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.

Cont.

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.

Cont.

- 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.

Cont.

- 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 sever 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 .

Component Therapy

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.

Cont.

NB:

- Thrombocytopenia due to dysproteinemia and uremia is best treated by plasmapharesis 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.

Cont.

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.

Cont.

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.

Cont.

- 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.

PLASMA DERIVATIVES

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

cont

Source of possible infected material	Prophylaxis recommended
❖ Known HBsAg-Positive	HBsIg given immediately and first dose of HBV vaccine (at different site)
❖ HBsAg status not Known but source is available • Check HBsAg ▪ If positive ▪ If negative	Dose of HBsIg given: immediately whilst awaiting results. Commence vaccination: No further action:
❖ Source unknown and HBsAg status unknown	Dose of HBsIg.

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 .

Cont.

- 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 .

Cont.

- End points are:
  - systolic BP > 100mmHg .
  - CVP 8-15 cm H_2O
  - 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

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

Adverse reactions to blood transfusion

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, asprin, sedative if needed.
- Recurrent reaction: use granulocyte depleted RBCs.

Cont.

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.

Cont.

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
- **Cl 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.

Cont.

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.
- **Cl/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.

Cont.

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 →↑ lactic acid →↓ PH
- **Hypothermia:** cold bl.→ myocardial depressant effect → cardiac arrest esp. with ↓Ca, ↑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.
  - **CI/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)
  - HepatitisB (HBV) and Delta agent.
  - Hepatitis C (HCV)
  - AIDS: HIV-1, HIV-2
- **Cell-associated**
  - CMV.
  - EBV.
  - HTLV-! & ATLV.

B) Parasitic infection:

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

C) Bacteria

- Syphilis (Treponema).
- Brucellosis (Brucella)

Cont.

- **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

Cont.

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:

Nutrient	Daily parenteral supplement	Nutrient	Daily parenteral supplement
Water (ml/kg)	30 (1 ml/kcal)	Vitamins[b]	
Calories[a]	25-45 kcal/kg	A	3300 IU
Protein	0.6-1.5 gm/kg	D	200 IU
Linoleic acid	4% of calories	E	10 IU
Major minerals		C	100 mg
Na	50-250 mEq	Thiamine (B_1)	3 mg
K	30-200 mEq	Riboflavin (B_2)	3.6 mg
Cl	50-250 mEq	Pantothenic acid (B_3)	15 mg
Ca	10-20 mEq	Niacin (B_5)	40 mg
Mg	10-30 mEq	Pyridoxine (B_6)	4 mg
P	10-40 mmol	Biotin (B_7)	60 µg
Other minerals		Folacin (B_9)	400 µg
Zn	2.5-4 mg	Cobalamin (B_{12})	5 µg
Cu	0.5-1.5 mg	K	5 mg/week
Cr	10-15 µg		
Mn	0.15-0.8 mg		
Fe	50 mg/month		
I	50-75 µg		
Se	120µg		

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