Clinically Significant Antibodies and the Provision of Blood

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Aims

• What is a clinically significant antibody?
  • Pre-transfusion testing process
  • Which antibodies are a problem?
• How we provide blood for these patients
Antibodies

An antibody can be defined as a protein (i.e. an immunoglobulin with specific antigen binding sites) produced as a result of the introduction of a foreign antigen, that has the ability to combine with (and, in many cases, destroy) the cells carrying the antigen that stimulated its production.
Clinically Significant Antibody

Usually judged by their capacity to shorten red cell survival by causing haemolytic transfusion reactions (HTR) or through their association with haemolytic disease of the newborn (HDN).

- Increased destruction of red cells (or platelets) due to the presence of an antibody
  - Alloantibody - directed against someone else's red cells e.g. anti-D in RhD- patient = Transfusion reaction
  - Autoantibody - directed against patient's own red cells e.g. anti-D in a RhD+ patient = AIHA
- Destruction of fetal cells from maternal antibody = HDN
Laboratory Pre-Transfusion Testing

Aim of pre-transfusion testing

• Determine ABO and RhD type

• Identify any irregular antibodies

• Check patient details/results vs. historical record
Sample and Form Requirements

- Check Sample vs. Request form
- Must be NO discrepancies
- Error = increased risk of WBIT
- We need enough sample to test!
Sample Processing

- Sample is booked onto LIMS system to check for historical record
- Sample is centrifuged to separate into packed red cells (ABO/RhD typing) and plasma (antibody screening)
- Analyser is a fully automated walkaway system - Electronic transfer of information - no human intervention = patient safety.
How the Gel Test works

Principle of the Gel Test

Gel Technique

- Agglutination
- Gel

Microtube

Gel card for blood group determination
ABO / RhD Typing & Antibody Screening

Test red cells for antigen -A, B or AB

• Test plasma for antibody -anti-A, anti-B or anti-A,B

• Allows check of group

Test patient plasma with 3 reagent red cells of known types

• If positive – antibody identification panel of 11 cells required

• Allows identification of most antibodies
Investigation Process

Receive sample

ABO and D type

- Antibody screen
  - Crossmatch – EL/serological

ABO and D type

- Antibody screen
  - Antibody identification
    - Referral to NHSBT
      - Serological crossmatch
        - Transport of blood
Antibody Present

• Causes delay in provision of blood

• Need communication of clinical urgency vs delay in testing

• May be resolved in hospital blood bank

• May need referring to NHSBT -hours of delay!

• Delay depends upon specificity of antibody
Red Cell Antibody Production

• For patients to have formed irregular antibody, they must have been previously exposed to foreign red cells –either transfusion or pregnancy

• No previous transfusion/pregnancy = no clinically significant red cell antibody

• Except....
ABO.....but why?

- Naturally occurring antibody ALWAYS present antigen not on red cells
- Only 3% population group AB, 97% have anti-A, anti-B or anti-A, B
- Over 50% of population have A or B (or both) antigens on red cells
- Antibody is capable of destroying incompatible red cells by Complement activation = Immediate Intravascular Haemolysis
Why RhD Typing?

• D is very immunogenic

• 30% of RhD- people would form anti-D

• Capable of causing transfusion reaction

• Causes severe / fatal HDN
GENERAL BLOOD PROVISION

• Antibody screen = negative
  - Select ABO matched
  - D matched where possible
  - Can be Ei or serological crossmatch

• Woman of child bearing potential
  - MUST receive RhD- blood if they are RhD-
  - MUST receive K- blood unless K+
Electronic Issue

• Electronic Issue of red cells for transfusion is the selection of donor units from blood bank stock of the same ABO/D type

• This form of red cell selection is only suitable for patients when
  - Testing and result entry is fully automated
  - There are no blood group discrepancies
  - The antibody screen is negative

• Computer software must be validated to ensure that ABO incompatible blood cannot be reserved or issued
Serological Crossmatch

- Suitable for all patients
- Reacting plasma from the patient with the red cells from the proposed donor unit
- Must be ABO/D suitable and if required antigen negative for any known antibodies.
If an antibody is detected ......

• Not all antibodies are clinically significant:
  - N, Le\(^a\), Le\(^b\), P\(_1\)
  - No additional selection criteria required

Clinically significant antibodies
Commonly encountered antibodies

- **Rh** – anti-D, -C, -c, -E, -e
- **K** – anti-K
- **Jk** – anti-Jk\(^a\), anti-Jk\(^b\)
- **Fy** – anti-Fy\(^a\), anti-Fy\(^b\)
- **MNS** – anti-M, anti-N, anti-S, anti-s

• Must select antigen negative units
• Availability depends on specific type
Provision of units

Different blood groups have different frequencies

• 91% population K-
  - Average national blood stocks = 9 out of every 10 units – always available in hospital blood bank

• 17% population Fy^b-
  - Average national blood stocks = 1 in 5 units (not all units are Fy^b typed) – would need special order from NHSBT.

• People who form 1 antibody are more likely to form additional ones
• Each additional selection requirement reduces availability of units.
Example .......

• Group O patient: anti-D+K+Jka+Fya

• 322 units out of 40,000 (1 in 125) would be suitable for patient

• May need to import from another centre
Rare antibodies

• A high number of other red cells antigens / antibodies
• High frequency antibodies
  - <3% of population is negative for antigen
  - These people can form an antibody – require antigen negative blood

• Dependent on population:
  - Caucasian population <1% Fy (a-b-)
  - Black population 66% Fy (a-b-)

• Some very very rare in all populations - e.g. Rh null – less than 50 individuals ever identified worldwide.
Blood provision for rare cases

- National blood stock – maybe available
- Rare donor panel
- Frozen blood bank in Liverpool
- International donor panels.
Summary

• Red cell antibodies can cause significant destruction of transfused red cells

• Identification of the antibody may cause delays in blood provision

• All transfusions should be benefits vs risks

• If an antibody is detected there must be clear communication between medical and laboratory staff – provision of clinical need vs. availability of compatible blood
Transfusion of compatible blood to a corpse is not a successful outcome of transfusion.