Transfusion in gastroenterology and liver diseases

By

Prof. Dr. Fardous Ramadan
Blood and component therapy

• General Consideration

A)) Bl. Donation:

• Bl. Can be donated every 8ws of 450 ml whole bl.

• Avoid complications to donor, careful history, exam.

• Tests before bl. donation:
  
  HBsAg, anti-HCV, HIV-1,2, ALT, Serology for $, HTLV-1
B)) Options available:

• Loss of 1000ml or less → replace by crystalloid/colloid.

• In ac. Emergency: - cross matching before completion of screening tests.

• Extreme emergency: use compatible units.

• Life threatening situations: use universal donor.
C)) Principles for transfusion:

1- Identification to avoid errors.

2- Equipment: large bore needle, use filters.

3- Addition of drugs or solutions.

4- Infusion rate: depends on clinical situation:
   - Generally RBC unit transfused over 2-3 hrs, not more than 4hrs to avoid bacterial contamination.
   - FFP, platelets → 200 ml/hr.
   - Cryoprecipitate: within 6 hrs of thawing
   - Granulocytes: within 4 hrs.
5- **Administration:** start slowly 5 ml/m’ for 15 m’ with close observation of vital signs bec. severe reactions occur in the first 50cc’ then increase infusion rate.

6- **Bl. warmers:** avoid transfusion of cold bl. warm bl. in approved warming machine not exceed 38 c°.

7- **Bl. bags** must not be put under hot tap water, microwave oven or immersed in unmonitored water bath.

8- **Bl.** that has been warmed and not used → discard.
D)) Storage of bl:

- Whole bl → 21- 35 days.
- RBCs → 21- 42 days (-1 -6 C°).
- Bl. stored more than 5 days → loose 50% of its platelets, more than one w → loose 50% of 2,3 DPG.
- Platelets should be transfused within one w.
- FFP has normal levels of coagulation factors including factors V, VIII.
- Liquid stored plasma: lower levels of V, VIII.
E)) Compatibility tests

- Should be done for whole bl, RBCs.
- Not performed for FFP, cryoprecipitate or platelets but should be compatible with recipient RBCs.
  - Granulocyte concentrates contain RBCs, ABO compatibility between donor and recipient is also required.
Blood Transfusions
• Blood transfusion carries a slight but definite risk.
• No-transfusion should be administered unless the problem is evaluated as a whole.
• Most patients generally tolerate Hb 7-10gm/dl.
• Bl. transfusion is not recommended in chronic iron deficiency anemia, iron therapy will raise Hb, $B_{12}$ and folic acid improve megaloblastic anemia.
Whole Blood Transfusion

**Indication**

- Acute bl. loss of more than one third of bl.
- Symptomatic deficit in O$_2$ carrying capacity.
- Hypotension and hypovolemia not fully corrected by crystalloid or colloid infusion, it's most suitable for actively bleeding patients.
• Such patients have: tachycardia, shortness of breath, pallor, fatigue, syncope, postural hypotension, angina or cerebral hypoxia with decrease Hb and Hct.

• expected outcome: one unit blood increase Hb 1 gm/dl, and Hct 3%.
RBCs Transfusion

**INDICATION:**

- The need to increase $O_2$ carrying capacity without a need of volume expansion.
- Chronic anemia.
- CHF.
• Old age who can't tolerate rapid change in blood volume.

• Bone marrow failure: post chemotherapy.

• Expected outcome: as whole blood transfusion.
LEUCOCYTE DEPLETED RBCS

• It's used to prevent a recurrence of a nonhemolytic febrile transfusion reaction in patient who have had at least two reactions.

• Expected outcome: as RBCs transfusion.
Washed RBCs

- RBCs washed in saline rather than plasma, used for prevention of recurrent severe anaphylactic reaction in anemic patients.
FROZEN DEGLYCEROLIZED RBCs.

- RBCs frozen for up to 10 years at (-65°C).
- It's used for rare blood groups, and patients who have alloantibodies against high frequency RBCs antigen.
- It's very expensive and available only in certain centers.
IRRADIATED RBCs

• Irradiation with gamma rays.

• Is used to:
  – Prevent GVHD after liver transplantation.
  – Symptomatic anemia in lymphoma of GIT.
  – After operations of GIT malignancies.
PLATELETS TRANSFUSION

INDICATION

• To control active bleeding or prevent hemorrhage associated with deficiency in platelet number or function.

• Dilutional thrombocytopenia in massive transfusion, 15-20 units of blood may significantly dilute platelets below haemostatic level.

• Qualitative platelet defect.
NB:

- Thrombocytopenia due to dysproteinemia and uremia is best treated by plasmapheresis and dialysis.
- In ITP, TTP and hypersplenism: platelet transfusion is not effective as the pathology will affect the transfused ones.
- Platelet transfusion should be repeated- every 3 days "half life 3-5 days"
- Platelet transfusion should be given for a defined need and in appropriate minimum amounts.
Dose:

- Platelet 60,000 - 80,000/ cmm, patients usually not bleed especially if bleeding time is less than 2 times of normal.
- Therapy: 50,000 - 80,000/ cmm.
- Prophylaxis: 10,000:- 20,000/ cmm.
- Preoperative: 50,000/ cmm.
- One unit/10 kgm- BW.

Outcome:

- Platelet increase 5,000 - 10,000 per unit.
GRANULOCYTE TRANSFUSION

• Indicated in severely neutropenic patients with granulocyte count < 500/ml, and documented sepsis that have proven resistant to at least 2 days of appropriate aggressive antibiotic therapy.
FRESH FROZEN PLASMA

• **INDICATIONS:**

1- Specific coagulation factor-replacement: -
   
   – Isolated factor V and XI deficiency.
   
   – AT III: deficiency: -

   Acquired:-
   
   - Liver dis.
   
   - Oral contraceptive.
   
   - DIC.
2- Multiple clotting factor deficiency:
   a- Severe liver disease esp:-
      • If patient is bleeding.
      • During maneuvers e.g. liver biopsy.
   b- Coumarin drug reversal.
   c- Massive transfusion.
   d- Acute DIC.

3- Treatment of TTP.

**Dose:** 12-15 ml/kgm BW.

Expected outcome: correction of PT or PTT to less than 1.5 x upper limit of normal.
Cryoprecipitate

- 20 ml bag contains:
- VIII 100u, VWF 40-70% Factor XIII and 150-250 mg. of fibrinogen

**Indication:**

- Factor XIII deficiency.
- Fibrinogen, deficiency
  - Congenital.
  - Liver disease.
  - DIC.
• Cryoprecipitate is the only available source of fibrinogen in a concentrated form.

• At present the major indication for the use of cryoprecipitate is fibrinogen replacement when it's associated with bleeding.
1- Albumin and plasma protein fraction

Composition:

- Albumin is available in 5% and 20-25% solutions.
- In both 96% of total protein is albumin.

5% solution:

a- 400 ml. bottle.

b- 5% albumin.

c- 150 mg/l sodium "Hypertonic" more crystalloid. Transfusion rate 10 ml/min

20-25 % solution:

a- 100 ml bottle.

b- 250 g/l albumin "Hyperoncotic".

c- Poor-salt and chloride, more colloid.

d- Transfusion rate 0.2-0.4 ml/min.
INDICATION:

5 % solution:
- Patient should be both hypovolemic and hypoproteinemic:
  - Hypovolemia following burn.
  - As a replacement fluid in plasma exchange.
  - Initially in hemorrhagic shock, whilst awaiting for blood.

20-25% solution:
- Hypoalbuminemia associated with severe peripheral edema in patients who can not tolerate fluid:
  - End stage liver disease.
  - Following large volume paracentesis.
- Nephrotic syndrome.

N.B.:
- 20-25% solution is a hyperoncotic solution, it has to be given slowly particularly in patients who are at risk of circulatory overload and not to be given undiluted to patients with dehydration.
2- Immunoglobulin:-

a) Human normal immunoglobulin (HNI)
   - HAV prophylaxis:
     - to travelers
     - post exposure.
   - HCV:
     - protection against ictric non A non B.
     - following needle stick exposure.

b) Specific immunoglobulin HBV.
   - Maternofetal transmission
   - Regular sexual contacts of carriers and cases of HBV
   - prophylaxis for known or suspected acute exposure to hepatitis B
<table>
<thead>
<tr>
<th>Source of possible infected material</th>
<th>Prophylaxis recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>❖ Known HBsAg-Positive</td>
<td>HBsIg given immediately and first dose of HBV vaccine (at different site)</td>
</tr>
<tr>
<td>❖ HBsAg status not Known but source is available</td>
<td></td>
</tr>
<tr>
<td>• Check HBsAg</td>
<td>Dose of HBsIg given: immediately whilst awaiting results.</td>
</tr>
<tr>
<td>▪ If positive</td>
<td>Commence vaccination:</td>
</tr>
<tr>
<td>▪ If negative</td>
<td>No further action:</td>
</tr>
<tr>
<td>✤ Source unknown and HBsAg status unknown</td>
<td>Dose of HBsIg.</td>
</tr>
</tbody>
</table>
Management of bleeding oesophageal varices in patients with chronic liver diseases.

A) Volume expansion:

- Insert one or two large bore cannulas, a central line may be indicated.
- Ensure fresh blood is available and order 4-6 units.
- Signs of volume depletion are managed by Volume expanders till blood is available.
- Crystalloids should be used carefully as sodium retention is usual and lead to ascites.
B) Blood Transfusion

- Acute GIT bleeding with shock is an indication for the use of whole blood.

- Rate of transfusion 400 ml/ 15-30m’ in moderate – severe hypotension, till patient is stable.

- Packed RBCs is used for stable patients and in sub acute blood loss.

- If there is continued bleeding with a platelet count below 50X10^9/ L, Platelet transfusion may be considered to control, variceal bleeding.

N. B: platelet count may show little increment in patients with splenomegaly.
• Fresh frozen plasma is indicated only if there is documented coagulopathy (prothrombin ratio >20).

• Provided blood volume is replaced and cardio respiratory function is adequate, Hb of 9 g/dl appear to be adequate. Giving red cells to try to raise Hb towards normal values may raise portal venous pressure.

• Coagulation factor concentrates may have a risk of thrombogenicity and should be used only with expert guidance.
• End points are:
  – systolic BP > 100mmHg.
  – CVP 8-15 cm H₂O
  – PTR <20.
  – Hb>9g/dl. - Ht 30-35%
  – Urine output >0 .5 ml / Kg/ hr.
# Fluids and blood products used in managing patients with acute non variceal gastrointestinal bleeding

<table>
<thead>
<tr>
<th>Severity</th>
<th>Clinical features</th>
<th>I.V infusion</th>
<th>End point</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Severe</strong></td>
<td>• History of collapse OR • Shock: - systolic Bp&lt;100 mmHg - pluse &gt;100/min</td>
<td>• <strong>Replace fluid:</strong> - Crystalloid (if blood lost up to 1 liter OR. - colloid (if blood lost is &gt; 1 liter) • Ensure red cells are available. • Use available emergency transfusion protocol • Transfuse red cells according to clinical assessment and Hb/Hct</td>
<td>• Maintain urine output &gt;0.5 ml/kg/hr and systolic Bp&gt;100 mmHg. • Maintain Hb above 9 g/dl</td>
</tr>
<tr>
<td><strong>Significant</strong></td>
<td>• Resting pulse &gt;100/min and/or Hb&lt;10g/dl</td>
<td>• Replace fluid order compatible red cells (4 units)</td>
<td>• Maintain Hb &gt; 9 g/dl</td>
</tr>
<tr>
<td><strong>Trivial</strong></td>
<td>• pulse and Hb normal</td>
<td>• Maintain IV access until diagnosis is clear • Send patient sample for red cell group and antibody screen</td>
<td></td>
</tr>
</tbody>
</table>
1- Acute reactions:

A- Febrile nonhemolytic reactions:

- This is characterized by post transfusion rise of 1°C in absence of hemolysis.
- It is due to antibodies stimulated by previous transfusion against antigens on donor lymphocytes, granulocytes and platelet.
- Clinically:
  - Flushing, palpitation, tachycardia, cough, chest discomfort.
  - ↑DBP, headache, fever, rigors
- First time reaction: slow: drip rate, warm drink, aspirin, sedative if needed.
- Recurrent reaction: use granulocyte depleted RBCs.
B- Acute hemolytic transfusion reaction:

- Complement mediated lysis of donor RBCs in intravascular hemolysis and extra-vascular hemolysis in liver and spleen.
- This is due to anti A, anti B, anti Lewis in recipient plasma.
- CI/P:
  - Fever, nausea, vomiting, chest pain.
  - Restless, discomfort at infusion site.
  - ↓ Bl.P, D.I.C.
  - Loin pain and renal impairment.
- Treatment:
  - Stop transfusion immediately.
  - I.V. saline
  - Recheck the unit of bl.
  - I.V.: mannitol, diuretics to increase urine output >100ml/kg.
  - Hemodialysis.
C- Transfusion related acute lung injury:

- Acute resp. distress in absence of primary heart failure.
- This is due to passive infusion of donor antibody directed against recipient leucocytes, followed by release of toxic material and ↑capillary permeability

- **C I P:**
  - Fever, chest pain, dyspepsia.
  - Cyanosis, cough hemoptysis.
  - Hypoxemia 1-4 hrs post transfusion.
  - X-ray: pulm. Infiltrate, non cardiogenic pulm oedema.

- **Rx:**
  - Stop transfusion.
  - Mechanical resp. support.
  - Prophylaxis.
D- Allergic reactions:

- This is due to interaction between donor plasma proteins and recipient IgE antibody.

- **CI/P:**
  - Chest, lumbar pain.
  - Facial flushing
  - Generalized urticaria.
  - Laryngeal and facial oedema.
  - Bronchospasm.
  - Anaphylactic reaction in IgA deficient.

- **Rx:**
  - Use I.V adrenaline.
  - Prophylaxis in recurrent cases
  - use washed RBCs.
E- Circulatory overload:

- Occur in cases of impaired myocardial reserve.

- **Rx:** stop transfusion
- IV frusemide.
- $O_2$ inhalation.
- Rotating venesection.
F- Bacterial sepsis:

- Due to transfusion of infected bl or platelets.
- **CI/P:**
  - toxemia, fever, rigors and G.I.T upsets
  - Pain along the vein, after transfusion of 50-70ml.
- **Rx:**
  - Stop transfusion
  - Bl c/s.
  - Proper antibiotics.
G- Thrombophlebitis:

- Occurs when dextrose or saline is used in addition to blood.
- Common with cutdowns.
- In cases with prolonged transfusion.
- More with plastic canula than with metal needles.
H- Complications of massive transfusion:

- **Bleeding complication:** dilutional thrombocytopenia, consumption coagulopathy.

- **Hypocalcemia:** due to citrate in the bl.

- **Hyperkalemia:** esp. transfusion of old RBC.

- **PH abnormalities:** citrate metabolism $\rightarrow\uparrow$ lactic acid $\rightarrow\downarrow$ PH

- **Hypothermia:** cold bl. $\rightarrow$ myocardial depressant effect $\rightarrow$ cardiac arrest esp. with $\downarrow$Ca, $\uparrow$K.

- **ARDS:** due to massive transfusion

**Rx:**

- Replace platelet and coagulation factors.
- Ca and K replacement.
- Correction of PH abnormalities.
2- Delayed transfusion reactions

- **Delayed hemolytic transfusion reaction**
  - It is due to alloantibody mediated RBC destruction which manifest one week after transfusions.
  - **Cl/P:** triad: anemia, fever, jaundice after transfusion.
  - **Rx:** rarely needed.
• **Iron overload:**
  
  – Endocrine, cardiac and liver dysfunction occur in adults who receive 60-120U of bl.

  – **Rx:**

    • iron chelation therapy
    • Use fresh units
    • Extend transfusion interval.
    • Decrease the frequency of transfusion.
Cont.

• **Post transfusion purpura:**
  – Profound thrombocytopenia 5-9 days post transfusion, due to transfused antibodies against antigen on recipient platelet.
  – Other causes of the thrombocytopenia should be excluded.
  – Clinical awareness is required

  – **RX:**
    • Mild forms: no action is needed.
    • Life threatening:
      – High dose steroids
      – Plasma pharesis
      – High dose IV immunoglobulins
• Transfusion transmitted diseases

A) Viruses

– Plasma borne
  • Hepatitis A (HAV)
  • Hepatitis B (HBV) and Delta agent.
  • Hepatitis C (HCV)
  • AIDS: HIV-1, HIV-2

– Cell-associated
  • CMV.
  • EBV.
  • HTLV-I & ATLV.

B) Parasitic infection:

• Malaria: can be detected 7-50 days post transfusion.
• Chagas dis: T.cruzi,
• Toxoplasmosis.

C) Bacteria

• Syphilis (Treponema).
• Brucellosis (Brucella)
• Graft versus host dis.

• Immunosuppressive effect of bl. transfusions.
Total Parenteral Nutrition (TPN)
A) Indications:

- TPN for nutritional repletion e.g.
  - GIT malignancy
  - Preoperative
  - Adjuvant to chemotherapy and radiotherapy.

- Bowel rest:
  - Crohn’s disease.
  - Inflammatory colitis.
  - Short bowel syndrome.
  - Severe pancreatitis.
B) Initiation of TPN:

• Verify correct location of the catheter tip.
• Infuse no more than 1000ml of amino acid- dextrose in the first 24 hrs.
• Monitor carefully for hyperglycemia
C) Example formulas:

- Glucose amino acid combination.
- **Lipid emulsion**: co-infused to increase non protein calories.
- **Major minerals**: provided in the range of daily requirement esp. K.
- **Trace minerals**: are added to one TPN bottle daily. Zinc 0.8 – 4 mg, Copper 0 – 2 – 1 mg, Manganese (0.1 – 0.5 mg), Chromium (2 – 10 mg).
- **Iron**: 1ml iron dextran (50 mg elemental iron), IM or IV every month
- **Vitamins**:
  - One vial (10ml) daily vitamine combination added to dextrose amino acid combination.
  - Vit K 5mg /w IM.
  - $B_{12}$ 200 -500 µgm/month, if not included in the multivitamin preparation.
## Nutrients delivered in total parenteral nutrition for adults:

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Daily parenteral supplement</th>
<th>Nutrient</th>
<th>Daily parenteral supplement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (ml/kg)</td>
<td>30 (1 ml/kcal)</td>
<td>Vitamins&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Calories&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25-45 kcal/kg</td>
<td>A</td>
<td>3300 IU</td>
</tr>
<tr>
<td>Protein</td>
<td>0.6-1.5 gm/kg</td>
<td>D</td>
<td>200 IU</td>
</tr>
<tr>
<td>Linoleic acid</td>
<td>4% of calories</td>
<td>E</td>
<td>10 IU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C</td>
<td>100 mg</td>
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<tr>
<td>Major minerals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td>50-250 mEq</td>
<td>Thiamine (B&lt;sub&gt;1&lt;/sub&gt;)</td>
<td>3 mg</td>
</tr>
<tr>
<td>K</td>
<td>30-200 mEq</td>
<td>Riboflavin (B&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>3.6 mg</td>
</tr>
<tr>
<td>Cl</td>
<td>50-250 mEq</td>
<td>Pantothenic acid (B&lt;sub&gt;3&lt;/sub&gt;)</td>
<td>15 mg</td>
</tr>
<tr>
<td>Ca</td>
<td>10-20 mEq</td>
<td>Niacin (B&lt;sub&gt;6&lt;/sub&gt;)</td>
<td>40 mg</td>
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<tr>
<td>Mg</td>
<td>10-30 mEq</td>
<td>Pyridoxine (B&lt;sub&gt;6&lt;/sub&gt;)</td>
<td>4 mg</td>
</tr>
<tr>
<td>P</td>
<td>10-40 mmol</td>
<td>Biotin (B&lt;sub&gt;7&lt;/sub&gt;)</td>
<td>60 µg</td>
</tr>
<tr>
<td>Other minerals</td>
<td></td>
<td>Folacin (B&lt;sub&gt;9&lt;/sub&gt;)</td>
<td>400 µg</td>
</tr>
<tr>
<td>Zn</td>
<td>2.5-4 mg</td>
<td>Cobalamin (B&lt;sub&gt;12&lt;/sub&gt;)</td>
<td>5 µg</td>
</tr>
<tr>
<td>Cu</td>
<td>0.5-1.5 mg</td>
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<tr>
<td>Cr</td>
<td>10-15 µg</td>
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</tr>
<tr>
<td>Mn</td>
<td>0.15-0.8 mg</td>
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<tr>
<td>Fe</td>
<td>50 mg/month</td>
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<tr>
<td>I</td>
<td>50-75 µg</td>
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<td>Se</td>
<td>120µg</td>
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</tbody>
</table>
D) Monitoring during stable TPN:

- Vital signs 4 times daily, weight daily, intake and output daily.

- Check urine and blood for glucose.

- Measure electrolytes, BUN.

- Monitor S. Ca, Mg and P. weekly.

- Liver enzymes and S. bilirubin weekly.

- Follow blood counts, serum albumin, prothrombin time.
Complications of TPN

1- Metabolic:
   - Hyperglycemia and hyperosmolarity.
   - Hypoglycemia.
   - Electrolyte abnormalities. Vitamine deficiencies.
   - Elevation of BUN.
   - Hypercapnia.
   - Reactions to lipid emulsion.
   - Liver dysfunction.
   - Metabolic bone disease.

2- Non metabolic complications:
   - Complications related to catheter placement.
   - Venous thrombosis.
   - Catheter infection.
Thank you