National Guidelines for the Clinical Use of Blood and Blood Products

National Blood Service, Ghana

National Guidelines for the Clinical Use of **Blood and Blood Products** in Ghana

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WHO Country Office Accra, Ghana.

Coordinator
Dr. Justina K. Ansah, Director NBS

Participants in consensus workshop for development of Guidelines

Prof. G. Ankra-Badu	Consultant Haematologist, KBTH
Dr. Ivy Ekem	Consultant Haematologist, KBTH
Dr. M. Lartey	Consultant Physician, KBTH
Dr. E. Aniteye	Consultant Anaesthetist, KBTH
Dr. E. Kossko	Consultant Anaesthetist, KATH
Dr. G. Arthur	Obstetrician Gynaecologist, KBTH
Dr. V.N. Addo	Obstetrician Gynaecologist, KATH
Dr. S. Deganus	Obstetrician Gynaecologist, Tema General Hospital
Dr. K. Tete	Obstetrician Gynaecologist, Koforidua Gov't Hospital
Dr. C Enweronu	Consultant Paediatrician, KBTH
Dr. T. Rettig	Consultant Paediatrician, KATH
Dr. H. Aduful	Consultant Surgeon, KBTH
Dr. G. Nyamuame	Consultant Surgeon, Ho Gov't Hospital
Prof. Addae Mensah	Consultant Surgeon, KATH
Dr. A. O. Addo	Orthopaedic Surgeon, KBTH
Dr. Quansah	Orthopaedic Surgeon, KATH
Mrs. Amah Nkansah	Clinical Pharmacist, KBTH
Mr. Anthony Mensah	Clinical Pharmacist, KATH
Dr. S. Ayirakwa	D.D.H.S, Nsawam Gov't Hospital
Dr. Ben Aflakpui	D.D.H.S, Winneba Gov't Hospital
Dr. S K. Akpablie	D.D.H.S, Saltpond Gov't Hospital

Dr. Ruth Owusu	Medical Officer, Accra Area Centre, NBS
Dr. R. Amenyah	General Practitioner, St. Martin's Hospital, Agomanya
Dr. K. Setsoafia	General Practitioner, Suhum Gov't Hospital
Dr. J. Doe	General Practitioner, Battor Catholic Hospital

Members of the Technical Working Group on 'Safe Clinical Transfusion Practice'

Prof. J. K. Acquaye	Consultant Hematologist, KBTH
Dr. Nelson Damale	Consultant Obstetrician/Gynaecologist, KBTH
Dr. C Enweronu Laryea	Consultant Paediatrician, KBTH
Dr. Ivy Ekem	Consultant Haematologist, KBTH
Dr. E. Aniteye	Consultant Anaesthetist, KBTH
Dr. Justina K. Ansah	Director, NBS
Dr. Lucy Asamoah-Akuoko	Head, Accra Area Blood Centre, NBS
Dr. Shirley Owusu-Ofori	Head, Transfusion Medicine Unit, KATH

Editors

Dr. Ivy Ekem	Consultant Haematologist, KBTH
Dr. Justina K. Ansah	Director NBS

Reviewers

Prof. J. K. Acquaye	Consultant Haematologist, KBTH
Prof. G. Ankra-Badu	Consultant Haematologist, KBTH
Dr. E. A. Boateng	Consultant Haematologist, KBTH

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FOREWORD

Blood Transfusion, although lifesaving, can be associated with life-threatening or even fatal consequences. With the scourge of HIV/AIDS, the need to streamline and strictly control blood collection, screening, storage, distribution and use becomes more pertinent. This role is spear-headed by the National Blood Service.

The establishment of the National Blood Service and Blood Policy to guard/guide all blood users demands the support of every citizen to meet the cardinal goals of:-

1. 100% collection of blood from voluntary non remunerated blood donors from low risk population.
2. Appropriate screening of all donated blood.
3. Appropriate clinical use of blood and blood products only when absolutely indicated, and the use of simple alternatives such as crystalloids or colloids wherever possible.

The bulk of the nation's blood still goes to women and children. Anaemia in this group and the general population as a whole should be prevented at the Primary, Secondary and Tertiary levels by:-

1. Good nutrition, food supplementation, prophylactic iron and folate therapy.
2. Strengthening of laboratories to give quick, reliable and accurate full blood count (FBC) and to aid diagnosis when indicated
3. Quick and adequate management of malaria, worm infestation and anaemia especially in pregnancy.
4. Use of autologous blood transfusion, meticulous haemostasis including the use of diathermy during surgery and active management of the third stage of labour to reduce haemorrhage

Education to all sectors of the community, and at every opportunity, should be the constant preoccupation of all health workers.

This booklet is meant as a guide to blood users in the situation where blood must be given to save life or to reduce morbidity.

INTRODUCTION

Over 5-10% of blood and blood products such as concentrated red cell (CRC), fresh frozen plasma (FFP), cryoprecipitate and platelet concentrate (PC) may be infective for one agent or the other. These agents may be viral (e.g. Human Immunodeficiency Virus (HIV), Hepatitis B, Hepatitis C and Cytomegalovirus), bacterial (e.g. syphilis) or protozoan (e.g. malaria). Transfusion of blood and its products therefore must be taken seriously and only prescribed when strongly indicated, where there is no other alternative and where withholding blood will jeopardize life or prolong morbidity.

It is to this end that these guidelines have been drawn, based on personal experiences, guidelines of the World Health Organization (WHO) and views of practising clinicians stated in text books and articles.

The proceedings of a one-day national consensus workshop to review the national policy and guidelines on the clinical use of blood and blood products, is the basis of this booklet. The above workshop held on Monday 12th November 2001 at the conference room of the National Cardiothoracic Centre, Korle Bu was organised by the National Blood Service and sponsored by the WHO country office. Thirty clinicians and pharmacists in relevant areas of blood usage were drawn from the Korle Bu and Komfo Anokye teaching hospitals and selected regional and district hospitals in the country. The first edition of the Guidelines was printed in January 2002.

The Health Services Rehabilitation Project (HSRP) II of the Ministry of Health focuses on “Support to Blood Services” as its second component. Under this component, a Technical Working Group on Safe Clinical Transfusion Practice was constituted in July 2009 and tasked to review and update the Guidelines as part of its Terms of Reference.

The working group, comprising Blood Transfusion Specialists, Consultants in Haematology, Obstetrics and Gynaecology, Paediatrics and Anaesthesia; executed the task by circulating the guidelines among specialists in the respective clinical specialties, reviewing comments and inputs that were received and updating the entire document.

The current version was completed in July 2009. The chapter on transfusion in Child Health (chapter 3) has been extensively reviewed, as well as updates on autologous transfusion and some aspects of transfusion in general medicine.

1 TRANSFUSION OF BLOOD AND BLOOD PRODUCTS

1.1 ETHICAL CONSIDERATIONS

Written consent of patients/guardians for blood transfusion should be sought before blood/blood products transfusion, after the condition and other therapeutic options had been explained. Consent forms should be available on all wards. Refer appendix I for sample of consent form.

1.2 SOME FACTS AND FIGURES

1.2.1 Blood volume

NEONATES	85-90ml/kg body weight
CHILDREN	80ml/kg body weight
ADULTS	70ml/kg body weight

An adult male of 70kg has approximately 5 litres of blood and an adult female of about 60kg has about 4.2 litres of blood. Loss of half litre of blood causes a fall of haemoglobin (Hb) of about 1.5g/dl. Transfusion of one unit of blood raises the haemoglobin by 0.8 to 1g/dl.

1.2.2 Volume of blood/blood products to transfuse

1.2.2.1 Children

A. Whole blood

[required increment in Hb g/dl] x 5 x [child's weight in kg]

i.e. 5ml per Hb rise expected per kg body weight

Example: For a 10kg child with Hb 4.0g/dl, if expected Hb is 10g/dl, then the deficit is 6g/dl; and volume of whole blood required is 6x5x10 = 300ml.

B. Concentrated Red Cells

[required increment in Hb g/dl] x 3 x [child's weight in kg]

i.e. 3ml per Hb rise expected per kg body weight

Example: For a 10kg child with Hb 4.0g/dl, if expected Hb is 10g/dl, then the deficit is 6g/dl; and volume of concentrated red cells required is 6x3x10 = 180ml.

Note: use 4ml instead of 3ml when using sedimented cells.

1.2.2.2 Adults

A. Whole blood/concentrated red cell

Generally 4ml per kg body weight raises venous Hb by about 0.8-1g/dl.

Whilst the dose should be matched to patient's size and blood volume, the amount given should be sufficient to raise patient's Hb level to relieve hypoxia.

B. Blood products

i. Fresh frozen plasma

Dosage – Initial dose of 15-20ml/kg. Further therapy is dependent on clinical response and laboratory monitoring (PT, APTT).

ii. Cryoprecipitate

Dosage – Initial dose of 10-15 packs (1.5-2.0 packs/10kg body weight). Further therapy is dependent on clinical response and laboratory monitoring (PT, APTT, fibrinogen level).

iii. Platelet concentrate

10ml/kg body weight for neonate or small child.

1 platelet concentrate pack/10kg body weight in an adult should raise the platelet count by 20-40 x 10^9/L.

1.3 BLOOD LOSS AND THERAPEUTIC OPTIONS IN BLOOD REPLACEMENT

The amount of blood lost and the patient's clinical condition will determine the urgency of treatment, the choice of product and the volume to be replaced.

A loss of 20% blood volume in a healthy adult is generally tolerable and requires no replacement.

A 20-30% loss in a healthy adult requires volume replacement using volume expanders; this is about 1.5L in a 60kg female.

More than 30% volume loss may lead to shock. This requires urgent volume replacement and may require blood.

The initial critical decision involves use of plasma expanders instead of blood.

They are immediately available, are relatively inexpensive and do not have most of the dangers associated with the use of whole blood. In addition blood is rarely necessary in the initial stages of treatment of hypovolaemia. Plasma expanders are of two classes; crystalloids and colloids.

1.3.1 Crystalloids and colloids available for volume replacement

1.3.1.1 Crystalloids

- Perfectly satisfactory as the sole replacement fluid for small losses (up to 20% blood volume replacement) in fit adults.
- Used as supplement to red cell concentrate transfusion during surgery or trauma.
- As initial therapy for resuscitation after major haemorrhage and other extracellular fluid losses.
- Leave the circulation into the interstitium rapidly, hence infuse at least three (3) times the blood volume lost.
- Infection risk is nil.
- Cautious use in situations where local oedema may aggravate pathology: e.g. head injury.
- May precipitate volume overload and heart failure when large volumes are used especially in older or elderly patients.

A. Normal saline

- High chloride content (45 mmol more than Ringer's lactate).
- May cause hyperchloraemic acidosis thus worsening tissue acidosis that occurs in the setting of hypovolaemic shock (serious in impaired renal function).

B. Ringer's lactate (RL):

- A buffered solution.
- Designed to simulate the intravascular plasma electrolyte concentration.
- Prolonged infusion of RL may cause acidosis in predisposed patients (since unmetabolised lactate can be converted to lactic acid).

1.3.1.2 Colloids

- Balanced salt solutions containing large oncotically active molecules which are derived from natural products i.e. proteins (albumin), carbohydrate (dextran, starches) and animal collagen (gelatin).
- Their concentration in the solution infused is of the greatest importance for the effect on fluid distribution between the various body compartments as well as the degree of blood volume expansion.
- Optimal concentration: 2%-4%; 3.5% and 6% superior to 10%.
- 3.5% and 6% colloid solutions are more effective than electrolyte solutions.
- Almost all of them carry a risk of allergic or anaphylactoid reactions and clotting abnormalities, therefore blood for grouping and crossmatching should be taken first before infusion.
- These largely stay in circulation and hence can be used to replace blood volume for volume. For each type of colloid, there is a maximum volume that must not be exceeded in a day.
- Infection risk is nil.

They include:-

A. Synthetic colloids

i. Dextran 70

- Dosage should not exceed 20ml/kg body weight in the first 24hrs and then 10ml/kg body weight/day for the next three days.
- Platelet aggregation may be inhibited with a transient increase in bleeding time.

- Contraindicated in patients with pre-existing disorders of haemostasis.

ii. Gelofusine

- Dosage should not exceed 1.5 litres in the first 24 hours.
- Contraindicated in patients with established renal failure.
- Infusion may be followed by marked osmotic diuresis.

iii. Haemaccel

- Dosage should not exceed 2 litres in the first 24 hours.
- Do not mix with citrated blood because of high calcium concentration.
- Can be given however at the same time as blood transfusion using a separate IV infusion set.
- Contraindicated in patients with established renal failure.
- Can be infused rapidly in case of hypovolaemic shock without ill effect.

iv. Hydroxyethyl starch

- Has very little chance of causing hypersensitivity reactions
- Dosage should not exceed 30-50ml/kg in 24hrs
- May aggravate bleeding in the susceptible
- May also aggravate acute renal failure

B. Plasma derived (natural) colloids

i. 5% albumin

- No risk of transmission of viral infection if correctly manufactured.
- Dose depends on size of patient, severity of trauma, continuing fluid and protein loss as well as response to treatment (refer to information leaflet)
- Infuse 5-16ml/min for adults or 5-10ml/min for children.
- No compatibility testing required and no filter needed.
- Has fallen into disuse because of cost.

1.4 GENERAL CONSIDERATIONS

1.4.1 Clinical features of acute blood loss

Clinical features of acute haemorrhage are largely determined by:-

- Amount and rate of blood loss.
- Patient's compensatory response.

Signs and symptoms

- Thirst
- Tachycardia
- Reduced blood pressure
- Decreased pulse pressure
- Cool, pale, sweaty skin
- Increased respiratory rate
- Reduced urine output
- Restlessness or confusion

1.4.2 Clinical features of chronic anaemia

Signs and symptoms

- Tiredness/lack of energy
- Light headedness/dizziness or syncopal attacks
- Blackouts
- Shortness of breath/air hunger
- Ankle swelling
- Palpitations
- Headache
- Worsening of any pre-existing symptoms e.g. angina
- Exercise intolerance
- Pale mucous membranes
- Rapid breathing
- Tachycardia
- Raised jugular venous pressure
- Heart murmurs
- Ankle oedema
- Postural hypotension
- Altered mental state
- Heart failure

1.4.3 General indications for red cell replacement

Situations requiring blood transfusion are limited and well defined.

A. Acute anaemia with symptoms and signs of cerebral anoxia or imminent cardiac failure.

i. Blood loss

- Accident/Trauma
  - External bleeding.
  - Internal bleeding: traumatic e.g. chest, spleen, pelvis, femur.
  - Internal bleeding: non traumatic e.g. bleeding peptic ulcer, varices, ruptured ectopic pregnancy, ante partum haemorrhage, ruptured uterus.
- Surgery
- Disseminated intravascular coagulation (DIC)
- Obstetric complications

ii. Acute haemolysis

- Intravascular haemolysis e.g. glucose 6-phosphate dehydrogenase (G6PD) deficiency
- Malaria
- Hyperhaemolytic crisis e.g. sickle cell anaemia
- Immune haemolysis e.g. drugs, autoimmune

iii. Sequestration crisis in sickle cell anaemia and severe hypersplenic states.

iv. Aplastic crisis in sickle cell anaemia.

B. Chronic anaemia with symptoms and signs of cerebral anoxia or imminent cardiac failure. Chronic anaemia may arise from:

i. Malnutrition.

ii. Duodenal ulcers, haemorrhoids or other GIT bleeds.

iii. Bone marrow failure as occurs in aplastic anaemia, anaemia of chronic disorders etc.

iv. Chronic haemolytic anaemia, e.g. sickle cell disease (SCD), thalassemia.

v. Hookworm/schistosomiasis infection.

vi. Chronic inflammation/infection.

vii. Chronic renal failure.

viii. HIV/AIDS.

ix. Vitamin B12 deficiency.

Please note:

- Patients with chronic anaemia may have few symptoms, but chronic anaemia increases the need for transfusion when the patient experiences sudden loss of red cells from bleeding or haemolysis or during pregnancy or child birth.
- Iron deficiency is the commonest cause of chronic anaemia, however a patient's anaemia may have several causes e.g. nutritional deficiency, malaria, HIV, parasitic infestation, haemoglobin disorder or malignancy.
- Transfusion is rarely needed for chronic anaemia. Many transfusions are given that do not benefit the patient, could do harm and could have been avoided. Simple preventive measures can greatly reduce the prevalence of iron deficiency anaemia and reduce the need for transfusion.
- In endemic malaria areas, there is a high risk of transmitting malaria by transfusion. It is therefore important to give the transfused patient routine treatment for malaria.

1.5 Alternatives to transfusion of donor blood

1.5.1 Autologous blood transfusion

- Autologous transfusion involves the collection and subsequent reinfusion of the patient's own blood or blood products.
- It should only be considered where sufficient blood loss to require a transfusion has occurred or is anticipated to occur although, in emergency, it may be the only readily available source of blood for transfusion.
- Different methods of autologous transfusion can be used alone or in combination to reduce or eliminate the need for allogeneic blood.

A. Preoperative autologous blood donation (PABD)

Preoperative blood donation involves the collection and storage of the patient's own blood prior to elective surgery.

i. A unit (450ml) of the patient's own blood is collected every seven days (weekly) in the period leading up to surgery.

ii. The blood is tested, labelled and stored to the same standard as allogeneic blood and the patient is prescribed oral iron supplements.

iii. This blood can be stored for up to five (5) weeks using standard hospital blood bank conditions.

iv. On the date of operation, up to 4-5 units of stored blood are then available if transfusion becomes necessary during the procedure.

v. Before re-transfusion, autologous blood units must be ABO and Rh D grouped and compatibility checked.

Patients suitable to predonate their own blood for surgery are those in whom:

- Operation scheduled is likely to need red cell transfusion.
- Date for surgery is fixed, so blood does not become outdated.
- Attendance for blood collection is possible.
- Initial haemoglobin ≥ 11 g/dl (both male and female).
- There is sufficient time before surgery to donate at least 2 units of blood.

B. Acute normovolaemic haemodilution (ANH)

Acute preoperative normovolaemic haemodilution involves:

- The removal of a predetermined volume of the patient's own blood immediately prior to the commencement of surgery.
- Its simultaneous replacement with sufficient crystalloid or colloid fluids to maintain the blood volume.

During surgery, the haemodiluted patient will lose fewer red cells for a given blood loss and the autologous blood collected can subsequently be reinfused, preferably when surgical bleeding has been controlled.

The fresh units of autologous blood will contain a full complement of coagulation factors and platelets.

Precautions

i. Exclude unsuitable patients, such as those who cannot compensate for the reduction in oxygen supply due to haemodilution.

ii. Carefully assess the volume of blood to be removed and replace with crystalloid (at least 3 ml for every 1 ml blood collected), or colloid (1 ml for every 1 ml collected).

iii. Monitor the patient carefully and maintain blood volume and oxygen delivery at all times, particularly when surgical blood loss occurs.

C. Blood salvage (intra-operative/post-operative)

Blood salvage involves the collection of shed blood from a wound, body cavity or joint space and its subsequent reinfusion into the same patient. It can be used both during elective surgery (e.g. cardiothoracic procedures) and in emergency or trauma surgery (e.g. ruptured ectopic pregnancy or ruptured spleen).

Contraindications

i. Blood contaminated with bowel contents, bacteria, fat, amniotic fluid, urine, malignant cells or irrigants.

ii. Reinfusion of salvaged blood which has been shed for more than 6 hours: the transfusion is likely to be harmful since there will be

haemolysis of red cells, hyperkalaemia and a risk of bacterial contamination.

Although manual collection systems have been used in the past, automated suction collection system is the method of choice. These commercially available systems, often called cell-savers, collect, anticoagulate, wash, filter, and re-suspend red cells in crystalloid fluid prior to reinfusion.

D. Hypervolaemic haemodilution

Hypervolaemic haemodilution involves the in vivo dilution of erythrocytes by creating hypervolaemia with asanguinous fluids in an attempt to reduce erythrocyte loss.

Indicated when blood loss is expected to be >10ml/kg or 1000ml.

IV fluids are given fast to reduce the Haematocrit to about 25%; Fluids at 40ml/kg,

Contraindications

i. Elderly patients with poor cardio-respiratory reserve

ii. Patients with cardiac disease

iii. Patients with fixed cardiac output states

1.5.2 Antifibrinolytic drugs

Tranexamic acid has been used to reduce blood loss in surgical patients. This reduces allogeneic transfusion requirement in cardiac by-pass surgery.

1.6 What to do before transfusion of blood (Pre-transfusion)

1.6.1 Investigations/procedures before transfusion

i. Examine for clinical features of acute decompensated anaemia in adults.

ii. Baseline checks – Pre-transfusion full blood count (FBC) + blood films + malaria parasites (mps) + sickling.

iii. Start investigations for suspected underlying condition.

The pre-transfusion haemoglobin (Hb) must be known before red cell transfusion is requested. When this is not possible blood should be drawn for Hb estimation at the same time that blood is drawn for the grouping and crossmatching.

Before deciding to transfuse remember:-

The amount of blood lost and the patient's clinical condition will determine the urgency of treatment, the choice of product and the volume to be replaced.

The initial critical decision involves use of plasma expanders (crystalloids or colloids) instead of blood (refer page 5). Volume replacement is more urgent than red cell replacement in acute blood loss.

A decision should be taken on how much blood is to be given. This is easy to estimate when there is no bleeding or bleeding has stopped 24 hours previously and the patient's haemoglobin is known.

In cases where bleeding continues only a rough estimate can be made.

1.6.2 Transfusion in severe (decompensated) anaemia

i. Do not transfuse more than necessary. If one unit of red cell is enough to correct symptoms, do not give more units. There are few situations however when a single unit transfusion may be appropriate. Remember that:-

- The aim is to give the patient sufficient haemoglobin to relieve hypoxia.
- The dose should be matched to the patient's size and blood volume.

ii. Patients with severe anaemia may be tipped into cardiac failure by infusion of blood or other fluids. If transfusion is necessary, give one unit per day, preferably of red cell concentrate, over 2 to 4 hours and give a rapid acting diuretic (frusemide 40mg IV).

    Reassess the patient and, if symptoms of severe anaemia persist, give a further 1-2 units.

iii. It is not necessary to restore the haemoglobin concentration to normal levels. Raise it enough to relieve clinical symptoms.

iv. It is advisable to transfuse concentrated red cell (CRC) in cases of severe anaemia.

v. Transfuse whole blood (WB) only in acute blood loss with hypovolemia.

    In most patients with severe or life threatening anaemia, red cells transfusion may be an essential first line of treatment.

vi. In cases of disseminated intravascular coagulation (DIC), rapid treatment and removal of the cause, if possible is essential. Transfusion of red cells, fresh frozen plasma (FFP), cryoprecipitate and platelets may be required whilst the underlying cause is dealt with.

1.6.3 Management of the transfusion therapy

A. Acute blood loss

- Insert large IV cannula and obtain blood samples.
- Infuse crystalloids rapidly until an acceptable systolic blood pressure is restored.
- Manage other aspects of patient's condition (oxygen, maintain temperature, pain relief etc.).
- Request coagulation screen if necessary.
- Transfuse red cells to maintain adequate blood oxygen transport capacity.
- Achieve surgical control of bleeding.
- Pulse rate, systolic BP, pulse pressure should be regularly charted.

B. Whole blood, concentrated red cells, plasma and cryoprecipitate

- Use a new, sterile blood administration set containing an integral 170-200 micron filter.
- Change the set at least 12-hourly during blood component infusion.

C. Platelet concentrates

- Use a fresh blood administration set, primed with saline.

D. Time limits for infusion

	Start infusion	**Complete infusion**
Whole blood or red cells	Within 30 minutes of removing pack from refrigerator	Within 4 hours
Platelet concentrates	Immediately	Within 20 minutes
Fresh frozen plasma and cryoprecipitate	As soon as possible	Within 20 minutes

Blood should run faster if acute blood loss is being treated. The rate should be slow in cases of septic shock, cardiac failure, respiratory failure and in old people.

E. Recording the transfusion

The following information should be recorded in the patient's notes.

- Type and volume of each product transfused.
- Batch number of each unit transfused.
- Blood group of each unit transfused.
- Time at which the transfusion of each unit commenced.
- Time the transfusion is completed.
- Any adverse effect.
- Signature of the person administering the blood component.

1.6.4 Monitoring the transfused patient

A. For each unit of blood or blood products transfused, monitor the patient.

- Before starting the transfusion.
- As soon as the transfusion is started.
- 15 minutes after starting the transfusion.
- At least every hour during transfusion.
- On completion of the transfusion.
- 4 hours after completing the transfusion.

B. At each of these stages, record the following information on the patient's chart.

- Patient's general appearance
- Temperature
- Pulse
- Blood pressure
- Respiratory rate
- Fluid balance:
- - Oral and IV fluid intake
- - Urinary output.

4.5.5 What to do after transfusion of blood (Post-transfusion)

Record the process of transfusion, whether it was satisfactory or otherwise in the patient's folder. Fill attached form for the blood bank. (refer appendix II).

If there is a transfusion reaction, fill the appropriate form and return to the blood bank with the appropriate samples. (refer appendix IV).

After transfusion, check within 48 hours, the haemoglobin (Hb) for red cell transfusion, and within 24 hours the platelet count for platelets transfusion and coagulation profile for cryoprecipitate and FFP.

Post transfusion hepatitis can develop weeks or months later. Keep watch.

2 GENERAL/INTERNAL MEDICINE

2.1 CLINICAL DECISIONS ON TRANSFUSION

Clinical situations requiring blood transfusion are limited and well defined. Generally these are:

A. Acute anaemia with symptoms and signs of cerebral hypoxia or imminent cardiac failure

i. Bleeding
- Blood loss with symptoms of shock and cerebral hypoxia, e.g. gastro intestinal tract bleeding.
- DIC from severe septicaemia

ii. Acute haemolysis associated with cerebral hypoxia.
- Intravascular haemolysis e.g. glucose 6-phosphate dehydrogenase (G6PD) deficiency, malaria
- Hyperhaemolytic crisis e.g. sickle cell anaemia
- Immune haemolysis e.g. drugs, autoimmune
- Severe septicaemia

iii. Sequestration crisis in sickle cell anaemia and severe hypersplenic states.

iv. Aplastic crisis in sickle cell anaemia.

B. Chronic anaemia with symptoms and signs of cerebral hypoxia or imminent cardiac failure. Causes include:

i. Malnutrition

ii. Duodenal ulcers, haemorrhoids or other GIT bleeds

iii. Bone marrow failure as in aplastic anaemia, anaemia of chronic disorders etc.

iv. Chronic haemolytic anaemia

v. Hookworm/schistosomiasis infection

vi. Chronic inflammation/infection

vii. Chronic renal failure

viii. HIV/AIDS

ix. Vitamin B12 deficiency

2.2 INDICATIONS AND USE OF BLOOD AND BLOOD PRODUCTS

2.2.1 Transfusion in acute blood loss

Management of acute blood loss has already been dealt with. (refer to page 15).

2.2.2 Transfusion in acute haemolysis

In acute G6PD deficiency anaemia, avoid blood transfusion unless there is severe haemolysis when Hb continues to fall rapidly, in which case concentrated red cell should be given slowly to raise the Hb to about 8g/dl. An IV diuretic may be given at the same time if whole blood is used. Bed rest is very important in severe anaemia under treatment.

2.2.3 Transfusion in severe decompensated anaemia

Management in severe decompensated anaemia has already been dealt with. (refer page 14).

2.2.4 Transfusion in chronic anaemia

i. Deficiency anaemia: Transfuse only if there is cerebral hypoxia or incipient cardiac failure or Hb < 4g/dl. There is no need to raise the Hb higher than 7g/dl.

ii. Chronic anaemia not due to micronutrient deficiency: Transfuse only when Hb ≤ 5g/dl with symptoms and signs of cerebral hypoxia or imminent cardiac failure.

iii. Regular red cell transfusion may be essential in patients with myelodyplastic syndromes, chronic lymphocytic leukaemia, aplastic anaemia or malignant infiltration of the bone marrow. In this situation maintain Hb not less than 8.0g/dl. (refer page 10 for management of patients with chronic anaemia).

2.2.5 Transfusion in special clinical situations

A. Sickle cell disease patient in crisis

Indications for transfusion are more lax than in the general population since the Hb may drop suddenly or over a short time due to sequestration or acute haemolysis. Sickling of red cells and therefore

reduced tissue oxygenation may also be precipitated by fever, infection, pain etc.

Thus the indication for transfusing a sickle cell patient in crisis is not dependent on the Hb per se, but the clinical state, the progression of the disease, expected complications and outcomes etc. Example a sickle cell disease patient with malaria and intravascular haemolysis and a Hb of 7g/dl may require transfusion as part of the management.

Transfuse when Hb less than 5g/dl or 2g/dl below patients steady state Hb especially with sequestration and aplastic crisis.

Exchange transfusion is required in cases of cerebrovascular accidents (strokes) to reduce the HbS to less than 30%.

Blood for transfusion should be sickling negative.

B. The patient on cytotoxic treatment

Due to an anticipated fall in haemoglobin and platelet levels it is generally required that Hb should be $\geq$ 8g/dl and platelet $\geq$ $100x10^9$ before therapy.

C. The elderly

Their cardiac reserve is not optimal and waiting for Hb to fall to 5g/dl or below before considering transfusion may be detrimental.

In the elderly, patients with evidence of cardiac failure and in chronic deficiency anaemia with Hb < 4g/dl give one (1) unit concentrated red cell in three hours and transfuse not more than two (2) units a day.

D. Bleeding disorder due to factor VIII deficiency

Table 2-1: Dosage of Factor VIII and Cryoprecipitate for treatment of bleeding disorder due to factor VIII deficiency

Severity of bleed	*Purified factor VIII dose*	*Cryoprecipitate 80-100 IU pack*
Mild bleed (nose, gums etc.)	14 IU/kg	1 pack/6kg
Moderate bleed (joint, muscle, gastrointestinal tract), minor surgery	20 IU/kg	1 pack/4kg
Major bleed (e.g. cerebral)	40 IU/kg	1 pack/2kg
Prophylaxis for **major surgery**	60 IU/kg	1 pack/1kg

- For all categories of bleeds, repeat dose 12 hourly if bleeding persists or swelling is increasing. With more severe bleeds, it is necessary to continue treatment with half of total daily dose 12 hourly for 2–3 days or occasionally longer.
- For major surgery prophylaxis, start therapy 8 hours before surgery. Continue 12 hourly therapy for 48 hours post-operatively. If no bleeding occurs, scale down gradually over next 3–5 days.
- As adjunct to factor replacement in mucosal or gastrointestinal bleeding and surgery give fibrinolytic inhibitor, tranexamic acid (oral) 500-1000mg 3 times/day. Do **not** use for haematuria.
- In an emergency, if none of the above is available, use fresh frozen plasma (FFP) to treat bleeding disorders (give 3 units initially) after taking a sample of patient's blood for coagulation screen.
- Careful assessment of the patient's fluid intake is important to avoid fluid overload when using fresh frozen plasma or large doses of cryoprecipitate.

Desmopressin (DDAVP): 0.3-0.4µg/kg IV lasts for 4–8 hours and avoids the need to use plasma products. The dose can be repeated

every 24 hours, but the effect is reduced after some days of treatment. This is useful only in minor bleeds.

E. HIV infection

There is the need to accord the HIV infected patient the same safety precautions as all other patients e.g. patient grouping, crossmatching, investigating transfusion reaction etc.

Blood transfusion is usually required for chronic anaemia but acute anaemia may occur after the use of antiretroviral e.g. zidovudine

F. Bleeding due to non-immune thrombocytopenia

Indications for platelet concentrate transfusion are:

i. Bleeding - Serious spontaneous haemorrhage or clinical evidence of severe microvascular bleeding such as purpura or epistaxis with a platelet count below 50 x 10^9/L.

ii. Prophylaxis - Platelet count < 10 x10^9/L. Maintain platelet count above 20 x10^9/L. (each unit is expected to raise the platelet count by 5–10x10^9/L.

Transfusion may be necessary every 2–3 days.

Repeated Transfusions

If repeated transfusions are required, it is preferable to use leucocyte-reduced red cells and platelets wherever possible.

Quantity of Blood Transfused

Most adults who have to be transfused will require at least two units of blood and the practice of transfusing only one unit should be avoided unless absolutely necessary (refer item 1.6.2)

Alternatives to Blood transfusion

Where possible and practicable, alternatives to blood transfusion (e.g. the use of erythropoietin) should be considered as these may help to reduce the amount of blood required and also the adverse effects of blood transfusion.

3 CHILD HEALTH

Most cases of anaemia in children can be prevented by good nutrition, prevention and appropriate treatment of malaria, worm infestations and use of haematinics when indicated.

3.1 DEFINITIONS

3.1.1 Normal haemoglobin

Neonate	17 ± 3g/dl
1 month to 6 months	11 ± 2g/dl
7 months to 6 years	12 ± 1.5g/dl
7 years to 13 years	14 ± 1.5g/dl

3.1.2 Severe anaemia

Hb < 5g/dl in children.

Hb < 10g/dl in the newborn less than 1 week old.

3.1.3 Compensated anaemia

The anaemia develops slowly (chronic). If the child is pale but otherwise well, do not transfuse. Investigate for the cause of anaemia or any other illness and treat appropriately. Monitor the child for clinical signs of decompensation and worsening anaemia.

3.1.4 Decompensated anaemia

A child with decompensated anaemia will have one or more of the following:-

- Respiratory distress (laboured breathing, grunting, flaring of nostrils).
- Difficulty in feeding.
- Signs of congestive heart failure (increased heart rate, air hunger, and hepatomegaly).
- Change in mental status (restlessness, agitation)
- Prostration (the child is very ill and needs immediate supportive treatment and blood transfusion)

Exclude other causes of these symptoms e.g. pneumonia, septicaemia, pain, high grade fever, heart disease, or shock. Infections may cause decompensation in a child with moderate anaemia.

3.2 THE CHILD WHO NEEDS A TRANSFUSION

The decision to transfuse any child should be based on:

A. Cause of anaemia
   i. Blood loss.
   ii. Reduced red blood cell (RBC) production e.g. leukaemia, severe iron deficiency.
   iii. Increased RBC destruction e.g. haemolysis (sickle cell disease, malaria or G6PD deficiency)

B. Clinical status of the child – compensated or decompensated.

C. Haemoglobin level.

D. Age of patient.

3.2.1 Indications for Blood Transfusion

1. Hb < 4g/dl (haematocrit/ packed cell volume (PCV) < 12%) whatever the clinical status.
2. Hb 4–6g/dl (haematocrit/PCV 13-18%) **if any** of the following clinical features are present.
   - Signs of decompensation (see above).
   - Hyperparasitemia (> 20% or malaria parasites > ++).
   - Life threatening illness e.g. septicaemia, meningitis, cerebral malaria, pneumonia, shock, moderate/severe burns (second or third degree).
   - On-going or active haemolysis.
3. On-going blood loss

3.3 CARE OF THE CHILD WHO REQUIRES BLOOD TRANSFUSION

If transfusion is needed; give sufficient blood to make the child clinically stable, but ***do not*** *expose the child to more than one donor* in order to reduce the risk of infection and alloimmunization.

The total volume required in transfusion of whole blood may precipitate or worsen cardiac failure. Whenever possible, concentrated red cell (CRC) transfusion is preferred for medical indications.

3.3.1 Immediate supportive treatment

This is very important in the severely anaemic or decompensated child ***before*** and ***during*** transfusion.

- Ensure adequate ventilation: Position the child to maintain **patent airway** e.g. sitting up in bed.
- Give high concentration **oxygen** to improve oxygenation – preferably using 2 nasal tubes/prongs or face mask.
- Control **fever** (to reduce oxygen demands) with tepid sponging and paracetamol.
- **Treat** cardiac failure and volume overload with IV furosemide 1mg/kg (maximum dose 20mg).
- **Treat** acute bacterial infection or malaria.

3.4 PROCEDURE FOR BLOOD TRANSFUSION

3.4.1 Pre-transfusion checks

Do the following checks to ensure the right patient receives the right blood product:

- Check blood product for any signs of leakage, clumps or abnormal colour.
- Patient identification. Name, DOB, Blood Transfusion Record and pack tag/label. Are they identical?
- Blood product identification. Check the pack number on the Blood Transfusion Record, pack tag/label and the product. Are they identical?
- Blood Group. Check the blood group (ABO and Rh D) of the product on the Blood Transfusion Record, pack tag/label and the product. Do they match?
- Check expiry date on the pack.
- Check medical orders: product type, special requirements and administration requirements.
- Complete documentation: sign, date, time the Blood Transfusion Record and file in the patient's medical record.

If there is any discrepancy between the blood product, patient details & pack tag/label, or if you are concerned about the appearance of the product DO NOT TRANSFUSE. Report to Blood Bank immediately

The recommended fluid for priming the intravenous line for transfusion is normal (0.9%) saline

3.4.2 Volume to be infused

Use small volume (5 - 10 ml/kg of CRC) aliquots in the severely decompensated child and repeat the transfusion later to prevent fatal heart failure due to volume overload. Inform blood bank about your plan in order to prevent multi donor exposure and extra cost.

- Whole blood: 30 – 40 ml /kg
- Sedimented red blood cells/whole blood: 20 – 30ml/kg.
- Concentrated red cells: 10 – 15ml/kg.

3.4.3 Rate of transfusion

- Transfuse over 2 – 3hrs at a rate of 10 – 20ml/kg/hr
- A lower rate is used for decompensated patients (duration not more than 4 hours)

3.5 MONITORING THE CHILD DURING AND AFTER TRANSFUSION

- Monitor the child for signs of fever, respiratory distress, haemolysis (jaundice, hepatosplenomegaly), hypotension, bleeding, heart failure, acute transfusion reaction
- This should be done every 15min in the first hour, then every 30min.
- After the transfusion, recheck the child's clinical condition. Recheck haemoglobin after 24 hours
- Assess the need for repeat transfusion. This may occasionally be necessary e.g. ongoing haemolysis.
- If there are any signs of heart failure or pulmonary oedema (air hunger, increased heart rate and respiratory rate), give oxygen and furosemide 1mg/kg IV.

3.5.1 Acute transfusion reactions

The risk of transfusion reactions is greatest when an emergency cross-match is used instead of a full cross-match. Use the following categories to check for and record the severity of the transfusion reaction and decide on management.

In all cases of suspected transfusion reaction, send the following to the blood bank and chemical pathology laboratory respectively:

- Sample from the blood bag or blood-giving set that was used
- Blood sample from another site
- Urine samples collected over 24 hours.

3.5.2 Mild reactions:

Manifests as itchy rash (urticaria), headache, low grade fever <38^{0}C. Management includes:

- Slow the transfusion. Give IV hydrocortisone 4mg/kg + chlorpheniramine 0.1mg/kg IM
- Continue the transfusion at the normal rate if there is no progression of symptoms after 30 minutes. If symptoms persist, treat as moderate reaction (see below).

3.5.3 Moderately severe reactions:

Usually result from moderate hypersensitivity, non-haemolytic reactions, pyrogens or bacterial contamination. Clinical signs usually develop 30-60 minutes after start of transfusion and include severe itchy rash (urticaria), flushing, rigors, restlessness, raised heart rate, fever >38^{0}C or >100.4^{0}F (note that fever may have been present before the transfusion). Management includes:

- Stop the transfusion, replace the giving set and keep IV line open with normal saline
- Give IV hydrocortisone 4mg/kg + chlorpheniramine 0.1mg/kg IM, nebulized bronchodilator if wheezing

If child improves but is assessed to require blood transfusion, restart transfusion slowly with a **new blood unit.** Observe carefully. If no improvement in 15 minutes, treat as life-threatening reaction.

3.5.4 Life-threatening reactions:

These may be due to haemolysis, bacterial contamination and septic shock, fluid overload or anaphylaxis. Clinical signs include fever >38^{0}C, rigors, restlessness, raised heart rate, fast breathing, haemoglobinuria, unexplained bleeding, confusion, collapse. In an unconscious child, uncontrolled bleeding or shock may be the only signs of a life-threatening reaction.

Management includes:

- Stop the transfusion, replace the giving set and keep IV line open with normal saline
- Maintain airway and give oxygen * give adrenaline 0.01mg/kg body weight
- Treat shock
- Give IV hydrocortisone + chlorpheniramine 0.1mg/kg IM, bronchodilator, if wheezing
- Consult the senior doctor in charge and report to blood bank as soon as possible
- Maintain renal blood flow with IV furosemide 1mg/kg
- Give antibiotic treatment as for septicaemia

3.6 TRANSFUSION IN SPECIAL CLINICAL SITUATIONS

3.6.1 Hyperbilirubinaemia in the newborn

Exchange blood transfusion (EBT)

In the newborn the most common indication is the prevention of neurological complications (kernicterus) caused by rapidly rising unconjugated bilirubin concentration. Newborns are more prone to the toxic effects of bilirubin if they have:

- Acidosis, Hypoxia, Asphyxia, Pre-maturity
- Haemolysis, Septicaemia, Hypoglycaemia, Hypothermia
- Hypoproteinaemia or exposure to drugs that displace bilirubin from albumin (e.g. ceftriaxone)

Newborns with any of these factors are at increased risk of kernicterus and are referred to in this document as having **complicated** hyperbilirubinaemia. The goal of therapy is to prevent the concentration of unconjugated (indirect) bilirubin from reaching neurotoxic levels.

Table 3-1 Suggested maximum indirect serum bilirubin concentrations in pre-term and term infants more than 48 hours old

Birth weight (gm)	Uncomplicated	Complicated
1300 – 1500	12 – 14mg/dl (200 - 240µmol/l)	10 – 12mg/dl (170 - 200µmol/l)
1501 – 2499	16 – 20mg/dl (270 - 340µmol/l)	15 – 17mg/dl (250 - 290µmol/l)
> 2500/term	20 – 22mg/dl (340 - 380µmol/l)	18 – 20mg/dl (310 - 340µmol/l)

In infants weighing < 1500gm or jaundiced at the age of less than 48 hours old, start phototherapy when you notice clinical jaundice and refer to a paediatrician as soon as possible.

The selection of blood depends on the reason for the exchange. The four reasons are:-

a) Exchange due to Rhesus (Rh) D haemolytic disease of the newborn (HDN).

b) Exchange due to ABO HDN.

c) Exchange due to other causes of neonatal jaundice e.g. G6PD deficiency.

d) Exchange due to other Rh antibody or a non-Rh antibody, such as anti-c or anti-kell.

Use relatively fresh whole blood that is **less than 5 days old** with haematocrit of 0.50–0.60 e.g. by removing 100ml of plasma from the whole blood (this should be done at the blood bank).

The blood to be transfused should be cross matched with the mother's serum.

The table below shows the type of blood to be used in the exchange transfusion for Rh D and ABO incompatibility:

Table 3-2 Blood Group Requirements for HDN Exchange Transfusion

Baby's group	Blood for EBT in Rh D HDN	Blood for EBT in ABO HDN
O Rh Positive	O Rh D Negative	Not applicable
O Rh Negative	Not applicable	Not applicable
A Rh Positive	A Rh Negative/O Rh Negative	O Rh Positive
A Rh Negative	Not applicable	O Rh Negative
B Rh Positive	B Rh Negative/O Rh Negative	O Rh Positive
B Rh Negative	Not applicable	O Rh Negative
AB Rh Positive	AB Rh Negative/O Rh Negative	O Rh Positive
AB Rh Negative	Not applicable	O Rh Negative

The correct selection of blood for EBT is very important. When in doubt, do EBT with blood group O packed cells suspended in blood group AB plasma (to be done at the blood bank).

Do a two volume exchange i.e. 170ml/kg.

3.6.2 Thrombocytopenia

Platelet transfusion

When platelet transfusion (e.g. platelets < 20 x 10^9) is indicated:

- Start the transfusion immediately after removing the platelet pack from platelet shaker at room temperature.
- The transfusion must be completed within 20 minutes
- The doses for platelet transfusion are as follows:

  Give 1 platelet concentrate (30–50ml) if child < 15kg.
  2 platelet concentrates (60–100ml) if child is 15-30kg.
  4 platelet concentrates (120–200ml) if child > 30kg.

- Use crystalloids or colloids to maintain blood volume if necessary.

3.6.3 Acute blood loss

Transfusion of crystalloids or colloids when blood is not immediately available:

- Take blood for cross-matching.
- Give crystalloids or colloids to maintain blood volume.
- If child has lost significant blood volume (20% of total blood volume) there will be signs of hypovolaemia e.g. pale colour of mucous membrane, increased respiratory and heart rate, cool hands and feet, poor capillary refill and reduced urine output.
- Give supportive treatment as decompensated anaemia if there are signs of hypovolaemia.
- Transfuse with enough blood to make the child clinically stable.

D) Haemophilia A

- Do not give intramuscular injections.
- Give cryoprecipitate or factor VIII concentrate as quickly as possible.
- The transfusion must be completed within 20 minutes

The initial dose of cryoprecipitate is 1.5-2.0 packs/10kg body weight. Further therapy is dependent on clinical response and laboratory monitoring (PT, PTT, and Fibrinogen level).

3.7 FOLLOW UP MANAGEMENT OF THE ANAEMIC CHILD

The cause of the anaemia should be identified and treated e.g. malaria, hookworm, malnutrition etc.

For iron deficiency prescribe, 3mg/kg/day of elemental iron for 3 months, to replenish iron stores.

This may be given as 15mg/kg ferrous sulphate
26mg/kg ferrous gluconate
9mg/kg ferrous fumarate,

Also give folic acid 5mg/day to correct the anaemia due to haemolysis and malnutrition

4 SURGERY AND ANAESTHESIA

4.1 Care in the preoperative period

Preoperative transfusion is generally indicated when:-

a) The patient is actively bleeding or bleeding has stopped temporarily. In such cases, the patient must be prepared for anaesthesia to correct the cause of bleeding.

b) The anaemia is impossible to correct by other means e.g. sickle cell anaemia or highly vascularised bleeding malignancies.

Routine transfusion before elective surgery to 'TOP UP' the haemoglobin must be discouraged.

A haemoglobin level of 10g/dl or more will be ideal for the elective surgical patient. However, studies have shown that patient with haemoglobin levels of 7–8g/dl can be operated upon if need be, provided that they are well compensated and are otherwise healthy.

A higher preoperative haemoglobin level will be required if the patient has signs and symptoms of inadequate compensation of anaemia e.g. congestive cardiac failure (CCF) or if there is coexistent cardiopulmonary disease which may limit his/her ability to further compensate for the reduction of oxygen supply due to operative blood loss or the effects of the anaesthetic agent.

Patients on anticoagulants or antiplatelets must be referred to centres where coagulation profiles can be performed and where correction of defects can be effected.

All patients on aspirin must have their treatment stopped at least 10 days prior to major operations. If prophylaxis is required they can be switched to subcutaneous heparin.

Patients on warfarin must have the drug stopped at least 3 days prior to their operation. The INR must be checked until it is ≤ 2 before heparin can be started by subcutaneous injection.

See Table 4.1 for the full protocol.

In sickle cell patients, preoperative steady state haemoglobin of 6–7gm/dl in a well hydrated, well oxygenated and compensated patient may be adequate for operations.

If need be use blood which is sickling negative on screening.

In cases where there is no urgency, pre-operative anaemia which is responsive to haematinics should be treated appropriately before surgery. It is important to correct the anaemia completely so as to avoid any transfusion as far as possible during or after surgery; i.e. it is better to have a pre operative Hb of 12 to 14g/dl than 10g/dl.

4.2 Care in the intraoperative period

4.2.1 Blood loss

Operative blood loss has to be kept to the barest minimum. It can be significantly reduced by the following methods.

1. **Surgical technique:**

   Meticulous haemostatis including the use of diathermy, warm packs and collagen felt.

2. **Posture of the patient:**

   The site of operation should be raised above the level of the heart to minimize venous blood loss e.g. in lower limb varicose vein surgery, the head down (Trendelenburg) position is adopted and in thyroid surgery the reverse of this is used.

3. **Vasoconstrictors:**

   Blood loss from skin can be reduced significantly by the use of adrenaline containing local anaesthetics or normal saline containing adrenaline. The adrenaline dose should not usually exceed 0.1mg in an adult, equivalent to 20ml of 1-in-200,000 strength or 40ml of 1-in-400,000 strength. Swabs soaked in saline solution/local anaesthetic containing adrenaline can also be used to control bleeding from donor site and also from granulation tissue.

   - Extreme care must be taken when using adrenaline in patients who are having halothane anaesthesia since there is a high incidence of arrhythmias.
   - Local anaesthetic solutions containing adrenaline should not be used for anaesthetizing areas with end arteries such as the digits and the penis, to avoid vasoconstriction and ischaemia.

4. Tourniquets:

Can be used to reduce blood loss from operations on the limbs. The limbs should first be exsanguinated and the inflation pressure should be maintained at approximately 100– 150mmHg above the systolic pressure.

- Tourniquets should not be used in patients with sickle cell disease or trait (AS, SS, SC etc.) it should also not be used for amputation especially in patients with peripheral vascular disease.

5. Anaesthetic techniques:

Properly administered anaesthesia can help to prevent blood loss during major surgery. As much as possible coughing and straining must be prevented. Hypertension, tachycardia and carbon dioxide retention (hypercarbia) must also be prevented. The use of hypotensive techniques such as spinal and epidural anaesthesia must be encouraged.

6. Antifibrinolytic agents

These agents have been found to help in the control of haemorrhage. Tranexamic acid is the only agent available in this country.

4.2.2 Fluid replacement and transfusion

Intraoperative blood loss can be replaced by crystalloids e.g. Ringers Lactate and Normal Saline or colloids e.g. Haemaccel and Gelofusine. Aim to maintain normovolaemia at all times during the course of the operation.

Blood should only be transfused when there is significant blood loss. Amount of fluid/blood to be replaced should follow the guidelines for acute blood loss.

4.2.3 Estimation of blood loss:

Operative blood loss can be estimated simply by:

1. Weighing gauze before operation, and after it has been used (whilst still wet). The amount of blood loss is 1ml x (difference in dry weight and wet weight in grams).
2. Blood loss into drains and suction bottles (measured).

3. Blood loss into drapes and pooling of blood on the floor (estimated).

4. Amount of tissue removed e.g. length of resected bowel or removal of an enlarged spleen (estimate).

4.2.4 Replacement of blood loss

As already stated blood loss > 30% need to be replaced during the course of operation. It is also very important to base transfusion requirement during operations on careful assessment of other factors, in addition to volume of blood lost. These factors include rate of blood loss (actual and anticipated), patient's clinical responses to blood loss and fluid replacement therapy and signs that indicate inadequate tissue oxygenation.

Allowable blood loss can be calculated by two methods:

- Percentage method
- Haemodilution method

Refer table 4.2 for details

If blood loss is in excess of 1.5L, whole blood can be used in addition to crystalloids.

As much as possible, blood from an appropriate clean operating field should be considered for auto transfusion. Where massive transfusion is given, attention must be paid to:

i. Reducing citrate toxicity by using concentrated red cells.

ii. Associated clotting factor deficiency. This should be managed with fresh frozen plasma (FFP).

iii. Hypothermia, which may be induced by infusion of cold, refrigerated blood. In such cases blood should be warmed prior to transfusion.

4.3 Care in the postoperative period

- Blood loss may continue postoperatively hence continuous monitoring of the patient and adequate pain relief is required to forestall hypovolemia and further bleeding.
- Transfusion is not necessary in most cases if operative blood loss has been adequately replaced.
- Post-operative Hb may be deceptive due to haemodilution or haemoconcentration. It is therefore ideal to check this on the third postoperative day when the patient is stable, for an objective assessment.
- Transfusion to promote wound healing is not indicated.
- Iron to replace loss, folic acid for the rapid proliferation and Vitamin C will serve the healing process well.
- It is important to prepare the patient well before surgery. This prevents unnecessary transfusion.

Table 4-1 : Preoperative Management of Patients on Anticoagulation Therapy

Patients Fully Anticoagulated With Warfarin

Elective surgery

1. Stop warfarin three days preoperatively and monitor INR daily.
2. Give heparin infusion or subcutaneous heparin when INR is < 2.0.
3. Stop heparin 6 hours preoperatively.
4. Check INR and APTT ratio immediately prior to surgery.
5. Commence surgery if INR and prothrombin ratio (PR) are < 2.
6. Restart heparin as soon as possible postoperatively.
7. Restart warfarin at the same time and continue until INR is in the therapeutic range.

Emergency surgery

1. Give vitamin K, 0.5-2.0 mg by slow IV infusion.
2. Give fresh frozen plasma, 15ml/kg. This dose may need to be repeated to bring coagulation factors to an acceptable range.
3. Check INR immediately prior to surgery.
4. Commence surgery if INR and APTT ratio are <2.

Patients Fully Anticoagulated With Heparin

Elective surgery

1. Stop heparin 6 hours preoperatively.
2. Check APTT ratio immediately prior to surgery.
3. Commence surgery if APTT ratio is < 2.0.
4. Restart heparin as soon as possible postoperatively.

Emergency surgery

1. Consider reversal with IV protamine sulphate. 1mg of protamine sulphate neutralises 100 iu heparin.

Patient Receiving Low Dose Heparin

It is rarely necessary to stop heparin injections, used in the prevention of deep vein thrombosis and pulmonary embolism prior to surgery.

WHO

Table 4-2: Methods of Estimating Allowable Blood Loss

Percentage Method of Estimating Allowable Blood Loss

This method simply involves estimating the allowable blood loss as a percentage of the patient's blood volume.

1. Calculate the patient's blood volume.
2. Decide on the percentage of blood volume that could be lost but safely tolerated, provided that normovolaemia is maintained. For example if 10% were chosen, the allowable blood loss in a 60kg patient would be 420ml.
3. During the procedure, replace blood loss up to the allowable volume with crystalloids or colloids to maintain normovolaemia.
4. If allowable blood volume is exceeded, further replacement should be with blood.

Haemodilution Method of Estimating Allowable Blood Loss

This method involves estimating the allowable blood loss by judging the lowest haemoglobin (or haematocrit) that could be safely tolerated by the patient as haemodilution with fluid replacement takes place:

1. Calculate the patient's blood volume and perform a preoperative haemoglobin (or haematocrit) level.
2. Decide on the lowest acceptable haemoglobin (or haematocrit) that could be tolerated by the patient.
3. Apply the following formula to calculate the allowable volume of blood loss that can occur before a blood transfusion becomes necessary.

$$\text{Allowable blood loss} = \text{Blood volume} \times \frac{\text{(preoperative Hb – Lowest acceptable Hb)}}{\text{(average of preoperative and lowest acceptable Hb)}}$$

4. During the procedure, replace blood loss up to the allowable volume with crystalloid or colloid to maintain normovolaemia.
5. If the allowable blood loss is exceeded, further replacement should be with blood.

WHO

5 OBSTETRICS & GYNAECOLOGY

Transfusion practice in gynaecology follows the same principle stated for general surgery. Autologous transfusion either using blood lost during the surgery or blood collected from the patient some weeks/days prior to the surgery should be actively resorted to when appropriate. Blood use in obstetrics is either to correct acute anaemia occurring as a result of haemolysis or bleeding or chronic anaemia as occurs in general medical practice. It is noteworthy that the major cause of maternal death is obstetric haemorrhage.

5.1 Conditions associated with blood transfusion in obstetrics and gynaecology

1. Anaemia in Pregnancy: WHO defines anaemia as Hb <11.0g/dl and severe anaemia as Hb < 7.0g/dl.

   > The general rule is that no woman should enter labour with Hb <10.0g/dl.

2. Massive Obstetric Haemorrhage: These are due to ruptured ectopic gestations, abortions, APH, PPH, ruptured uterus and clotting abnormalities.
3. Coagulopathy: These occur in association with
   - severe pelvic sepsis,
   - pre-eclampsia/eclampsia,
   - massive haemorrhage from obstetric complications e.g. abruptio placenta, intrauterine fetal death, missed abortion and occasionally
   - idiopathic causes.
4. Gynaecological conditions leading to severe/chronic anaemia include e.g. menorrhagias secondary to uterine fibroids and gynaecological malignancies: e.g. cervical, ovarian and endometrial carcinomas.

5.2 Anaemia in pregnancy

70% of anaemia in antenatal clients in Ghana can be prevented with good nutrition and regular antenatal care.

Prevention of anaemia in pregnancy includes iron and folic acid supplementation for all women, and Intermittent Preventive Treatment (IPT) with Fansidar from 16 weeks gestation for 3 doses before 36 weeks gestation. Iron and folic acid supplementation should continue until 3 months after birth to replenish stores.

Antihelmintic treatment should be considered in the second trimester in endemic areas.

Three (3) years spacing between births should be advocated to prevent anaemia in pregnancy.

5.2.1 When to transfuse

The decision to transfuse should not be based on haemoglobin levels alone, but also on the patient's clinical need.

The following factors must be taken into account:

- Stage of pregnancy
- Presence of symptoms of anaemia (refer page 8)
- Evidence of cardiac failure
- Presence of acute infection: e.g. pneumonia, malaria
- Obstetric history
- Anticipated delivery:
    - Vaginal
    - Caesarean section
- Haemoglobin level

5.2.2 Transfusion guidelines for chronic anaemia in pregnancy

A. Duration of pregnancy less than 36 weeks

i. Haemoglobin 5.0g/dl or below, even without clinical signs of cardiac failure or hypoxia

ii. Haemoglobin between 5.0 and 7.0g/dl and in the presence of the following conditions:

- Established or incipient cardiac failure or clinical evidence of hypoxia.
- Pneumonia or any other serious bacterial infection.
- Malaria.
- Pre-existing heart disease, not causally related to the anaemia.
- Sickle cell crisis

B. Duration of pregnancy 36 weeks or more

i. Haemoglobin 6.0g/dl or below.

ii. Haemoglobin between 6.0g/dl and 8.0g/dl and in the presence of the following conditions:

- Established or incipient cardiac failure or clinical evidence of hypoxia (i.e. dyspnoea).
- Pneumonia or any other serious bacterial infection.
- Malaria.
- Pre-existing heart disease, not causally related to the anaemia.

C. Elective caesarean section

When elective caesarean section is planned and there is a history of:

- Ante partum haemorrhage (APH)
- Post partum haemorrhage (PPH)
- Previous Caesarean section

i. All patients going in for caesarean section must have blood samples taken to establish/confirm blood group and save freshly taken serum for crossmatching, since emergencies cannot always be predicted.

ii. Haemoglobin between 8.0 and 10.0g/dl: establish/confirm blood group and save freshly taken serum for crossmatching.

iii. Haemoglobin less than 8.0g/dl: two units of blood should be crossmatched and available.

5.3 Massive obstetric haemorrhage

This often occurs suddenly, often unpredictable, and profuse with rapid patient deterioration.

Many of the conditions leading to haemorrhage however can be identified earlier and preventive or prompt interventions taken to reduce massive loss with need for massive transfusions. e.g. by identifying placenta praevias, history of PPH, twin gestations, prolonged labour and grandmultiparity.

5.3.1 Preventive interventions include:-

i. Surgical delivery e.g. caesarean section (C/S) for praevia.

ii. Active management of third stage of labour (controlled cord traction with use of oxytocics).

- Improved availability and judicious use of oxytocics – prophylactically and therapeutically (adequate dosages and by the correct routes during emergencies).
- Use of other techniques for reducing blood loss in emergency e.g. bimanual compression, uterine tourniquets etc.

iii. Where available the use of ultrasound to localize placenta in all pregnancies.

5.3.2 Management of major obstetric haemorrhage

A. Resuscitate

1. Establish intravenous access with 2 large-bore cannulae.
2. Administer high concentrations of oxygen.
3. Head down tilt/raise legs.
4. Take blood for Hb estimation, patient grouping and crossmatching and inform blood bank this is an emergency.
5. Infuse crystalloid replacement fluids or colloids as rapidly as possible. Restoration of normovolaemia is a priority.
6. Give group O negative and/or uncrossmatched group specific blood until fully crossmatched blood is available. (under such circumstances a written authorization by the senior personnel available in charge of patient must be sent to the blood bank).
7. Use a pressure infusion and warming devices, if possible.
8. Call extra staff to help.

B. Monitor/investigate

1. Send sample to blood bank for cross matching of further blood, but do not wait for crossmatched blood if there is serious haemorrhage.
2. Order full blood count.
3. Order coagulation screen. Where service is not available, perform bedside clotting time.
4. Continuously monitor pulse rate and blood pressure.
5. Insert urinary catheter and measure hourly urine output.
6. Monitor respiratory rate.
7. Monitor consciousness level.
8. Continue to monitor haemoglobin or haematocrit.

C. Stop the bleeding

1. Identify the cause.
2. Examine cervix and vagina for lacerations and repair these.
3. Evacuate uterus of retained products and blood clots.
4. If retained products of conception is evacuated and uncontrolled bleeding persist, treat as disseminated intravascular coagulation (DIC).
5. If uterus hypotonic or atonic, manage with IV oxytocics e.g. ergometrine and syntocinon drip.
6. Consider surgery earlier rather than later.
7. In life threatening situations, early hysterectomy saves lives.

5.4 Autologous transfusion

Preoperative, intraoperative and/or postoperative blood salvage for autologous transfusion should be used where appropriate; e.g. use of intraoperative salvage in ruptured ectopic pregnancy.

5.5 Coagulopathies

Identifying and managing, or preventing obstetric conditions that lead to DIC can result in a reduction in blood transfusion requirements. These include pre-eclampsia/eclampsia, safe abortions including adequate antibiotic cover, and prompt delivery of abruptio placenta.

Once DIC is allowed to set in from severe pre-eclampsia or sepsis, it may be too late to salvage the patient. Early delivery of patients with severe pre-eclampsia is strongly recommended, even if pre-term.

5.6 Management of disseminated intravascular coagulation

1. Treat the cause:
   - Deliver foetus and placenta.
   - Evacuate uterus, as indicated for retained or necrotic tissue.
2. Give uterine stimulants to promote contraction: e.g. oxytocin, ergometrine and/or prostaglandin.

3. Use blood products to help control haemorrhage. In many cases of acute blood loss, the development of DIC can be prevented if blood volume is restored with a balanced salt solution: such as Ringer's lactate or normal saline.

   If needed for oxygen perfusion, give the freshest whole blood available (or concentrated red cells).

4. Avoid the use of cryoprecipitate and platelet concentrates unless bleeding is uncontrollable.

   If bleeding is not controlled and if coagulation tests show very low platelets, fibrinogen, prolonged PT or PTT, replace coagulation factors and platelets with:

   - Cryoprecipitate: at least 15 packs initially.

   If cryoprecipitate is not available, give:

   - Fresh frozen plasma (15ml/kg): 1 unit for every 4-6 units of blood to prevent coagulation defects resulting from use of stored red cell concentrates or suspensions.

   If there is thrombocytopenia, give:

   - Platelet concentrates

   If these blood components are not available, give the freshest whole blood available (ideally not more than 36 hours old).

5. If DIC is due to severe sepsis aggressive antibiotic and steroid therapy is indicated.

   Even where DIC has developed ensuring good uterine contraction and proper suturing of bleeding points etc. can reduce continuing blood loss. As a rough guide in DIC use cryoprecipitate 1 unit/10kg twice daily, FFP 1 unit/20kg/day, concentrated red cells as required and 6 units platelets every third day.

5.7 Other anaemias that may require transfusion

5.7.1 Acute Anaemia

Management is as for acute blood loss. (refer page 15).

5.7.2 Chronic anaemia

Causes include:

i. Iron deficiency,
ii. Sickle cell anaemia,
iii. Septicaemia
iv. Renal failure
v. Anaemia with heart failure
vi. Folate deficiency

The use of blood in these conditions in pregnancy and labour is more liberal than in non-pregnant states.

- Patients with sickle cell anaemia even those with low steady state Hb may not require transfusion during pregnancy. Maintain Hb at 7.0g/dl and above. Blood given to these patients should be negative for sickling.
- If the anaemia is encountered during labour, more blood is required using concentrated red cells. Continuous oxygen therapy will also improve oxygen transfer to the baby. The patient should be given intravenous diuretics and the transfusion closely monitored.
- In patients with sepsis, chronic renal failure and anaemia of chronic disorder maintain the haemoglobin between 8 and 9g/dl during pregnancy.
- When chronic renal disease is associated with severe hypertension, termination in early pregnancy should be offered.
  Good antenatal care will reduce the need for transfusion in these cases to a minimum.

APPENDIX I

CONSENT FORM

FOR TRANSFUSION OF BLOOD/BLOOD PRODUCTS

Health Facility

Dr .....
has explained to me that I need* / my ward needs* a transfusion of blood or blood components in view of my / his or her medical condition. *(*delete as appropriate)*

I understand the benefits and possible risks. These risks include, but are not limited to, allergic reactions, fever, haemolysis, or rarely, death. I understand there is also risk of exposure to HIV or hepatitis, but that the risk is very remote. I understand that these risks exist in spite of the blood being carefully tested. No guarantees have been made to me about the outcome of the transfusion. I understand that alternatives, including the choice of not being transfused, are much slower acting than the direct transfusion of blood or blood components, and are not recommended in my present condition.

Therefore

- ☐ **Yes**, I give my informed and voluntary **CONSENT** to receiving the transfusion. This consent remains valid for all transfusions I may require during this admission.
- ☐ **No**, I **REFUSE** to consent to the transfusion. I understand that the risks associated with this refusal include permanent injury and possible death. I accept full responsibility for those risks.

.....
(Name of patient, otherwise name of guardian if under 18 years)

....
Signature of Patient/Legal Guardian Witness

.....
Date

Article 28 of the Constitution of the Republic of Ghana stipulates that
"No person shall deny a child medical treatment by reason of religious or other beliefs."
This is reinforced by the Children's Act, 1988 (Act 560).

APPENDIX II

BLOOD TRANSFUSION MONITORING FORM

Health Facility

Surname: _____ First Name: _____

DOB/Age_____ Sex: _____ Ward:_____

Hospital Number: _____ NHIS _____

Blood component transfused:

☐ Whole blood ☐ CRC ☐ FFP ☐ Cryoprecipitate ☐Platelet Concentrate

Time STARTED _____ Time COMPLETED _____

	START	FINISH
BP:		
TEMP:		
PULSE:		
RESP:		

	15 MIN	30 MIN	1 HR	2 HR
PULSE:				
RESP:				

Was the whole unit transfused uneventfully? ☐ Yes ☐ No

If No, tick reasons for discontinuing transfusion:

☐ Challenges with venous access ☐ Patient reacted to transfusion

☐ Other reason (Please state) _____

In the event of a transfusion reaction, please complete a transfusion reaction form and return all blood units, required specimens and the completed form to the Blood Bank for investigation.

APPENDIX III

TRANSFUSION RECORD

Complete after transfusion and return to blood bank laboratory within 24 hrs.

Blood/blood products administered to

Patient's Name…… Age…….

Sex……. Ward…….

Batch Number……..

Time Started…….

Time Completed……..

Transfusion Reaction No/Yes

If YES fill transfusion reaction form and return together with appropriate samples to laboratory.

Signed……..…….

Name……

Date……..….

APPENDIX IV

REQUEST FOR INVESTIGATION OF TRANSFUSION REACTION

To be completed by the doctor who supervised the transfusion.

Patient's Name…… Age…….. Sex……...

Hospital No. …….. Ward …… Blood Group……..

Initial Diagnosis ……..

Reason for giving blood/blood products ……

Pre transfusion Hb: ……

Donor's Blood Group: …… Batch No. on bag ……..

X-match No. …….. Expiry Date …….

Date and Time transfusion started……

Date and time of onset of symptoms…….

Time transfusion stopped ……..

Volume of blood/blood products given before symptoms started……

Rate at which blood was transfused …… drops/min

Does patient have a history of allergy? Yes/No

Previous transfusion Yes/No

If yes state dates……..

Any reaction? ……

In the case of females, have there been any pregnancies?

If so any still births?…. Miscarriages?…. Jaundiced or anaemic babies?….

Pre Transfusion: Pulse ……../min. B.P…… Temp…… Resp. ……../min

Post Transfusion: Pulse ……/min B.P…….. Temp…… Resp……...../min

Nature of Transfusion Reaction (Please tick)

Dyspnoea	Itching	Tightness in chest
Dizziness	Fainting	Pain in muscles/loin
Urticaria	Rigor	Nausea
Shock	Agitation	Haematuria
Jaundice		

Was antihistamine given?…….. When and route? …….

Was the blood warmed before transfusion?……

Others……

Summary of Action Taken

……

……..……...

Date……

Name & Signature of Medical Officer……

SPECIMENS REQUIRED

1. Post transfusion Blood sample collected as soon as possible after the reaction INTO
    a. EDTA/sequestrene bottle - (2ml) anticoagulated sample
    b. Plain bottle - (5ml clotted sample)
2. Sample from the blood bags; those already transfused and the one which gave the reaction.
3. Post transfusion urine sample (depending on nature of reaction)