Common Problems in Blood Transfusion

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Genetics Resource Centre (GRC)

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<table>
<thead>
<tr>
<th>System</th>
<th>Most important antigens</th>
<th>Approx. no. antigens</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABO</td>
<td>A, A*, B</td>
<td>4</td>
</tr>
<tr>
<td>MNS</td>
<td>M, N, S, s, U</td>
<td>38</td>
</tr>
<tr>
<td>P</td>
<td>P, P*</td>
<td>1</td>
</tr>
<tr>
<td>Rh</td>
<td>D, C, E, c, e, G</td>
<td>45</td>
</tr>
<tr>
<td>Lutheran</td>
<td>Lu*, Lu b</td>
<td>18</td>
</tr>
<tr>
<td>Kell</td>
<td>K, k, Kp, Kp a, Js, Js b</td>
<td>21</td>
</tr>
<tr>
<td>Lewis</td>
<td>Le a, Le b</td>
<td>3</td>
</tr>
<tr>
<td>Duffy</td>
<td>Fy a, Fy b</td>
<td>5</td>
</tr>
<tr>
<td>Kidd</td>
<td>Jk a, Jk b</td>
<td>3</td>
</tr>
<tr>
<td>Diego</td>
<td>Di a, Di b, Wr a, Wr b</td>
<td>2</td>
</tr>
<tr>
<td>Cartwright</td>
<td>Yt a, Yt b</td>
<td>2</td>
</tr>
<tr>
<td>Xa</td>
<td>Xa a</td>
<td>1</td>
</tr>
<tr>
<td>Scianna</td>
<td>Sc1, Sc2</td>
<td>3</td>
</tr>
<tr>
<td>Dombrock</td>
<td>Do a, Do b</td>
<td>5</td>
</tr>
<tr>
<td>Colton</td>
<td>Co a, Co b</td>
<td>3</td>
</tr>
<tr>
<td>Landsteiner-Wiener</td>
<td>LW a</td>
<td>3</td>
</tr>
<tr>
<td>Chido/Rodgers</td>
<td>Ch, Rg</td>
<td>9</td>
</tr>
<tr>
<td>Hh</td>
<td>H a</td>
<td>1</td>
</tr>
<tr>
<td>Kx</td>
<td>Kx a</td>
<td>1</td>
</tr>
<tr>
<td>Gertlich</td>
<td>Ga2, Ga3, Go4, Wb, Le a</td>
<td>7</td>
</tr>
<tr>
<td>Cromer</td>
<td>Cr a, Tc a, WES a, Es a, UMC</td>
<td>10</td>
</tr>
<tr>
<td>Knoppe</td>
<td>Kn a, Ce a, Vx a, McC a</td>
<td>5</td>
</tr>
<tr>
<td>Indian</td>
<td>I a, I b</td>
<td>2</td>
</tr>
<tr>
<td>Very frequent, or 'public', antigens</td>
<td>Vel, Lai, JMH, etc</td>
<td>12</td>
</tr>
<tr>
<td>Very infrequent, or 'private' antigens</td>
<td>Bp a, Rd, Sw a, etc.</td>
<td>&gt;20</td>
</tr>
<tr>
<td>Other antigens</td>
<td>P, P a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I a, I b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sd a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bg (HLA on red cells)</td>
<td></td>
</tr>
</tbody>
</table>

*H is genetically independent from the ABO system; its status as a blood group system has not yet been officially recognized.

† Although 92 Rh antigens have been numbered, 7 have been deleted from the system.
Antibodies of Blood Group Systems

- **ABO System**
  - Naturally Occurring (Pre-formed)
  - Mostly IgM

- **Rh System**
  - Acquired (Take time to develop)
  - Mostly IgG
Compatibility Testing

- **Donor**
  - Red Cells
  - Plasma

- **Recipient**
  - Red Cells (Antigens)
  - Plasma (Antibodies)
Compatibility Testing

**Whole Blood**
- Group O recipient may receive: O, A, B, AB
- Group A recipient may receive: O, A
- Group B recipient may receive: O, B
- Group AB recipient may receive: O, A, B, AB

**Red Blood Cells**
- Group O recipient may receive: O, A, B, AB
- Group A recipient may receive: O, A, AB
- Group B recipient may receive: O, B, AB
- Group AB recipient may receive: O, A, B, AB
Blood Components

- Whole Blood
- Packed Cells
- Platelets
- FFP
- Cryoprecipitate
- Others
**Blood Components**

Step 1:
Whole blood is in Bag A (primary bag). Bag B (platelet bag) and Bag C (plasma bag) are termed "satellite bags."

Step 2:
Bags are spun in centrifuge, separating components within primary bag. Platelet-rich plasma rises to the top; red blood cells sink to the bottom.

Step 3:
Platelet-rich plasma (PRP) is forced into Bag B. Red blood cells (RBC) remain in the bottom of Bag A. Bag A is separated from Bags B and C. Red blood cells are stored at 4 to 6°C.

Step 4:
Bags are spun again, longer and harder than initial spin. Plasma and platelets are separated in Bag B. Plasma rises to the top, platelets sink to the bottom.

Step 5:
Plasma is forced into Bag C. Bags B and C are separated. Bag B contains a platelet concentrate in 40 to 70mL of plasma. Plasma in Bag C can be made into fresh frozen plasma or other products.
Case-1

A patient developed chills and rigors after the start of blood transfusion. The likely cause is:

- Rapid administration of cold blood
- Non Haemolytic Febrile Transfusion Reaction
- Allergic reactions
- Mismatched blood transfusion
Antigen-Antibody Complex
+ Complement
  \[ \rightarrow \]
  C1-C9
  \[ \rightarrow \]
  C3a
  \[ \rightarrow \]
  Mast cells
  \[ \rightarrow \]
  Serotonin
  \[ \rightarrow \]
  Histamine
  \[ \rightarrow \]
  C5a
  \[ \rightarrow \]
  Lysis of RBC
  \[ \rightarrow \]
  Hemoglobin
  \[ \rightarrow \]
  RBC stroma
  \[ \rightarrow \]
  Hemoglobinuria
  \[ \rightarrow \]
  Intrinsic clotting cascade
  \[ \rightarrow \]
  DIC
  \[ \rightarrow \]
  Thrombus
  \[ \rightarrow \]
  Consume coagulation factors
  \[ \rightarrow \]
  Fibrin degradation products
  \[ \rightarrow \]
  Hemorrhage
  \[ \rightarrow \]
  Factor XII (Hageman factor)
  \[ \rightarrow \]
  Kinin system
  \[ \rightarrow \]
  Bradykinin
  \[ \rightarrow \]
  Capillary permeability
  \[ \rightarrow \]
  Dilate arterioles
  \[ \rightarrow \]
  Hypotension
  \[ \rightarrow \]
  Sympathetic nervous system
  \[ \rightarrow \]
  Catecholamines
  \[ \rightarrow \]
  Vasoconstriction in kidney
A multiply transfused patient developed fever one hour after blood transfusion. The most likely cause is:

- Mismatched blood transfusion
- Transfusion of infected blood
- Malaria
- Anti-leukocyte antibodies
Case-3

A 62 years old patient developed dyspnoea half way during a blood transfusion. The likely cause is:

- Allergic reactions
- Mismatched blood transfusion
- Transfusion associated Acute Lung Injury
- Circulatory overload
A patient developed fever, anaemia, and mild jaundice three days after a blood transfusion. She had also received a blood transfusion three months earlier. The most likely cause for her symptoms is:

- Acute haemolytic blood transfusion reaction
- Transfusion of haemolysed blood
- Transfusion of infected blood
- Post transfusion hepatitis
- Delayed haemolytic transfusion reaction
A patient developed mild jaundice and abnormal liver function tests two months after a blood transfusion. The most likely cause for the symptoms is:

- Delayed haemolytic transfusion reaction
- Post transfusion hepatitis
Serologic Pattern of Acute HCV Infection with Progression to Chronic Infection

- **anti-HCV**
- **Symptoms +/-**
- **HCV RNA**
- **ALT**

Titer

Months

Years

0 1 2 3 4 5 6 1 2 3 4

Time after Exposure

Normal
Progression to Chronic Hepatitis B Virus Infection
Typical Serologic Course
A known case of ITP failed to achieve a rise in platelet count following repeated platelet transfusions. The most likely cause is:

- Anti-platelet antibodies
A 41 years old male presented with weakness and fatigability for 2½ months. Examination showed pallor and no other abnormality.

- Blood CP showed:
  - Hb: 6.8 g/dl
  - TLC: 4.5 X 10^9/L
  - MCV: 125 fl
  - Platelets: 89 X 10^9/L
  - RBC Morphology: Macrocytosis ++
  - Reticulocytes: 0.5%
# Monthly Consumption of Blood at PNS Shifa

<table>
<thead>
<tr>
<th></th>
<th>Surgical</th>
<th>Gynae</th>
<th>Medical</th>
<th>Paeds</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total (270)</strong></td>
<td>54 (20%)</td>
<td>81 (30%)</td>
<td>58 (21%)</td>
<td>77 (29%)</td>
</tr>
<tr>
<td><strong>Routine</strong></td>
<td>4/54 (7%)</td>
<td>9/81 (11%)</td>
<td>8/58 (14%)</td>
<td>46/77 (60%)</td>
</tr>
<tr>
<td>67/270 (25%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Urgent</strong></td>
<td>50/54 (93%)</td>
<td>72/81 (89%)</td>
<td>50/58 (86%)</td>
<td>31/77 (40%)</td>
</tr>
<tr>
<td>203/270 (75%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Packed Cells</strong></td>
<td>11/54 (20%)</td>
<td>35/81 (43%)</td>
<td>42/58 (72%)</td>
<td>75/77 (97%)</td>
</tr>
<tr>
<td>163/270 (60%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Whole Blood</strong></td>
<td>43/54 (80%)</td>
<td>46/81 (57%)</td>
<td>16/58 (28%)</td>
<td>2/77 (3%)</td>
</tr>
<tr>
<td>107/270 (40%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hb (Mean)</strong></td>
<td>9.3 g/dl (4.9-12.2)</td>
<td>8.3 g/dl (4.4-11.1)</td>
<td>7.0 g/dl (4.1-10.6)</td>
<td>7.3 g/dl (2.6-9.6)</td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.66</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Monthly Consumption of Blood at PNS Shifa

![Graph showing monthly consumption of blood at PNS Shifa with categories: >10g/dl, 9-10g/dl, 8-9g/dl, 7-8g/dl, <7g/dl. Red line for Surg & Gynae and blue line for Med & Paeds.]