

A primer on red cell transfusion in Manitoba

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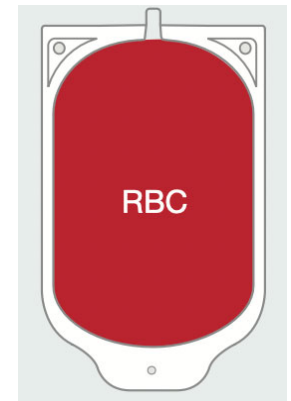
Presenter Disclosure

- **Faculty / Speaker's name:** Laura Tapley and Arjuna Ponnampalam
- **Relationships with commercial interests**
 - **Grants/Research Support:** None
 - **Speakers Bureau/Honoraria:** None
 - **Consulting Fees:** None
 - **Other:** None

Learning Objectives

The participant will be able to:

1. List indications for red blood cell transfusion
2. Recognize common transfusion related complications



Focus on

- Transfusion basics
- Transfusion alternatives
- Most common transfusion risks
 - Alloimmunization
 - TACO
- Restrictive transfusion strategy and thresholds

Case #1

- 28 yo female, G2P1, PMHx menorrhagia, currently 20 weeks gestation
- Mild fatigue, vitally stable, otherwise well
- Routine bloodwork:

Test	Value	Ref Range
HGB	75 g/L	120-160 g/L
MCV	78 fL	80-98 fL
Ferritin	3 ug/L	20-200 ug/L

Case #2

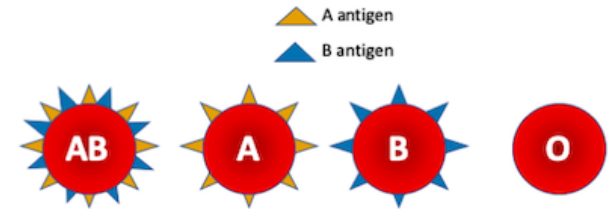
- 80 year old male with history of HTN, CHF
- Prolonged admission following colectomy with primary anastomosis for early stage adenocarcinoma
- Feels weak, too tired to work with physio

Test	Value	Ref Range
HGB	65 g/L	120-160 g/L
MCV	85 fL	80-98 fL
Ferritin	350 ug/L	20-200 ug/L

Transfusion Basics – Administration

- Informed consent
- Proper identification of samples, patient and product
- Non-urgent/non-bleeding – daytime hours
- Vital sign monitoring (pre, during, post)
- Infuse over 2h (max 4h)
- Expect 10 g/L increase in HGB per unit

Transfusion Basics



- 1 Unit of RBCs \approx 300 mL
- Stored 1-6 °C for up to 42 days

Pre-Transfusion Testing	Purpose
ABO Group	Patient RBCs tested for A and B antigen
Rh (D) Group	Patient RBCs tested for D antigen
Antibody Screen	Screen for RBC alloantibodies formed from prior transfusion or pregnancy
Antiglobulin Crossmatch	When RBC alloantibodies present. Incubation of donor RBCs, recipient plasma/serum and anti-IgG to assess for cross reactivity

Adapted from Callum JL, et al. *Bloody Easy*, 4th Ed.

Transfusion Basics – Prevention

- Identify cause of anemia and assess for alternative therapies
- Minimize unnecessary phlebotomy in stable inpatients
- Restrictive transfusion approach (more to follow)
- One unit at a time!

Red Blood Cell Transfusion
Adult Outpatients and Hospitalized Non-Bleeding Patients*

Symptomatic anemia?
If the cause of anemia is unknown, this must be investigated

YES

See Anemia Algorithm

Is the patient actively bleeding?
OR
Is the patient clinically unstable (hypotension or signs of tissue hypoperfusion)?

YES

Outpatients: Refer urgently to acute care facility
Inpatients: Initiate resuscitation measures including transfusion as needed

NO

***Does not apply to:**

- » Patients < 18 years
- » Massive transfusion protocol
- » Intraoperative transfusion
- » Labor and delivery including recovery room
- » Outpatient oncology and hematology
- » Patients with hemoglobinopathies such as sickle cell disease

Transfusion Associated Risks:

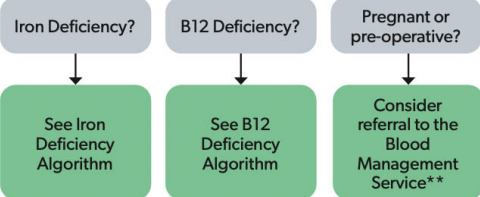
- » RBC alloantibodies 1 in 13 units issued
- » Transfusion associated circulatory overload (TACO) 1 in 100
- » Transfusion related acute lung injury (TRALI) 1 in 10,000
- » Hemolytic transfusion reactions 1 in 40,000
- » Anaphylaxis 1 in 40,000
- » Sepsis 1 in 250,000
- » Viral transmission <1 in 5 million

Are there alternatives to transfusion?

NO

HGB > 80 g/L	STOP	Do not transfuse
HGB 71-80 g/L	EVALUATE	If the patient is symptomatic, transfuse one unit of red blood cells Symptoms include dyspnea, angina, presyncope or unexplained fatigue and weakness
HGB ≤ 70 g/L	GO	Transfuse one unit of red blood cells

YES



Pre-Transfusion Checklist:

- » Obtain Type and Screen
- » Obtain consent and review risks
- » Consider pre-emptive diuretics for patients at risk of TACO

For non-bleeding adult patients, a single unit transfusion is recommended

TACO = Transfusion associated circulatory overload

Transfusion Medicine physician is available through Health Sciences Centre paging at 204-787-2071 for clinical consultation
**Blood Management Service: <https://bestbloodmanitoba.ca/clinical-groups/blood-conservation-service>

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Applicable Patient Population

- **Adult outpatients**
- **Hospitalized non-bleeding patients**
- **Excludes:**
 - Actively bleeding/unstable patients
 - Pediatrics, massive transfusion, intraoperative care, labor/delivery including recovery room, outpatient oncology/hematology, hemoglobinopathies

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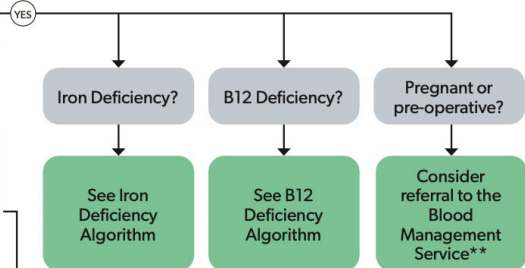
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Cause of Anemia

- Must be investigated if unknown
 - Dictates appropriate management!
- Basic investigations
 - CBC, blood film, reticulocyte count, ferritin, iron saturation, vitamin B12
- Goal
 - Determine etiology → assess for transfusion alternatives

Transfusion Alternatives



Don't transfuse blood if other non-transfusion therapies or observation would be just as effective.

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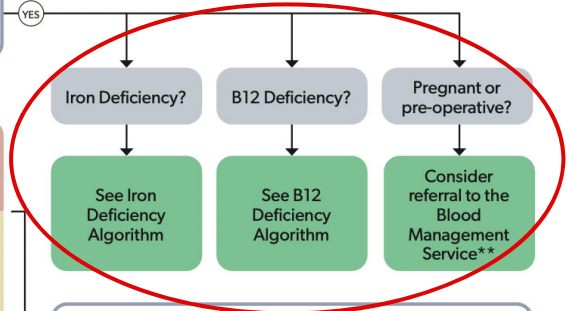
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Transfusion Alternatives

- Based on cause of anemia
 - There's an algorithm for that!
- Nutritional deficiency – **replace**
 - Iron, B12, erythropoietin
- Pregnancy or pre-op – **optimize**

Transfusion Alternatives – Why?

- Avoid potentially unnecessary associated risk
- Blood conservation

Transfusion Risks

Adverse Transfusion Event	Risk per unit transfused
RBC alloantibodies	1 in 13
TACO	1 in 100
TRALI	1 in 10,000
Hemolytic Transfusion Reaction	1 in 40,000
Anaphylaxis	1 in 40,000
Sepsis	1 in 250,000
Viral Transmission	< 1 in 5 million

Adapted from Callum JL, et al. *Bloody Easy*, 4th Ed.

Alloimmunization

- 1 in 13 units transfused
- New RBC alloantibodies in 8% of recipients within 6 months of transfusion
- Complications
 - Hemolytic transfusion reactions
 - Hemolytic disease of the fetus and newborn
 - More extensive testing for future transfusion
 - May cause delays!

Schoneville H et al. Transfusion, 2016

Delaney M et al. Am Soc Hematol Educ Program, 2015

Hemolytic disease of the fetus and newborn

- Maternal alloantibody crosses placenta and causes hemolysis in fetus/neonate
 - Predominantly RhD but others contribute
 - Preterm delivery – 1.4-2.4 RR
 - Stillbirth – 1.5-2.6 RR
- Risk of alloantibody formation ↑ with transfusion

Schoneville H et al. Transfusion, 2016

Delaney M et al. Am Soc Hematol Educ Program, 2015

Women of childbearing age (<45)

- Iron deficiency is prevalent in this population
 - Worldwide – 1 in 5 women have iron deficiency anemia
 - In pregnancy – 75% of anemia due to iron deficiency
- **Utilize alternatives to avoid unnecessary risk!**
 - Iron, iron and more iron

Kassebaum NJ, et al. Blood, 2014

Delaney M et al. Am Soc Hematol Educ Program, 2015

Transfusion Alternatives – How?

- Best Blood Manitoba – Blood Management Service
- Goals
 - Enhance patient care/satisfaction through blood & blood alternatives education
 - Provide process whereby patients are informed and appropriate alternatives are implemented
 - Decrease demand on blood supply

Transfusion Alternatives – Who?

- Prior to elective surgical procedures associated with
 - High blood loss
 - Staged procedures
- Anemic patients
- Obstetrical patients
- Small patients (low body weight)
- Difficult cross-match or multiple anti-bodies
- Patients who do not accept blood transfusion



MRN
 Client Surname
 Given Name
 Date of Birth
 Gender
 PHIN

Request for Consultation/Referral

Phone: 204-926-8006 Fax: 204-940-3255

Date of Referral:

PLEASE ATTACH MOST RECENT CBC, IRON STUDIES (FERRITIN, IRON, TIBC), MEDICAL HISTORY, MEDICATION, & RELEVANT DOCUMENTATION IN ORDER TO EXPEDITE CONSULT

Obstetrical



REASON FOR REFERRAL

- | | |
|---|--|
| <input type="checkbox"/> Non-consent for transfusion | <input type="checkbox"/> Staged or multiple surgeries |
| <input type="checkbox"/> High blood loss surgery | <input type="checkbox"/> Low body weight (less than 60 kg) |
| <input type="checkbox"/> History of anemia – current Hgb: | <input type="checkbox"/> Difficult cross-match |
| <input type="checkbox"/> Other (specify): | |



MRN
 Client Surname
 Given Name
 Date of Birth
 Gender
 PHIN

Request for Consultation/Referral for Obstetrical Patients

Phone: 204-926-8006 Fax: 204-940-3255

Date of Referral:

IMPORTANT

For a consult to be considered by Blood Management Service the patient must have met all of the following criteria.

- A serum Hgb below 80 g/L with evidence of iron deficiency anemia
- A failed trial of oral iron greater than 2 weeks
- At least 13 weeks gestation.

And/or:

- Low body weight (less than 60 kg) pre-pregnancy
- Increased risk of postpartum hemorrhage including but not limited to:
 - Placental abnormality
 - Multiple pregnancy
 - Multiple previous deliveries
 - Gestational hypertension
 - Large baby in current pregnancy
 - Past History Postpartum Hemorrhage
- Rare blood type or antibodies
- Non-consent for transfusion

Non-obstetrical



<https://bestbloodmanitoba.ca>

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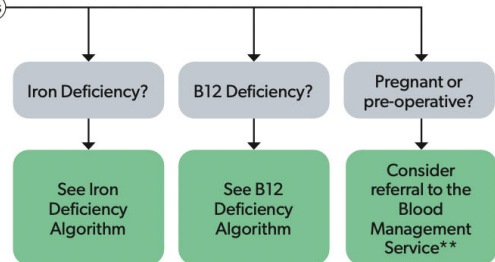
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Restrictive Transfusion Approach



Don't transfuse more than one red cell unit at a time when transfusion is required in stable, non-bleeding patients.

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	Number of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Liberal transfusion (Hb 9 g/dL to 10 g/dL)	Restrictive transfusion (Hb 7 g/dL to 8 g/dL)				
People receiving blood transfusions	841 per 1000	479 per 1000	RR 0.57 (0.49 to 0.65)	12,587 (31)	⊕⊕⊕⊕ High	-
30-day mortality	93 per 1000	90 per 1000 ↓	RR 0.97 (0.81 to 1.16)	10,537 (23)	⊕⊕⊕○ Moderate ^a	-
Myocardial infarction	17 per 1000 ↓	19 per 1000	RR 1.08 (0.74 to 1.60)	8303 (16)	⊕⊕⊕⊕ High	-
Congestive heart failure	36 per 1000	28 per 1000 ↓	RR 0.78 (0.45 to 1.35)	6257 (12)	⊕⊕○○ Low ^{b,c}	-
Cerebrovascular accident (CVA) - stroke	17 per 1000	13 per 1000 ↓	RR 0.78 (0.53 to 1.14)	7343 (13)	⊕⊕⊕⊕ High	-
Rebleeding	163 per 1000	144 per 1000 ↓	RR 0.75 (0.51 to 1.10)	3108 (6)	⊕⊕○○ Low ^{d,e}	-
Pneumonia	82 per 1000	76 per 1000 ↓	RR 0.94 (0.80 to 1.11)	6277 (14)	⊕⊕⊕⊕ High	-
Thromboembolism	10 per 1000	8 per 1000 ↓	RR 0.77 (0.41 to 1.45)	4019 (10)	⊕⊕⊕⊕ High	-

Restrictive Transfusion Approach

- Myocardial infarction
 - Signal 30-day mortality may be influenced by liberal vs restrictive strategy
 - Results not statistically significant
 - RR 3.88, 95% CI 0.83 – 18.13
 - Small studies

Restrictive Transfusion Approach

- Transfusion → increased morbidity and mortality in high-risk hospitalized inpatients
- Trigger HGB 70-80 g/L as effective as liberal approach
- Single unit for non-bleeding hospitalized patients
- Guide → symptoms and hemoglobin concentration
 - Dyspnea, angina, presyncope, unexplained fatigue/weakness

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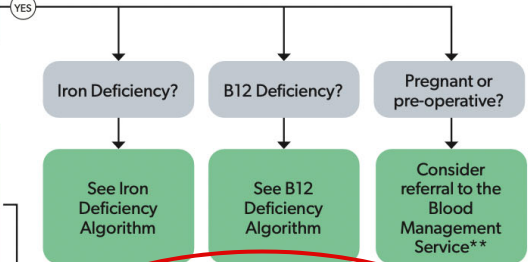
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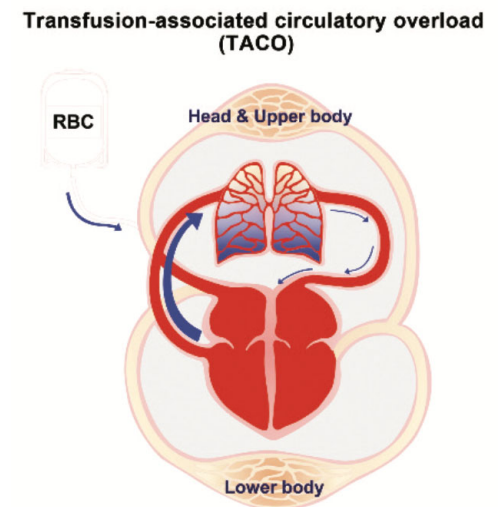
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Transfusion Associated Circulatory Overload (TACO)

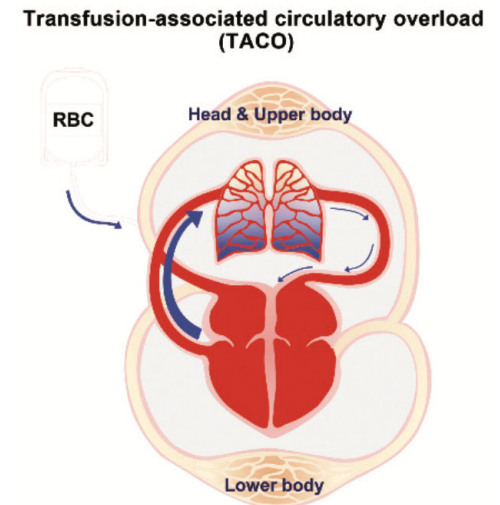
- Circulatory overload due to:
 - Cardiac dysfunction
 - Rapid rate of transfusion
- Most common cause of death from transfusion



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Transfusion Associated Circulatory Overload (TACO)

- Clinical presentation
 - Dyspnea
 - Orthopnea
 - Tachycardia
 - Increase venous pressure/JVP
 - Hypertension



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TACO Risk Assessment

- History of:
 - Age greater ≥ 70 years
 - Renal dysfunction
 - Left ventricular dysfunction
 - Prior or current CHF
 - Severe euvolemic anemia (hemoglobin < 50 g/L)
- **If YES** → Diuretics indicated

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Case #1 - Revisited

- 28 yo female, G2P1, PMHx menorrhagia, currently 20 weeks gestation
- Mild fatigue, vitally stable, otherwise well
- Investigations confirm **iron deficiency anemia**
- **Transfusion alternatives are available!**

Case #1 - Revisited

- Trial of oral iron x 2 weeks
 - GI upset, constipation
- Referred to Blood Management Service
- Given IV iron with return of HGB to physiologic level for pregnancy

Case #2 – Revisited

- 80 year old male with history of HTN, CHF
- Prolonged admission following colectomy with primary anastomosis for adenocarcinoma
- Feels weak, too tired to work with physio
- Investigations
 - Normocytic anemia with signs of inflammation
 - Daily phlebotomy since admission

Case #2 – Revisited

- Requires transfusion
- High risk for TACO

TACO Risk Assessment

- History of:
 - **Age greater ≥ 70 years**
 - Renal dysfunction
 - Left ventricular dysfunction
 - **Prior or current CHF**
 - Severe euvolemic anemia (hemoglobin < 50 g/L)
- **Diuretics are indicated**

Case #2 – Revisited

- Administered 1 unit of PRBCs with 40 mg of IV furosemide
- Tolerates transfusion well
 - Improved energy and working with physio
- Blood work frequency reduced to twice per week to minimize contribution of phlebotomy

Take home message

- Transfusion is not without risk
 - Alloimmunization
 - TACO
- Transfusion alternatives should be sought if available
- Restrictive transfusion strategy should be employed with symptoms to guide intervention

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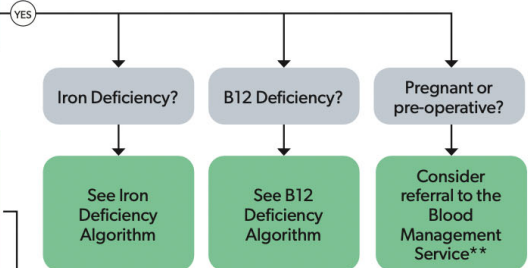
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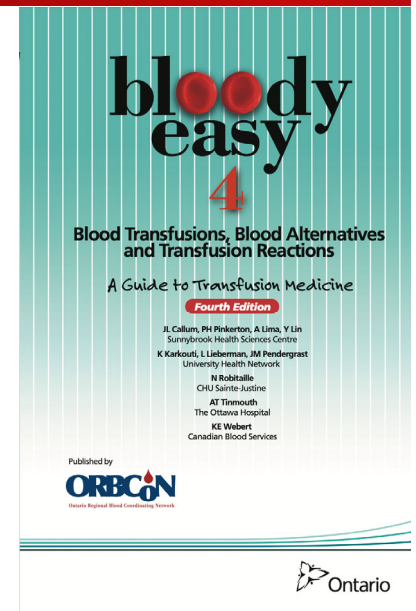
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Thank you

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