5times per year, in women 4times per year
- donation max.450 ml per blood bag
- anticoagulant-preservative solutions in bag(ACD-A)

Blood products-indication for use

- packed Red Blood Cells (T.U.-transfusion unit)
- EBR in T.U.(Hb min.45 g/T.U.,ht 0,65-0,75,volum 280+-50ml)
- ERD –leukocyte reduction WBC under 1mil/TU
- indications for use: replacement of blood loss and for therapy of anaemia
- its possible use supplementation of Fe

Blood products-indication for use

- blood loss (massive, acute)
- bone marrow failure (postchemotherapy, leukemias..)
- inherited RBC disorders (red cell aplasia, Hbpathia..)
- acquired RBC disorders (myelofibrosis,MDS, chronic anemias..)
- neonatal exchange transfusions

Blood products

- fresh frozen plasma (component prepared from whole blood or from plasma collected by apheresis,frozen within a period of time and to a temperature that will adequately maintain the labile coagulation factors in a functional state)
- storage bellow -30°C (exspiration time 3 years)
- parameters: f.VIIIc 70IU per 100 ml, residual cells RBC: under 6,0 x10 9/l, WBC under 0,1, plt under 50
- FFP : AB0 blood group compatible (AB0 universal)
- FFP should be used immediatelly following thawing. It should not be refrozen

Blood products(FFP) indications for use

- coagulation disorders (multiple coagul.disorders)
- polytrauma, loss of blood (many EBR…)
- need of stopping anticoagulation effect of drugs
- TTP
- combustio
- exchange transfusion in newborn

Blood products-FFP precautions in use

- FFP should not be used simply to correct a volume deficit in the absence of coagulation deficit nor as source of immunoglobulins
- FFP should not be used where a suitable virus inactivated specific clotting factor concentrate is available
- FFP should not be used in a patient with intolerance to plasma proteins
- AB0 group-compatible plasma should be used
- FFP- AB is universal
- FFP should be used immediately following thawing.It should not be refrozen
- Before use the product should be thawed in a properly controlled environment and the integrity of the pack should be verified to exclude any defects or laekages. No insoluble cryoprecipitate should be visible on completion of the thaw procedure.

Blood products-platelets

- platelets recovered (from fresh whole blood with contain the majority of the original platelet content in therapeutically effective form)
- platelets-apheresis (a component obtained by platelet apheresis of a single donor using automatised cell separation equipement)
- storage and stability: platelets must be stored under conditions which guarantee that their viability and haemostatic activities are optimally preserved
- plastic bags must be sufficiently permeable to gases to guarantee availabity of oxygen to platelets
- pH between 6,4-7,4
- agitation of platelets during storage must be efficient enough to guarantee availability
- storage temperature +20 to+24°C
- exspiration time 5 days

Blood products-platelets Indication for use

- to decision to transfuse platelets should not be based on a low platelets count alone
- trombocytopenia with clinical significant haemorhage attributable to the platelet deficit
- other indications for platelets transfusion are more or less relative and dependent on the clinical condition of the patient
- blood group : <u>compatible in AB0/RhD</u>

Blood products-granulocytes

- component consisting primarily of granulocytes suspended in plasma, obtained by single donor apheresis
- principal function of granulocytes is phagocytosis of bacteria
- leucapheresis by separator (centrifugal flow methods continuos or intermittent)
- storage and stability: this preparation is not suitable for storage and should be transfused as soon as possible after collection (storage is limited to 24 hours at + 20 to +24°C)
- volume under 500 ml
- granulocytes 1x 10^{10}/1 T.U.
- indications for use: pacients with sepsis with granulocytopenia(TBM)
- Blood group compatible in AB0/RhD

Irradiation of blood products

- gamma irradiation prevents the occurence of TA-GVHD by altering the DNA in the WBCs such that they cannot divide and therefore cannot engrafts in the recipient
- Indications for irradiation:
- low-birth weight neonates
- intrauterine transfusions
- bone marrow transplant patients
- patients wit congenital immunodeficiency syndromes
- patients with hematological diseases(leukemia,lymphomas etc..)
- units donated by a blood relative

Leukoreduction of blood products

- leukoreduction technology refers to methods to decrease the number of residual donor leukocytes in cellular blood components
- in laboratory leukoreduction-by filtration in laboratory of blood bank prior to release for transfusion (prestorage)
- Bed-side leukoreduction: by filtration at the time of transfusion to the patient leukoreduction

Leukoreduction of blood products

- indication for leukoreduction of blood products:is to reduce complications and risks of allogenic blood transfusions
- reduce incidence of febrile nonhemolytic transfusion
- reduce incidence of transfusion transmitted leukocyte associated infections diseases (CMV) at risk recipients
- reduce the frequency of primary HLA alloimmunization
- reduce transfusion-related immunomodulation

Pretransfusion compatibility testing

- AB0,Rh/D blood group typing (antigens A,B,anti-A,anti-B antibodies (naturally occuring antibodies)
- screening of irregular antibodies (against erythrocytes) in serum of pacient. In this test is using screening panel that contains special test erythrocytes, all of blood group 0 (if present anti-A, anti-B cannot disturb the test)-3 cell screening panel

Pretransfusion compatibility testing

- clinical important erythrocyte antibodies are: anti-C, anti-c, anti-D, anti-E, anti-e, anti-Kell, anti-cellano,anti-Fy(a), anti-Fy(b), anti-Jk(a), anti- Jk(b), anti-S and s, M,N..
- compatibility tests recipient serum is tested directly with the donors erythrocytes

Pretransfusion measures

- identification of patient at blood sampling (clear cut identification on the tube)
- order form with signature of phlebotomist
- blood samples which are inappropriately labelled should always be refused for blood typing and compatibility testing
- blood group serological investigations include: blood typing,antibody screening and compatibility testing before transfusion of red cell products

Transfusion-safety measures

- *the medical person who gives the transfusion to a patient is responsible for the control of identity and other safety measures*

- verification of identity of patient
- verification of compatibility between patient and blood unit
- 1) comparing identity information received from the patient with data on the laboratory certificate of compatibility
- 2) checking the certificate of the patients blood group against the blood group denoted on the blood unit label
- 3) checking that the exspiry date of blood unit has not been passed
- 4) recording the identity of the patient

Transfusion-clinical surveillance

- During transfusion of blood components careful observation of the patient is mandatory
- Control of blood group AB0 in patient (EP, MP, platelets) control of blood product RBC- antisera
- In the first 15-20 minutes of the transfusion where significant transfusion reactions are more likely to occur and in the transfusion of any component prepared by open system
- Blood components should be transfuded within the recommended time to avoid compromising clinical effectiveness and safety.

Transfusion-clinical surveillance

- Warming of blood(rapid transfusion of cold blood is dangerous).any warming device used must be controlled and monitored to ensure that the correct temperature of the blood has been achieved.
- Addition of medicinal products or infusion solutions to blood components must not be !! (risk of damage)
- FFP after thawing shall be inspected to ensure that all cryoprecipitate has been disolved and that container is not damaged.FFP shoud be transfused as soon as possible (and must not be refrozen!)
- Risk of air embolism
- Documentation carefully!!
- Storage of residual blood product after transfusion for 24 hours

Transfusion reactions

- Acute and delayed hemolytic transfusion reactions
- Result from immune mediated destruction of transfused incompatible EBR
- Acute hemolytic reaction occur within 24 hours of transfusion (serious complication)
- Delayed hemolytic reaction are caused by accelerated destruction of transfused RBC by a recipients immune response directed against an antigen on the donor RBC (within hours-days)
- AHR signs and symptoms:
- 1) cardiac: chest pain, hypo/hypertension, tachycardia)
- 2) renal: Hburia, oliguria, anuria,
- 3) hematological: anemia,bleeding uncontrolled,DIC,
- 4) generalized: fever, chills, flushing, nausea, vomiting,dyspnea,pain in site of venepunction, urticaria, abdominal pain

Transfusion reactions

- Febrile nonhemolytic transfusion reaction (most commonly transfusion reaction: 0,5-2% of T.U.
- Caused by action of pyrogenic cytokines(IL-1,IL-6,TNF) on the thermoregulary center of the anterior hypothalamus
- Leukocytes of donor may be stimulated by anti-HLA or other antibodies in the recipient
- Dif.dg: fever can be in transfusion reactions:FNHTR,AHTR,DHTR,TRALI,bacterial contamination

Transfusion reactions

- Allergic transfusion reactions to blood product transfusion encompasses a broad range of clinical symptoms and range of severity
- *Allergic reaction* mild (1-3%)
- *Anafylactoid reactions* (cardiovascular instability, hypotension,tachycardia,cardiac arrhythmia, cardiac arrest, shock) (1:50000 TU)
- Pathophysiology: soluble substances(proteins) in donor plasma.The interaction of these antigens with IgE can activate mast cells, that releas bioactive mediators-histamin, leukotriens, prostaglandins,PAF..

Transfusion reaction

- Other noninfectious complications of transfusion
  - *Circulatory overload* (expansion of a patients intravascular volume)
- **TRALI** (transfusion related acute lung injury)-respiratory distress :hypoxia, noncardiogenic oedema within 1-6 hours after transfusion incidence: less 1:5000 T.U.
- Pathophysiology of TRALI: presence of leukoaglutinated antibodies in donor plasma, that react with recipient leukocytes. The result is neutrofils aggregation in microvasculature of the lung
- *Citrate toxicity*
- *Hypothermia*
- *Posttransfusion purpura*
- *Iron overload*

Transfusion reactions

- Infectious complications of transfusion
- Hepatitis
- CMV and other Herpes viruses
- HIV
- Malaria
- Babesiosis
- Trypanosomiasis
- CJD