Adverse transfusion reactions and complications in a clinical practice

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Adverse reaction

- Adverse reaction and complication, event, accident, mistake, associated with transfusion of blood component.

- After -effect: death, life – threatening circumstances, health damage or limitation of abilities, admission or its prolongation, disease.

Causality!

Classification on the basis of cause

- Transfusion transmissible infections
- Imunological complications
- Cardiovascular and metabolic complications
- Unknown complications

Classification on the basis of timing

- **Acute** – no later than 24 hours after transfusion
- CAVE: - acute haemolytic transfusion reaction
- - septic shock
- - high body temperature

Delayed – in 24 hours,
few days even weeks after transfusion

Classification on the basis of a clinical development

- Mild - finishes when transfusion stops and after simple therapy
- Serious – organ breakdowns, monitoring of life functions is necessary (akute haemolysis, bacterial/septic, TRALI, TA-GvHD, anaphylactic shock, post-transfusion purpura, virus, parasitic or prion transmission).

Haemolytic transfusion reaction

- Haemolysis or accelerated clearance of erythrocytes in a transfusion recipient.
- Cause: immunological incompatibility between the donor and the recipient.

Haemolytic transfusion reaction

- ACUTE: no later than 24 hours after transfusion (intravascular haemolysis)

- DELAYED: within 5 - 7 days after transfusion
- (extravascular haemolysis)

Etiology and incidence AHTR

- ABo incompatibility
- Clerical error !!!
- 1:30 000 transfusion
- 1 - 2 T.U.incomp. ery - 25% pat. +
- More than 2 T.U. incomp. ery - 44% pat. +
- CAVE! ONLY 30 ml of blood group „A“ to pat. „0“ CAN CAUSE DEATH !!!

AB0 system and D antigen

- A RhD pos., A RhD neg.
- B RhD pos., B RhD neg.
- AB RhD pos., AB RhD neg.
- 0 RhDpos., 0 RhDneg.

ABO

- Erythrocytes

PATIENT	ERYTHROCYTES
A	A, o
B	B, o
AB	AB, A, B, o
o	o

ABO

PATIENT	PLASMA
A	A, AB
B	B, AB
AB	AB
o	o, A, B, AB

ABO

- PLATELETS

- Preferably the same blood group
- o (low antibody A and B titer)
- Platelets in the additive solution

Clerical error

- A mistaken identity of blood donor
- A mistaken blood donor sample
- A mistaken blood group record
- A mistaken labelling of blood components
- A mistaken patient sample
- A mistaken identity of patient
- A bedside mistaken blood component

Checks prior to transfusion

- The patient identification (NOT based on records)
- Documentation accompanying blood component
- Bedside check of patientś blood group and blood componentś blood group
- Blood pressure, pulse, body temperature
- Biological checking

Clinical signs of AHTR

- Within receiving as little as 20 ml of ABo-incompatible red cells.
- Fever.
- Chills.
- Pain at the infusion site or in the loin, in the abdomen, in the chest or in the head.
- Hypotension.
- Tachycardia.

Clinical signs of AHTR

- Agitation, distress and confusion, particularly in the elderly.
- Nausea or vomiting.
- Dyspnoea.
- Flushing.
- Haemoglobinuria.

Clinical signs of AHTR

- In anaesthetized patients, the only signs may be uncontrollable HYPOTENSION or excessive BLEEDING from the operative site, as a result of disseminated intravascular coagulation (DIC).

Complications of AHTR

- Renal failure in up to 36% of patients.
- DIC in up to 10% of patients.

Immediate action if you suspect AHTR

- NURSE: stop transfusion, close trf. kit, maintain vein (physiological solution), call a doctor in.
- DOCTOR: therapy depends on signs and clinical conditions of a patient.
- Diuresis: more than 1 ml/kg/hour!
- Maintain and monitor vital organ functions.

Ensuring of patient with AHTR

- Maintain adequate renal perfusion,
- Repeat COAGULATION and biochemistry screens 2-4 hourly,
- If diuresis falls below 1 ml/kg/hour, HEMOFILTRATION or HEMODIALYSIS is required,
- DIC – therapy depends on the DICś phase.

Prevention of AHTR

- Perform recommended controls.
- Staff training.
- If an error is found, analyse the situation and prepare corrective actions to be taken to avoid future mistakes.

Delayed haemolytic reaction (DHTR)

- Secondary immune responses following re-exposure to a given red cell antigen.
- The recipient has been primarily exposed in pregnancy or as a result of a previous transfusion.

- DHTR – is rarely fatal.

Clinical signs of DHTR

- Usually within 5 –10 days after transfusion, but intervals can vary (such as within 24 hours or after 21 days).
- Fever.
- Fall in haemoglobin concentration.
- Jaundice and hemoglobinuria.
- (Renal failure in up to 6% of cases).

Therapy of DHTR

- Symptomatic:

- A) Maintain vital functions
- B) Diuresis

Prevention of DHTR

- Complete compatibility testing
- Health history: pregnancy, transfusion!

HTR - conclusion

- Cause of immediate morbidity and mortality following a transfusion.

- Clinical signs - diverse and they can be unrecognized or misdiagnosed.

FNHTR

- The most often transfusion reaction
- Febrile episode (body temperature rises by 1 ° C during or soon after transfusion and there is no another obvious cause such a haemolytic transfusion reaction).
- The mildest reaction, patients have fever, but otherwise they are asymptomatic. Body temperature usually drops after 2 – 12 hours after disconnection of transfusion.

FNHTR

- Etiology:
- Recipientś HLA antibodies

  x

  blood componentś HLA Ag

- Cytokines (IL-1 beta, IL-6, IL-8, RANTES)

FNHTR

- Clinical signs:

  Fever without haemolysis (BT over 38°C or rises by 1°C), flushing, tachykardia, sometimes chills, shivers – usually occur about 30 mins to 2 h after the start of a red cell transfusion, and even earlier after a platelet transfusion.

- Dif.dg.: AHTR, bacterial contamination of the unit should also be suspected.

FNHTR

- Therapy:

  Administration of antipyretics in repeated reactions

- Prevention:

  Leucodepleted blood products

A Case Report

- A 25 year old female suffered a broken femur in a car accident, subsequently underwent surgery the next day and received 2 units of red cells intraoperatively.
- Patient was extubated after adequate spontaneous ventilation was established. Approximately 3 hours after transfusion and 15 mins after extubation, patientś respiratory rate increased from 12 to 32 breaths per minute. Her temperature rose from 36.7 to 38.7°C. Her blood pressure dropped from 120/70 to 101/74; oxygen saturation dropped from 100% to 90%; her chest x-ray showed severe pulmonary edema.

A Case Report

- The patient had hypoxemia and oxygen saturation was not maintained above 90% with O2 supplementation and patient was reintubated.

A Case Report

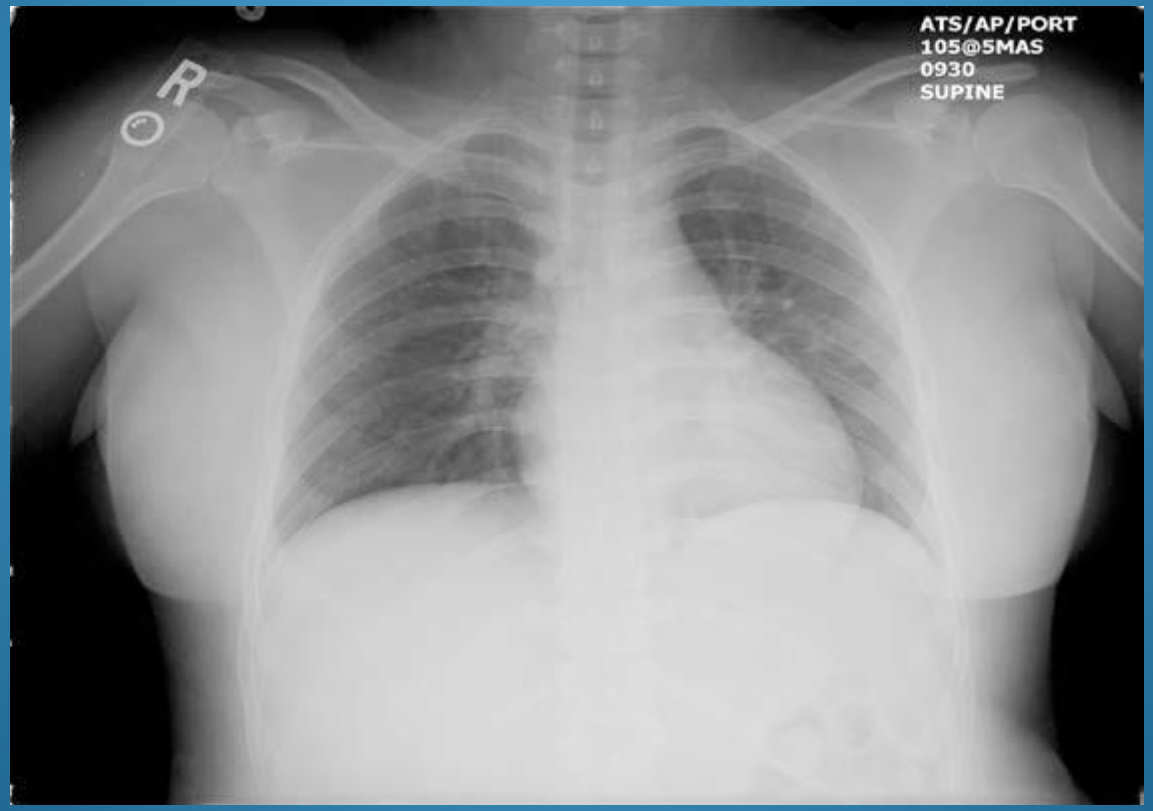
- **A differential diagnosis**:

- pulmonary/fat embolism,
- aspiration pneumonitis,
- pulmonary edema,
- fluid overload,
- ARDS,
- TRALI.

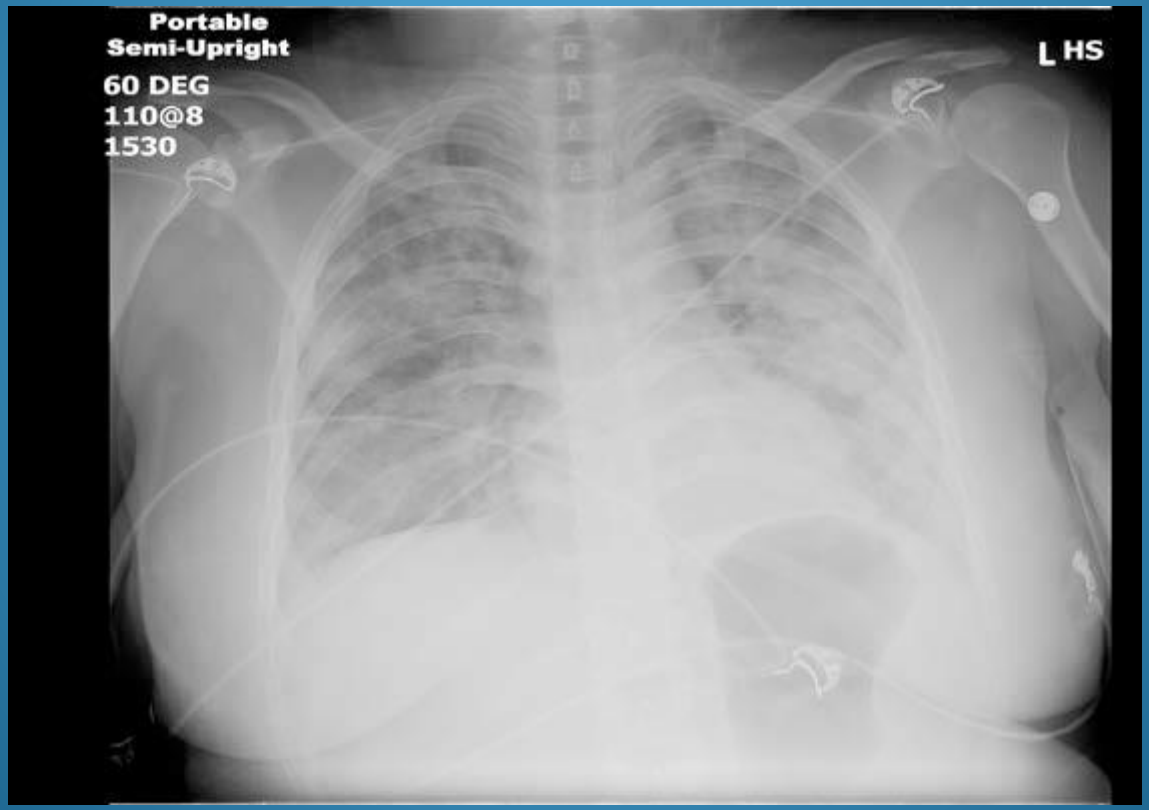
A Case Report

- Chest X-ray showed massive pulmonary congestion with diffuse infiltrates.
- By postoperative day two, chest X-ray became clear and the patient was weaned and extubated.
- Laboratory studies at the blood transfusion service confirmed the diagnosis of TRALI at a later day.

Pre - transfusion X-ray picture



Post-transfusion X-ray picture



TRALI

- TRALI = transfusion related acute lung injury
- - a serious acute lung reaction

- - transfusion of blood component containing donorś plasma

TRALI

Clinical signs:

- Acute respiratory insufficiency (within 6 hours after starting of a transfusion),
- hypoxemia,
- fever +bilateral lung infiltrate with pulmonary edema.

Clinical diagnosis.:

bilateral lung infiltrate with pulmonary edema

TRALI

- Etiology:
- Specific HLA antibodies
- Granulocyte antibodies
- Lipids with a biological activity

TRALI

Pathogenesis:

1. Adherence of granulocytes to lung endotel,
2. Lung leucostasis,
3. Releasing of proteolytic enzymes,
4. Activation of complement,
5. Releasing of cytokines and toxic oxygenometabolites from neutrofils.

IMPACT: damage of lung endotel in lung capillaries.

TRALI

- TRALI – THERAPY:
- Maintaining of vital functions

- PREVENTION: plasma free blood products.

- *Only plasma from men?*

TRALI

- Clinical improvement in 48-96 hours
- Lung infiltrates disappear within 1-4 days

- Mortality: 5%.

- PREVENTION: plasma free blood products.

- *Only plasma from men?*

Urticarial and anaphylactic reactions

- URTICARIA: recipient has plasma proteins antibodies

- ANAPHYLAXIS:
- recipient has IgA antibodies,
- recipient or donor is an allergic person.

Urticarial and anaphylactic reactions – clinical signs

- 1. **Non-systemic:** focal urticaria, angioedema,
- 2. **Mild systemic**: chest tightness, wheeze, generalized urticaria/angioedema,
- 3. **Moderate systemic**: wheeze, breathlessness, obstructive laryngeal oedema,
- 4. **Severe systemic (anaphylaxis):** severe difficulty with breathing, shock, arrhythmia, loss of consciousness.

Urticarial and anaphylactic reactions

- Therapy: transfusion to be stopped immediately,
- antihistaminics, steroids

- Prevention: washed blood products

- plasma!?

Bacterial contamination

- Clinical signs:

  fever (BT ≥ 2°C),

  chills, shivers,

  nausea, vomiting,

  HYPOTENSION, collapse, shock,

  DIC, intravascular haemolysis,

  renal failure.

Bacterial contamination

- THERAPY: 1. Stop the transfusion! (retain all packs for investigations)

  2. Symptomatic therapy – perform general supportive treatment (maintain vital functions, maintain diuresis).

  3. Give broad – spectrum ATB until the results of blood cultures are known.

Post-transfusion purpura

- Acute episode of severe thrombocytopenia occuring about a week after a blood transfusion.
- It usually affects HPA-1a negative women who have previously been alloimmunized by pregnancy.

- Platelets!

Post-transfusion purpura

- Clinical signs:
- severe thrombocytopenia and bleeding within 5-12 days following transfusion,
- rapid course,
- Widespread purpura and bleeding from mucous membranes and the gastrointestinal and urinary tracts.

Post-transfusion purpura

- **Without therapy**: usually spontaneous remission has been reported

- **Dif.dg.**: includes other causes of accute immune thrombocytopenia such as:
  autoimunne thrombocytopenia,
  drug – induced thrombocytopenia (heparin),
  non –immune platelet consumption (DIC).

Post-transfusion purpura

- Etiology: platelet specific alloantibodies

- THERAPY: 1.high dose of intravenous immunoglobulins (2g/kg for 2-5 days) – 85% react positively
- 2. Steroids and plasma exchange are effective only in some cases.

Post-transfusion purpura

- To use red cell and platelets concentrates from HPA-compatible donors or autologous transfusion only in severe cases.

- Prevention of recurence of PTP:

  1) HLA – compatible blood components
  2) Autologous transfusion
  3) Leucodepleted blood components

TA-GvHD

Immunologically competent allogeneic T lymphocytes

Severely immunocompromised recipient

Clinical signs are similar to classic GVHD

TA-GvHD - prevention

- Gamma irradiation of celular blood products with 25 Gy

Cardiovascular and metabolic complications of transfusion

- Fluid overload
- Dyspnoea
- Hypothermia
- High level of potassium
- Low level of calcium
- Hemosiderosis
- Hypotension
- Hypertension
- Still unknown complications!?

How we can continue?

- Red cells: a new unit
- Plasma: always new unit
- Platelets: it is possible to continue with suspected unit

Outcome

- Check transfusion
- Report adverse reactions

- Reports are important for a quality of hemotherapy!