Government of Malawi

Ministry of Health

GUIDELINES FOR THE CLINICAL USE OF BLOOD AND BLOOD PRODUCTS IN MALAWI

1ST EDITION

PREFACE

Blood transfusion complements treatment in almost all major clinical disciplines. It is a useful part of our health service. It is important that transfusion is as safe as possible. Major strategies in achieving blood transfusion safety include proper selection of blood donors, screening the donated blood for transfusion transmissible infections and testing for major red cell antigens and red cell alloantibodies among others.

It is well known that despite best efforts in implementing these strategies, there is still a residual risk that blood can transmit HIV and other transfusion transmissible infections. In addition, blood has other immune and non-immune adverse reactions some of which are potentially fatal.

Therefore, it is important that patients are not unnecessarily exposed to the risk of blood transfusion. These guidelines have been produced to help achieve that. They are part of the strategy for ensuring appropriate clinical use of blood and blood products and are part of the national strategy for attaining blood transfusion safety.

They contain useful information for all who prescribe blood, issue blood for transfusion and administer blood transfusions. They provide handy, easy to use information for quick reference during routine clinical work. They do not contain all the information necessary for one to use all types of blood products. They should therefore be used in that context and supplemented by detailed publications where necessary.

Numerous sources [1-9] have been used to compile these guidelines.

For further information readers are referred to the references at the end of this booklet.

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ABBREVIATIONS

DIC	Disseminated Intravascular Coagulation
DoB	Date of Birth
EDTA	Ethylene Diamine Tetra acetic Acid
FFP	Fresh Frozen Plasma
Hb	Haemoglobin
HDN	Haemolytic Disease of the New born
HIV	Human Immunodeficiency Virus
IM	Intramuscular
iu	International Unit
IV	Intravenous
MBTS	Malawi Blood Transfusion Service
PCV	Packed Cell Volume
TTIs	Transfusion Transmissible Infections
TTP	Thrombotic Thrombocytopaenic Purpura
WHO	World Health Organisation

CONTENTS

1. INTRODUCTION

Blood available for transfusion in Malawi is mostly from the recommended voluntary non-remunerated blood donors as supplied by the Malawi Blood Transfusion Service (MBTS). It is routinely tested for HIV, Hepatitis B, Hepatitis C, syphilis and malaria. This is supplemented by blood collected by hospital blood banks from family replacement blood donors. Other forms of blood donation such as pre-deposit autologous donation and directed blood donation are discouraged while paid blood donation is prohibited.

The MBTS processes donated blood to supply the following blood components:

- Whole blood
- Red cell suspensions (in paediatric and adult packs)
- Platelet concentrates
- Fresh frozen plasma (FFP) and
- Cryoprecipitate

Not all hospitals will have storage facilities for the stocking of all these blood components. Some components will have to be specifically ordered from the MBTS when ready to use them on arrival.

The Ministry of Health produced this booklet to provide useful information to blood users for the optimal management of patients requiring the transfusion of the available blood components. These blood users are doctors, clinical officers, laboratory technicians and nurses. The clinical use of blood products such as plasma derivatives (albumin, factor VIII, factor IX and immunoglobulins) and blood components for special patient groups (leuco-depleted red cells and irradiated red cells) is not covered in this booklet due to their limited availability or unavailability.

1.1 THE APPROPRIATE USE OF BLOOD AND BLOOD PRODUCTS

Key points

1. The appropriate use of blood and blood products means the transfusion of safe blood products only to treat a condition leading to significant morbidity or mortality that cannot be prevented or managed effectively by other means.

2. Transfusion carries the risk of adverse reactions and transfusion transmissible infections (TTIs). Plasma can transmit most of the infections present in whole blood and there are very few indications for its transfusion.

3. Blood donated by family/replacement donors carries a higher risk of TTIs than blood donated by voluntary non-remunerated donors. Paid blood donors generally have the highest incidence and prevalence of TTIs and are the least safe.

4. Blood should not be transfused unless it has been obtained from appropriately selected donors, has been screened for TTIs and tested for compatibility between the donor's red cells and the antibodies in the patient's plasma, in accordance with national requirements, in a quality assured environment.

5. Family replacement blood donors are strongly discouraged by the Ministry of Health in Malawi.

1.2 HOW TO AVOID TRANSFUSION

- The prevention or early diagnosis and treatment of anaemia and conditions that cause anaemia.
- The correction of anaemia and the replacement of depleted iron stores before planned surgery.
- The use of simple alternatives to transfusion, such as intravenous replacement fluids.
- Good anaesthetic and surgical management.
- Erythropoietin can be used in elective surgery.

NOTE: Erythropoietin and haematinics are not for use in emergencies.

1.3 THE USE OF FRUSEMIDE (FUROSEMIDE) IN TRANSFUSION

Many clinicians routinely use frusemide before transfusion for the fear of fluid overload. However there is no evidence base for this practice. Top up transfusion of 2-3 units of red cells in a stable patient with no history or signs of cardiac failure or fluid overload will not require frusemide premedication.

Fluid overload due to transfusion is likely to occur in:

- Patients with severe chronic anaemia.
- Patients with overt cardiac failure.
- Severely malnourished children.

Fluid overload can be prevented in these patients by either giving frusemide 40-80mg for adults and 1mg/kg for children, or by reducing the rate of transfusion. Frusemide is obviously not indicated in actively bleeding or hypovolaemic patients.

Frusemide should not be routinely used as premedication when transfusing blood or blood products.

2. ORDERING & ADMINISTRATION OF BLOOD/BLOOD PRODUCTS

'Getting the right blood/blood product to the right patient at the right time'

Safe transfusion of blood and blood products is the responsibility of all professionals involved in the patient's care. Before prescribing blood products for a patient, it is important to consider whether that patient really needs blood/blood product to prevent significant morbidity or mortality. Safety can be compromised at each stage of the process from ordering through to completion of the transfusion and post transfusion monitoring.

2.1 INFORMED CONSENT

The advent of HIV-AIDS and its spread through blood component therapy especially among haemophiliacs in the 1980s, led the impetus for the need for specific informed consent for transfusion therapy. It was argued that patients should participate in the decision to be exposed to the risks of transfusion. Although HIV is the risk that the public is most aware of and most scared of, it is recognised that there are other severe transfusion risks. In informed consent, patients need to be told about these as well.

However, the clinical benefits of transfusion therapy should not be underestimated. It should be borne in mind that most patients who require a transfusion might be at a higher risk of immediate morbidity and mortality from the underlying disease or condition. In such patients, the risks of transfusion reactions might be a lesser evil. The clinician has a legal responsibility to avoid carrying out non-medically indicated transfusions. This ensures that patients are not exposed to unnecessary risks. It is also the clinician's legal responsibility to document, in the patient's medical chart, the indications for any transfusion therapy carried out.

Most prescribers of blood are used to getting consent for surgery and the same principles apply for obtaining consent for blood transfusion.

• Informed consent should be obtained prior to all blood and blood product transfusions except in emergency situations where consent cannot be obtained without affecting the patient's clinical outcome.

• The patient giving consent should be competent through age and soundness of mind.

• The parent or guardian should provide consent for minors.

• The parent or guardian should provide consent for adults whose wishes regarding transfusions are not known and are not able to give consent such as those mentally disturbed, intellectually challenged *etc*.

NOTE:

1. The treating clinician or a member of the treating team who prescribes the transfusion is the only person(s) who may obtain consent.
2. The clinician must explain the procedure in terms and language that the patient understands.
3. The patient should be informed about:
   - Common risks and serious uncommon risks of transfusion
   - Potential benefits of transfusion
   - Alternatives to blood transfusion and their benefits and risks
   - Risks of declining transfusion therapy
4. The patient must have the opportunity to ask questions.
5. The patient must have the opportunity to make an uncoerced choice.
6. The clinician should document the discussion in the patient's medical chart.
7. Patient should sign the consent form (Appendix 1).

It is recommended that whenever possible, the consent and discussion should occur well in advance of any elective procedure so that there is adequate time to use alternatives should the patient so desire.

2.2 COMPLETION OF BLOOD REQUEST FORM, COLLECTION AND LABELLING OF SAMPLE FOR COMPATIBILITY TESTING

The safe transfusion of blood products starts with the positive identification of the patient at the time of drawing a blood sample for compatibility testing. This process is just as important in emergencies when mistakes are more likely to be made. An emergency is not a reason for neglecting the simple procedures to ensure the correct blood is supplied to a patient. Refer to appendix 3 for the procedure for the collection of blood sample for compatibility testing.

Patient identification

The WHO recommends that every patient admitted to hospital be issued with an identity wristband or firmly attached marker (such as a strip of tape around the patient's wrist) that displays a patient's unique hospital identification number. It should also include the patients name and date of birth (DoB) or age if DoB is not known. It is highly recommended that all hospitals in Malawi adopt this practice.

However as this is currently not a common practice in Malawi, the Ministry of Health recommends that the minimum standard for patient identification should consist of at least 3 of the following identifiers:

1. Patient's given and family names
2. Ward, clinic or operating room
3. Unique hospital identification number
4. Date of birth (or age if DoB is not known)

Identification is carried out by questioning the conscious patient or suitable responsible person. Each hospital should develop a system for identifying patients who are brought in unconscious by complete strangers such as victims of road traffic accidents.

The clinician should complete a standard blood request form (appendix 2) in full: outlining at least three patient identifiers plus details of previous medical, obstetric and transfusion history and number and type of blood product required.

The sample tube for compatibility testing should be labelled as clearly and accurately as possible at the patient's bed side as soon as the sample is drawn.

High molecular weight (over 150, 000) dextran or hydroxyethyl starch (HES) may cause problems in the cross matching; therefore the blood bank should be informed if these solutions have been infused. This information will assist the blood bank in finding the compatible units.

The blood bank should reject and return all incomplete or illegible request forms and specimen bottles even in emergencies as acceptance may compromise positive patient identification and lead to severe transfusion reactions.

2.3 RED CELL COMPATIBILITY TESTING

It is essential that all blood is tested before transfusion in order to:

- Ensure that transfused red cells are compatible with any antibodies in the recipient's plasma.
- Avoid stimulating the production of new red cell antibodies in the recipient, particularly anti-D.

All pre-transfusion test procedures should provide the following information about both the units of blood and the patient:

- ABO group
- RhD type

ABO group

In red cell transfusion, there must be ABO and RhD compatibility between the donor's red cells and the recipient's plasma.

1. Group O individuals can receive blood from group O donors only.
2. Group A individuals can receive blood from group A and O donors.
3. Group B individuals can receive blood from group B and O donors.
4. Group AB individuals can receive blood from group AB donors, and also from group A, B and O donors in that order of preference.

RhD red cell antigens and antibodies

Red cells have many Rh antigens. However unlike in the ABO blood group system, individuals very rarely make antibodies against these Rh antigens naturally, unless they have been exposed to them ('immunised') by previous transfusion or during pregnancy and childbirth.

The most important Rh antigen is the RhD antigen. A single unit of RhD positive red cells transfused to an RhD negative person will usually provoke production of anti-D antibodies. These antibodies can cause:

- Haemolytic disease of the newborn in subsequent pregnancies.
- Haemolysis of RhD positive red cells in subsequent red cell transfusion.

Red cell antibodies

Ideally immunological pre-transfusion test procedures should be capable of detecting both IgM and IgG red cell antibodies. This is done in the laboratory by carrying out a saline room temperature cross-match (also known as emergency cross-match) and an indirect antiglobulin test method at 370C.

The routine cross-match consists of (i) saline cross- match (also known as emergency cross-match, and (ii) indirect antiglobulin test. It is recommended that both tests are done before issuing a unit of a red cell product (red cell suspension or whole blood).

Malawians have relatively homogeneous red cell antigens compared with other populations; however health professionals should be aware that without a routine cross-match there is a risk of delayed haemolytic transfusion reactions. The routine cross-match, though not routinely done, should be considered for patients who have had a known delayed haemolytic transfusion reaction or patients who have had, or are likely to require multiple transfusions. These include patients with sickle cell disease, aplastic anaemia, leukaemia and those on chemotherapy.

2.4 COLLECTION OF THE BLOOD FROM THE BLOOD BANK

A common cause for transfusion reactions is the transfusion of the "wrong" blood intended for a different patient. This is often due to mistakes when collecting blood from the blood bank. The following procedure is recommended:

1. The person coming from the ward to collect the blood from the blood bank should bring written documentation to identify the patient(s). The documents may include a drug chart, patient's file or health passport.

2. Before issuing the blood the laboratory personnel will check that the following details on the compatibility label / crossmatch label (appendix 4) attached to the blood pack exactly match the details on the patient's documentation:
   - Patient's given and family names
   - Unique hospital identification number
   - Patient's ward, operating room or clinic
   - Patient's date of birth or age
   - Patient's ABO and RhD group

3. The blood bank should have a blood collection register which should be filled and signed for every blood product collected.

2.5 STORING THE BLOOD IN THE WARD OR OPERATING THEATRE

Once the blood product has been issued by the blood bank, the transfusion should be commenced within 30 minutes of the blood product removal from refrigeration.

If the transfusion cannot be started within 30 minutes, the blood product must be stored in an approved blood refrigerator or validated blood cold chain box at a temperature of 2° C to 10° C for a maximum of 6 hours. If the blood product cannot be transfused within 6 hours, it must be returned to the blood bank laboratory.

The temperature inside every refrigerator or a blood cold chain box used for blood storage in wards and operating rooms should be monitored and recorded daily – with a minimum and maximum temperature thermometer - to ensure that the temperature remains between 2° C and 10° C.

If the ward or operating room does not have a refrigerator or a blood cold chain box that is appropriate for storing blood, the blood should not be released from the blood bank until immediately before transfusion.

All unused blood and blood products should be returned to the blood bank so that their return and reissue or safe disposal can be recorded.

2.6 THE CANNULA AND GIVING SET

- Cannulae and giving sets for infusing blood must be sterile and must never be reused. Ideally use flexible plastic cannulae. Avoid opening either the cannula or giving set until it is to be used and avoid touching sterile components.
- Use designated blood giving sets as they have filters (about 20 micrometers in size) that filter out microaggregates and debris. Never use an ordinary IV line for blood transfusion.
- Clean the area for cannula insertion with at least 2 clean swabs with surgical spirit / alcohol. Do not re-use a swab.
- Do not add any fluid or drugs to the unit before or during transfusion. Remove blood giving-set after completion of transfusion and ideally remove cannula.

2.7 CHECKING THE BLOOD PACK

When starting a transfusion:

- Check the blood pack for signs of deterioration or contamination (appendix 5 and appendix 6)
- Check the identifiers on the blood pack and ensure that they match those of the patient.
  - Name
  - Age
  - Ward
  - Unique hospital identification number
  - Blood group
  - Look for the presence of malaria positivity label.

Ideally the patient's details should be checked against an identification label attached to the patient but when this is not available it should be done by asking the patient for the details one by one and checking against the details on the blood pack. When a patient is unable to provide their details (e.g. too unwell or patient is a child) then the patient's guardian should provide them. Open ended questions should be asked e.g. 'What is your name?' and not 'Are you John Phiri?'

2.8 MONITORING THE PATIENT DURING TRANSFUSION

One of the major roles of the nurse, in transfusion, is monitoring of the patient. The accurate and quick interpretation of adverse effects can prevent a fatal reaction from occurring.

1. For each unit of blood transfused, as a minimum, monitor the patient as follows:
   - Before starting the transfusion
   - 15 minutes after starting the transfusion
   - 1 hour after starting the transfusion
   - On completion of the transfusion
   - 4 hours after completing the transfusion.

2. At each of these stages ask the patient how they are feeling. In addition record the following information on the patient's chart:
   - Patient's general appearance
   - Temperature
   - Pulse
   - Blood pressure
   - Respiratory rate
   - Any abnormal symptoms existing at the start of transfusion should be noted e.g. dyspnoea, chills, oliguria, lumbar pain. Changes in intensity of these may also indicate the potential for a transfusion reaction and should be assessed clinically.
   - Extra care must be taken in the unconscious patient to monitor and react to changes in vital signs. Excess oozing from the operative site or various access points and unexplained hypotension may indicate that a haemolytic reaction is occurring.

GETTING THE RIGHT BLOOD TO THE RIGHT PATIENT AT THE RIGHT TIME	
1.	Assess the patient's clinical need for blood and when it is required.
2.	Inform the patient or guardian about the proposed transfusion treatment and record in patient's notes that you have done so.
3.	Record indications for transfusion in the patient's notes.
4.	Select the blood product and quantity required.
5.	Complete the blood request form accurately and legibly.
6.	If blood is needed urgently contact blood bank by telephone.
7.	Obtain and correctly label a blood sample for compatibility testing.
8.	Send blood request form and sample to the laboratory.
9.	Laboratory performs ABO and RhD grouping and cross-matching.
10.	Blood is collected from the hospital blood bank.

11. Transfuse the blood within 30 minutes of removal from refrigeration. If however it cannot be immediately transfused store it an approved blood refrigerator or validated blood cold chain box at 2-10oC.
12. Check the identity on: • Patient • Blood product • Patient documentation.
13. Administer the blood product.
14. Record in patient's notes: • Type and volume of each product transfused • Unique donation number of each unit transfused • Blood group of each unit transfused • Time at which the transfusion of each unit commenced • Signature of person administering the blood.
15. Monitor the patient before, during and on and after completion of the transfusion.
16. Record the completion of transfusion.
17. Identify and respond immediately to any adverse effect. Record any transfusion reactions in the patient's notes.

Overview of steps for safe blood transfusion (WHO, 2000)

3. RED CELL PRODUCTS

Red cell products are used to improve tissue oxygenation. They comprise whole blood and red cell suspensions.

3.1 WHOLE BLOOD

Whole blood is a complex tissue from which clinically appropriate components are processed. Many of the components, particularly clotting factors and platelets, deteriorate within hours of donation. Blood components are therefore made within 6-8 hours of blood donation. Whole blood collected in CPDA1 and stored continuously in a blood bank fridge at 4-6oC has the maximum shelf life of 35 days.

Indications

- As red cell replacement in the absence of red cell suspensions.
- Massive haemorrhage with the possibility of recurrence or continuation.
- Red cell replacement for severe anaemia in child with severe malnutrition.
- Red cell replacement in septicaemia patients who remain in shock after appropriate resuscitation with crystalloids.

3.2 RED CELL SUSPENSION

Red Cell Suspensions are prepared from a unit of whole blood from which plasma has been removed by centrifugation in a closed sterile system. Most of the plasma is removed and 100 mls of sterile preservative solution of saline, adenine, glucose and mannitol (SAGM) is added to nourish the cells for long-term storage of up to 42 days. The product has a haematocrit of 50-70% (haemoglobin of approximately 20g/dl). The white cells are not removed. These contrast with packed cells (red cell concentrates) in which plasma is removed with no additional preservative solution added.

Indications

- Product of choice for red cell replacement in anaemia or haemorrhage.
- Ideal for red cell replacement in paediatric patients.

Before prescribing red cell suspension or whole blood, consider the following questions:

- Is the patient's haemoglobin (Hb) low enough that without a transfusion they would be clinically compromised or at risk of death?
- Is the decision to give blood solely based on Hb level (which is only one aspect of the decision to transfuse) or does the patient have serious clinical signs of anaemia for which transfusion is required to relieve?
- Could the haemoglobin be raised (or worsening of anaemia be prevented) by either treating the underlying condition (e.g. malaria, intestinal parasites) or by haematinic supplementation (iron, folic acid, Vitamin B12)?
- When appropriate – e.g. acute blood loss - have you tried volume expansion with intravenous fluid replacement and reassessed to ensure that the patient still requires blood?

3.2.1 THE USE OF RED CELLS IN ADULT MEDICAL PATIENTS

- Take a sample for Hb – ideally as part of full blood count (FBC) - before making a decision to transfuse. In some hospitals, packed cell volume (PCV) or haematocrit (Hct) may be used in place of FBC. The PCV is roughly equivalent to 3 x the Hb in g/dl e.g. PCV of 30%is equivalent to Hb of 10 g/dL and PCV or Hct of 15% is equivalent to Hb of 5 g/dl.
- Start treatment for the cause of the anaemia.
- Asymptomatic chronic anaemia does not need any red cell transfusion.

There is no absolute red cell concentrates transfusion "trigger" but the following guidelines are offered:

- Hb<5g/dl: Usually transfuse.
- Hb>10g/dl: Do not transfuse.
- Hb: 5-10g/dl: Individualise the decision to transfuse by considering the patient's clinical condition.
  - Consider likely trend of Hb
  - Consider rate of change of Hb
  - Assess signs and symptoms
  - Asses cardiopulmonary reserve

Signs and symptoms of severe anaemia

Symptoms

Fatigue

Dyspnoea

Angina

Palpitation

Syncope

Signs

Tachycardia

Orthostatic hypotension

NOTE:

1. A unit of whole blood or red cell suspension will on average raise the Hb of a 70 kg adult by 1-1.5g/dl.
2. Do not attempt to normalise haemoglobin in chronically anaemic patients in one transfusion session.

3.2.2 THE USE OF RED CELLS IN OBSTETRICS & GYNAECOLOGY

Red cell products in obstetrics and gynaecology are indicated in:

a) Major obstetric haemorrhage (any blood loss in the peripartum period, concealed or revealed that endangers life, includes bleeding of abortion) and

b) Chronic anaemia.

Key points

- Anaemia in pregnancy is Hb< 11g/dl in the first and third trimester and Hb 10.5g/dl in the second trimester.
- The diagnosis and effective treatment of chronic anaemia in pregnancy is an important way of reducing the need for future transfusion.
- The decision to transfuse red cells should not be based on Hb levels alone, but also on the patient's clinical condition.
- Blood loss during normal vaginal delivery or Caesarean section does not normally necessitate transfusion provided that the maternal Hb is above 10g/dl before delivery.

- Reduce the wastage of blood by:
  - Using replacement fluids.
  - Actively managing the third stage of labour.
  - Using best anaesthetic and surgical procedures.
  - Minimising blood taken for laboratory investigations.

INDICATIONS FOR RED CELL TRANSFUSION IN CHRONIC ANAEMIA IN PREGNANCY

Duration of pregnancy less than 36 week

1. Hb ≤ 5 g/dl, even without clinical signs of cardiac failure or hypoxia.
2. Hb between 5 and 7 g/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
   - Preexisting heart disease, not causally related to anaemia

Duration of pregnancy 36 week or more

1. Hb ≤ 6 g/dl
2. Hb between 6 and 8 g/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
   - Preexisting heart disease, not causally related to anaemia

Elective Caesarean section

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

- Antepartum haemorrhage (APH).
- Postpartum haemorrhage (PPH).
- Previous Caesarean section.

1. Hb between 8 and 10 g/dl: establish blood group and save freshly taken serum for crossmatching.
2. Hb< 8 g/dl: two units of blood should be crossmatched and available

EMERGENCY MANAGEMENT OF MAJOR OBSTETRIC HAEMORRHAGE

Resuscitate

1. Call extra staff to help:
   - Senior obstetrician
   - Senior anaesthetist
   - Midwives
   - Nurses
2. Administer high concentration of oxygen.
3. Head down tilt/raise legs.
4. Establish IV line access with 2 large-bore cannulae (14 g or 16 g)
5. Infuse crystalloid or colloid fluids as rapidly as possible. Restoration of normovolaemia is a priority.
6. Inform the laboratory blood bank there is an emergency
   Give blood group O RhD negative blood, and/or uncrossmatched group specific blood until crossmatched blood is available.

Monitor/investigate

1. Send blood sample to laboratory blood bank for crossmatching of further blood, but do not wait for crossmatched blood if there is serious haemorrhage.
2. Order full blood count.
3. Order coagulation screen (if available).
4. Continuously monitor pulse rate and blood pressure.
5. Insert urinary catheter and measure hourly urinary output.
6. Monitor respiratory rate.
7. Monitor conscious level.
8. Continue to monitor Hb or haematocrit

Stop the bleeding

1. Identify the cause.
2. Examine cervix and vagina for lacerations.
3. If uterus hypotonic and atonic:
   - Ensure bladder is empty

- Give IV oxytocin 10 units
- Give misoprostol 1mg per rectal.
- Oxytocin infusion (40 units in 1000 ml of normal saline or Ringer's lactate)
- 'Rub up' fundus to stimulate a contraction
- Bimanual compression of the uterus

4. If there are no retained products of conception, and uncontrolled bleeding, treat as disseminated intravascular coagulation.
5. Consider surgery earlier than later.
6. Consider hysterectomy earlier than later.

3.2.3 THE USE OF RED CELLS IN SURGERY

Red cell products are transfused in both emergency and elective surgical conditions. During surgery, the decision to transfuse should primarily be based on the careful assessment of the volume and rate (actual and anticipated) of blood loss, the patient's clinical response (to blood loss and fluid replacement therapy) and signs indicating inadequate tissue oxygenation.

In both emergency and elective surgery red cell products are given as part of resuscitation measures after appropriate volume expansion with crystalloids or colloids.

In general surgery consider transfusion if:

- The pre-operative haemoglobin level is less than 8g/dl and surgery is associated with blood loss of > 10% of estimated blood volume).
- The intra- or post-operative haemoglobin falls below 7g/dl.

In burns transfuse red cells in patients with >35% full thickness burns after the shock phase has been successfully managed (usually after 48 hours).

When a split skin graft (SSG) is planned, ensure that the Hb is at least 8g/dl (PCV of at least 24%). If the Hb is lower than 8 g/dl a blood transfusion should be administered, after which the Hb should be rechecked before a SSG is carried out.

For the use of red cell products in elective surgical and gynaecological conditions, see the maximal blood ordering schedule (chapter 8).

3.2.4 GENERAL NOTES

Tourniquets

- Application of a limb tourniquet reduces blood loss when operating on extremities.
- The inflation pressure of the tourniquet should be approximately 100–150 mmHg above the systolic blood pressure of the patient. Towards the end of the procedure, deflate the tourniquet temporarily to identify missed bleeding points and ensure complete haemostasis before finally closing the wound.
- Do not use tourniquets on patients with sickle cell disease or trait (HbSS, HbAS, HbSC) because of the risk of precipitating sickling, or where the blood supply to the limb is already precarious: e.g. severe peripheral vascular disease.

Blood salvage

Blood salvage is 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 to blood salvage

- Blood contaminated with bowel contents, bacteria, fat, amniotic fluid, urine and malignant cells.
- 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.

Methods of blood salvage

Methods of blood salvage include gauze filtration, manual suction collection system and automated suction collection systems.

Gauze filtration is the only method available in most hospitals in Malawi at present. It is inexpensive and suitable for the salvage of blood from body cavities. At operation and using an aseptic technique, collect blood from the cavity using a ladle or small bowl. Mix the blood immediately with anticoagulant. Filter the blood through gauze and re-infuse into the patient. Do not use the salvaged blood if there are any concerns that the method of collection has not been aseptic or if there is suspicion that the blood has clotted.

4. PAEDIATRIC TRANSFUSION

Paediatric patients may require transfusion for reasons similar to those in adults but with some additional unique situations, primarily in the neonates. Any of the blood products described for transfusion to adults may be used in children. Neonates are babies within 4 weeks of life following normal gestational age (40 weeks). Infants are children within the first year of life.
Paediatric anaemia is defined as a reduction in haemoglobin concentration or red cell blood volume (PCV) below normal values for healthy children.

Normal haemoglobin/ PCV values differ according to the child's age.

Age	Haemoglobin (g/dl)	PCV (%)
Day 1	± 18	54
1 month	± 14	42
3 months	± 11	33
6 months – 6 years	±12	36
7-13 years	±13	39
14 years +	Same as adults, by sex	

4.1 PRETRANSFUSION TESTING FOR NEONATES

The neonate's immune system is not fully functional; any red cell alloantibodies in the neonate are those of the mother.

NOTE:
During the first 4 months of life, pre-transfusion testing differs from adults; a blood sample is obtained from both the mother and the child. As any antibodies in the child's plasma are the mothers, the child's sample is used for determining the blood group and the maternal plasma for cross-matching.
For children older than 4 months pre-transfusion testing procedures are the same as for adults.

4.2 INDICATIONS FOR RED CELL TRANSFUSION FOR NEONATES

- Hb < 12 g/dl (PCV < 36%) in the first 24 hours of life.
- Hb <12 g/dl (PCV <36%) in a neonate receiving mechanical ventilation.
- Hb <8-11 g/dl (PCV < 24-33%) and oxygen dependent.
- Hb < 7 g/dl (PCV < 21%) when stable and off oxygen.

4.3 EXCHANGE TRANSFUSION

Exchange transfusion is used to treat severe hyperbilirubinaemia (severe jaundice) and to manage severe anaemia at birth usually caused by haemolytic disease of the newborn (HDN). The aim, in exchange transfusion, is to remove RhD positive cells, reduce bilirubin levels and remove maternally derived anti-D antibodies.

In Malawi, whole blood is used in exchange transfusion. The whole blood used should be:

- Group O (or ABO compatible with maternal and neonatal plasma),
- RhD negative,
- Crossmatch compatible with maternal plasma and
- Less than 5 days old (to avoid hyperkalaemia and reduced levels of 2,3 diphosphoglycerate levels leading to poorer oxygen release).

The unit should not be transfused directly from the fridge. Instead it should be warmed during the procedure.

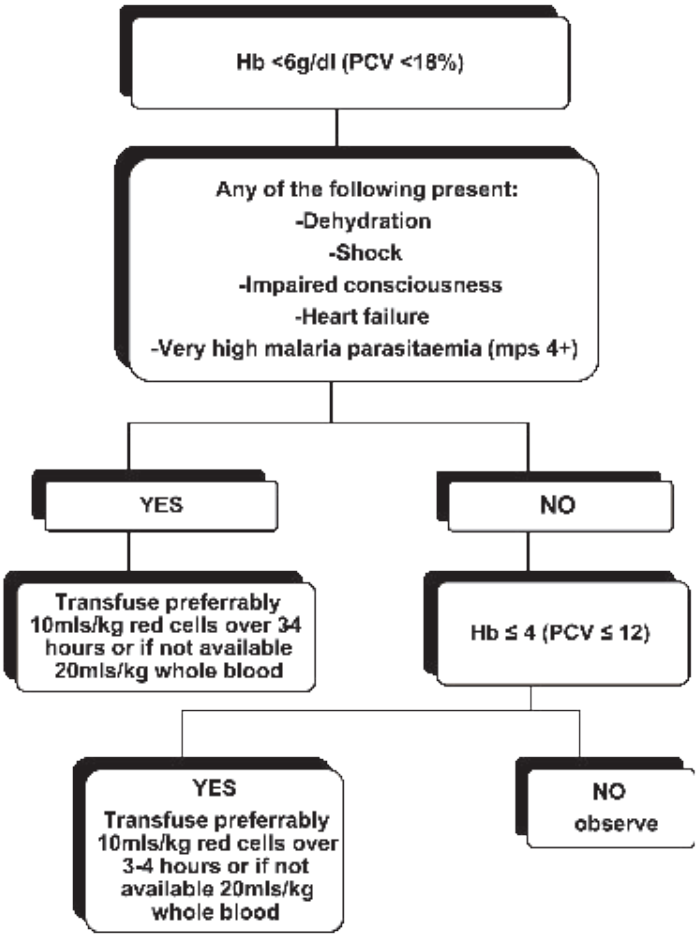
4.4 INDICATIONS FOR RED CELL TRANSFUSION IN INFANTS

General Notes

Signs and symptoms of anaemia in paediatric patients may sometimes be nonspecific, however the child with complicated anaemia will present with:

- Fast, deep breathing and chest in-drawing
- Flaring of nostrils
- Reduced drinking or breastfeeding

- Grunting
- Prostration (unable to sit unassisted for a >1year old child or unable to drink/breastfeed for a <1 year old child)
- Impaired level of consciousness
- Cool peripheries, slow capillary refill (≥ 3 seconds) and weak pulse.



Flow chart for management of severe anaemia in children >4 weeks old.

In severely malnourished children fluid overload is a serious complication. Give 10 ml/kg of red cells or whole blood (instead of 20 ml/kg).

Specific paediatric red cell suspension

The use of an adult red cell unit for infants will result in significant wastage since the volumes required are generally small. The MBTS prepares special red cell suspension or whole blood for paediatric use in 100-200 ml packs. Platelets and FFP however are not prepared specially for paediatric use.

4.5 PLATELET TRANSFUSION IN NEONATES

Platelet transfusion should be considered in all neonates with platelet count of less than 30 x 109/L at a dose of 5ml/kg

For platelet use in children refer to chapter 5.

4.6 FRESH FROZEN PLASMA TRANSFUSION IN NEONATES

In neonates with significant coagulopathy consider haemorrhagic disease of the new born. Initial therapy should be vitamin K 1mg IM (or IV if there is significant bleeding).

Fresh frozen plasma (FFP) should never be used for volume replacement. It should be reserved for neonates unresponsive to vitamin K with significant coagulopathy (i.e. prolonged PT or APTT) and at risk of bleeding or those who are about to undergo invasive procedure.

For children older than 4 weeks refer to chapter 6.

ABO group specific plasma (or AB plasma) is recommended.

Dosage: 15 ml/kg

5. PLATELETS

Platelet transfusions are required for the treatment or prevention of bleeding due to reduced platelet numbers or function.

Avoid aspirin and other non steroidal analgesics and IM injections in patients with significant thrombocytopaenia.

Platelet concentrates are made by centrifuging a unit of whole blood within 6 hours of collection. Platelets have a short shelf life of 5 days and are stored in platelet agitators at 20-24oC, under continuous agitation. A unit of platelets contains at least 55 x 109 platelets suspended in 50-70mls of plasma with residual red cells. White cells are not removed. In Malawi platelets are only likely to be available at central hospitals.

5.1 THE USE OF PLATELETS

Platelets should not be stored in the refrigerator but should be kept in special platelet agitator. Group specific platelets need to be given whenever possible. Avoid the use of Group O platelets in infants.

Avoid the use of RhD positive platelets in RhD negative individuals especially women of child bearing potential.

There is a risk of sensitisation if RhD positive platelets are given to RhD negative patients. If it is necessary to transfuse RhD positive platelets into RhD negative pre-menopausal women, administer anti-D, if available. The usual dose of anti-D is 500 IU intramuscular for 6-8 units of platelets transfused. Anti-D immunoglobulin is an intramuscular preparation and should only be given once the bleeding parameters have returned to suitable levels but within 72 hours of transfusion.

5.2 INDICATIONS FOR PLATELET TRANSFUSIONS

The decision to transfuse platelets should be based on a combination of clinical and laboratory findings rather than on empirical platelet levels. Transfusion of platelets is standard treatment for bleeding associated with thrombocytopaenia and/or defective platelet function in conditions such as:

- Bone marrow failure e.g. aplastic anaemia, acute leukaemia
- Congenital disorders of platelet function

- Acute disseminated intravascular coagulation (DIC).
- Massive transfusion with dilutional thrombocytopaenia.

When to transfuse platelets in thrombocytopaenic patients

- Patients with chronic thrombocytopaenia who have no symptoms of bleeding do not require platelet transfusion.
- Patients with acute thrombocytopaenia e.g. post chemotherapy should be considered for prophylactic transfusion if platelet count is<10x109/l (or < 20x 109 if febrile)
- Platelets <50x109/L and either post surgery or major haemorrhage.
- Platelets <50x109/L and for most surgical procedures e.g. laparatomy, liver biopsy surgery and central line insertion. Platelets should be transfused up to >50x109/L immediately before surgery.
- For surgery to the eye or brain a platelet level of >100 x 109 /L is recommended.
- Platelet transfusion is not required for bone marrow aspirate and biopsy. Application of local pressure is sufficient.

Contraindications to platelet transfusions

Platelets are generally contraindicated in patients with immune causes of thrombocytopaenia unless there is severe life threatening haemorrhage.

- Thrombotic thrombocytopaenic purpura (TTP): Platelet transfusion may potentiate thrombosis.
- Heparin induced thrombocytopaenia (HIT): May potentiate thrombosis.

The bleeding patterns in platelet abnormality (qualitative or quantitative) are mucocutaneous in nature. The typical bleeding includes:

- Diffuse oozing from surgical incision
- Scattered petechiae
- Oozing from venepuncture sites
- Ecchymoses in areas not associated with trauma or incisions
- Gum bleeding
- Nose bleeding
- Prolonged menses
- Retinal bleeding.

NB: Heavy blood loss is unlikely to be due to isolated thrombocytopenia.

Platelet administration and dose

Ideally platelets should be transfused through a platelet giving set; however they can also be given through ordinary blood giving sets.

A total dose of platelets should be given over a period of 15-30 minutes.

- For adults 1 unit per 10kg (5-6 units for most adults). In an adult all 5-6 units should be given over 15-30 minutes.

Monitoring

Response to platelet transfusion should be judged on clinical improvement, normalisation of bleeding time, and relative increase in circulating platelet count. Significant increases may not occur in the actively bleeding patient due to rapid utilisation.

- In an adult (approximately 70kg) 1 dose of platelet should raise platelet count by >20 x 109/L when measured 24 hours after transfusion.
- A poor response may be due to allo-immunisation, infection, DIC, splenomegaly, treatment with antibiotics or amphotericin. In such cases double the dose.
- If a response is not achieved a platelet count should be checked 1 hour post infusion and the situation discussed with a Haematologist if available.

A good clinical response with a poor platelet count increment means adequate treatment and is not an indication for administration of more platelets.

NB: Febrile non-haemolytic transfusion reaction is a common side effect of platelet concentrate transfusion, due to the presence of a high number of white cells.

6. FRESH FROZEN PLASMA

Fresh frozen plasma (FFP) is separated from anti-coagulated whole blood within 6 hours of donation. The separated plasma is then frozen and kept at -25oC or below. FFP contains all the clotting factors in normal physiological levels and comes in volumes of 200-300ml. FFP carries the same risk of latent viral infection as whole blood.

6.1 USE OF FRESH FROZEN PLASMA

- Fresh frozen plasma must be thawed before use.
- It is preferable to thaw fresh frozen plasma in a water bath at 30-37oC. (If a water bath is not available, a plastic basin with lukewarm or cold tap water can be used). Never use hot water.
- Frozen products are very brittle. The pigtails and the pack in general do break easily. Therefore avoid direct handling of plasma packs. MBTS issues these in plastic bags to minimise direct handling of the products.
- Ensure that the pigtails and portals do not come in direct contact with water for thawing.
- Fresh frozen plasma must be ABO compatible with the patient's red cells especially if large volumes are going to be transfused.
- If ABO group of the patient is not available use AB FFP, as it contains no anti-A or anti-B antibodies and is the universal donor for plasma transfusions.
- Fresh frozen plasma is hyper-osmolar due to the additives in the anticoagulant. Large volume transfusion can cause hypernatraemia and hypervolaemia.
- In elderly and very young patients, care should be taken not to precipitate pulmonary oedema especially if cardio-pulmonary function is compromised and tissue oedema is present.

Once thawed, FFP must be transfused as rapidly as possible (15-20 minutes per unit). Labile coagulation factors deteriorate within few hours of thawing.
Fresh frozen plasma must not be refrozen. FFP can be stored at 4oC for up to 24 hours if it is to be used for fibrinogen and other stable factors' replacement..

6.2 INDICATIONS FOR FFP USE

- Replacement of single factor deficiencies (if single factor concentrates are not available)
- Immediate reversal of Warfarin effect
- Vitamin K deficiency associated with active bleeding
- Acute DIC
- Thrombotic Thrombocytopenic Purpura (TTP)

FFP may be used in massive transfusion or liver disease if there is active bleeding and evidence of disturbed coagulation.

DOSE: 15-20 ml/kg (minimum dose about 1 litre in an adult)

No Justification for FFP use in:

- Hypovolaemia
- Nutritional support in protein losing states
- Plasma exchange except in TTP

Monitoring

- Clinical response
- Prothrombin time (PT)
- Activated partial thromboplastin time (APTT).

7. CRYOPRECIPITATE

Cryoprecipitate is the insoluble plasma proteins that precipitate out when fresh plasma is rapidly frozen to -65oC or below and thawed at 4oC. The precipitate is removed and suspended in 30 mls of plasma, refrozen and kept at -25oC or below.

Cryoprecipitate contains the same risk for latent viral infection as whole blood. In Malawi it is only likely to be available at central hospitals.

Cryoprecipitate contains:

- Fibrinogen (150-250 mg per unit)
- Factor VIII (± 100 iu per unit)
- von Willebrands factor (± 100 iu per unit)
- Fibrinectin
- Factor XIII

7.1 INDICATIONS FOR CYROPRECIPITATE USE

- Haemophilia A
- von Willebrands Disease
- Factor XIII deficiency
- Hypofibrigenaemia
- Disseminated intravascular coagulation
- Dilutional coagulopathies/massive transfusions

Detailed description of the use of Cryoprecipitate in factor deficiency will not be given as hospitals in Malawi do not have the capacity to diagnose these conditions. Should you suspect anyone to have any of these conditions contact the MBTS Medical Director. In central hospitals the blood bank should have cryoprecipitate for use in dilution coagulopathies including massive transfusions, and for use in DIC.

Dose: The dose for cryoprecipitate will depend on the underlying condition. For example if cryoprecipitate is transfused for Haemophilia A, dose will depend on the desired increase in factor VIII levels.

8. MAXIMUM SURGICAL BLOOD ORDERING SCHEDULE (MSBOS)

Maximum surgical blood ordering schedule aims at eliminating unnecessary use of scarce blood and to minimise the costs to the patient or the hospital in elective surgery. Bearing in mind that blood transfusions are not without risks, it is important that all efforts be undertaken to avoid transfusions except where they are absolutely necessary to prevent mortality or significant morbidity.

For use of blood in elective surgery in hospitals in Malawi the following MSBOS is given as a guide to the number of units of blood that should be reserved for patients with these conditions. There may be exceptions. However when this is the case written justification must be provided with the order for the reason for needing additional blood.

The laboratory should not accept orders for blood that are higher than those detailed below except where written justification for the additional units has been provided.

SURGICAL PROCEDURE	NUMBER OF RED CELL UNITS TO ORDER
Amputation above or below knee	0 - 1
Burr holes	1
Colectomy (subtotal)	2
Colectomy (total/AP resection)	2 - 3
Common bile duct exploration	1
Cholecystectomy	0
Exploratory laparotomy	0 - 2
Gastrectomy	2
Hip arthroplasty	2

Intra abdominal shunt operations	2 - 3
Intra abdominal tumour resection	2
Major pelvic surgery	2
Major spinal surgery	3
Mastectomy	1
Mandibulectomy or maxillectomy	2
Nephrectomy	2
Oesophagectomy	2
Prostatectomy (open)	2
Splenectomy	1
Thyroidectomy	1 - 2
Major vascular procedures	2 - 3

NOTE:
The following conditions may require the transfusion of a lot of blood and blood products:

- Abruptio placentae
- Postpartum haemorrhage
- Ruptured uterus
- Ruptured oesophageal varices
- Major trauma.

9. RISKS OF BLOOD TRANSFUSION

Transfusion of blood and blood products involves the clinician in the evaluation of the risk/benefit ratio to the patient. All blood products carry a risk of immune and non-immune-mediated adverse effects including the transmission of TTIs such as HIV. Transfusion reactions are described as 'acute' when they occur within 24 hours of transfusion and as 'delayed' when they occur after 24 hours of transfusion. This can be days, months or even years after transfusion as is the case with some TTIs.

The MBTS endeavours to minimise the TTI risk by employing different methodologies including careful donor selection and screening for TTIs.

9.1 TRANSFUSION TRANSMISSIBLE INFECTIONS AND DONOR SELECTION

Health screening of blood donors

All blood donors are screened by means of a written questionnaire for evidence of any past or present infections that might be transmitted to the patient. This screening includes questions about the behavioural patterns that may identify a risk of HIV and other infections. All blood donors undergo a pre-donation counselling session where further verbal questioning is done before being allowed to donate blood.

Testing

All donated units of blood are screened for laboratory evidence of syphilis, Hepatitis B and C, HIV 1 and 2 and malaria.

The tests used are internationally validated and are subject to stringent quality control.

MBTS uses ELISA for Hepatitis B surface antigen, antibodies to Hepatitis C; HIV 1 and 2 antibodies, HIV p24 antigen (using a combo assay); antibodies to syphilis and thick film microscopy for malaria. All units of blood positive for these infectious agents are removed from quarantine and incinerated. Low malaria parasitaemia blood (+1) may be issued to hospitals when blood stocks are low. They are clearly labelled malaria positive for the knowledge of hospital blood

bank staff and clinicians for their action. Testing for HIV p24 antigen potentially reduces the window period to about 2 weeks. [Note that test method is just one factor in the length of the diagnostic window period. Other factors play a part (patient immune system; infectious dose, etc.) and these may make the window period considerably longer or shorter].

Malaria positive blood should not be transfused to high risk population groups such as children under 5 years of age, pregnant women and those who have no or low immunity to malaria. Malaria treatment should be given when transfusing malaria positive blood.

Given the strict adherence to international standards of donor selection and sensitive test systems, the risk of hidden infection is low but recipients must be informed about the risk.

9.2 SERIOUS TRANSFUSION REACTIONS

MBTS tests for ABO blood group in two separate laboratories and the results must tally before labelling is done. RhD testing is done in a manner that allows for the diagnosis of weak RhD positives (Du). Most serious transfusion reactions can be avoided by cross matching, compatibility testing and strict attention to details of patient identification at point of issue. The clinician ordering the blood should ensure strict specimen identification by indicating patient unique identifiers. The laboratory should be given enough time for a full cross match whenever possible. A full crossmatch should still be performed after blood has been issued following an emergency crossmatch.

Haemovigilance programs throughout the world have identified administration of blood to the incorrect patient as the leading cause of serious transfusion reactions responsible for morbidity and mortality in transfusion medicine.

Signs and symptoms highly suggestive of a serious acute transfusion reaction

- Chills/rigours
- Fever/sweating
- Tachycardia/Bradycardia
- Dyspnoea
- Hypertension
- Hypotension

- Urticaria
- Nausea/vomiting
- Oliguria/anuria
- Chest or flank pains
- Haemoglobinuria
- Agitation

These signs and symptoms are grouped to give an indication of the severity of the transfusion reactions, which will help in the management of the reactions.

9.3 RECOGNITION AND MANAGEMENT OF ACUTE TRANSFUSION REACTIONS

Category 1: Mild Reactions

Symptoms: Pruritus (itching)

Signs: Localised cutaneous reactions: Urticaria and/or rash

Possible cause: Hypersensitivity (mild)

Immediate Management

Slow the transfusion.

Administer antihistamine IM/IV or PO

- Chlorpheniramine 0.1 mg/kg IM or IV for children; 10mg IM/IV for adult or chlorpheniramine 4mg PO.
- Promethazine 6.25-12.5mg for children aged 5-12 yrs and 25mg for adults.

If no clinical improvement within 30 minutes or if signs and symptoms worsen, treat as Category 2.

Category 2: Moderately Severe reactions

Symptoms: Anxiety, Pruritus, Palpitations, Mild dyspnoea, Headache

Signs: Flushing, Urticaria, Rigors, Fever, Restlessness, Tachycardia

Possible cause: Hypersensitivity (moderate to severe), Febrile non-haemolytic transfusion reaction, Contamination with pyrogens and / or bacteria.

Immediate management

Seek help immediately from the anaesthetist, emergency team or whoever is available and skilled to assist.

Stop the transfusion. Replace the infusion set and keep IV line open with normal saline.

Notify the clinician responsible for the patient and the blood bank immediately. Send blood unit with infusion set, freshly collected urine and new blood samples (1 clotted and 1 anticoagulated) from vein opposite infusion site with appropriate request form to blood bank for laboratory investigations.

Administer antihistamine IM/IV or PO

- Chlorpheniramine 0.1 mg/kg IM or IV for children; 10mg IM/IV for adult or chlorpheniramine 4mg PO.
- Promethazine 6.25-12.5mg for children aged 5-12 yrs and Promethazine 25mg for adults.

Give oral or rectal antipyretic (e.g. paracetamol 10 mg/kg or 0.5mg – 1 g in adults). Never give aspirin.

Give IV corticosteroids and bronchodilators if there are anaphylactoid features (e.g. bronchospasm, stridor).

Collect urine for next 24 hours for evidence of haemolysis and send to laboratory.

If there is clinical improvement, restart transfusion slowly with new blood unit and observe carefully.

If no clinical improvement within 15 minutes or if signs and symptoms worsen, treat as Category 3.

Category 3: Life threatening reactions

Symptoms: Anxiety, Chest pain, Pain near infusion site, Respiratory distress, Loin or back pain, Headache, Dyspnoea

Signs: Rigors, Fever, Restlessness, Hypotension (fall of 20% in systolic blood pressure), Tachycardia (rise of 20% in heart rate), Haemoglobinuria (red urine), Unexplained bleeding (DIC).

Possible causes: Acute intravascular haemolysis, Bacterial contamination and septic shock, Fluid overload, Anaphylaxis, Transfusion associated acute lung injury (TRALI)

Immediate management

Seek help immediately from the anaesthetist, emergency team or whoever is available and skilled to assist.

Stop the transfusion. Replace the infusion set and keep IV line open with normal saline.

Infuse normal saline (initially 20- 30 ml/kg) to maintain systolic BP, if hypotensive, give over 5 minutes and elevate patient's legs.

Maintain airway and give high flow of oxygen by mask.

Give adrenaline (as 1:1000 solutions) 0.01 mg/kg body weight by slow intramuscular injection.

Give IV corticosteroids and bronchodilators if there are anaphylactoid features (e.g. bronchospasm, stridor).

Give a diuretic: e.g. frusemide 1 mg/kg IV or equivalent (if there is fluid overload) Notify the clinician responsible for patient and the blood bank immediately.

Send blood unit with infusion set, fresh urine sample and new blood samples (1 clotted and 1 anticoagulated) from vein opposite infusion site with appropriate request form to blood bank for investigations.

Check a fresh urine specimen visually for signs of haemoglobinuria.

Start a 24 hour urine collection and fluid balance chart and record all intake and output. Maintain fluid balance.

Assess for bleeding from puncture sites or wounds. If there is clinical or laboratory evidence of a DIC treat accordingly.

Reassess, if hypotensive:
Give further saline 20 - 30 ml/kg over 5 minutes.

Give inotrope, if available.

If urine output is falling or there is laboratory evidence of acute renal failure (rising K+, urea, creatinine):

Maintain fluid balance accurately

Give further frusemide

Consider dopamine infusion, if available

Seek expert help: the patient may need renal dialysis

If bacteraemia is suspected (rigors, fever, collapse, no evidence of a haemolytic reaction), start broad-spectrum antibiotics IV and send blood product bag to the laboratory for culture of contents.

NOTE:

- If moderately severe or life threatening transfusion reaction occurs, stop the transfusion immediately check the blood pack labels and ensure correct patient's identity and consult the blood bank.
- In an unconscious or anaesthetised patient, hypotension and uncontrolled bleeding may be the only signs of an acute intravascular haemolysis.
- In a conscious patient undergoing a severe haemolytic transfusion reaction, signs and symptoms may appear very quickly – within minutes of infusing only 5 -10ml of blood. At the start of the infusion, close observation for signs and symptoms of transfusion reactions for each unit is essential.
- Transfer the patient to high dependency unit (HDU) or intensive care unit (ICU).

9.4 INVESTIGATING ACUTE TRANSFUSION REACTIONS

1. Immediately report all acute transfusion reactions to the clinician responsible for the patient and to the hospital blood bank.
2. Record the following information on the patient's notes:
   - Type of transfusion reaction
   - Length of time after the start of transfusion that the reaction occurred
   - Volume, type and pack numbers of the blood products transfused.
3. Take the following samples and send them to the blood bank for laboratory investigations:
   - Immediate post transfusion blood samples (1 clotted and 1 anticoagulated: EDTA/Sequestrene) from the vein opposite the infusion site for:
     - Repeat ABO and RhD group
     - Repeat cross match
     - Full blood count
     - Coagulation screen if available
     - Direct antiglobulin test
     - Urea and creatinine
     - Electrolytes
   - Blood culture in a special blood culture bottle

- Blood unit and infusion set containing red cell and plasma residues from the transfused donor blood
- First specimen of the patient's urine following the reaction.

4. After the initial investigation of the reaction, send the following to the blood bank for laboratory investigations:
   - Blood samples (1 clotted and 1 anticoagulated: EDTA/ Sequestrene) taken from the vein opposite the infusion site 12 hours and 24 hours after the start of the reaction
   - Patient's 24 hour urine sample.
5. Record the results of the investigations in the patient's records for future follow –up.
6. Complete the transfusion reaction form (appendix 7).

9.5 SPECIFIC COMPLICATIONS OF TRANSFUSION

9.5.1 Acute intravascular haemolysis

- Acute intravascular haemolytic reactions are caused by the infusion of incompatible red cells. Antibodies in the patient's plasma haemolyse the incompatible transfused red cells.
- Even a small volume (10-50 ml) of incompatible blood can cause a severe reaction and larger volumes increase the risk.
- The most common cause is an ABO incompatible transfusion. This almost always arises from:
  - Errors in the blood request form.
  - Taking blood from the wrong patient into a pre-labeled sample tube.
  - Incorrect labeling of the blood sample tube sent to the blood bank.
  - Poor systems in the laboratory in either sample identification or labeling and issue of crossmatched units of blood.
  - Inadequate checks of the blood against the identity of the patient before starting a transfusion.
- Antibodies in the patient's plasma against other blood group antigens of the transfused blood, such as Kidd, Kell or Duffy systems, can also cause acute intravascular haemolysis.
- In the conscious or unanaesthetised patient, signs and symptoms usually appear within minutes of commencing the transfusion, sometimes when less than 10 ml have been given.

- In an unconscious or anaesthetised patient, hypotension and uncontrollable bleeding due to DIC may be the only signs of an acute intravascular haemolysis.
- It is therefore essential to monitor the patient at the start of the transfusion of each unit of blood.

Prevention of acute intravascular haemolysis

- Correctly label blood samples and request forms.
- Place the patient's blood sample in the correct sample tube.
- Ensure correct sample identification in the laboratory.
- Use suitable compatibility labels.
- Maintain a blood issuing register in the blood bank.
- Always check the blood against the identity of the patient at the bedside before commencing a transfusion.

9.5.2 Bacterial contamination and septic shock

- Globally, bacterial contamination affects up to 0.4% of red cells and 1-2% of platelet concentrates.
- Blood may become contaminated by:
  - Bacteria from the donor's skin during blood collection (usually skin staphylococci)
  - A bacteraemia present in the blood of a donor at the time the blood is collected (e.g. Yersinia)
  - Improper handling in blood processing
  - Defects or damage to the plastic blood pack
  - Thawing fresh frozen plasma or cryoprecipitate in a water bath with contaminated water (mainly due to overstay of the water bath water).
- Some contaminants, particularly Pseudomonas species, grow at 2°C to 6°C. They can survive or multiply in refrigerated red cell units. Rapid multiplication (growth) occurs when blood is allowed to warm. As such, the risk increases with time out of refrigeration.
- Staphylococci grow in warmer conditions and proliferate in platelet concentrates at 20°C to 24°C, limiting their storage life.
- Signs usually appear rapidly after starting infusion, but may be delayed for a few hours.

- A severe reaction may be characterized by sudden onset of high fever, rigors and hypotension.
- Urgent supportive care and high dose intravenous antibiotics are required.

9.5.3 Fluid Overload

- Fluid overload can result in heart failure and pulmonary oedema. It may occur in the following situations:
  - When too much fluid is transfused
  - Too rapid transfusion
  - Renal dysfunction
- Fluid overload is particularly likely to happen in patients with:
  - Chronic severe anaemia
  - Underlying cardiovascular disease

9.5.4 Anaphylactic reaction

- A rare complication of transfusion of whole blood, blood components or plasma derivatives.
- The risk is increased by rapid infusion, typically when fresh frozen plasma is used (as an exchange fluid in therapeutic plasma exchange).
- Cytokines in the plasma may be one cause of broncho-constriction and vasoconstriction in occasional recipients.
- IgA deficiency in the recipient is a rare cause of very severe anaphylaxis.

This can be caused by any blood product since most contain traces of IgA.

- Occurs within minutes of starting the transfusion and is characterised by:
  - Cardiovascular collapse
  - Respiratory distress
  - No fever
- Anaphylaxis is likely to be fatal if it is not managed rapidly and aggressively.

9.5.5 Febrile non haemolytic reactions

It is due to a reaction between the patient's antibodies and leucocytes of the donor blood. The symptoms usually develop within 1-2 hours from onset of transfusion, and include fever (or a rise in temperature of > 1OC), headache, myalgia, malaise, chills and tachycardia. The condition is self-limiting. It must be differentiated from early acute intravascular haemolysis and other causes of a fever.

It is commonly found in multiparous women or previously transfused individuals. It can be prevented by transfusing leucocyte depleted blood components (not available in Malawi).

9.5.6 Transfusion-associated acute lung injury (TRALI)

- Usually caused by donor plasma that contains antibodies against the patient's leucocytes.
- Usually presents within 1 to 4 hours of starting a transfusion.
- Presents with severe dyspnoea, hypoxaemia and rapid failure of pulmonary function.
- Diffuse opacity on the chest X-ray typical of any acute respiratory distress syndrome (ARDS).
- There is no specific therapy. Intensive respiratory and general support in an intensive care unit is required.

9.6 DELAYED COMPLICATIONS OF TRANSFUSION

9.6.1 Delayed haemolytic transfusion reactions

This is caused by IgG red cell alloimmune antibodies in a previously sensitised patient that were not detected during crossmatching. This is common when the routine crossmatch is not routinely done.

Signs and symptoms

- Signs appear 5-10 days after transfusion and may include:
  - Low grade fever
  - Anaemia
  - Jaundice
  - Occasionally haemoglobinuria.
- Severe, life-threatening delayed haemolytic transfusion reactions with shock, renal failure and DIC are rare.

Management

- No treatment is normally required.
- Treat as for acute intravascular haemolysis if hypotension and renal failure occur.
- To identify a unit of blood to be used to transfuse the patient, keep crossmatching more units of blood. Usually a unit that passes the crossmatch will be found.

- Refer to the MBTS for antibody screening and identification if serial crossmatching does not identify compatible blood.

Investigations

- Recheck the patient's blood group
- Direct antiglobulin test is usually positive
- Raised unconjugated bilirubin

Prevention

Always carry out a full crossmatch. In an emergency, a unit of blood may be used after the saline phase. However, always perform the full crossmatch and communicate the results to the patient's doctor.

9.6.2 Post-transfusion purpura

- A rare but potentially fatal complication of transfusion of red cells or platelet concentrates, caused by antibodies directed against platelet-specific antigens in the recipient.
- Most commonly seen in female patients.

Signs and symptoms

- Acute, severe thrombocytopenia 5-10 days after transfusion, defined as a platelet count of less than 100 x 109/L.
- Mucocutaneous bleeding (refer to chapter 5).

Management

Management becomes clinically important at a platelet count of 50 x 109/L, with a danger of hidden occult bleeding at 10 x 109/L

- Give high dose corticosteroids.
- Monitor the patient's platelet count.
- It is preferable to give platelet concentrates of the same ABO type as the patient's.
- Unmatched platelet transfusion is generally ineffective. Recovery of platelet count after 2-4 weeks is usual.

Prevention

There are no effective ways of preventing this condition in the country.

9.6.3 Graft-versus-host disease

- A rare and potentially fatal complication of transfusion.
- Commonly occurs in immunocompromised patients that are transfused

with blood from a relative (the patient and donor have a compatible tissue human leucocyte antigen, HLA).

- Due to the immunodeficiency and compatible HLA types, the immunocompetent donor lymphocytes proliferate in the recipient (host) and start recognising the host as foreign.

Signs and symptoms

- Typically occurs 10-12 days after transfusion
- Characterised by:
  - Fever
  - Skin rash and desquamation
  - Diarrhoea
  - Hepatitis
  - Pancytopenia

Management

This condition is usually fatal. Treatment is supportive; there is no specific therapy.

Prevention

Gamma irradiation of cellular blood components to stop the proliferation of transfused lymphocytes prevents the graft-versus host disease.

9.6.4 Iron overload

There are no physiological mechanisms to eliminate excess iron and thus transfusion-dependent patients can, over a long period of time, accumulate iron in the body resulting in haemosiderosis. Iron overload occurs in patients who are on chronic transfusions.

Signs and symptoms

There is organ failure such as that of the heart and liver in transfusion-dependent patients.

Management and prevention

- Iron-binding agents, such as desferroxamine, are widely used to minimise the accumulation of iron in transfusion-dependent patients.
- Aim to keep serum ferritin levels at <1000 mg/litre.

9.6.5 Transfusion-transmitted infections

The following infections may be transmitted by transfusion

- HIV-I and II

- Human T-cell Lymphotropic Virus-I and II (HTLV I and II)
- Hepatitis B and C
- Syphilis (Treponema pallidum)
- Sleeping sickness (Trypanosoma rhodiense)
- Malaria
- Cytomegalovirus (CMV)
- Human parvovirus B19
- Brucellosis
- Epstein-Barr virus (EBV)
- Toxoplasmosis.
- Borrelia

Since a transfusion transmissible infection may be detected days, weeks, months or years after the transfusion, the association with the transfusion may easily be missed.

It is essential to record all transfusions accurately in the patient's case-notes and to consider transfusion in the differential diagnosis.

10. APPENDICES

APPENDIX 1:THE CONSENT FORM

I……..……have been advised that the transfusion of blood and/or blood products may be necessary for me or the patient for whom I am guardian. I have received information on benefits and risks of transfusion; alternatives to transfusion and risks of declining transfusion therapy. I have had the opportunity to ask questions. I fully understand transfusion therapy and the available alternatives and do hereby GIVE PERMISSION / DECLINE for me/……to be transfused with blood and/or blood products.

Signature…… **Date**……

Status: Patient/Guardian (circle whichever is applicable)

Witness

Name…….. **Signature**……..

Date……

APPENDIX 2: BLOOD PRODUCT ORDERING FORM

MINISTRY OF HEALTH

ORDERING FORM FOR BLOOD & BLOOD PRODUCTS

PLEASE USE CAPITAL LETTERS Blood will not be issued unless this form is ***completed in full*** by the CLINICIAN

The particulars on the form and on the specimen label must agree in every detail.

Patient details:

Hospital Details: **Clinical details:**

SURNAME: _____

FIRST NAME:

Other names: _____ **SEX MALE/FEMALE**

TITLE Mr/Mrs/Ms/Baby **RACE African/Caucasian/Asian**

Date of birth / / **age if DOB unknown**

Hospital Number Specific to Patient

WARD

Hospital _____

Diagnosis:

.....

.....

.....

Haemoglobin: _____ **g/dL**

Hct/PCV _____ **%**

BLOOD REQUIREMENTS

Urgency Circle Please Standard (~ 1 hr) Emergency (5-10min) Un cross-matched

Day & Date Blood Required _____ Time Required _____

Any previous transfusions? Circle YES/NO/NOT KNOWN

If yes: Where _____ When _____

Has patient ever been pregnant? Yes/No/Not Known/NA

Is patient pregnant now? Yes/No

Clinician's Name: _____ **Clinician's Signature** _____ **Time** _____ **Date** _____

Sample collected by Name .....**Signature**.....

AMOUNT OF BLOOD REQUIRED (& guidelines for ordering)

Human blood Products	Unit Vol. (m)	Units required	Clinical Condition	Guidelines for Transfusion
Red Cell suspension (HCT 50-70%)	300-325		(i) General Surgery	Hb<8g/dl
with SAGM			(ii) Cardiac, pulmonary or vascular surgery	Hb<10g/dl
			(iii) Low Hb	Not indicated
			(iv) Significant Anaemia	Adults – See Clinical use of Blood Guideline
				Children 10ml/kg
Paediatric Packed Cells (Hct 50-70%)	125-150		(i) Significant Anaemia	10ml/kg
with SAGM				
Platelets concentrates single donor	50-70		Neurosurgery or blind invasive procedures	Platelet Count <50 x 10^5 /L
(approx 5.5 x 10^{10}/L platelets)			ITP	Except if too low and bleeding
			Low Platelet count	Not indicated if no evidence of bleed
			HIV thrombocytopenia	except if too low <20x10 in all ages
			Massive transfusion	Not indicated unless bleeding
Fresh Frozen Plasma	250		Haemorrhage	INR>1.4 or PT>24 seconds
			Haemorrhage Warfarin Effect	
			General Surgery	Reversal of Warfarin Effect
			Massive Transfusion	
			Haemophilia B	Indicated only in cases of known
			Liver disease	coagulopathy e.g. DIC
Cryoprecipitate (80 i.u./Bag)	30		DIC	Indicated
			Massive transfusion	
			Haemophilia A	
			Von Willebrands disease	
Whole blood (for children blood should be ≤7 days old)	500		Severe anaemia plus shock	20 ml/kg in children. Adults see guidelines
Whole blood (for neonates blood should be ≤5 days old)			Haemolytic disease of the new born	Exchange transfusion in neonates

PRIVATE PATIENTS essential for All private patients with respect to Medical Insurance

Address details: _____

Medical Scheme& Membership No. _____

CAUTION: All blood is donated to the Malawi Blood Transfusion Service (MBTS) by voluntary non-remunerated blood donors. Every unit is routinely tested for markers of transmissible disease viz: HIV p^{24} Antigen; anti-HIV 1 & II; anti-HCV; Syphilis and malaria. There is, never the less, a risk of transmitting these and other diseases by blood transfusion even though the blood is tested and found negative for these markers. The prescribing doctor must take this into consideration and consider possible alternatives, as appropriate.

FOR LABORATORY USE ONLY

(Details on specimen agree with those on request form) Yes ☐ No ☐

Routine Cross-match set up on (date/day): ..... Time: .....

By: .....

Date Cross Match	Product Type	Pack No.	ABO & RhD	Expiry Date	Compatible by Routine/ Emergency	Signature by	Date & Time Issuing	Issued by	Taken by

Any Comments: .....

.....

***The signature of the person issuing the blood certifies that:**

1. Haemolysis is slight or absent. 2. The expiry date has not been reached. 3. No discrepancies exist between the labels on the packs and this form

OTHER PRODUCTS ISSUED

Product type	Pack No.	ABO &RhD gp	Expiry Date	Signature	Date & Time of Issuing	Issued by	Taken by:

.Lab Ref.....

APPENDIX 3: SOP FOR TAKING A BLOOD SAMPLE FOR COMPATIBILITY TESTING (WHO, 2002)

TAKING BLOOD SAMPLES FOR COMPATIBILITY TESTING

- If the patient is conscious at the time of taking the sample, ask him or her to identify themselves by given name, family name, date of birth or age.
- Check the patient's name against:
- Patient's identity label (if available)
- Patient's medical records
- If the patient is unconscious, ask a relative/guardian to provide the details above.
- Take the blood sample into the type of sample tube required by the blood bank. For adults, this is usually 3-5 ml, with no anticoagulant.
- Label the sample tube clearly and accurately with the following information at the patient's bedside at the time the blood sample is being taken:
- Patient's given and family names
- Patient's date of birth or age
- Patient's hospital number
- Patient's ward
- Date
- Signature of person taking the sample.
  - ❖ Ensure that the patient's name is spelt correctly. Do not label the sample tube before obtaining the specimen because of the risk of putting the patient's blood into wrong tube.
- If the patient needs further red cell transfusion, send a new blood sample for compatibility testing.
  - ❖ This is particularly important if the patient has had a recent red cell transfusion that was completed more than 24 hours earlier.Antibodies to red cells may appear very rapidly as a result of the immunological stimulus given by transfused donor red cells.
  - ❖ A fresh blood sample is essential to ensure that the patient does not receive blood which is now incompatible.

APPENDIX 4: RECOMMENDED CROSS MATCH LABEL

PLEASE RETURN TO BLOOD BANK IMMEDIATELY IF THE BLOOD IS NOT USED

Pack Number ……

Blood group ……

THIS BLOOD IS COMPATIBLE WITH

Name……

Age……Sex……..

Ward…… Blood Group ……

Date Xmatched……../……/……..

Date expires……../……/……..

SALINE…… ALBUMIN……..COOMBS…….

FFP……..CRYO……PLT……

Unit amount ……

PLEASE RETURN TO BLOOD BANK IMMEDIATELY IF THE BLOOD IS NOT USED

Pack Number ……

Blood group ……

THIS BLOOD IS COMPATIBLE WITH

Name……

Age……Sex……..

Ward…… Blood Group ……

Date Xmatched……../……/……..

Date expires……../……/……..

SALINE…… ALBUMIN……..COOMBS…….

FFP……..CRYO……PLT……

Unit amount ……

APPENDIX 5: SOP FOR CHECKING A BLOOD UNIT FOR SIGNS OF CONTAMINATION (WHO, 2002)

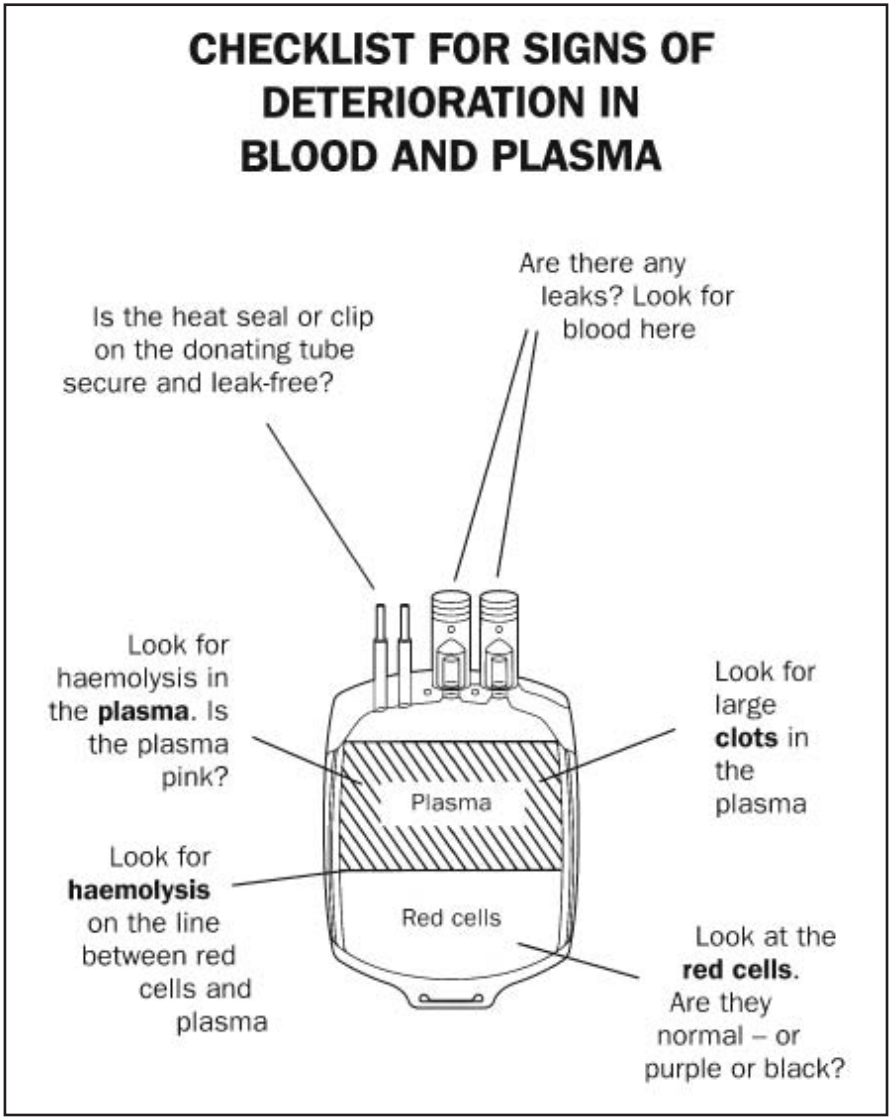
Discolouration or signs of leakage may be the only warning that the blood has been contaminated by bacteria and could cause a severe or fatal reaction when transfused.

Check for:

1. Any signs of haemolysis in the plasma indicating that the blood has been contaminated, allowed to freeze or become too warm.
2. Any signs of haemolysis on the line between red cells and plasma.
3. Any signs of contamination, such as change of colour in the red cells, which often look darker or purple/black when contaminated.
4. Any clots, which may mean that the blood was not mixed properly with the anticoagulant when it was collected or might also indicate bacterial contamination due to utilisation of citrate by proliferating bacteria.
5. Any signs that there is a leak in the pack or that it has already been opened.

Do not administer the transfusion if the blood pack appears abnormal or damaged or it has been (or may have been) out of a temperature-controlled environment for longer than 30 minutes. Inform the blood bank immediately.

APPENDIX 6: CHECKLIST FOR SIGNS OF DETERIORATION IN BLOOD AND PLASMA (WHO, 2002)



APPENDIX 7: TRANSFUSION REACTION REPORT FORM

TRANSFUSION REACTION FORM

SECTION A

PATIENT'S NAME _____ DOB/AGE _____ WARD _____ HOSP NO _____ DATE OF REACTION _____

SECTION B

Time Transfusion Started _____ Time Reaction started _____ No of Units transfused _____ Number in series to time of reaction _____ Volume transfused (of index blood unit) _____

Nature of Components transfused _____

SECTION C

Pre-transfusion (immediate)				Post-transfusion (immediate)			
Temperature	BP	PR	RR	Temperature	BP	PR	RR
_____	_____	_____	_____	_____	_____	__ _____	

SECTION D

Clinical signs and symptoms (Tick those present)

☐ Increased PR	☐ Muscle aches	☐ Failure to clot	☐ Hypertension
☐ Chills	☐ Dark or red urine	☐ Jaundice	☐ Dyspnoea
☐ Elevated Temperature	☐ Decreased urine output	☐ Hypotension	

Other:

SECTION E

NURSING ACTION

Perform clerical check on Blood bag label, patient arm band and paperwork

Accurate_____ Inaccurate_____ Performed by (Name and signature)_____

Date performed_____

SECTION F

Investigations

Perform lab clerical check on all labels, tubes and paperwork Accurate _____Inaccurate_____

Performed by (name and signature) _____ Date performed_____

Visual check for	Pre	Post	Unit
free hemoglobin	_____	_____	_____

- Check appearance of
- Blood bag _____ _____
- Saline _____ _____
  Administration set _____ _____

- If performed
  Gram Stain _____
  Culture _____

- DAT _____ _____ _____
- ABO and RhD _____ _____ _____
- Major Cross-match _____ _____
- Minor Cross-match _____ _____
- Urine free hemoglobin _____ _____
- Serum bilirubin _____ _____
- CXR features

_____

Interpretation _____

_____

- Reporting Doctor (Name and Signature) _____
- Date reported _____

APPENDIX 8: GLOSSARY

Activated partial thromboplastin time (APTT)	Test of the blood coagulation system. Prolonged by plasma deficiency of coagulation factors XII, XI, IX, VIII, X,V, II and fibrinogen.
Anti –D	Human immunoglobulin G preparation containing a high level of antibody to the RhD antigen.
Autologous blood donor	A person who donates blood for his/her own use.
Bedside	Refers to patient's side - whether patient is in bed or a trolley or sitting in a chair.
Blood	Refers to human whole blood which is un-separated and has been collected into approved container with an anticoagulant preservative solution.
Blood Cold Chain	Optimal storage and transportation conditions that ensure that blood and blood products remain efficacious and safe.
Blood product	Any product separated from blood [blood components and plasma derivatives such human albumin solution, clotting factor concentrates, anti-D immunoglobulin and therapeutic immunoglobulins]
Blood component	Therapeutic constituent of human blood i.e. red cells, platelets, fresh frozen plasma and cryoprecipitate
Colloid solution	A solution of large molecules which have restricted passage through capillary membranes. Used as an intravenous replacement fluid. Colloid solutions include gelatins, dextrans and hydroxyethyl starch.
Crystalloid solution	Aqueous solution of small molecules which easily pass through capillary membranes e.g. normal saline, Ringer's lactate and Hartmann's solution.

Desferroxamine	An iron-chelating (binding) agent that increases excretion of iron.
Disseminated intravascular coagulation	Activation of the coagulation and fibrinolytic systems, leading to deficiencies of coagulation factors, fibrinogen and platelets.
Directed donor	A person who donates blood for a particular patient. The patient can only receive the blood donated by that person.
Family replacement blood donor	A person who donates blood for use by a family member, friend or community member. The donated blood is either transfused into the intended patient or is used to replace the blood which the patient may have received already.
Massive transfusion	Replacement of the equivalent of the total blood volume within 24 hours, or transfusion of 50% of total blood volume within 3 hours.
Paid blood donor	A person who receives money or other awards which can be exchanged for money for the donated blood.
Plasma derivatives	Human plasma proteins prepared under pharmaceutical manufacturing conditions (albumin, factor VII, factor IX, immunoglobulins)
Prothrombin time (PT)	A test of blood clotting system. Prolonged by deficiencies of coagulation factors VII, X, V, II
Whole blood	Refer to blood.
Voluntary non-remunerated blood donor	A person who donate blood at his/her own will and receive no money or other form of payment, which can be considered a substitute for money, such as time off work except that time reasonably needed for blood donation and travel.

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NOTES