Blood Components and Blood Products

Douglas Watson
Better Blood Transfusion
SNBTS

Acute Care Day - January 2012
Blood Sample (centrifuged)

Plasma containing Antibodies

Buffy Coat

Red Cells with Antigens
Preparation of Blood Components (donor to patient)

Education
Recruitment
Selection
Donation

Test for:
HIV
Hepatitis B
Hepatitis C
HTLV
Syphilis
ABO + RhD
Other phenotypes
Red Cell Antibodies
[CMV]
[HbS]
[Malaria]

Process into blood components

Filter to remove leucocytes

Red cells
Pooled platelets
Fresh frozen plasma

Plasma (from non-UK source)

Fractionation

Plasma derivatives: e.g. Albumin, immunoglobulin

Patient

Platelet
Pheresis

4°C 36 days
Confirm compatibility

22°C 5 days
(Pool)

-30°C 2 years
(Thaw)
<table>
<thead>
<tr>
<th>Blood Component</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC’s</td>
<td>2,209,153</td>
</tr>
<tr>
<td>Platelets</td>
<td>266,312</td>
</tr>
<tr>
<td>Fresh Frozen Plasma</td>
<td>306,740</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>121,555</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,903,760</strong></td>
</tr>
</tbody>
</table>
Background

• Pressure on supply (fewer donors)
• Demand reducing (38 units per 1000 population), but use likely to increase with ageing population
• Safety issues – enforced changes
• Regulation EU (BSQR)

Need to optimise blood use!!
Where is the evidence to support optimal use of blood?

“Surprisingly, despite millions of units collected and administered, there is very little evidence on when and where RBCs are effective/ineffective and what constitutes the optimal RBC product”

Dean Fergusson
Red Cell meeting, Edinburgh 2009
RBC Units Transfused by age band: 2005/06

RBC units transfused per 1,000 population by agegroup and sex (all Scotland, excluding FV)

Age group

Male
Female

RBC units per 1,000 population

0-4
5-9
10-14
15-19
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
>=85

0
50
100
150
200
250
300

Age group
**Indication:** to increase oxygen carrying capacity of blood

**Product:** leucocyte depleted CRC (SAG-M)
Volume 280+/- 60ml, >40g/unit Hb (mean 55), HCT 57%

**Shelf life** – 35 days at 4 ± 2°C

ABO/ RhD compatible

Special requirements e.g.
- CMV negative or irradiated
- fresh, washed, paedipacks etc
Red Cells required?

Symptoms: acute or chronic

Signs

Laboratory findings
Acute blood loss

Need for RBC based on estimate of lost circulating volume
15% loss (750ml): usually no need for Tx
15-30% loss (800-1500ml): Need crystalloid / colloid, unlikely to need RCCs
30-40% loss (1500-2000ml) Rapid volume replacement with crystalloid or synthetic colloid. RCC likely to be required
≥40% loss (≥2000ml): Rapid volume replacement including RCCs required

Platelets

2 sources:-
- Buffy Coat Derived i.e from 4 donors.
- Apheresis single donor ≥ 2 ADEs

Move towards apheresis only in UK – current target 80% apheresis-derived

Most platelets are given as prophylaxis!!
What’s in a bag of platelets?

Platelets (>240x10^9/unit)
Plasma
Anticoagulant
(Red Blood Cells)

Total Volume
150-300 ml

Storage - 22 ± 2°C, with gentle agitation
Shelf life - 5 days
**Platelet Prescribing**

**Who?**
- Certain thrombocytopenic patients; platelet dysfunction (? secondary to medication)

**How?**
- ABO + Rh Group compatible (Group O + Immune anti A &/or B)
- Platelet giving set (170-200μm filter)
- Do not infuse with drugs/solutions

Expected 24hr increment $\geq 20 \times 10^9$ /l

*Guidelines for the use of Platelet transfusions. BCSH web page or BJHaem 2003: 122, 10-23*
Platelet Refractoriness

‘Repeated failure to obtain satisfactory responses to platelet transfusion’

Causes: Immune
- HLA alloimmunisation
Non immune
- Consumption/bleeding, DIC, pyrexia

HLA antibodies (HPA antibodies rare in absence of HLA antibodies, 0 - 2% and do not always cause platelet refractoriness)
Fresh Frozen Plasma (FFP 1)

Plasma obtained from leucocyte depleted whole blood
Rapidly frozen to -30°C, separated from red cells before cooling

Can be treated to further reduce viral risk
e.g. MB FFP for children
Possible changes in sourcing of UK FFP
What’s in a single unit of FFP?

Plasma
- Coagulation factors (Factor VIII > 0.7iu/ml)

Anticoagulant

Pack Volume 200-300ml
FFP (2)

- Storage ≤ -30°C, max 24 months
- Thaw before transfusing – remember in emergency!!!!
- Post thaw storage 4 ± 2°C, max 24hrs
- Dose – 10 - 20ml/kg
- Transfuse by ABO Group (Rh irrelevant)
- Transfuse in 30-40mins
Cryoprecipitate

Manufactured by thawing FFP at 4°C then frozen

Coagulation Factors I, VIII, XIII

Pool of cryo, 4-5 donors – volume 100 - 250ml

Primarily used for hypofibrinogenaemia

? Fibrinogen concentrate
Pathogen reduced FFP and Cryoprecipitate

1. Methylene Blue Treated (MBT) + removed
2. Solvent Detergent (S/D) treated
Enveloped viruses – HBV, HCV, HIV, HTLV
∴ HAV & Parvovirus B19 survive

Imported Plasma (↓ vCJD risk) – USA for children ≤ 16 yrs old

Note ≈ 30% less FVIII than standard FFP
ie. filtering does not just remove the “bad”!
Indications for transfusing FFP and Cryoprecipitate

a) Multiple coagulation factor deficiencies- with bleeding and/or DIC

b) Single Coagulation factor deficiency when virus – safe product e.g. F1 unavailable, FV deficiency

b) TTP, plasma exchange (use SD plasma - Octaplas)

Often given where no bleeding and mild coagulopathy!!

Guidelines for the use of FFP, cryoprecipitate & cryosupernatant. BCSH web page or BJHaem 2004: 126: 11-28
Risks associated with blood components

Blood transfusion can never be risk free

Transfuse only for sound clinical indications

Assess effectiveness of treatment

Report any transfusion-related adverse reaction (SABRE)

DOCUMENT!!!
Complications of Blood Component Transfusion

- Acute or Delayed
- Immune or Non-immune
Acute reactions to blood component transfusion

- Acute haemolytic transfusion reaction e.g. incorrect unit transfused
- Transfusion related acute lung injury (TRALI)
- Transfusion Associated Circulatory Overload (TACO)
- Bacterial contamination
- Allergic/ anaphylactic reactions
Delayed reactions to blood component transfusion

- Delayed haemolytic transfusion reaction
- Transfusion associated graft versus host disease (TaGVHD)
- Post transfusion purpura
- Infection - viral: Hepatitis A, B & C, HIV, HTLV, - others: Malaria, vCJD
- Iron overload (> 20 units) – 250 mg iron in one unit – may need iron chelation therapy
Plasma / Blood Products

Manufactured from imported plasma - EU &/or USA (↓vCJD risk)

Examples:-
Intravenous immunoglobulin – PID; neuro; Haematology; Rheumatology – new Scottish guidelines - now available via Pharmacy
Albumin
Anti D immunoglobulin etc

Prescribing information – see product datasheets
Further Reading


2. Guidelines for the use of FFP, cryoprecipitate & cryosupernatant. BCSH web page or BJHaem 2004: 126: 11-28


www.transfusionguidelines.org.uk