Current Methods in Pre transfusion testing relevance of antibody screening

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Pre-transfusion Steps

1. Identity of the patient and the donor.
2. Review of the past records of patient on transfusion.
4. Screening for unexpected antibody.

Of these, the steps 3-5 are essentially the basic immunohaematologic steps popularly known as the compatibility test important in a safe blood transfusion.
Clerical errors cause transfusion accidents

Errors may occur while:
1. Patient’s blood collection in the ward,
2. Patient’s identification at transfusion
3. Issuing blood unit to a wrong patient.

How to avoid such errors?
Standard operating procedure (SOP) must be in place as to proper identification of the patient and the donor.
2. Reviewing the Past Records

- Record on ABO and Rh confirms the patient’s identity for blood bank proceedings.

- Record on unexpected antibody/ specificity guides as to find the ‘antigen-negative’ blood unit for cross-match.
3. Blood Grouping

On Patient’s Blood Sample:

**ABO Blood Groups:**
- Performed in tube; in emergency, on slides.
- The forward and reverse grouping results, must tally.
- Discrepancy must be resolved before selecting a unit.
- In emergency, Group O packed cells may be used.

**Rh Blood Group:**
- Only antigen D to select homologous blood.
- D neg unit for partial D having immune anti-D.
Blood Grouping...

On the donor’s blood unit:

At the Blood collection facility (e.g. CBB):
- Sampling from pilot tube,
- ABO, D (weak D), antibody screening,
- Results are shown on labels of the blood products.

At the hospital blood transfusion laboratory:
- Sampling from segment of tube from blood bag.
- ABO cell grouping of blood unit, just to confirm.
- Rh.D grouping on those with the Rh.D-negative units.
  - No need for weak D, unexpected antibodies.

At the hospital bed/ transfusion site (Optional):
- Sampling from segment of tube from blood bag.
- ABO & Rh.D grouping of blood unit (to confirm)
4. Antibody Screening Test (AST)

- Over 25 other blood group systems are known, some of which have clinic. signify antibodies.
- For supplying blood for transfusion, these are not typed as
  - Antibodies of the other blood groups do not occur regularly (unlike ABO blood groups)
  - Antigens are not as potent immunogen (unlike Rh).
- However, an antibody present in a patient to the antigens on the donor may cause HTR
- Antibody Screen is an approach to detect CSA using screen cells by indirect antiglobulin test.
- The CSA is identified using cell-panel; Ag-neg blood unit is provided for transfusion.
5. Cross matching

- Matching blood components between a Pt & a D is a direct compatibility test.
- The red cells & Plasma are cross matched thru **Major** and **Minor** cross match, defined as to an amount of Ab to react with Ag
  
  - **Major**: the patient's serum & the donor's RBCs.
    - large amount of Antibody has greater impact
  
  - **Minor**: the patient's RBCs & the donor's serum.
    - Small amount of Antibody has little impact
Cross matching: approaches...

Extended (Full-Length) Cross-match
- Performed on Recipients having:
  - Unexpected antibodies or its prior record
  - Problems with transfusion reaction, if any

- The Antibody should be identified prior to transfusion, if possible
  - Help in searching an Ag-neg blood unit for cross matching/ transfusion.

- Methods include IS, 37 and AHG phases.
Cross matching: approaches...

**Type & Screen cross match:**
- Patient ABO, Rh, & AST are performed but no units are cross matched or reserved for the Pt.
- Used for Pre-Surgical Patient with:
  - No anomaly for ABO & Rh Grouping
  - No unexpected Ab detected now or before
  - No history of any transfusion problem.

**Abbreviated cross match:**
- Immediate Spin Cross match.
Heterologous Transfusion, If homologous blood is not available.

Once ABO group specific blood becomes available, switch to group specific blood, but

Before returning to ABO group specific blood, test the Pt’s serum for anti-A &/or anti-B,
- If the Recipient doesn’t revert to its own reverse group, give Group O packed cells

Informed consent must be obtained from the doctor. if you issue the heterologous blood.
## Selection of blood for cross-match

<table>
<thead>
<tr>
<th>Patient</th>
<th>Donor</th>
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<tbody>
<tr>
<td>A</td>
<td>A, O.</td>
</tr>
<tr>
<td>B</td>
<td>B, O</td>
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<tr>
<td>O</td>
<td>O</td>
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<tr>
<td>AB</td>
<td>AB, A, B, O.</td>
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<tr>
<td>Rh.D +</td>
<td>D +ve, D -ve</td>
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<tr>
<td>Rh.D -ve</td>
<td>D -ve,</td>
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Cross Matching: Special conditions

Extreme Emergency:

- Doctor signs ‘release form’, to omit pre-transf tests - ABO, Rh typing, AST, Cross match.
- Initially, the unit of choice is Gr O Rh Neg; later on, if the patient is typed as Rh Pos, switch to Rh Pos blood
- Full compatibility test is completed later even if the unit is already transfused/OR if the Pt dies.
- Rh pos blood may be given to a Rh neg patient, with informed consent from the doctor, if the patient
  - has NO evidence of anti-D,
  - is male, OR a female beyond child bearing age
Intrauterine & Infant Transfusions:

- Blood unit must be tested with the mother’s serum.
- If the ABO & Rh of the fetus or infant is known, then group specific blood can be given if the blood unit is compatible with the mother.
- If the ABO & Rh are unknown or are ABO incompatible, give O Neg blood after cross matching with the mother.
Massive Transfusion: When a patient is replaced with amount of blood equal to his/her blood volume within 24 hours, e.g. A Pt. undergoing cardio-vascular by-pass surgery

- Ask for fresh blood sample after 48 hrs of transfusion
- If chimerism observed after transfusion, give blood of original group of the patient.
- A patient having cold agglutinins (CA) may be tested for thermal amplitude of the CA as surgery is carried out under hypothermia.
Cross Matching: Special conditions

Patient with Auto-immune Haemolytic Anaemia:

- Impossible to find compatible blood.
- Use the least incompatible blood, if essential.
- Patient’s serum, titrated with several donor’s red cells and the least incompatible blood that shows minimum reaction with the Pt’s auto-antibody.
  - Blood unit must be compatible with the patient's auto-absorbed-serum.
- Transfusion should be done under medical supervision.
Clinical haemolysis is seen in some transfused with the compatible blood units.

In vivo compatibility test:
Decided by the blood bank medical director & the treating doctor
Small amount of the donor’s RBCs, tagged with radioactive chromium ($^{51}$Cr), are injected in the patient’s vein and the RBCs survival time in circulation is determined.
  - A unit showing good survival is transfused.
Blood should be transfused slowly under carefully monitored medical supervision.
Limitations of compatibility test:

- Transfusion accidents due to clerical errors.
- Possible immunization to other blood groups.
- Some Rh.D positive individuals of partial D categories are recognized only through immunization.
- Cases where in vivo survival is reduced in spite of having nothing wrong with results of the compatibility test.
Computer Cross match

- Computer system contains logic to detect and alert any discrepancy between Pt & donor.
- The test results are entered into a computer that, then selects the most appropriate Donor unit in terms of ABO, Rh, & expiration date for that patient.
- Most important aspects:
  - Two different individuals must do the ABO, Rh on the same patient’s specimen OR
  - the same individual performs the tests on 2 different collections of the same patient
  - Every keystroke in the computer system must be validated
Problems in Cross matching:

- A positive test in cross match requires explanation as to the problem involved.

- The patient should not be transfused until the cause of the problem is decided as it guides on selection of appropriated blood for cross matching.

- When an incompatibility is detected, the results of the auto-control and antibody screening test (AST) should be reviewed.
Causes for problems in cross matching:

1. Incorrect ABO grouping.

2. Presence of allo-antibody:
   - Antibodies to the high-frequency antigens,
   - Multiple antibodies,
   - AST is neg but cross matching test is pos:
     - ABO incompatibility
     - Antibody in patient to rare antigen on a donor


4. Donor with positive DAT.

5. Rouleaux Phenomenon.


6. Poly (pan-) agglutinins.
In our center (Isfahan BTO) we omit the reservation of RBC for elective surgeries with two procedures.

One blood sample from elective surgical patient will be collected and send to the blood bank for ABO, Rh, cross match and type & screening.

If the patient during the surgery needs blood for infusion by phone they will inform the blood bank with code number of the patient. The blood bank will start the cross match, compatibility of the first step blood will send for infusion and cross match will completed up to the end.
• We prepared the local check cell (Isfahani Donors) and test all the patients’ serum for Type & Screening (ABO, Rh, IAT) with this check cells.
• This procedure is done only for patients with elective surgery.
• If IAT was negative therefore all PC in the blood bank will be compatible with patient.
• Having these two procedures, in our center the ratio of C/ T is approximately 1:1 fig 1, 2
Fig_1 Analyses of blood components with different blood groups received from I.B.T.O. 20 April to 20 Aug 2010 Isfahan, Iran
Fig. 2: infusion of blood and blood components with different blood groups in Alzahra University Hospital, 20 April to 20 Aug 2010, Isfahan, Iran
FUTURE Perspectives....

- RBC substitutes: Hb for O2 delivery; no need for cross-matching
- Enzymatic removal of A and B to make group O
- Automation procedures; micro-plate, gel-column.
- Blood typing by molecular genetics- NAT/PCR
- Computer-cross match: electronic identification of a blood unit for a particular patient
- Some are in place, others are on their way!