TRANSFUSION MEDICINE

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- In severe anaemia give blood transfusion to
  - A) All children with a heamatocrit of less than 12 or Hb of less than 4gm/dl

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- B) Less severely anaemic haematocrit of 13%-18% Hb 4-6gm/dl with any of the following clinical features
  - Clinically detectable dehydration
  - Impaired level of consciousness
  - Heart failure
  - Deep and laboured breathing
  - very high parasitaemia (more than 10% of red cells with parasites)

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- C) Acute loss when 20-30% of total volume has been lost or bleeding is continuing
- D) Septic shock
- E) To provide plasma and platelets for clotting factors
- F) Exchange transfusion in neonates

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RED BLOOD CELL TRANSFUSION

- Red blood cells (RBCs) are transfused to increase the oxygen-carrying capacity of the blood and, in turn, to maintain satisfactory tissue oxygenation

- If the estimated blood loss is >25% of the circulating blood volume (>17 mL/kg)and the patient's condition remains unstable, RBC transfusions may be indicated

In acutely ill children with severe pulmonary disease requiring assisted ventilation, it is common practice to maintain the hemoglobin level close to the normal range

With chronic anemia, the decision to transfuse RBCs should not be based solely on blood hemoglobin levels because children compensate well and may be asymptomatic despite low hemoglobin levels.

Patients with iron-deficiency anemia are often treated successfully with oral iron alone,

- even at hemoglobin levels of <5 g/dL.

Factors other than hemoglobin concentration to be considered in the decision to transfuse RBCs include:

- the patient's symptoms, signs, and functional capacities
- the presence of cardiorespiratory, vascular, and central nervous system disease
- the cause and anticipated course of the anemia
- alternative therapies are not available

- In chronic anaemia
  - It is important to balance the detrimental effects of anemia on growth and development
  - vs the potential toxicity associated with repeated transfusions..

RBC transfusion in neonates

- all neonates experience a decline in circulating RBC mass caused both by physiologic factors

- in sick premature infants, by phlebotomy blood losses.

- In healthy term infants, the nadir hemoglobin value rarely falls to <11 g/dL at an age of 10–12 wk.

- This “physiologic” drop in RBCs does not require transfusions.

❖the decline occurs earlier and is more pronounced in premature infants

❖ the mean hemoglobin concentration falls to approximately 8 g/dL in infants of 1.0–1.5 kg

❖ birthweight and to 7 g/dL in infants weighing <1.0 kg at birth

. Most infants with birthweight of <1.0 kg need RBC transfusions.

nadir hemoglobin values of premature infants are lower coz of

relatively diminished plasma EPO level in response to anemia

The mechanisms responsible for low plasma EPO levels are

- is the reliance of preterm infants on the liver as the primary site of EPO production during the first few wk of life.
  - The liver is less responsive than the kidneys to anemia and tissue hypoxia.

- Preterm infants exhibit a sluggish EPO response to falling hematocrit values.

  - Low plasma EPO levels provide a rationale for the use of recombinant EPO in the treatment of anemia of prematurity.

    - Proper doses of EPO and iron effectively stimulate neonatal erythropoiesis

✓Stable neonates do not require RBC transfusion, regardless of their blood hemoglobin level

- ✓ unless they exhibit clinical problems attributable to anemia.

The RBC product of choice

❖ is the standard suspension of RBCs separated from whole blood by centrifugation and re-suspended in an anticoagulant/preservative storage solution at a hematocrit value of approximately 60%.

- The usual dose is 10–15 mL/kg

- N.B.
  - transfusion volumes vary greatly, depending on clinical circumstances (continued vs arrested bleeding, hemolysis).

For neonates

Preference a packed RBC concentrate (hematocrit of 70–90%).

Either is infused slowly (over 2–4 hr) at a dose of approximately 15 mL/kg.

Because of the small quantity of extracellular fluid given at these relatively high hematocrit values and the slow rate of transfusion, the type of RBC anticoagulant/preservative solution used does not pose risks for premature infants.

Guidelines for Pediatric Red Blood Cell Transfusions

INFANTS WITHIN THE FIRST 4 MO OF LIFE

- Hemoglobin of <13.0 g/dL and *severe* pulmonary disease
- Hemoglobin of <10.0 g/dL and *moderate* pulmonary disease
- Hemoglobin of <13.0 g/dL and *severe* cardiac disease
- Hemoglobin of <10.0 g/dL and *major* surgery
- Hemoglobin of <8.0 g/dL and *symptomatic* anemia

CHILDREN AND ADOLESCENTS

- Acute loss of >25% at circulating blood volume
- Hemoglobin of <8.0 g/dL in the perioperative period
- Hemoglobin of <13.0 g/dL and *severe* cardiopulmonary disease
- Hemoglobin of <8.0 g/dL and *symptomatic* chronic anemia
- Hemoglobin of <8.0 g/dL and *marrow failure*

TRANSFUSION PROCEDURE

- In severe anaemia ,If packed cells are available give 10mls/kg over 3-4 hours
  - Preferred over whole blood if not fresh whole blood 20mls/kg over 3-4 hours
- Check respiratory rate and pulse rate every 15 min if rise is noted transfuse slowly
- If evidence of overload occurs give frusemide 1-2mg/kg

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- If after transfusion no increment of Hb transfuse again

- In malnourished child give packed cells 10ml/kg or whole blood 10ml/kg

  - N.B. Do not repeat transfusion in malnutrition

Platelet transfusion

- Guidelines for platelet (PLT) support of children and adolescents with quantitative and qualitative PLT disorders are similar to those for adults

- where the risk of life-threatening bleeding after injury or occurring spontaneously can be related to the severity of thrombocytopenia

✓ PLT transfusions should be given to patients with PLT counts of $<50 \times 10^9/L$ when they are bleeding or are scheduled for an invasive procedure.

✓ Studies of patients with thrombocytopenia resulting from bone marrow failure indicate that spontaneous bleeding increases markedly when PLT levels fall to $<20 \times 10^9/L$, if serious complications (infection, organ failure, clotting abnormalities, or anemia) are present.

- In this setting, prophylactic PLT transfusions are given to maintain a PLT count of >20 × 10^9/L.

- PLT transfusions may be given to maintain relatively high PLT counts in situations of DIC, sepsis, active bleeding or need for invasive procedure

❖In Qualitative PLT disorders, PLT transfusions are justified only if significant bleeding occurs.

❖ Because inherited PLT dysfunction is long term and repeated transfusions may lead to alloimmunization and refractoriness, prophylactic PLT transfusions are rarely justified, unless an invasive procedure is planned

- a bleeding time of > twice the upper limit of laboratory normal or an abnormal result may be taken as diagnostic evidence of PLT dysfunction

- bleeding time or any other laboratory test result is poorly predictive of hemorrhagic risk or the need to transfuse PLTs.

- Alternative therapies, particularly desmopressin acetate, should be considered to avoid PLT transfusions.

- Antiplatelet medications (nonsteroidal anti-inflammatory drugs) should be avoided in these patients.

- In neonates, hemostasis is quantitatively and qualitatively different from that in older Children

- Approximately 25% of neonates treated in ICU exhibit blood PLT counts of $<150 \times 10^9/L$ at some time during admission

  - pathogenetic mechanisms are
    - accelerated PLT destruction
    - diminished PLT production

- The goal of most PLT transfusions is to raise the PLT count to >50 × 10^9/L and to increase that for neonates to >100 × 10^9/L.

- Dose 10 mL/kg

- Transfused within 2 hr.

Guidelines for Pediatric Platelet Transfusions*]

CHILDREN AND ADOLESCENT

- PLTs < 50×10^9/L and bleed**ing**
- < 50×10^9/L and an *invasive* procedure

- PLTs < 20×10^9/L and *marrow failure* with hemorrhagic risk factors

- PLTs < 10×10^9/L and *marrow failure* without hemorrhagic risk factors

- PLTs at any count, but with PLT dysfunction plus bleeding or an invasive procedure

INFANTS WITHIN THE FIRST 4 MO OF LIFE

- PLTs < 50×10^9/L and an invasive procedure
- PLTs < 20×10^9/L and *clinically stable*
- PLTs < 100×10^9/L and *clinically unstable*
- PLTs at any count, but with PLT dysfunction plus bleeding or an invasive procedure

Fresh Frozen Plasma Transfusions

- FFP is transfused to replace clinically significant deficiencies of plasma proteins for which more highly purified concentrates are not available

- Requirements for FFP vary with the specific factor being replaced, but a starting dose of 15 mL/kg

- Transfusion of FFP for the treatment of deficiencies of clotting factors II, V, X, and XI.

- Deficiencies of factor XIII and fibrinogen are treated with cryoprecipitate.

❖Transfusion of FFP is not recommended for the treatment of patients with severe hemophilia A or B or for factor VII deficiency because safer factor VII, VIII, and IX concentrates are available.

❖ FFP is used for rapid reversal of the effects of warfarin

- Transfusion of FFP in patients with chronic liver disease and prolonged clotting times is not recommended unless bleeding is present or an invasive procedure is planned because correction of the clotting factor deficiencies is brief.

Guidelines for Pediatric Fresh Frozen Plasma Transfusions

INFANTS, CHILDREN, AND ADOLESCENTS

- *Emergency reversal* of warfarin effects
- Dilutional coagulopathy and bleeding
- Anticoagulant protein (antithrombin III, proteins C and S) replacement
- Plasma exchange replacement fluid for thrombotic thrombocytopenic purpura

TRANFUSION REACTION

Mild reaction due to mild hypersensitivity

- Itchy rash
  - Mngnt
    - slow the transfusion
    - Give chlopheniramine 0.1mg im
    - Continue transfusion at normal rate if there is no progression of systoms after 30min
    - If systoms persist treat as moderate reaction

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- Moderately severe reaction
- Due to moderate hypersensitivity,non-haemolytic reaction,pyrogen or bacterial contamination
- S/S
  - severe rash ,flushing,fever of above 38o C
  - Rigors,restlessness,raised heart rate

- RX
  - Stop transfusion but keep line patent with N/S
  - Give i.v hydrocortisone 200mg or chlorpheniramine 0.25mg/kg
  - Give bronchodilator if wheezing
  - Send the following to the lab
    - blood giving set that was used
    - blood sample from another site
    - urine sample collected over 24 hours

- if there is improvement restart transfusion slowly with new blood and observe carefully

- If no improvement in 15 minutes treat as life threatening. report to doctor in charge and blood bank

- Life threatening reactions
- Due to haemolysis, bacterial contamination, septic shock, fluid overload, anaphylaxis
- S/S
  - Fever above 38,rigors,restlessness,raised heart rate .fast breathing, dark red urine, unexplained bleeding, collapse

Rx

- stop transfusion but keep the line patent
- Maintain airway and oxygen
- Adrenaline 0.01mg/kg body weight(0.1mlof 1 in 10000)
- Treat shock

- IV hydrocortisone 200mg or chlorpheniramine 0.1mg/kg
- Give bronchodilator if wheezing
- Report
- Maintain renal flow IV Lasix 1mg/kg
- Give antibiotics as for septiceamia