

Transfusing Appropriately



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No involvement with Industry

Educational Objectives

Indications for transfusing in an acute or chronic disorder

- Quantity of blood required preoperatively for different procedures
- Transfusion of appropriate blood components

History of Blood Transfusion

- 1492 Pope Innocent VIII – Coma received oral transfusion of blood from 3 children
- 1667 sheep blood into boy
- 1670 Transfusion of animal blood banned
- 1818 Dr. James Blundell – Obstetrician Post Partum Hemorrhage

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- 1840 Drs. Lane & Blundell
 - hemophiliac

 - 1901 Karl Landsteiner – Human blood groups

 - 1910 Anticoagulants – Blood Bank

 - 1930 Charles Drew separated plasma and red cells

bloody easy 3

Blood Transfusions, Blood Alternatives and Transfusion Reactions

A Guide to Transfusion Medicine

Third Edition

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The 10 Commandments

1. Transfusion is one part of patient management
2. Decisions based on National Guidelines
3. Blood loss should be minimized
4. Effective resuscitation in acute blood loss
5. Do not transfuse solely on hemoglobin value

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6. Know risks of transfusion
 7. Benefits should outweigh risks
 8. Record the reason for transfusion
 9. Continuous monitoring
 10. Informed consent

Educational Objectives

Indications for transfusing in an acute or chronic disorder

- ❑ Quantity of blood required preoperatively for different procedures
- ❑ Transfusion of appropriate blood components

Indications for RBC Transfusions

- Acute Blood Loss
 - Maintain hemoglobin $>70\text{g/L}$
 - Consider higher levels in certain situations
 - Unlikely to benefit if hemoglobin $>100\text{g/L}$

Indications for RBC Transfusions

- Critical/Coronary Care
 - Maintain hemoglobin $>70\text{g/L}$
 - Acute Coronary Syndrome - controversial

Indications for RBC Transfusions

□ Chronic Anemia

- Last resort
- Maintain lowest hemoglobin level not associated with symptoms
- Assess and treat for iron overload.

Indication for RBC Transfusions

□ Chronic

- Transfuse day time hours
- Transfuse one unit at a time
- Single unit???
- Assess patient prior to ordering another unit
- Infuse over 2 hours but within 4 hours of issue from blood bank
- Slower rate if at risk for circulatory overload

Perioperative patients

- Manage patients undergoing elective surgery preoperatively, intraoperatively, and postoperatively with strategies to minimize the need for RBCs.⁶ (see pages 74-75)
- Administer RBCs one unit at a time in non-urgent settings.^{7,20}
- Assess patient prior to transfusing additional units (clinical exam and hemoglobin level).⁷
- For orthopedic patients with cardiovascular disease, post operative transfusion for symptomatic anemia or hemoglobin of less than 80 g/L does not increase adverse outcomes or delay recovery compared to a transfusion trigger of 100 g/L.²¹
- Follow guidelines for perioperative patient:⁷

A T T E N T I O N

RBCs:
One unit at a time.

Educational Objectives

- Indications for transfusing in an acute or chronic disorder
- **Quantity of blood required preoperatively for different procedures**
- Transfusion of appropriate blood components



Max. Surgical Blood Orders

Urology Adrenalectomy 3 Units

Educational Objectives

- Indications for transfusing in an acute or chronic disorder
- Quantity of blood required preoperatively for different procedures
- **Transfusion of appropriate blood components**

Process for Preparing Blood Components from Donated Units

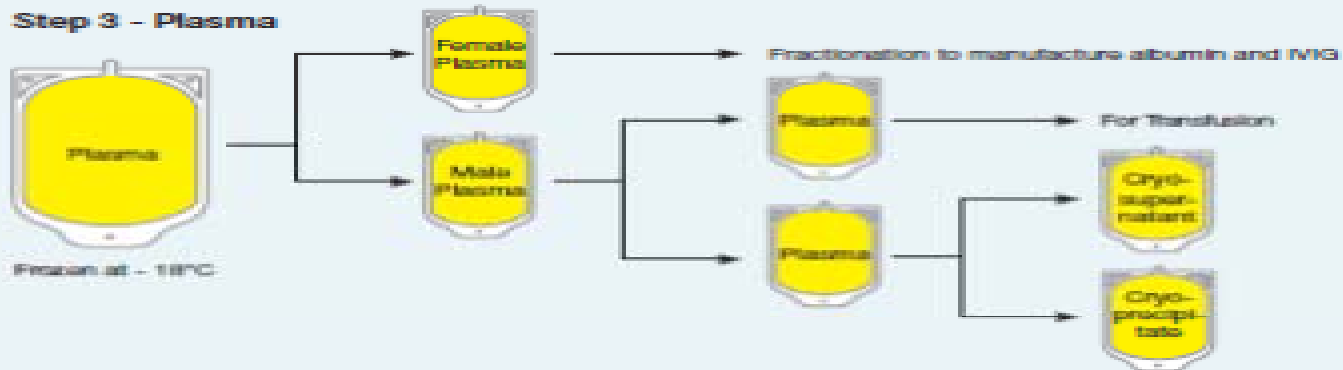
Step 1 - Whole Blood Separation



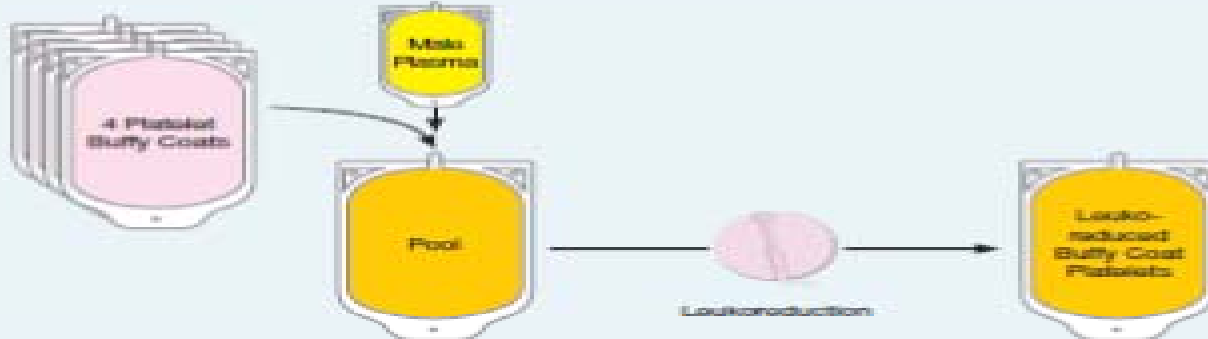
Step 2 - RBC



Step 3 - Plasma



Step 4 - Buffy Coat Platelet



Indications & Infusion Recommendations

PLT ($\times 10^9/L$)	CLINICAL SETTING	SUGGEST
< 10	Non-immune thrombocytopenia	Transfuse 1 pool of platelets ²⁸
< 10	Non-immune thrombocytopenia & HLA-alloimmunized	Transfuse 1 unit of HLA-matched apheresis platelets ²⁸
< 20	Non-immune thrombocytopenia and fever $> 38.5^\circ C$ or coagulopathy	Transfuse 1 pool of platelets ²⁸
< 20	Procedures not associated with significant blood loss	Transfuse 1 pool of platelets ²⁸

20-50	Procedures not associated with significant blood loss	1 pool of platelets on hold, transfuse only if significant bleeding ²²
< 50	Epidural anesthesia and lumbar puncture	Transfuse 1 pool immediately before procedure ³⁰
< 50	Procedures associated with blood loss or major surgery (> 500 ml expected blood loss)	Transfuse 1 pool immediately before procedure ^{22,31}
< 50	Immune thrombocytopenia	Transfuse platelets only with serious bleeding ³²
< 100	Pre-neurosurgery or head trauma	Transfuse 1 pool of platelets ^{33,34}
Any	Platelet dysfunction and marked bleeding (e.g., post cardiopulmonary bypass, aspirin, antiplatelet agents)	Transfuse 1 pool of platelets ²²

Indication for Frozen Plasma

- INR, PT or PTT >1.5 x normal
- When no coag. factors available

Cryoprecipitate

Cryoprecipitate contains factor VIII (8), fibrinogen, and von Willebrand factor.

- ◆ Each unit of cryoprecipitate contains 150 mg of fibrinogen



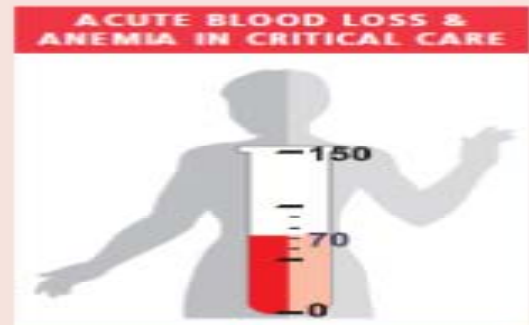
Indications for RBCs

Acute blood loss

- Maintain hemoglobin > 70 g/L during active bleeding.⁶
 - Consider rate of bleeding, hemodynamic factors, evidence of tissue ischemia, institutional speed of blood delivery/ laboratory testing in decision about transfusion.
 - Ensure prompt blood availability when hemoglobin is < 80 g/L
- Consider maintaining a higher hemoglobin level for patients with:⁷
 - Impaired pulmonary function
 - Increased oxygen consumption (fever, chills)
 - Unstable or acute coronary syndromes^{8,9,10}
 - Coronary artery disease⁹
 - Uncontrolled/unpredictable bleeding.
- Consider that patients with hemoglobin >100 g/L are unlikely to benefit from transfusion.

Anemia in critical care and coronary care

- Recommend a transfusion when the patient's hemoglobin is less than 70 g/L.⁹
- In a patient with an acute coronary syndrome, there is controversy over where to maintain the hemoglobin level.^{8,9,10}
 - There are insufficient data to recommend maintaining the hemoglobin above some arbitrary level
 - Consider transfusing if there are clear signs of inadequate tissue oxygen delivery in a patient with a low hemoglobin and an acute coronary syndrome
- Unnecessary phlebotomy for laboratory testing is a major contributor to anemia in a critically ill patient.
- Except for patients with unstable coronary artery syndromes, a restrictive transfusion policy (trigger Hb 70 g/L) has proved at least as effective as a liberal transfusion policy for critically ill patients.^{9,11}



A T T E N T I O N

Minimize blood work as it contributes to need for transfusion in critical care.

CHRONIC

Transfuse

- In non-urgent/non-bleeding/inpatient settings red blood cells should be transfused during **daytime hours** (for patient safety) and transfused **one unit at a time**.
- Assess patient prior to ordering another unit.
- Each unit is usually infused over 2 hours, but always within 4 hours of issue from blood bank.
- Consider a slower rate for patients at risk of circulatory overload.
- In massive transfusion, blood should only be warmed using an approved blood warming device.

HEMOGLOBIN

RECOMMENDATION

> 100 g/L

Likely inappropriate except in exceptional circumstances

70-100 g/L

Likely to be appropriate if there are signs or symptoms of impaired oxygen delivery

< 70 g/L

Likely to be appropriate

< 60 g/L

Transfusion highly recommended²²

◆ Young patients with low risk of ischemic cardiovascular disease can sometimes tolerate greater degrees of anemia

Chronic anemia ^{23,24}

- Administer transfusions only when alternatives do not exist or have failed.⁶
- Administer RBCs at intervals to maintain the hemoglobin just above the lowest concentration that is not associated with symptoms of anemia.⁶
- Assess patients that are expected to have long-term transfusion dependent survival for iron overload.
- Chelation therapy should be considered in patients who are iron-overloaded, transfusion dependent, and who have a life expectancy of more than one year.
- Iron overload is typically present after 20 units of RBCs (patients with a significant component of ineffective erythropoiesis and upregulation of iron absorption may become iron overloaded more quickly).
- Monitor serum ferritin and transferrin saturation: tissue iron overload is likely if ferritin > 1000 ug/L and transferrin saturation > 75%.
- Either desferrioxamine or deferasirox are appropriate as first line therapy, with target ferritin between 500 and 1000 ug/L, and appropriate monitoring for drug toxicity (including annual eye and ocular examinations).

Indications for Frozen Plasma

1. Bleeding or prior to an operative procedure in patients with INR, PT or PTT more than 1.5 times normal when no coagulation factor concentrates or other alternative therapy are available.²
 - ◆ Repeating INR/PT/PTT after infusion of FP may be beneficial to ensure that replacement is adequate³³

Note: ^{39,40,41,42}

- If available, prothrombin complex concentrates (PCCs) should be used for urgent reversal of warfarin therapy or treatment of vitamin K deficiency in a bleeding patient OR a patient requiring an emergency invasive procedure. Vitamin K (2-10 mg i.v.) should also be given.
- For non-emergent reversal of warfarin or vitamin K deficiency, vitamin K should be used rather than PCCs.
 - ◆ For patients without bleeding and INR > 5 and < 9 due to warfarin, 1-2 mg of oral Vitamin K will bring INR within the therapeutic range. For an INR ≥ 9, use 5-10 mg of oral vitamin K
 - ◆ After intravenous administration, Vitamin K effect can be detected after 2 hours and the INR should be normalized after 12-24 hours
 - ◆ SC and IM NOT recommended due to variable absorption: intravenous formulation can be used orally for more rapid effect or if oral tablets are not readily available

A T T E N T I O N

FP is NOT indicated or required when INR < 1.5 as coagulation factor levels are adequate for hemostasis.

A T T E N T I O N

IV Vitamin K works faster than oral.

A T T E N T I O N

FP is NOT indicated or effective for reversal of heparin, low molecular weight heparin, rivaroxaban or dabigatran.