Working Party on Rare Donors Case Studies 2023 - #3

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Clinical History

A 7-year-old child of Turkish origin with a severe course of sickle cell disease (e.g. stroke in history) was scheduled for allogeneic stem cell transplantation.

The child had been transfused on several occasions prior to transplantation.

Serologic History

An anti-Yt^a had been detected 2 years prior to transplantation.

Yt(a-) units had been selected for transfusion thereafter.

Current Sample Presentation Data

ABO/Rh: O; D+ C+ E- c+ e+; K-

DAT: non-reactive

Antibody Screen Method:
antiglobulin test in column agglutination technique (Bio-rad)

Antibody Screen Results: reactive

Antibody Identification Method:
antiglobulin test in column agglutination technique

Antibody Identification Results:
anti-Yt^a
(monocyte monolayer assay was not performed)

Genotyping Results

No blood-group genotyping of the patient was done.

Challenge with the Current Presentation

Stem cell donor: donor also tested Yt(a-)

Transplantation: Schedule and blood need

- conditioning was planned for week 42
- transplantation in week 43
- post transplantation care in weeks 44 to 49

More than 36 compatible RBC units were requested:
weeks 42 to 46: for each week 6 units of Yt(a-) RBC
week 47: 4 RBC units Yt(a-)
week 48: 2 RBC units Yt(a-)
week 49: some “standby” RBC units appreciated

ISBT Terminology of the System

The Yt blood group system consists of 6 antigens carried on a membrane bound GPI-linked glycoprotein acetylcholin-esterase (AChE) that consists of 617 amino acids.
It has a leader sequence of 31 amino acids and a carboxyl-terminal GPI motif of 29 amino acids, both of which are cleaved from the mature erythrocyte isoform AChE-E.
The protein is encoded by *ACHE* (or *YT*, acceptable if analysis is to predict a blood group antigen).

Gene name: *ACHE* (*YT*) acetylcholinesterase

Number of exons: 6

Initiation codon: Beginning of exon 2

Stop codon: Within exon 6 (exon 5 in *ACHE-E*)

Entrez Gene ID: 43; LRG: 804

Reference: https://www.isbtweb.org/isbt-working-parties/rcibgt.html

Family Study information

The stem cell donor was the patient's brother.

His RBCs were group O, D+ C+ E- c- e+; K-; Yt(a-).

Solution to Blood Needs (1)

Frozen units:

2 German centres cryopreserve red blood cells.

22 units were available in Ulm.

According to specification for licensing of the centre, the shelf life of thawed units is 12 h or 24 h.

Centre 1 and 2 cryopreserved using the low glycerol method,

Centre 1 in addition had started with the high glycerol method.

Solution to Blood Needs (2)

Liquid units:

Four major Red Cross blood services searched their donor files.

The staff of 10 local institutes contacted Yt(a-) donors, asked for availability, and reported to the coordinating blood bank of the transplant centre.

Appointments had to be made:

- blood drive locations close to the homes of the donors and donation date had to be matched
- in addition, nationwide all donations had to be coordinated according to the schedule of the transplant centre

Supply of red cell units

Frozen units:

No thawed units were used.

Liquid units:

43 Yt(a-) units were transfused (prior to and after transplantation), all units were Rh compatible to the

- patient's phenotype prior to transplantation
- donor's phenotype after transplantation

After the patient was discharged, he no longer needed transfusion support.

Conclusions

The blood services collected commitments of donors according to the schedule of the transplant centre.

With these commitments, the patient's conditioning was started, and stem cell transplantation was performed.

All the requested Yt(a-) RBC units were supplied.

The transplantation was successful.

Summary of Case Challenges

- A patient with anti-Yt^{a} scheduled for stem cell transplantation: large demand for compatible units, but there was time to plan.
- Stem cell donor was also Yt(a-)
- Yt(a-) donors in Germany: ~ 1:500
  but phenotyping or genotyping for Yt is only done in regional rare-donor programs
- 10 institutes coordinated acceptable locations and dates of blood drives for more than 36 donors.

Lessons Learned from the Case

Donations in blood centres instead on blood drives would be much easier to coordinate.

Rare donor programs should:

- be intensified in order to identify more rare donors

- focus on identifying rare donors living near of blood centres

Brief Review of the Blood Group System or Antibody

The antigen Yt^{a} (freq. 0.981 to 0.998) and its antithetical antigen Yt^{b} (freq. 0.08. to 0.26) reside on a phosphatidyl-inositol-anchored protein of the erythrocyte membrane.

Some Yt antibodies give positive results in the monocyte monolayer assay and some cause mild, delayed haemolysis. Several patients have received incompatible transfusions without signs of illness.

However, in a patient with sickle cell disease, a fatal delayed haemolysis was attributed to anti-Yt^{a}.

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