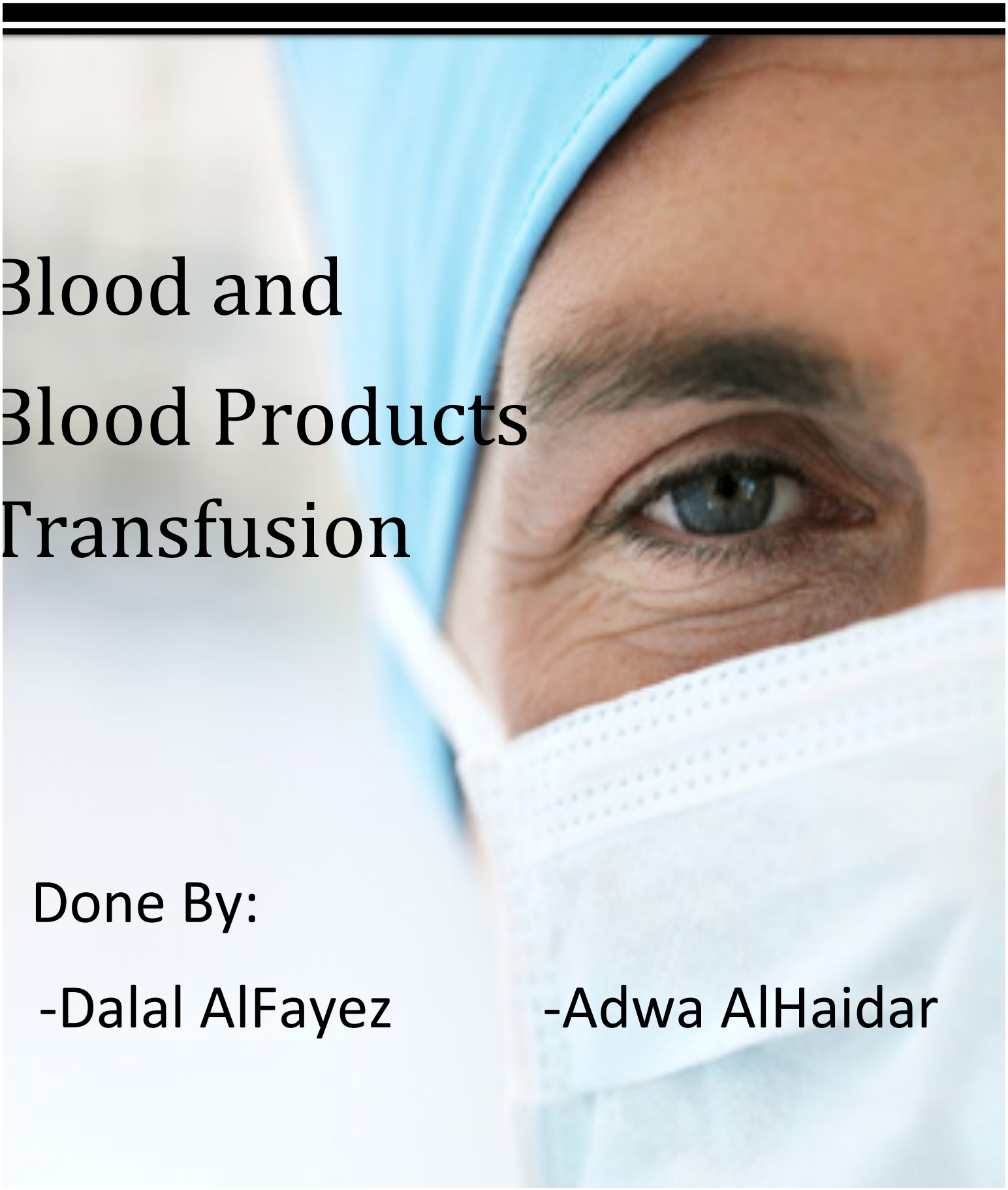
430 Surgery Team



Blood and Blood Products Transfusion

Done By:

-Dalal AlFayez

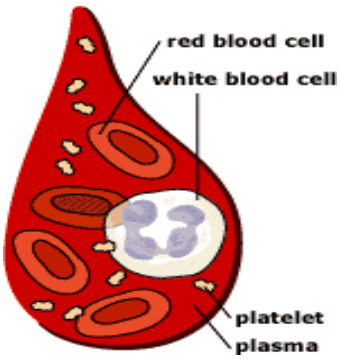
-Adwa AlHaidar

History of Transfusions:

- Blood transfused in humans since mid-1600's
- 1828 – First successful transfusion
- 1900 – Landsteiner described ABO groups
- 1916 – First use of blood storage
- 1939 – Levine described the Rh factor

Objectives:

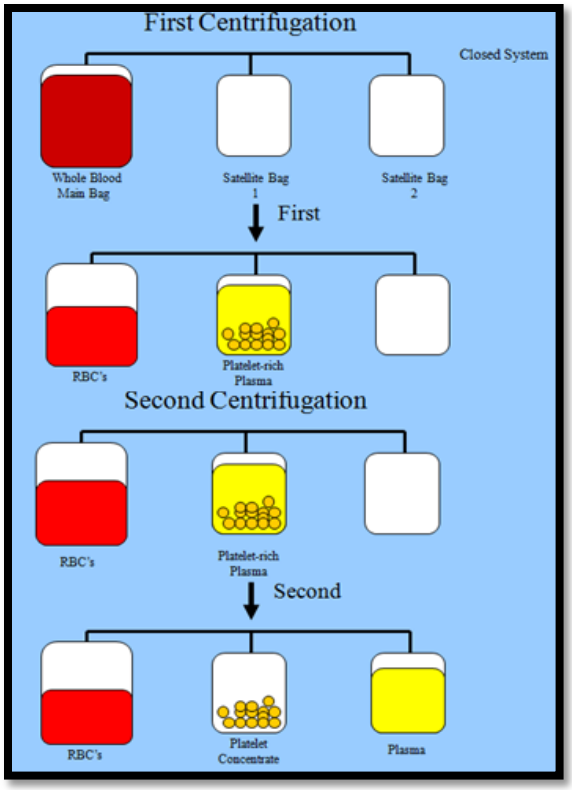
- Blood components
- Indications for transfusion
- Safe delivery
- Complications



Blood components: (MCQ)

- Prepared from Whole blood collection
- Whole blood is separated by differential centrifugation

1. Red Blood Cells (RBC's)
2. Platelets
3. Plasma
    - Cryoprecipitate
    - Others (include Plasma proteins—IV Ig, Coagulation Factors, albumin, Anti-D, Growth Factors, Colloid volume expanders)
4. WBC's



Differential Centrifugation:

Done twice

- First Centrifugation →Separates RBCs from platelet rich plasma
- Second Centrifugation → Separates platelets from plasma

After taking blood from the donor we send a sample to the lab to do:

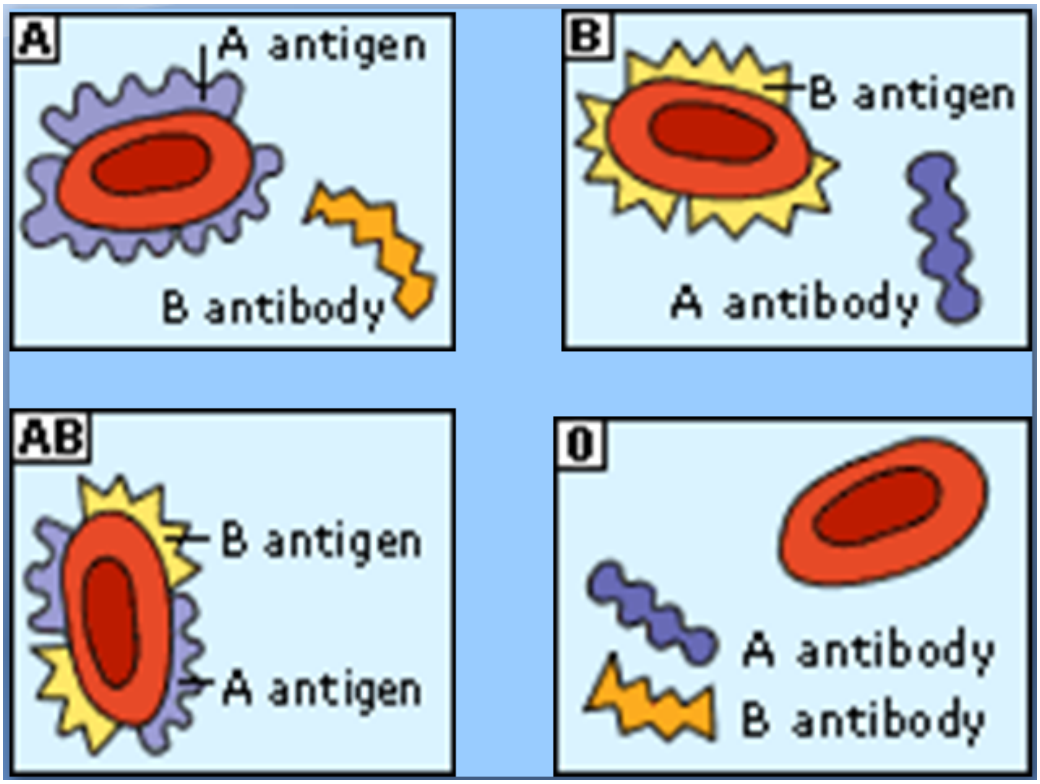
1) Screening test to avoid transmitted infections (viruses)
2) Blood group ABO testing (done in Whole blood and RBCs not in platelets and plasma)
3) Cross match test (Rh test)

-ABO compatibility means that the donor and recipient have the same blood group.

-Rh is either :

1) +ve if there is Anti-D

2) Or –ve if Anti-D is absent



Important notes

- A → A antigen, B antibody
- B → B antigen, A antibody
- AB→ has both A&B antigens, NO antibodies (can receive from any blood group)
- O→ NO antigens, bus has Both A&B antibodies (can give any blood group but don't take from any)

-Because of the high risk of infections in blood transfusion we should not give blood if unnecessary, instead, we give colloids or crystalloids to compensate the volume loss.

-Blood is only given in cases of low Hb level (to increase oxygen carrying capacity) ex: anemia

-Early sign of anemia → resting tachycardia

	Whole blood	RBC concentrate	Platelets	Plasma and FFP (Coagulation Factors (1 unit/ml))
Storage	4° for up to 35 days	4° for up to 42 days, can be frozen	Up to 5 days at 20-24° (at room temperature-don't need to be warmed)	FFP--12 months at –18 degrees or colder
Indications	Massive Blood Loss/Trauma/Exchange Transfusion	Many indications—ie anemia, hypoxia, etc.	• Thrombocytopenia, Plt <15,000 • Bleeding and Plt <50,000 • Invasive procedure and Plt <50,000	Coagulation Factor deficiency (hemophilia), fibrinogen replacement, DIC, liver disease, exchange transfusion, massive transfusion
Considerations	• Use filter as platelets and coagulation factors will not be active after 3-5 days • Donor and recipient must be ABO identical	• Recipient must not have antibodies to donor RBC's (note: patients can develop antibodies over time) • Usual dose 10 cc/kg (will increase Hgb by 2.5 gm/dl) • Usually transfuse over 2-4 hours (slower for chronic anemia)	• Contain Leukocytes and cytokines • 1 unit/10 kg of body weight increases Plt count by 50,000 • Donor and Recipient must be ABO identical	• Plasma should be recipient RBC ABO compatible • In children, should also be Rh compatible • Usual dose is 20 cc/kg to raise coagulation factors approx 20%

Leukocyte Reduction Filters: (IV blood transfusion filter)

- Used for prevention of transfusion reactions
- Filter used with RBC's, Platelets (not really because platelet destruction will occur), FFP, Cryoprecipitate
- Other plasma proteins (albumin, colloid expanders, factors, etc.) do not need filters—NEVER use filters with stem cell/bone marrow infusions
- May reduce RBC's by 5-10% (but we must use it)

RBC Transfusions:

1) Preparations:
   - Type
     - Typing of RBC's for ABO and Rh are determined for both donor and recipient
   - Screen
     - Screen RBC's for atypical antibodies
     - Approx 1-2% of patients have antibodies

- Crossmatch
  - Donor cells and recipient serum are mixed and evaluated for agglutination

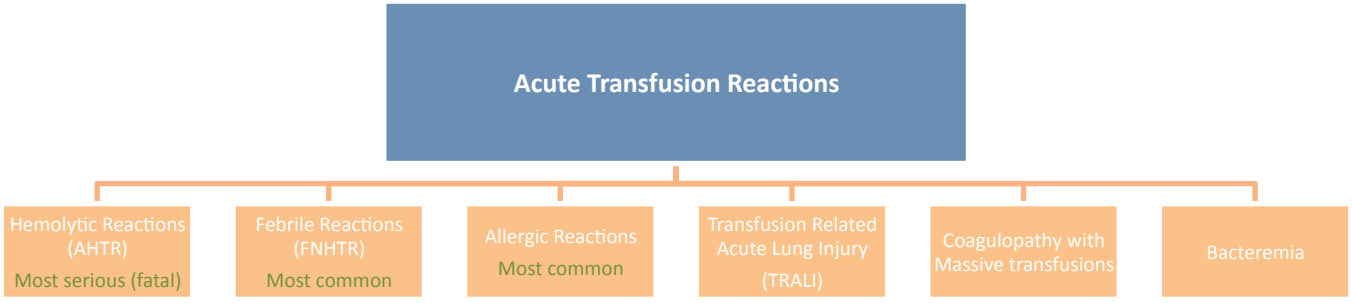
2) Administration

Before blood administration of blood 2 people should check the blood pack for:
1-Patient name
2-File number
3-Blood group (Mainly ABO)
4-Expiration date
Any mistake is fatal

- Dose
  - Usual dose of 10 cc/kg infused over 2-4 hours
  - Maximum dose 15-20 cc/kg can be given to hemodynamically stable patient
- Procedure
  - May need Premedication (Tylenol and/or Benadryl)
  - Filter use—routinely leukodepleted
  - Monitoring—VS q 15 minutes, clinical status (vital signs every 15 minutes)
  - Do NOT mix with medications
- Complications
  - Rapid infusion may result in Pulmonary edema
  - Transfusion Reaction

3) Complications

- Acute Transfusion Reactions (ATR's)
- Chronic Transfusion Reactions (seen in thalassemia and sickle cell anemia)
- Transfusion related infections



Acute Transfusion Reactions (ATR's)

1. Acute Hemolytic transfusion Reactions (AHTR):

- It occurs when:

Incompatible RBC's (usually ABO or Rh) are transfused into a recipient who has pre-formed antibodies → Antibodies activate the complement system, causing intravascular hemolysis → causing hemoglobinuria

- 1-2 cc of RBC's (little amount) can cause this hemolytic reaction
- Labeling error is the most common problem can be fatal
-
- Symptoms occur within minutes of starting the transfusion and includes:

- High fever/chills
- Hypotension
- Back/abdominal pain
- Oliguria
- Dyspnea /chest pain
- Dark urine
- Pallor due to destruction of blood
- Nausea/vomiting

If AHTR occurs while the patient is under general anesthesia, the only symptom may be hypotension, tachycardia, or dark urine that reflects hemoglobinuria

What to do If an AHTR occur?

STOP TRANSFUSION

ABC's

- Maintain IV access and run IVF NS (Normal Saline) or LR (Ringer lactate)
- Monitor and maintain BP/pulse
- Give diuretics
- Obtain blood and urine for transfusion reaction workup
- Send remaining blood back to Blood Bank

Hydration is very imp. , Open another cannula and give a lot of fluids

Take blood sample from the patient to check the Hgb rate after RBC's destruction because the patient may need another transfusion if the rate was low and do cross matching again.

Check electrolytes, renal function (because hemoglobinuria can cause some problems) and coagulation.

Blood Bank Work-up of AHTR?

- Check paperwork to assure no errors
- Check plasma for hemoglobin
- Repeat crossmatch
- Repeat Blood group typing
- Blood culture

Monitoring in AHTR?

- Monitor patient clinical status and vital signs
- Monitor renal status (BUN, creatinine)
- Monitor coagulation status (DIC panel– PT/PTT, fibrinogen, D-dimer/FDP, Plt, Antithrombin-III)
- Monitor for signs of hemolysis (LDH, bili, haptoglobin)

Monitor the patient, in case he had hypotension or tachycardia; support him using ionotropes or blood transfusion

2.Febrile non-hemolytic transfusion Reactions (FNHTR): (most common)

- Definition--Rise in patient temperature >1°C (associated with transfusion without other fever precipitating factors).
- Occurs with approx 1% of PRBC (Packed RBC) transfusions and approx 20% of Platelet transfusions.

What to do If an FNHTR occur?

STOP TRANSFUSION
Use of Antipyretics—responds to Tylenol
Use of Corticosteroids for severe reactions
Use of Narcotics for shaking chills

} Manage the symptoms

Future considerations:

Use filter to prevent reaction with leukocyte
Use single donor platelets and fresh platelets
Washed RBC's or platelets to minimize the inflammatory response

Washed Blood Products

PRBC's or platelets washed with saline

Indicated to prevent recurrent or severe reactions

Washed RBC's must be used within 24 hours

RBC dose may be decreased by 10-20% by washing

3. Allergic (non-hemolytic) Reactions: (common) There is no destruction of RBC's

Etiology:

May be due to plasma proteins or blood preservative/anticoagulant

Presents with urticaria and wheezing

Treatment:

Mild reactions—Can be continued after Benadryl

Severe reactions—Must STOP transfusion and may require steroids (anti – inflammatory) or epinephrine

Prevention—Premedication (Antihistamines)

4. Transfusion Related Acute Lung Injury (TRALI):

Clinical syndrome similar to ARDS (Acute respiratory distress syndrome)

Occurs 1-6 hours after receiving plasma-containing blood products

Caused by WBC antibodies present in donor blood that result in pulmonary leukostasis*

Treatment is supportive (oxygen or ICU intubated ventilation in severe cases)

High mortality

* Is a white blood cell count above 100,000/µL. It is characterized by abnormal intravascular leukocyte aggregation and clumping. It is most often seen in leukemia patients. The brain and lungs are the two most commonly affected organs.

5. Massive transfusions

Coagulopathy may occur after transfusion of massive amounts of blood (trauma/surgery)

Coagulopathy is caused by failure to replace plasma

See electrolyte abnormalities:

- Due to citrate binding of Calcium
- Also due to breakdown of stored RBC's

To measure Blood volume :

65ml / kg (female)

70ml / kg (male)

A 60kg male patient has 4,200mL of blood.

It occurs when you give blood more than the body blood volume in 24 h.

Ex. Blood volume is 2000 and you give the patient 4000 ml of blood in 24 hours

It may cause: → coagulopathy

Electrolyte disturbance → hypocalcemia

Hypothermia :

If the warmer wasn't used → Hyper/hypokalemia

Metabolic alkalosis/acidosis

When these complications occur, you should start supporting the platelets (because they will decrease in number as well as the coagulation factor) and replace it.

In case of trauma or major surgery where there is active bleeding, large amounts of blood will be transfused to the patient and as we said this will lead to massive transfusion, which in turn will cause diluted platelet and coagulation factor. So platelets and Fresh Frozen Plasma should be ordered from the blood bank to prevent these complications. They're also ordered if the patient is a known case of thrombocytopenia. or coagulation disorder.

Note: Blood can be returned to the blood bank as long as it wasn't warm whereas, platelets and FFP should be used when they're ordered. (So only order it when you need it).

6.Bacteremia:

More common and more severe with platelet transfusion (platelets are stored at room temperature)

Organisms:

Platelets—Gram (+) organisms, i.e. Staph/Strep,

RBC's—Yersinia, enterobacter

Risk increases as blood products age (use fresh products for immunocompromised)

Chronic Transfusion Reactions

- Alloimmunization
- Transfusion Associated Graft Verses Host Disease (GVHD)
- Iron Overload
- Transfusion Transmitted Infection

Transfusion related infections

Transmitted diseases can be transmitted during blood transfusion

- Hepatitis C
- Hepatitis B
- HIV
- CMV = Citomegalovirus

CMV can be diminished by leukoreduction, which is indicated for immunocompromised patients.