

Blood and Components, Safe and Appropriate Use

Laura Green

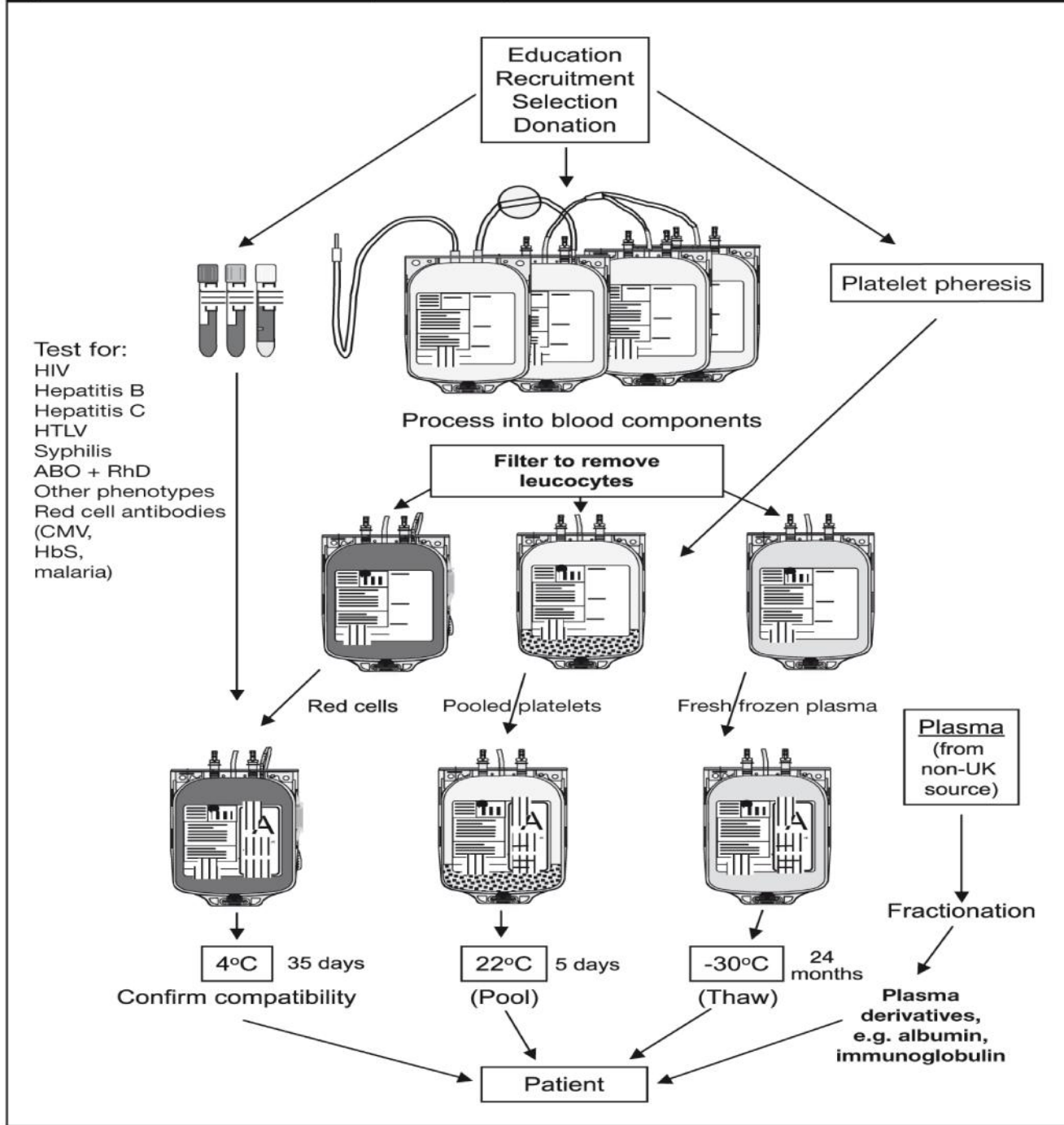
Consultant Haematologist

Barts Health NHS Trust & NHSBT

Topics to be covered

- Red blood cells
 - Compatibility procedures
 - Risks and adverse events
- Platelet
- Plasma (Fresh Frozen Plasma and cryoprecipitate)
- Autologous blood and cell salvage

Figure 2 Production of blood components and plasma derivatives



Red Blood cells (RBC)

RBC

- Indicated for treatment of anaemia
- In the UK, all RBC are leucodepleted
- Contains ~20 mL of plasma and SAGAM (saline, adenine, glucose and manitol)
- Stored up to 35 days at +2-6⁰C

RBC MUST be compatible with the recipient's ABO (and usually RhD type)

Patient's ABO blood group	Patient's plasma	RBC that are compatible
O	Anti -A, -B	O
A	Anti - B	A, O
B	Anti - A	B, O
AB	Neither	AB, O

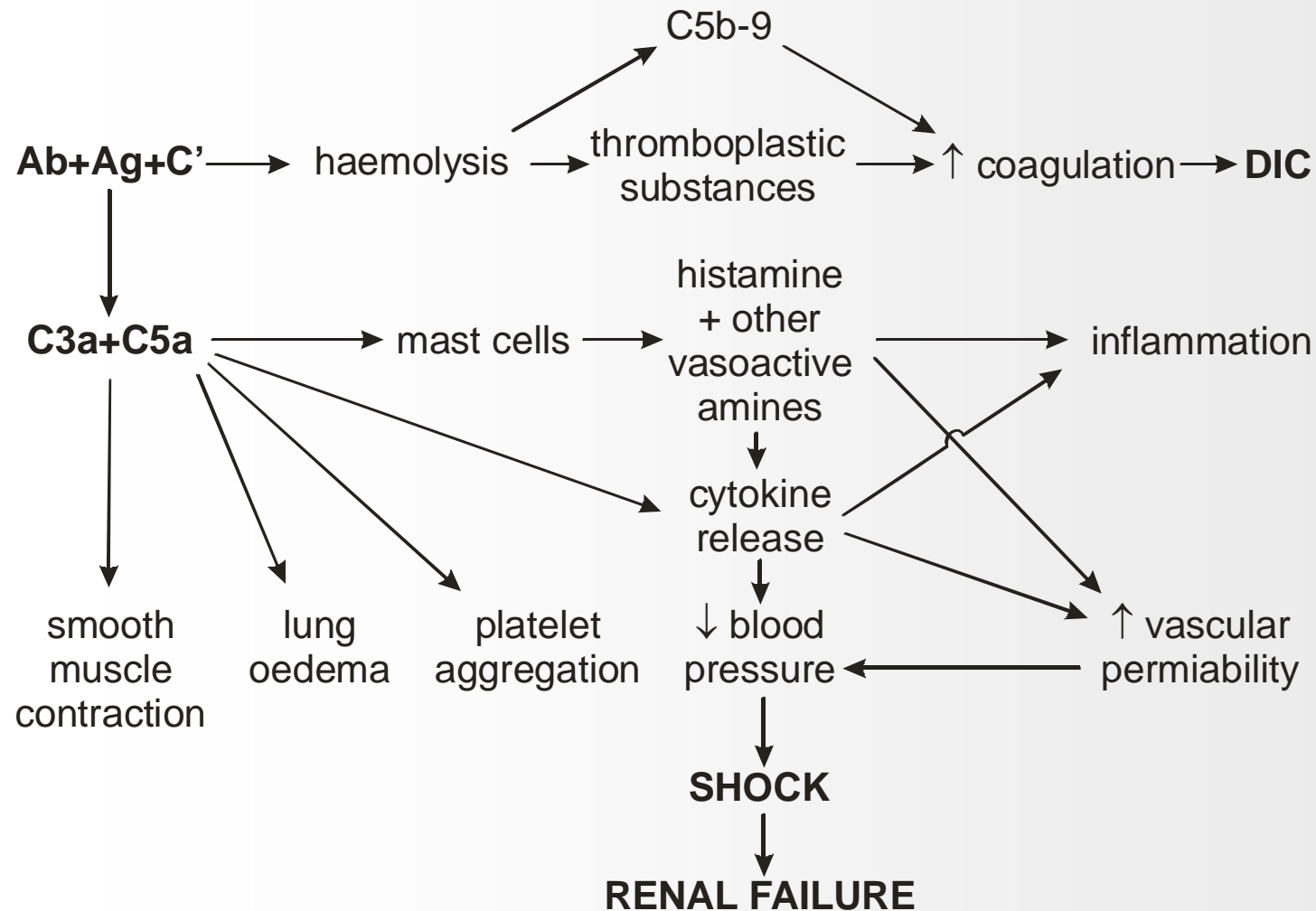
Compatibility procedure

- Group & Screen (tests for patient's ABO and RhD type and the presence of Anti A, - B or - AB in the plasma)
- Crossmatching (above testing + confirm compatibility with each of RBC units to be transfused)
- Electronic issue (computer crossmatch)
 - ABO and RhD typing confirmed on the 2nd sample
 - No RBC allo antibodies
 - Patient's ID is reliable

Right Blood, Right Patient, Right Time, Right Place

- Competency assessment
- Patient Identification and Consent
Sample labelling
- Wristband Identification
 - The patient !
 - The Blood label
 - Prescription chart
 - Notes


Acute transfusion reaction due to ABO mismatch



Delayed Haemolytic transfusion reaction

- Due to red cell Ab's
- Rh system/ Kell/ Fy^a/ Jk^b etc
- 7 to 10 days post transfusion
- Failure of haemoglobin to rise and Jaundice
- Positive Direct Antiglobulin Test (DAT)

Febrile non-haemolytic transfusion reactions

- During or soon after transfusion
 - Fever, rise in temp $> 1^{\circ}\text{C}$, shakes/ rigors, \pm  pulse
 - Unpleasant but not life threatening - must exclude 'wrong blood' or bacterial infection

Allergic Reactions

- Urticarial Rash ± wheeze
 - Often not severe
 - hypersensitivity to a 'random' plasma protein

Anaphylaxis

- Severe, life-threatening reaction soon after transfusion started
- Wheeze/ asthma, ↑ pulse, ↓ BP (shock)
- Laryngeal oedema/ facial oedema
- IgA deficiency

Other Immune risks

PTP (Post Transfusion Purpura) - rare

- 7-10 days after transfusion (blood or platelets)
- HPA 1 negative patients forms antibodies after transfusion or pregnancy
- After further transfusion, destruction of own platelets

Transfusion Associated Graft-Versus-Host Disease

- Rare, but always fatal
- Mediated through viable lymphocytes in Donor's blood transfused to an immunocompromised host



Infective risks of Blood Transfusion

Infection	Testing started	Risk of infection per unit of blood 2008
Hepatitis B	1975	1 in 850,000
HIV	1985	1 in 6 million
Hepatitis C (Anti HCV and NAT testing)	1991 & 1998	1 in 51 million

Haemovigilance

- Serious Acute Reactions and Events
 - Mandatory reporting to MHRA (Medicines and Healthcare products Regulatory Agency) under Blood safety and quality regulations
- Reporting to Serious Hazards of Transfusion (SHOT)

Maximum Surgical Blood Order Schedule (MSBOS)

- developed using local audit of crossmatched to transfused ratios per procedure
- allows more efficient use of blood stocks and reduces wastage

Procedure	no of units
Caesarian	G&S
Myomectomy	2
Hip replacement	G&S
Hip revision	2
Knee bilateral	2
Anterior Resection	3
Appendicectomy	G&S
Cholecystectomy	G&S
Fem-pop bypass	2

An example MSBOS

Pre-operative assessment - anaemia

- Pre-op haemoglobin <120 g/L increases likelihood of transfusion three fold
- Iron deficiency major public health issue
 - estimated prevalence of anaemia 4.1% in men and 10.8% in women in UK
- Patients must be assessed at least 4 weeks prior to surgery to allow time to address anaemia.
- If confirmed to be iron deficient treat with oral iron or if non responsive or intolerant intravenous iron
- Look for cause of iron deficiency

Platelets

Platelets

- Can be either from
 - Buffy coat from whole blood donation
 - 4 pools = 1 dose
 - Single donor Apheresis
- All leucodepleted
- Stored at 22°C with gentle agitation for up to 7 days

Platelet: Clinical Indication - 1

- Lack of evidence base for guidelines
- Bone marrow failure
 - To prevent spontaneous bleeding when platelet count $<10 \times 10^9/\text{litre}$
 - or $<20 \times 10^9/\text{litre}$ if there is an additional risk, e.g. sepsis
- Prophylaxis for surgery
 - Minor procedures $50 \times 10^9/\text{l}$;
 - More major surgery $80 \times 10^9/\text{l}$; CNS or eye surgery $100 \times 10^9/\text{l}$
 - Epidural – BCSH ITP guidelines $80 \times 10^9/\text{l}$

Platelet: Clinical Indications - 2

- Cardiopulmonary bypass
 - Platelets should be readily available
 - Use platelets only if bleeding
- Abnormal Platelet Function; antiplatelet drugs
- Neonatal alloimmune thrombocytopenia
 - high risk intracranial haemorrhage
 - HPA 1a neg, 5b neg platelets for emergency use

Plasma

Fresh frozen plasma (FFP) - UK specification

- From whole blood donations (or apheresis), separated & frozen to -30°C within a few hours of collection
- Leucocyte depleted by filtration
- Source of clotting factors
- Specification: 75% of units to contain 0.7iu/ml factor VIII
- shelf life 24 months at -30°C
- post-thaw shelf life 4 hours at room temp OR 24 hours at 4°C

Methylene Blue FFP and Solvent Detergent FFP

- Methylene Blue
- Photodynamic process-oxygen radicals
 - MB + white light
- Single units
- Sourced from US
- For Children born after 1.01.1996
- Solvent detergent
- SD dissolves lipid coated viruses
- Needs POOLING of 500-1000 donations
- Non UK plasma
- Plasma exchange for TTP
- Commercially from Octapharma- 'Octaplas'

Guidelines for FFP use

- **Acute DIC with bleeding**
 - **Surgical bleeding**
 - **Massive haemorrhage**
 - **Liver disease – bleeding, procedures**
- **Dose FFP 10 – 15 ml/kg**
 - **Monitor coagulation**
- **FFP should not be used to reverse warfarin- use PCC**
- **Increase use of FFP to manage major bleeding episodes, particularly trauma; evidence is lacking**

Cryoprecipitate

- Cryoglobulin fraction of plasma obtained by thawing FFP at 4°C
- Contains FVIII, vWf, fibrinogen
- Stored at -30°C; Post thaw shelf life 4hrs at room temp
- Current clinical use – replacement fibrinogen
 - In UK, fibrinogen concentrate does not have a license for use in massive haemorrhage

Autologous blood and cell savage

Use of Autologous blood

- Pre-operative Autologous Donation
 - no longer routinely recommended or available UK
 - no evidence that patients receive any less donor blood
 - It is only used in rare cases of unusual antibody formation, or if patients have rare blood group that we cannot provide blood for
- Acute Normovolaemic Haemodilution (ANH)
 - A meta-analysis showed only modest benefits
 - Technique not currently encouraged

Cell salvage

- Use of Intra-operative Cell Salvage reduces demand on donor red cells and is a cost effective
- Need resources to set up and maintain an ICS service in a safe, appropriate and cost effective manner:
 - clinical lead
 - member of theatre management team responsible for ensuring overall management
 - training and competency
 - documentation and audit

Example of blood component
use for Management of major
haemorrhage at the Royal
London Hospital

SENIOR MEMBER OF TRAUMA TEAM LEADER MUST DECLARE **CODE RED** if:

- Systolic BP < 90
- Poor response to initial fluid resuscitation
- Suspected active haemorrhage



Take baseline blood samples prior to transfusion for:

- FBC, G&S, clotting screen and fibrinogen, Near patient testing – ABG, FBC and ROTEM



Nominate a member of team to call blood bank on 61108 to activate **CODE RED**
State “patient unique identifier & **CODE RED TRAUMA**”

Request:

EITHER “CODE RED PACK A” (contains: 6 units RBC, 4 units FFP)

OR

“CODE RED PACK B” (contains: 6 units RBC, 4 units FFP, 1 unit platelets, 2 pools cryoprecipitate)

- Send porter to lab to collect pack immediately
- Take Immediate Blood Transfusion (red cells) from RESUS fridge
- Use O NEG units in females or O POS units in males
- Use group specific blood as soon as available
- Check Ca++ levels after 6 units of RBC

Check if bolus dose of Tranexamic acid (TxA) has been given by HEMS team prior to arrival in ED

Give bolus of 1g IV TxA over 10min (within 3 hrs of massive haemorrhage) followed by IV infusion of 1g over 8 hrs

IF BLEEDING CONTINUES:

Continue requesting one **“CODE RED PACK B”** until bleeding stops

Use near patient testing to determine if Ca⁺⁺ therapy is required (CaCl₂ 10 mls 10% IV)

If bleeding persists after **2 x “CODE RED PACK B”** Transfusion
Lab must contact the on call haemophilia SpR on
bleep 1155 or via switchboard
out of hours

If bleeding is controlled **REPEAT FBC AND CLOTTING SCREEN** and administer:

- Platelets: if count $<100 \times 10^9/l$
- Cryoprecipitate: if Fibrinogen $<1.5g/l$
- FFP: to maintain PT/APTT ratio $<1.2 \times$ normal
- Keep Temp $>36^\circ C$ and Ca⁺ >1.0

References

- Local policies based on national guidance
- British Committee for standards in haematology
 - www.bcshguidelines.com
- The Association of Anaesthetists of Great Britain and Ireland
 - www.aagbi.org
- Handbook of transfusion medicine
 - www.transfusionguidelines.org.uk
 - Hospital Transfusion Policy
 - Investigation of Transfusion reactions
 - Clinical use of Red Cells, Platelets and plasma
 - Massive haemorrhage