THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL BLOOD TRANSFUSION SERVICE (NBTS)

CLINICAL GUIDELINE FOR APPROPRIATE USE OF BLOOD AND BLOOD PRODUCTS

Second Edition

November, 2015

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL BLOOD TRANSFUSION SERVICE

CLINICAL GUIDELINE FOR APPROPRIATE USE OF BLOOD AND BLOOD PRODUCTS

Second Edition
November, 2015

Contents

Foreword

The Ministry of Health, Community Development, Gender, Elderly and the Children through The National Blood Transfusion Service (NBTS) considers blood transfusion services as an integral part of quality health services provision. Blood availability in a timely manner can save lives, but is also not without untoward events. There has been generally a lack of up to date guidelines on blood utilization leading to inefficiency of the services. In strengthening blood transfusion services, the Ministry has taken a number of steps, one of which is the development of this tool. It is intended to ensure efficient utilization of blood and its components and at the same time ensure safety to the recipients.

The document covers areas of general consideration as well as specific issues pertaining to each and every blood component available at the NBTS. Areas that clinicians will find new and interesting are the legal aspects and blood transfusion consent in the field. Additionally, there are products mentioned here which are currently not prepared by NBTS but would be available in the near future. These are included here for reference.

To ensure that this guideline is adhered to, each facility accredited to offer transfusion services is required to establish "Transfusion Committees" headed by a registered medical practitioner. This committees' function will be highlighted during the dissemination of the guideline, but will include among other things to oversee performance, monitoring and quality management programs that addresses the use of blood and its components.

Lastly, this is not a treatment guideline for any specific disease entity but rather a guideline for utilization of blood. Therefore, for specific diseases clinicians should refer to specific guidelines and only refer to this when blood or its products are to be used. It is my expectation that the users are going to enjoy reading this guideline and are going to find it useful during their clinical practice.

Prof. Muhammad Bakari Kambi
CHIEF MEDICAL OFFICER

Acknowledgement

We are much indebted to WHO for the funding, without which this document would not have been possible. Secondly, to all clinicians for their contributions that enabled the development of the guideline. Special thanks go to the following for having come to put together this document in such a timely manner:

Dr. Efesper A. Nkya - NBTS Programme Manager

Dr. Mpoki Ulisubisya - Executive Director, MRH

Dr. James Rwehabura - Consultant Haematologist, MNH

Dr. Fredrick Francis - Paediatrician and Nephrologist, MUHAS

Dr. Alex Magesa - Haematologist and Head of Laboratory Services, MNH

Dr. Mugisha Clement - Neurosurgeon, MOI

Dr. Abdu Juma - NBTS Operation Officer

Dr. Balthazar Nyombi - Head of Laboratory Services, KCMC

Dr. Avelina Mgasa - NBTS Manager, Eastern Zone

Dr. Fredrick Venance - NBTS Manager, Lake Zone

Dr. Vincent R.Mtweve - NBTS Manager, Southern Zone

Dr. Ipyana Kiganuka - NBTS Manager, Western Zone

Dr. Willhellmuss Mauka - NBTS Manager, Northern Zone

Dr. Kokuhabwa Mukurasi - NBTS Manager, Southern Highlands Zone

Mr. Dustan Haule - NBTS Quality System Officer

Ms. Grace B. Mlingi - NBTS Head of Laboratory Service

Dr. Kondo Chilongo - Consultant Surgeon, KCMC

Dr. John France - Head of Obstetrics and Gynaecology, MRH

Dr. Koheleth Winani - National Coordinator SMI, Ministry of Heath

Mr. Abdu Mahamoud - Principal Laboratory Technologist, BMC

Dr. Said S. Kilindimo - Emergency Medicine Physician, MUHAS

Dr. Mathew Kallanga - Head of Obstetrics and Gynaecology, MNH

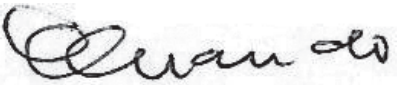
Dr. Edwin Lugazia - Head of Anaesthesiology Department, MUHAS

Mrs. Hilda Maya - Head of Blood Transfusion Services, MNH

Dr. Abel Makubi - Local Lead Consultant and Haematologist, MUHAS

Dr. Patricia Knox - Technical Consultant, AABB

Last but not the least, The Ministry of Health, would like to acknowledge the tireless efforts, invaluable guidance and contribution from the peer technical reviewers Dr. Akoko Larry Onyango (Head, Department of Surgery, MUHAS), Dr. Magdalena Lyimo (Head, Department of Haematology & Blood Transfusion, MUHAS) and Dr.Elineema Meda (Consultant Haematologist MNH).



Dr. Margaret E. Mhando
Director of Curative Services

List of Abbreviations

BP	Blood Pressure
CVP	Central Venous Pressure
CMV	Cytomegalovirus
CPAP	Continuous Positive Airway Pressure
DIC	Disseminated Intravascular Coagulation
DDAVP	Des-Di-Amino Vasopressin
DAT	Direct Antiglobulin Test
EDTA	Ethylene Diamine Tetracetic Acid
EBV	Epstein Barr Virus
FFP	Fresh Frozen Plasma
FNHTR	Febrile Non-haemolytic transfusion reaction
HIV	Human Immunodeficiency Virus
HCV	Hepatitis C Virus
HBV	Hepatitis B Virus
HPA	Human Platelet Antigen
INR	International Normalized Ratio
KCMC	Kilimanjaro Christian Medical Centre
MUHAS	Muhimbili University of Health and Allied Sciences
MNH	Muhimbili National Hospital
MRH	Mbeya Referral Hospital
NBTS	National Blood Transfusion Services
PRBC	Packed Red Blood Cells
PLT	Platelet
PTP	Post Transfusion Purpura
QMS	Quality Management System
RBC	Red Blood Cell
Rh	Rhesus
SOP	Standard Operating Procedure
TTIs	Transfusion Transmissible Infections
TAH	Total Abdominal Hysterectomy
TTP	Thrombotic Thrombocytopenic Purpura
TPDF	Tanzania People Defence Forces
TIA	Transient Ischaemic Attack
vWD	von Willebrand's disease
WHO	World Health Organization
WB	Whole Blood

Chapter One

1.0 INTRODUCTION

1.1 Background

Blood is the most donated and transplanted tissue in human history. It has been in use for the longest time for all human tissue donations, even before the science surrounding it has been well known to modern science. Consequently, our current knowledge of safety is only limited to the prevailing scientific evidence available. As such, the transfusion of blood can be a life saving intervention when it is safe and used properly, and can be fatal if standards and safety is not observed. Similarly, several infections have been known to be transmissible through blood transfusion and are prevalent in our settings as well. Hepatitis B and C viruses, Human Immune Deficiency Virus, Syphilis and malaria are few among them. Therefore, the Ministry of Health, Community Development, Gender, Elderly and Children through the National Blood Transfusion Services (NBTS) aims to ensure the safety and reliability of the supplied blood for use in Tanzania. To accomplish this, there must be:-

Reliable constant supply of blood and its products which are safe and adequate to meet national needs. Rationale use of blood which includes appropriateness of blood products and clear indications.

To achieve these, there must be a highly coordinated effort between the NBTS both at the National and Zonal levels, and the clinicians on the other end. The two must understand that like any tissue, blood is donated by the love of one to the others hence it is very much valuable and at the same time very expensive to collect, transport, process and store. Clinicians must adhere to Evidenced Based Medicine at all times to avoid irrational use of blood which will continue to drive scarcity of this already scarce resource.

1.2 Guiding Principles of Clinical Blood Transfusion Practice

- If at all possible, transfusion should be avoided if there are other means of correcting anaemia that do not put the life of the patient at risk. Transfusion should be prescribed only when the benefits to the patient are likely to outweigh the risks.
- All efforts at minimizing blood loss in a patient should take the precedence. This will help to minimize the need for blood transfusion.

- The prescribers must have clear knowledge of the indications, benefits and risks associated with the procedure.
- The patient's haemoglobin value, although important, should not be the sole deciding factor in starting transfusion. This decision should be supported by the need to relieve clinical signs and symptoms and prevent significant morbidity or mortality.
- Transfusion of blood and blood components is a medical procedure and should only be prescribed and issued under the supervision of a registered clinician.
- Prescribing blood should be based on national guidelines on the clinical use of blood, taking individual patient needs into account.
- A unit of blood collected from a donor is a precious asset; therefore there should be no financial incentive to prescribe a blood.
- There must be appropriate documentation of the transfusion as required including events that arise from the procedure.
- An informed consent must be obtained in writing from patients before transfusion is started. The prescriber has no right to forcefully prescribe to a patient under any circumstances.
- Where advanced directives to not transfuse are available, all efforts must be taken to honour them. Alternative consents for emergency situation should be obtained just like for any other medical procedure that requires a written informed consent.
- Component transfusion should be tried and where possible whole blood transfusion should be discouraged.
- Patients must be evaluated individually to determine the proper transfusion therapy, taking care to avoid inappropriate over- or under-transfusion.
- Transfusion decisions should be based on clinical assessment and not on laboratory values alone.
- Red blood cells should not be used to treat anemia that can be corrected with a non-transfusion therapy (e.g. iron therapy). They also should not be used as a source of blood volume, or oncotic pressure or to improve wound healing, or sense of well being.
- In the event that an adverse event occurs, it must be documented,

reported and investigated thoroughly. The transfusion set must be sent back to the laboratory along with the index unit.

1.3 General Guidelines for Appropriate Transfusion Practice

The prevention or early diagnosis and treatment of anaemia and the conditions that cause anaemia can avert the need for blood transfusion. The patient's haemoglobin level can often be raised by iron and vitamin supplementation without the need for transfusion. Blood transfusion is needed only if the effects of chronic anaemia are severe enough to require rapid rise of the haemoglobin level. The need for transfusion can often be minimised by using the following principles.

- Blood transfusion is not a cure for anaemia. Blood transfusion is used to relieve the clinical signs of cardiac or respiratory distress, but the underlying cause of the anaemia needs to be investigated and treated.
- The indications for blood transfusion in Tanzania are frequently urgent conditions. Efforts should first be made to stabilise patients without the use of blood through prompt and appropriate supportive care, such as the use of intravenous replacement therapy, e.g. crystalloid or colloid solutions, and oxygen therapy. Supportive care should be initiated immediately and should not wait until blood is available.
- Blood transfusion is rarely indicated when haemoglobin levels are greater than 10g/dl, and is usually indicated when haemoglobin concentrations are less than 5g/dl. However, even severely anaemic patients (Hb<5g/dl) who are clinically stable may not require transfusion. The decision to transfuse should be based on an estimate of the patient's risk for developing complications of inadequate tissue-oxygen delivery.
- A patient should be re-evaluated by clinical and nursing staff immediately prior to blood transfusion to ensure that the transfusion is still required. The patient may have stabilised with supportive measures and may no longer need transfusion. The patient should not be transfused purely because compatible blood is available.
- Surgeons must adhere to good anaesthetic and surgical management, including, using the best anaesthetic and surgical techniques to minimise blood loss during surgery.
- Using alternative approaches such as desmopressin, aprotinin or erythropoietin where appropriate is encouraged.

1.4 General Administration Principle of Blood

The ordering of blood is done by the clinicians and the administration is in most of the instances a nursing function. However, this does not take away the responsibility from the clinician as the overall manager of patient care hence must ensure safety of transfusion and adherence to blood administration SOP which should cover the following:

- There must be detailed patient identification and verification with the unit delivered for transfusion.
- Detailed inspection of the unit for evidence of macroscopic contamination.
- Delivered blood must be compatible: whole blood and PRBC must be ABO and Rh-D compatible with the recipient
- If additional transfusions are required and the time period since the last transfusion is more than 72 hours, a new sample shall be submitted to perform compatibility testing
- The blood should be given by weight based dosing to children or using the formula volume (mls) = 4 x weight of patient (expected Hb-current Hb) or 20mls/kg for whole blood or 10mls/kg for packed red blood cells
- During administration of whole blood the rate of flow should be 5ml/min and in chronic anaemia, a slower rate of 2mls/min is recommended.
- Whole blood must be stored in the refrigerator at 2-6°C and transfusion should be started within 30 minutes after removal from refrigerator and completed within 4 hours of commencement.
- Whole blood need only be warmed for massive transfusion or when infusion rate is >50ml/kg/hour (adult) or >15ml/kg/hr in a child or for a neonatal exchange transfusion or a patient has clinically significant cold agglutinins.
- Measure and record vital signs prior to transfusion and during the first 15 minutes of transfusion and thereafter at least every hour. Patients who are at risk for fluid overload should be monitored for 12-24 hours post transfusion.
- Never add medication to a unit of whole blood during administration.
- Blood must be administered through a special blood giving set depending on the product being transfused.

Chapter Two

2.0 BLOOD COMPONENTS AND THEIR INDICATIONS

A single donation of blood can benefit several different patients because blood constituents can be separated into several blood components. Due to technology and financial limitations, in Tanzania whole blood can be processed to four main components: packed red blood cells, Fresh Frozen Plasma, single unit platelet (plasma rich) and whole blood units.

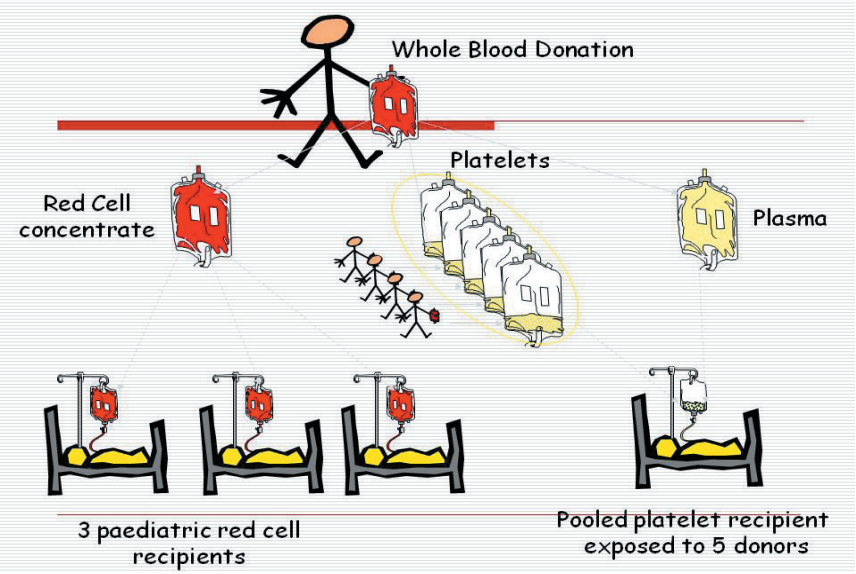


Figure: 1 Illustration of blood components that can be prepared from a single whole blood unit by NBTS

2.1 Whole Blood (WB)

Whole blood is considered to be a complex tissue from which numerous and appropriate components are processed. In most transfusion services whole blood is reserved for those few clinical situations where it can be best utilized.

- It is poor in platelets and clotting factors as they deteriorate within 6 – 12 hours of donation.
- The unit content of whole blood is 450mls collected in a bag containing

63mls of CPDA -1 anticoagulant..

- It has hematocrit of 35 – 45%, haemoglobin of 12g/dl and can be stored for up to 35 days at 2-6 0C temperature.

2.1.1 Indications for Whole Blood

1. Exchange transfusion in neonates.
2. Can be used in absence of PRBCs for patient with acute blood loss and hypovolaemia
3. In open heart surgery with patients on heart lung machine.

2.1.2 Administration Principles for Whole Blood

General administrations principles as in section 1.4 above

1. There must be detailed patient identification and verification with the unit delivered for transfusion.
2. Detailed inspection of the unit for contamination and defective bags.
3. Delivered blood must be compatible: whole blood, PRBC must be ABO and Rh-D compatible with the recipient
4. If additional transfusions are required and the time period since the last transfusion is more than 72 hours, a new sample shall be submitted to perform compatibility testing
5. The dose of whole blood is given by volume needed (mls) = (Hb desired – Hb current) x weight of the patient (kg) x 4 (constant) or 20mls/kg
6. During administration, the rate of flow should be 5ml/min and in chronic anaemia, a slower rate of 2mls/min is recommended.
7. It must be stored in the refrigerator at 2-6°C and transfusion should be started within 30 minutes after removal from refrigerator and completed within 4 hours of commencement.
8. It needs only be warmed for massive transfusion or when infusion rate is >50ml/kg/hour (adult) or >15ml/kg/hr in a child or for a neonatal exchange transfusion or a patient has clinically significant cold agglutinins.
9. Measure and record vital signs prior to transfusion and during the

first 15 minutes of transfusion and thereafter at least every hour. Patients who are at risk for fluid overload should be monitored for 12 – 24 hours post transfusion.

2.1.3 Adverse effects due to whole blood:

- Acute haemolytic transfusion reactions which might occur due to ABO/Rh-incompatibility and development of blood group alloantibody
- Febrile Non-Haemolytic Reactions and Allergic reactions are more common but less serious with whole blood administration.
- Risk of Infection: due to bacterial contamination or HIV, HBV, HCV and Syphilis.

2.2 Packed Red Blood Cells (PRBCs)

Red Blood Cells consist of erythrocytes concentrated from whole blood donations by centrifugation in a closed sterile system. The component is collected in CPDA-1 preservative–anticoagulant system giving it a storage life of 35 days at 2-60C with hematocrit of 60 - 80%.

- A unit contains an average of 50mls of plasma and up to 42-80g of hemoglobin depending on hemoglobin level of the donor, the starting whole blood collection volume, and the collection methodology or further processing.
- Each unit of PRBC contains approximately 147- 278 mg of iron, most in the form of hemoglobin.
- If nutrient solution is added, with maximal plasma removal, the shelf life can be prolonged to 42 days at 2-60C.
- Dose of one unit of compatible Red Blood Cells will increase the hemoglobin level in an average sized adult who is not bleeding or hemolyzing by approximately 1 g/dl or Hct by 3%.
- In neonates, a dose of 10-15mL/kg is generally given, and will increase the hemoglobin by about 3 g/dl.

2.2.1 General Indications Packed Red Blood Cells (PRBCs)

Red blood cells are indicated for patients with a symptomatic deficiency of oxygen-carrying capacity or tissue hypoxia due to an inadequate circulating red cell mass.

They are also indicated for exchange transfusion (e.g., for hemolytic disease of the newborn) and red cell exchange (e.g., for acute chest syndrome in sickle cell disease).

2.2.2 Specific indications of packed red blood cells include

Chronic Anaemia patients

1. Haemoglobin of <5g/dl in patients with symptoms of cardiac or respiratory distress.
2. Pre radiotherapy patients with haemoglobin value of less than 10g/dl.
3. Pre and post chemotherapy patients with haemoglobin<9g/dl
4. Patients admitted to ICU with Haemoglobin value of less than 7/dl

Acute Blood Loss patients

1. Transfuse to patient with acute blood loss with >30-40% of blood loss, where initial volume resuscitation has been carried out with crystalloid solutions. For every three equivalent units of fluid used in resuscitation, one unit of PRBC should be given

General Surgery patients

1. In patients scheduled for elective surgery with haemoglobin of <5g/dl, and
    a. Other methods to raise haemoglobin have failed.
    b. No time to delay surgery to raise haemoglobin level
2. Preoperative patients with haemoglobin value of less than 8g/dl and are expected to lose at least 500mls of blood during surgery.
3. If patients lose blood intra-operative and develops signs of circulating volume deficit.
4. The presence of atherosclerotic heart disease with haemoglobin level of <8g/dl.

In Cardiac patients

1. Patients with acute coronary syndromes (ACS) and evidence that a haemoglobin level may fall below 8g/dl as it may be deleterious to patient if not corrected.

2.2.3 Administration Principles of PRBCs

Patient preparation, monitoring and unit inspection refer to ***section 1.4 above***

1. The patient must be prepared thoroughly before blood transfusion. This entails correct nurse identification & verification of the patient against the blood unit.
2. The unit must be inspected and if found to have signs of deterioration or contamination the unit **MUST NOT** be transfused. It should be returned to the hospital's blood bank.
3. Compatibility: PRBC blood must be ABO and Rh-D compatible with the recipient and both blood group O Negative and O Positive are considered to be universal blood type, can be given to patient with any other blood type.
4. If additional transfusions are required and the time period since the last and transfusion is more than 72 hours, a new sample shall be submitted to perform compatibility testing
5. The dose of PRBCs is given by volume needed (mls) = (Hb desired – Hb current) x weight of the patient (kg) x 4 (constant) or 10 ml/kg for PRBC
6. During administration of PRBCs, the rate of flow should be 5ml/min and in chronic anaemia, a slower rate of 2mls/min is recommended
7. PRBCs must be stored in the refrigerator at 2-6°C and transfusion should be started within 30 minutes after removal from refrigerator and completed within 4 hours of commencement.
8. PRBCs need only to be warmed for massive transfusion or when infusion rate is >50ml/kg/hour (adult) or >15ml/kg/hr in a child or for a neonatal exchange transfusion or a patient has clinically significant cold agglutinins.
9. Monitor vital signs before, during and after transfusion in the first 15 minutes of transfusion and thereafter at least every hour for the duration of the transfusion. Patients who are at risk for fluid overload should be monitored for 12 – 24 hours post transfusion.

2.2.4 Adverse effects due to PRBCs transfusion

- Acute haemolytic transfusion reactions which might occur due

to ABO/Rh-incompatibility and development of blood group alloantibody

- Febrile Non-Haemolytic Reactions and Allergic reactions are rarely and less serious with PRBC administration.
- Risk of Infection: due to bacterial contamination or HIV, HBV, HCV and Syphilis.

2.3 Specialized Red Cell Components and their indications

2.3.1 Leukocyte Depleted Red Blood Cells

Leucocytes depleted PRBC is defined as a red cell suspension or concentrate containing $<5 \times 10^6$ white cells per pack: prepared by filtration through a leucocytes depleting filter. Leukocytes are most effectively removed from the red cells within 72 hours after they are collected and are referred to as "pre-storage leukocyte-reduced" red cells.

Leucocytes depletion is an effective alternative to the use of CMV seronegative blood components for the prevention of transfusion transmitted CMV infection to high risk patients.

Patients who have received transfusions of standard blood products and women who have been pregnant may become sensitized (allo-immunized) to leukocyte and sometimes platelet antigens. Sensitization to leukocyte or platelet antigens may manifest as:

- Febrile transfusion reactions.
- Refractoriness to platelet transfusion.
- Transfusion-related acute lung injury (TRALI).

Indications of Leucocytes Depleted Red Blood Cells

1. If patient get recurrent Febrile Non-haemolytic Transfusion Reaction (FNHTR) occurs after red cells transfusion.
2. Patients on chronic transfusion regimens.
3. Patients with severe aplastic anaemia who are potential stem cell transplant recipients.
4. Paediatric: In foetal/neonatal transfusions, infants less than 1 year of age but definitely recommended for infants 4 months and younger.

2.3.2 Washed Red Blood Cells

Washed red cells component prepared by the removal of plasma protein (e.g. anti-IgA) and the buffer layer, from whole blood donations. The residual red blood cells are suspended in isotonic saline and centrifuged; the saline from the first saline 'wash' is then removed, and the red cells re-suspended in isotonic saline. Approximately 250mls of cold (4°C±2°C) sterile, isotonic saline is added to the red cell. Because washed cells are manipulated in an open system, with a possibility of bacterial contamination, they must be transfused within 24 hours of preparation. Consequently saline washed RBC should be ordered at least 24 hours in advance of anticipated need, since several hours are required to prepare them. Since the washing process destroys up to 20% of the RBCs, patients who receive washed red cells usually require a greater number of units to achieve the same HcT than patients given PRBC.

Indications of washed red blood cells

1. History of severe allergic reaction to whole blood, packed cells or plasma products.
2. Patients with known class or subclass specific anti-lgA antibodies
3. Transfusion of neonates with T-cell activation due to necrotizing enterocolitis.
4. Patients who have paroxysmal nocturnal Haemoglobinuria or Post Transfusion Purpura (PTP)

2.3.3 Frozen Red Blood Cells

Frozen Red Blood Cells is prepared by freezing red cells in a glycerol medium at temperature -800C. This is a method of storing blood units that have special or rare antigen types for patients who have unusual or multiple red cell antibodies. Frozen RBC expires 24 hours after thawing due to the possibility of bacterial contamination, therefore Frozen RBC should only be ordered if they are certain to be used since they expire 24 hours after thawing.

2.3.4 Irradiated Red Blood Cells

Irradiation of red blood cells results in reduced post transfusion red cell recovery and increases the rate of potassium leakage from RBC into the extracellular fluid. Packs irradiated within 14 days of collection

expire 28 days after collection. Packs irradiated more than 14 days after collection expire, either 5 days after irradiation or at original expiry of pack, whichever comes first.

Indications for use of Irradiated Red Blood cells

1. To prevent Transfusion Associated Graft-Versus Host Disease (TA-GVHD)
2. Immuno-compromised patients i.e. severe combined immune deficiency syndrome (SCIDS), Common Variable Immune Deficiency (CVID), Malignancy, transplant recipients (bone marrow and solid organ) and Haematology/Oncology patients
3. Intrauterine and exchange transfusions

2.4 Platelet Products

There are several types of platelet products depending on production technique employed that can be obtained from a single whole blood unit.

A single random donor platelet (RDP):

This type of platelet is also known as plasma reach platelet. It is prepared from one whole blood unit and contains 5.5 x 109/L platelets in 50ml unit.

Random donor pooled platelets (RDPP):

This type of platelets unit is prepared from 4 to 6 donor units 'pooled' into one pack. It contains an adult dose of at least 55 × 109/L platelets with a volume of 200-300mls. Random donor platelets are indicated for patients with acute causes of thrombocytopenia e.g. DIC and who are unlikely to require long term platelet transfusion therapy.

A single donor aphaeresis Platelet (SDP):

This type is prepared by platelet aphaeresis machine. One unit of (SDP) contains 300 x109/L platelets (equivalent to 5 to 6 units of RDP) in a 300mls unit. Leucocytes reduction occurs during aphaeresis procedure; therefore recommended for patients who experience recurrent febrile reactions as a result of sensitization to leucocytes antigens and is recommended for patients who are on long term therapy e.g. leukaemia.

NBTS currently prepare and supply a single random donor platelets

(RDP) due to limited financial, technical and lack of equipments

2.4.1 General Good Platelet Transfusion Practice

- Transfusion of platelet concentrates is standard treatment for bleeding associated with thrombocytopenia and /or defective platelet function
- Platelet transfusions are required for the treatment or prevention of bleeding due to reduced platelet numbers or function. In general, the risk of bleeding increases only when the platelet count falls to below 50x109/L and spontaneous bleeding seldom occurs at platelet counts above 20x109/L.
- Platelets should be transfused in accordance not only with clinical guidelines but also with reference to the individual patient's clinical status.
- Do not give prophylactic transfusions without verification of the platelet count on the peripheral smear.
- Ensure that the patient is not on drugs which might potentiate bleeding e.g. Aspirin.
- Consider the appropriate use of other measures such as antifibrinolytics, fibrin glue etc.

2.4.2 Indications for Prophylactic Platelet Transfusion:

1. To prevent spontaneous bleeding to patients with platelets counts of :-
   - <10 x 109/L
   - <20x109/L, with additional risk factors for bleeding such as sepsis, DIC, fever, peptic ulcer, severe anaemia, on Amphotericin B or anticoagulant therapy.
2. To prevent bleeding during surgery to patients with platelets counts of:-
   - <50 x 109/L and planned for surgery so as to raise platelet count > 50 x 109/L
   - <100 x 109/L and planned for surgery in critical sites (brain or eyes) so as to raise platelet count > 100 x 109/L
3. In massive transfusion to maintain platelet count at >50x 109/L.

4. In situations of multiple injury and head injury, to maintain platelet count at > 100x109/L.
5. In microvascular bleeding and platelet count <100 x109 /L and planned for cardiopulmonary bypass.

2.4.3 *Indications for Therapeutic Platelet Transfusion:*

Therapeutic indication of platelets is given in a patient with thrombocytopenia (platelet count <50x 109/L) with clinical evidence of bleeding like mucocutaneous bleeding

- Haematemesis
- Meleana
- Gum bleeding
- Menorrhagia
- Retinal haemorrhage
- Diffuse oozing from surgical incision
- Oozing from venepuncture site
- Scattered patechiae or ecchymosis

2.4.4 *Contraindication of Platelet Transfusion*

1. Absolutely contraindicated in Heparin induced thrombocytopenia (HITT) & Thrombotic thrombocytopenic Purpura (TTP).
2. Not recommended in Idiopathic Thrombocytopenia (ITP) unless a life-threatening bleeding episode is probable.

2.4.5 *Administration Principles for Platelets*

1. The patient must be prepared thoroughly before blood transfusion. This entails correct identification & verification of the patient against the blood unit.
2. The unit must be inspected and if found to have signs of deterioration or contamination the unit MUST NOT be transfused. It should be returned to the hospital's blood bank.
3. Compatibility: The first choice of platelets is that of the same ABO/ Rh group as the patient and no need of compatibility test. If the same

group is not available, platelets of a different ABO group is acceptable, provided on inspection there is no red cell contamination.

4. Platelet Dosage: For adult, a dose is 1 unit RDP (50mls) per 10 kg. This means 5-6 RDP units or 1 SDP (200–300 ml); and for paediatric: infants less than 10kg the dose is 5mls/kg. For one adult dose the increase platelet count should be approximately 20-40 x 10^9/L.
5. Store platelet at 20-24^{0}C with constant gentle agitation, do not store in the refrigerator. The life span is 3 – 7days from the date of donation depending on the type of blood bag used.
6. Transport platelet at 20-24^{0}C and should reach their destination within 24 hours, which is the maximum time allowed without agitation. Once receipt keep them agitating before transfusion. Agitation is essential to avoid platelet clumping which leads to loss of viability
7. It must be infused immediately as it arrives in the ward from hospital blood bank and complete transfusion within 15-20minutes to avoid platelet clumping.
8. Administer though special administration set.
9. Measure vital signs prior to transfusion and monitor vitals during the first 15 minutes of transfusion and thereafter at least every hour.

2.4.6 Adverse effects due to platelet transfusion

- Bacterial contamination is high due to the required room temperature (22 - 24^{0}C) for storage.
- Febrile non-haemolytic transfusion reactions (FNHTR) may occur due to the plasma content.
- A risk of Infections such as HBV, HIV, HCV and Syphilis

2.5 Plasma Components and Derivative Products

There are wide ranges of plasma components available with specific indications for their use. Plasma components are produced by processing whole blood in laboratories and rely purely on physical separation techniques (e.g. fresh frozen plasma, cryoprecipitate). All plasma derivative products utilize liquid or frozen plasma as their starting material. This may then be subjected to simple physical or more complex chemical-physical processing to produce specific products (e.g. albumin, immunoglobulin, clotting factor concentrates).

2.5.1 Indications of Fresh Frozen Plasma (FFP)

Fresh frozen plasma (FFP) is prepared by separating plasma from anticoagulated whole blood within 6-8hours of collection in a closed sterile system and frozen at -180C and the expiry for this plasma is 12 months if stored at -180C.

Approximately FFP contains 200-300mL of plasma separated from one unit of whole blood and contains all the clotting factors in normal physiological levels except slightly reduced amounts of clotting Factors V and VIII. FFP contains no RBC and insignificant numbers of leukocytes.

Coagulation factor levels in FFP

Factor	Average Level
Fibrinogen	200mg per unit of FFP
Factor II	1.03 IU/ml
Factor V	0.64 IU/ml
Factor VII	1.21 IU/ml
Factor VIII	0.85 IU/ml
Factor IX	0.95 IU/ml

NOTE: Thawed FFP contains normal coagulation factor levels up to 5 days except for Factors VIII (75- 86% of normal) and V (84-91%) of normal and is used interchangeably with FFP/FP in all patients

Indications of Fresh Frozen Plasma (FFP)

1. Congenital single factor deficiency e.g. Haemophilia (if no factor concentrate available).
2. Replacement of multiple clotting factor deficiencies in bleeding patients who have significant coagulopathy (defined as PT > 18 sec, or PTT > 55sec) due to multiple factor deficiencies, e.g. massive transfusion, DIC, Vitamin K deficiency.
3. Reversal of warfarin if the patient is bleeding.
4. Thrombotic Thrombocytopenic Purpura (TTP) or Haemolytic Uremic Syndrome (HUS) - either as plasma exchange or repeated

plasma transfusions.

5. Vitamin K deficiency associated with active bleeding.
6. In the treatment of Scoline Apnoea.
7. Used in treatment of Haemorrhagic Disease of the Newborn: use FFP & intravenous Vitamin K.

Caution: FFP is hyperosmolar, therefore in elderly and very young patients with cardiopulmonary compromise and tissue oedema, care should be taken not to precipitate pulmonary oedema. Hypernatremia and hypokalemia may occur if large volumes are transfused.

NB: FFP is not indicated for use as volume expanders, plasma exchange, replacement in protein losing states and nutritional support.

2.5.2 Administration Principles for Fresh Frozen Plasma (FFP)

1. Compatibility: No compatibility testing required.
2. The first choice of FFP is that of the same ABO group as that of the patient, if not available, FFP of a different ABO group is acceptable, provided anti-A and anti-B titre is low.
3. AB plasma is the universal plasma and should be used in neonates if ABO compatible FFP is not available. Group O FFP should especially be avoided in non-group O neonates.
4. The Dose: FFP dose is 10-20 ml/kg (4 - 6 units for an adult) to achieve minimum of 30% of plasma clotting factor. For the treatment of Warfarin reversal 5-8 ml/kg will be sufficient.
5. Administration: Thaw FFP in water bath at 30°C-37°C for 30 minutes and commence transfusion immediately after thawing or within 30 minutes after thawing. Infuse FFP as rapid as can be tolerated by the patient and complete infusion within 15-30 minutes. FFP expires 24 hours post-thawing

2.5.3 Adverse effects due to transfusion of FFP

- Fresh frozen single donor plasma carries the same risk of latent viral infection as a unit of red cell concentrate.
- Allergy limited to skin resulting in Urticaria occurs in 1-3% of transfusions, but anaphylaxis is rare.

- Transfusion-related acute lung injury (TRALI) manifest clinically as severe respiratory distress usually develops within 4 hrs of transfusion.
- A risk of Infections such as HBV, HIV, HCV and Syphilis

2.5.4 *Indications of Cryoprecipitate*

Cryoprecipitate is defined as a concentrate of high molecular weight plasma proteins (Factor VIII-rich precipitate) that precipitate when fresh frozen plasma is slowly thawed at 1-6oC. The precipitate is then resuspended in 10-15ml of plasma to save the Factor VIII - rich precipitate. Each bag or "unit" contains 80 -100U of Factor VIII, 200-300mg of fibrinogen, 80U of von Willebrand's Factor, and 40-60U of Factor XIII in a volume of about 15ml and it is stored at <-18oC for up to 1 year. Like FFP, it also expire 24hours post thawing.

Indications of Cryoprecipitate

1. For the treatment of patients with hypofibrinogenaemia (<100-150 mg/dl) either acquired or congenital type.
2. In absence of commercial concentrates, can be used to treat haemophilia A (FVIII deficiency) and von Willebrand's disease.
3. It may also be used for treating hereditary Factor XIII deficiency.
4. Cryoprecipitate is usually administered in pools of 10units.

2.5.5 *Cryosupernatant (Cryo-Poor Plasma)*

Cryosupernatant is prepared from slowly thawed FFP that has been centrifuged to separate the insoluble cryoprecipitate from the plasma. The remaining plasma (Cryosupernatant plasma) is then refrozen and has an average volume of approximately 265mls. Cryo-poor FFP supernatant does not contain measurable amounts of Factor VIII or fibrinogen but contains low levels of the von Willebrand's multimers implicated in the pathogenesis of TTP.

Indications of Cryosupernatant plasma

1. Cryosupernatant plasma is indicated only for patients with TTP who have failed FFP therapy or are deemed at very high risk.

2.5.6 Indications of Plasma Derivative Products

Coagulation Factor Concentrates

The products mentioned here are currently not available from NBTS but can be available from commercial outlets for use. Therefore, for the treatment of conditions for which they are indicated, the users are advised to refer to the treatment guidelines on those conditions and the manufacturers' recommendation on use. However, as blood transfusion practice in Tanzania is still evolving, it is good that a mention of the products is brought here for familiarity purposes.

Haemosolvate Factor

This is an intermediate purity Factor VIII concentrate produced and prepared from freshly frozen plasma pools. It is indicated for Factor VIII and VonWilbrands disease treatments.

Haemosolvex Factor IX

This is a prothrombin complex concentrate produced and prepared from fresh plasma and contains prothrombin, factor VII, factor X and factor IX. It is indicated in the management of Haemophilia B and the treatment of warfarin induced bleeding.

Albumin (Albusol 4% & 20%)

These are prepared from pooled human plasma and indicated for:

- Blood volume expansion: following Fluid resuscitation in acute clinical conditions associated with Hypovolaemia (e.g. trauma).
- Replacement fluid following paracentesis: Albumin is beneficial in preventing acute complications of hyponatraemia and renal impairment.
- Therapeutic plasma exchange: Albumin is the replacement fluid of choice for most procedures. The exception is TTP, where FFP or cryo supernatant are indicated.

Chapter Three

3.0 INDICATIONS OF BLOOD IN SPECIAL DISEASE CONDITIONS

3.1 Blood Transfusion in Paediatric Patients

The field of transfusion medicine for children shares most of the same principles as that of adults but it has distinctive features which need separate consideration. Those children who require blood products are also among the most intensively transfused of all patients. Because they are likely to have a long life span following transfusion, minimizing adverse events is of great importance.

There are different age categories for children and the indications for transfusion are different according to different groups. The following are different age groups in paediatrics;

- Newborn up to 1 week
- Neonate up to 1 month
- Infant up to 1 year
- Child up to 14 years

But for the purposes of the rest of this document, the term 'neonate' includes infant up to the age of 4 months.

3.1.1 Indications of Packed Red Blood Cells Transfusion in Neonates and Infants

Indications of Packed Red Blood Cells (PRBC) in Newborns

Suggested transfusion threshold Hb (g/dl)but also depending on clinical situation

Post natal age	Ventilated	On oxygen/ CPAP	Off oxygen
First 24 hours	< 12 g/dl	< 12 g/dl	< 10 g/dl
≤ week 1 (days 1-7)	< 12 g/dl	< 10 g/dl	< 10 g/dl
Week 2 (days 8-14)	< 10 g/dl	< 9.5 g/dl	< 7.5-8.5 g/dl
≥ week 3 (day 15 onwards)	< 8.5 g/dl	< 8.5 g/dl	< 8.5 g/dl

Indications of Packed Red Blood Cells (PRBC) in Infants

- Haemoglobin concentration of 4g/dl or less (or haematocrit 12%), whatever the clinical condition of the patient.
- Haemoglobin concentration of 4–6g/dl (or hematocrit 13–18%) if any of the following clinical features are present:
  - » Clinical features of hypoxia; Acidosis (usually causes dyspnoea)
  - » Impaired consciousness
  - » Malaria hyper - parasitaemia (> 20%)
  - » Clinically detectable dehydration
  - » Shock
  - » Heart failure

Note: The decision to transfuse should not be based on the haemoglobin level alone, but also on a careful assessment of the patients' clinical condition. Both laboratory and clinical assessment are essential to determine who should be transfused.

Indications of RBC for paediatrics more than 4 month's age

- Hb<8g/dl (Hct<24%) in perioperative period with symptoms of anaemia, chemotherapy or radiotherapy
- Hb<13g/dl (Hct <40%) in severe pulmonary disease or major surgery

Indications of Packed Red Blood Cells (PRBC) for Exchange Transfusion in Neonates and Infants

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

- The bilirubin level at which an exchange transfusion is indicated varies according to the weight and gestational age of the baby.
- The early administration of intravenous immunoglobulin (1g/kg) to Coombs positive infants with neonatal jaundice significantly reduces the level of exchange transfusions for hyperbilirubinemia.

Characteristics of The red cell component used for exchange transfusion

- Haematocrit of 0.5-0.6l/l
- The unit should be group O (or ABO compatible with maternal and neonatal plasma)
- The unit should be Rh-D negative, cross match compatible with maternal plasma
- The unit should be <5 days old
- If irradiated, must be transfused within 24 hours of irradiation
- The unit should be leucocytes-depleted
- It should not be transfused directly from cold storage and should be warmed during the procedure with care taken to avoid overheating
- In sick, preterm neonates monitoring of ionized calcium is advisable.

Administration Principles for Packed Red Blood Cells in neonates and infants up to 4 months post-delivery

Proper selection of donor's blood group is essential to prevent transfusion hazards. It is known that ABO antigen is fully developed at birth but the newborn baby does not produce ABO antibodies until 5 to 6 months of age, therefore:

The ABO antibodies present in the serum of newborn babies are derived from mother's blood due to placental transfer. This means there are no anti-A or anti-B in serum of newborn babies, but there could be IgG transferred from mother to baby through placenta.

- So the identification of blood group of the newborn baby and neonates is done by ABO antigen grouping (forward grouping) only, antibody grouping (reverse grouping) is not required due to absence of anti-A & anti-B antibodies in their serum.
- Compatibility: newborn baby and neonates serum will be compatible with any blood group because has no antibodies.
- In case of transfusion of blood in newborn under 4 months of age, cross-matching of newborn baby and neonates serum is done with donor's cells to exclude transferred IgG and mother's serum with donor's cells exclude presence IgG in mother's serum using

immediate spin and Indirect Antiglobulin Test(IAT).

- Therefore, Selection of blood for transfusion in newborn baby and neonates' with less than 4 months of age require
  - » Packed Red Cells (PRBCs) of the same ABO & Rh type to the neonate, so make sure you are sure with the blood group of the newborn baby.
  - » It should be compatible with any ABO or atypical red cell antibody present in the maternal serum
  - » In absence of the same ABO, PRBCs blood group O should be given.
  - » **DO NOT** give whole blood because of high risk titres in plasma.
- The age of the unit does not matter for small volume top-up transfusions, but large volume transfusions (exchange transfusion or acute blood loss) should be < 7days old with high level of 2, 3 DPG in order to avoid Hyperkalemia and ensure high tissue oxygen release.
- For most transfusion a flow rate of 5 ml /kg/hour should be observed over 3-4hours
- Blood need only be warmed when infusion rate is >15ml/kg/hour in a child or for a neonatal exchange transfusion or a patient has clinically significant cold agglutinins.
- The dose of PRBCs is given by volume needed (mls) = (Hb desired – Hb current) x weight of the patient (kg) x 4 (constant) or 10 ml/kg for PRBC

Adverse effects due to transfusion of PRBCs in neonates

- Risk of fluid overload: Check the respiratory rate and pulse rate every 15 min. If either rises or there is other evidence of heart failure, such as basal lung crepitations, enlarged liver or raised jugular venous pressure, transfuse more slowly. If there is any evidence of fluid overload due to the blood transfusion, give IV frusemide at 1-2mg/kg, up to a maximum dose of 20mg. In children with severe acute malnutrition, fluid overload is a common and serious complication. Give packed red cells when available or whole blood at 10 ml/kg (rather than 20 ml/kg), and do not repeat transfusion

based on the Hb level, or within 4 days of transfusion.

- Other adverse effect as in Adults.

3.1.2 Platelet Transfusion in Paediatrics (Neonates and Infants)

A normal neonate's platelet count is 80-450 x 109/L, after one week of age it reaches adult levels of 150-400 x 109/L.

Thrombocytopenia is common in sick pre-term infants and is associated with an increased risk of severe periventricular haemorrhage.

The guideline thresholds for platelet transfusion are:

- In all neonates with platelet count < 30 x 109 /l
- In all neonates with major bleeding and platelets count of <100x 109/L
- In all neonates if they have an increased bleeding risk and platelet count of < 50 x 109 /l, <1000g and < 1 week old
- In all neonates who are clinically unstable (e.g. labile blood pressure)
- In all neonates with previous major bleeding
- In all neonates with current minor bleeding
- In all neonates with coagulopathy
- In all neonates with planned surgery or exchange transfusion

Platelets with ABO group specific platelets are recommended.

In neonatal alloimmune thrombocytopenia, Human Platelet Antigen (HPA)-compatible platelets are required. In an emergency, use of maternal platelets is an option when the count is < 30 x 109/l.

Dosage for platelets for neonates is 5-10 ml/kg is recommended.

3.1.3 Fresh Frozen Plasma (FFP) Transfusion in Neonates and Infants

ABO group specific plasma (or AB plasma) is recommended. Group O FFP should not be given to neonates who are not group O owing to the potential risk of the infusion of significant amounts of anti-A and anti-B.

FFP should never be used for volume replacement. It should be reserved

for neonates with a significant coagulopathy {International Normalized Ratio (INR) or activated partial thromboplastin time (APTT) ratio > 1.5 and significant risk of bleeding} or who are about to undergo an invasive procedure, at a dose of 15 ml/kg.

3.2 Blood Transfusion in Sickle Cell Anaemia Patients (SCA)

Children with sickle cell anaemia (SCA) do not develop symptoms until they are six months old; beyond six months they usually get crises. The main aim of management is to prevent Sickling crises. Overall 60% of patients with sickle cell disease receive a transfusion during their lifetime and it is more common for patients with Hb SS and Hb S-ß0 thalassemia.

3.2.1 Indications for Transfusion in Sickle Cell Anaemia

There are three main types of blood transfusion in Sickle Cell Patients

- Acute Simple/episodic Transfusion.
- Chronic/Top up Transfusion.
- Exchange blood transfusion.

Acute Simple Transfusion

The purpose of a simple transfusion is to increase the patient's red blood cell mass and oxygen carrying capacity, this means will stabilize patient by reversing acute complications. Simple transfusion will increase Hb/Hct and decrease % Hb S, but not to the extent of exchange methods.

Indications for Acute Simple Transfusion in Sickle Cell Patients

- Patient symptomatic from anaemia, regardless of hematocrit
- Severe, acute anaemia with Hb decrease of 2 g/dl from the baseline
- Patient with acute chest syndrome (hypoxia, tachypnea, respiratory distress)
- Prior to surgery with general anaesthesia
- Splenic sequestration crisis (moderate or severe)

Chronic/Top up Transfusion

Chronic transfusion is for a long term prophylaxis and prevents future complications in SCA patients. Long term blood transfusions are used to suppress endogenous erythropoiesis, hence maintain a lower level

of sickled RBC and thus prevent certain complications of sickle cell disease. Usually long term transfusion is given over 6 months. However, it can lead to iron overload, alloimmunization and other transfusion-related complications.

Indications of Chronic Transfusion in Sickle Cell Patients

- Prevent secondary stroke in patient who had history of previous stroke (CVA).
- Prevent primary stroke for high risk patients based on elevated transcranial Doppler ultrasound (TCD) and/or diffusion MRI.
- Multiple, severe episodes of acute chest syndrome requiring transfusion and at least two (2) admissions in past year.
- Chronic lung disease secondary to multiple episodes of acute chest syndrome or severe reactive airway disease not responsive to maximal pharmacological management.
- Two or more episodes of splenic sequestration syndrome either awaiting or deferring surgical Splenectomy.
- Recurrent and severe episodes of vaso-occlusive crisis, at least 6 admissions in past year.
- In SCA patient with organ failure

Exchange Transfusion in Sickle Cell Patients

- Exchange transfusions are performed by removing the patient's own blood and replacing it with an equal volume of transfused PRBCs and/or normal saline. The purpose of an acute exchange transfusion to remove patient sickled RBCs and replace with donors normal RBCs hence reduce the percentage of RBCs that contain haemoglobin S (i.e., reduce the "percent sickle") to 30-40%. It can be achieved in the following two ways:-
- Manual exchange transfusion: Removal of patient whole blood (sickle haemoglobin) and replace with donor RBC
- Automated erythrocytapheresis: Removal of patient sickled RBCs though automated centrifugation and replace with donor PRBCs.

Indications for Exchange Transfusion in Sickle Cell Patients

- Suspected acute stroke or Transient Ischaemic Attack (TIA)

- Acute chest syndrome: symptomatic patient (hypoxia, respiratory distress), episode involving multiple lobes, not responsive to simple transfusion
- Prior to general anaesthesia in patient with high baseline Hb (e.g. Hb SC disease) or history of severe ACS or pulmonary disease
- Intractable priapism.

3.2.2 Administration Principles of Packed Red Blood Cells in Sickle Patients

Type of Blood: All sickle cell patients should have an extended RBC phenotype performed, preferably between 6 and 12 months of life and before the first blood transfusion. This phenotype should become a part of the permanent blood bank record. PRBC transfusions should be matched to blood donors with minor antigens as thoroughly as possible (K, C, E, S, Fy, and Jk) to prevent alloimmunization. This is essential for patients needing chronic or repeated transfusions and for those with a history of alloantibodies.

The dose of PRBCs: The volume of PRBCs to be transfused is calculated aiming to raise the patient's haematocrit to 30% (target range 28-33%) or Hb to 10g/dl. Do not exceed Hct of 36% due to theoretical risk of hyperviscosity. The dose of PRBCs blood is given by: volume (mls) = 4 x weight of patient (expected Hb-current Hb) or 10ml/kg

Rate of Transfusion: In patient without history of fluid intolerance or heart failure, rate is 3-5ml/kg per hour while patient with history of fluid intolerance or heart failure, rate is1-2ml/kg per hour

3.3 Blood Transfusion in Obstetrics Patients

Anaemia in pregnancy is defined by haemoglobin concentration of less than 11 g/dl in the first and third trimesters and 10.5 g/dl in the second trimester (WHO).

The diagnosis and effective treatment of chronic anaemia in pregnancy is an important way of reducing the need for future transfusions.

Blood loss during delivery is about 500 ml at normal vaginal delivery and 1000 ml during Caesarean section rarely necessitates transfusion provided that the maternal haemoglobin is above 10.0-11.0 g/dl before delivery.

Obstetric bleeding may be unpredictable and massive. Every obstetric unit

should have a current protocol for major obstetric haemorrhage and all staff should be trained to follow it.

If disseminated intravascular coagulation is suspected, do not delay treatment while waiting for the results of coagulation tests.

The administration of anti-Rh D immunoglobulin to all Rh D negative mothers within 72 hours of delivery is the most common approach to the prevention of Rhesus disease of the newborn.

3.3.1 Indications for Blood Transfusion in Obstetric Patient

The decision to transfuse blood 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
- Evidence of cardiac failure
- Presence of infection: e.g. pneumonia, malaria
- Obstetric history
- Anticipated mode of delivery: Vaginal or Caesarean section
- Haemoglobin level.

Indications of Blood Transfusion for Chronic Anaemia in Pregnancy

- Blood is indicated in all pregnant women with severe anaemia (Hb<7g/dl) at any stage of the pregnancy provided they are not in labour. Give one unit of **PRBC SLOWLY** over 6hours.
- Do not give blood transfusion while in labour, Transfuse packed red cells 24 hours post delivery
- Blood is indicated when elective caesarean section is planned and there is a history of: antepartum haemorrhage (APH) or postpartum haemorrhage (PPH) with Hb between 8.0 and 10.0 g/dl or Hb <8.0g/dl
- Blood is indicated in all major obstetric haemorrhage such as antepartum haemorrhage (APH) or postpartum haemorrhage (PPH)

Disseminated Intravascular Coagulation in Obstetric Patient

In disseminated intravascular coagulation (DIC), the coagulation and fibrinolytic systems are both activated, leading to consumption of clotting factors, platelets and hence deficiencies of the coagulation factors, fibrinogen and platelets. DIC is a cause of massive haemorrhage in obstetric haemorrhage such as antepartum haemorrhage (APH) or postpartum haemorrhage (PPH). Its causes include; Intrauterine death, amniotic fluid embolism, sepsis, pre-eclampsia, abruption-placenta, retained products of conception, induced abortion, excessive bleeding, acute fatty liver.

Management of DIC

If DIC is suspected, do not delay treatment while waiting for the results of coagulation tests. The following steps for management of DIC must be followed.

- Treat the cause: Deliver foetus and placenta, evacuate uterus, as indicated for retained or necrotic tissue.
- Give uterine stimulants to promote contraction.
- In many cases of acute blood loss, the development of DIC can be prevented if blood volume is restored with a balanced crystalloid solution. If bleeding is not controlled and if coagulation tests show very low platelets, fibrinogen, prolonged PT or APTT, replace coagulation factors and platelets with:
- Cryoprecipitate - at least 15 packs
- Fresh frozen plasma (15 ml/kg): 1 unit for every 4-6 units of whole/ PRBC unit of blood.
- Platelet concentrates 6 units, if there is evidence of thrombocytopenia
- If there is massive blood loss requiring replacement of one's volume or more, institute a massive transfusion protocol, **refer to chapter 4.**

Chapter Four

4.0 BLOOD TRANSFUSION PROTOCOLS

4.1 Emergency Blood Transfusion Protocol (EBTP)

In emergency situations patients may require life-saving blood transfusion before the usual necessary routine Pre-transfusion Testing (ABO group and Rh (D) typing, Antibody screen for irregular antibodies and compatibility testing). The most frequently encountered clinical situations where emergency transfusion is required in most hospitals are massive gynaecological/obstetrics haemorrhage (APH/PPH), post trauma, massive gastrointestinal haemorrhage.

4.1.1 Types of Blood to be used for Emergency Transfusion

Blood Group O-negative/O-Positive uncross matched RBCs

- Blood group O-negative/O-positive blood has been termed as the universal donor and hence can be used in emergency transfusion when typing, cross match or ABO group of the patient is not available. However, sample for subsequent testing must be collected prior to administration of the blood.
- Blood group O-negative will be issued as emergency release based on the sex/age of the patient preference to women of child-bearing age (to avoid rhesus sensitization).
- Blood group O-positive blood will be dispensed to all male patients and postmenopausal females. If an Rh negative woman of child-bearing age has received Rh positive blood, the Blood Bank physician will advise the patient's physician about the administration of Rh immune globulin within 72 hours of transfusion.
- Packed RBC should be preferred to whole blood since they have smaller amount of anti-A and anti-B titres
- Two units may be given before switching to the patient's known group and type. As soon as the patient's type has been established, blood bank personnel will switch the O units to the correct patient's type. If more than two units of type O Rh-negative uncross matched whole blood is transfused the patient probably cannot be switched to his or her blood type (A, B, or AB) until the blood

bank determines that the transfused anti-A and anti-B has fallen to levels that permit safe transfusion of type-specific blood.

Group compatible uncross matched (O-Positive) packed red cells

Group compatible uncross matched (type specific) red cells when transfusion is required urgently before full testing can be completed. The laboratory issues red cells based on the blood group from a current sample. The emergency blood transfusion should base on the blood group from a current sample.

Emergency full cross matched

This is usually preferred option but takes longer, usually 45 to 60 minutes or up to 2 hours, alternatively the above options (1&2) can be used while sending sample for full cross match and type specific blood.

4.1.2 Clinician Responsibilities

In an emergency, the patient's physician must:

- Weigh the risks of transfusing uncross matched or partially cross matched blood against the hazard of waiting for a completed cross match test and routine pre transfusion testing.
- He/she must indicate both the urgency and acceptance of additional risk in writing that in my best judgment, immediate transfusion is needed, and any delay necessitated by the completion of the requirements of the pre transfusion tests may be detrimental to this patient.
- Sign the emergency blood request for uncross-matched blood or blood without routine pre transfusion testing.
- Indicate clearly physician name on the form to assist the blood bank staff in communicating information about subsequent compatible cross-matches and testing.
- Request the appropriate blood support and communicate this to the blood bank
- Ensure a pre-transfusion sample is taken for subsequent testing
- Communicate with the haematologist/Laboratory Manager regarding ongoing blood product support.

4.1.3 Laboratory Scientist Responsibilities

- In an emergency, the Laboratory scientist must state and indicate all necessary pre transfusion testing requirements that were **NOT** completed
- Complete the cross match form, entering all identification detail of the unit issued
- Complete the cross matches or pre testing and notifies the treating physician of the outcome.
- Scientist is required to notify the haematologist/Laboratory Manager who will assist the scientist in prioritizing laboratory workload, obtain further blood stocks according to likely need, predict likely need for Fresh Frozen Plasma, Cryoprecipitate and Platelet support and ensure products are available and provide clinical advice regarding management of coagulopathy if requested.
- Each hospital blood banks is required to maintain an "Emergency Blood Kit" comprising 15 units of tagged 5 O Rhesus (D) negative, 5 O Rhesus (D) positive and 5 Kell negative RBC units to be available for immediate release.
- When uncross matched blood has been transfused in emergency situation, the circumstances should be documented (indication, effort to trace full cross matched blood etc and it should be under a specialist physician whose name and signature should be documented.

4.2 Massive Blood Transfusion Protocol (MTP)

Massive blood transfusion is arbitrarily defined as the transfusion of blood volume to patient equivalent to his/her total blood volume(7%-8% of the body weight) in less than 24 hours, or as the acute administration of more than half the patient's estimated blood volume per hour or transfusions of 10 units or more in 24 hours

The aim of treatment is to restores an adequate blood volume and maintains blood composition within safe limits with regard to haemostasis, oxygen carrying capacity, oncotic pressure and biochemistry. The priority is for definitive surgical arrest of haemorrhage.

4.2.1 The Trigger of Massive Transfusion Protocol (MTP)

- The simplest trigger is when a senior physician suspects impending or actual haemorrhagic shock in bleeding patient.
- When you transfuse a patient with 10 blood units of RBCs within 24 hours and still patient present with ongoing major bleeding, activate MTP.
- Systolic Blood Pressure is < 90mmHg, pulse rate >120 and pH 7.4.

4.2.2 General Principle of Managing Patients with Massive Bleeding

The following are guidance principle for managing patient with a massive haemorrhage.

- Hypotension should be treated initially by crystalloid or colloid infusions (rather than delay fluid administration).
- At the start of resuscitation, blood sample should be taken to request laboratory investigations: FBC, PT, PTT, INR, fibrinogen, ABO, compatibility, biochemical profile, blood gases, pulse oxymetry and repeat FBC, PT, PTT, fibrinogen every 4hrs after blood transfusion
- Inform blood bank as soon as possible to prepare PRBC, FFP and Platelets as described below.
- Prevent the onset of the lethal triad of shock by:
  - » Aggressive warming by covering patients and warming fluids to avoid hypothermia.
  - » Continuous Monitoring of circulation to prevent hypoperfusion which might lead to lactic acidosis,
  - » Control ongoing blood loss as far as possible and avoiding coagulopathy by using FFP and platelets during resuscitation.
- Correction of hypocalcaemia may be required if whole blood is used for resuscitation however is seldom required if red cell component is used give CaCl 1gm IV slowly or 10ml of 10% calcium gluconate administered intravenously
- Perform tertiary Trauma Survey

4.2.3 Massive Blood Transfusion Protocol (MTP) Steps

- Request and administer in parallel a 1:1:1 ratio of 6 Units of RBCs, 6 Units of FFP and 6 Units of Platelets. This ratio of blood products simulates the composition of whole blood. The target is to achieve 1:1:1 ratio over 6 hours. Aim the PT, PTT <1.5x control mean, fibrinogen >1 g/L, target platelet > 100x109/L if pts has CNS trauma, eye and > 50x109/L for other type of injuries.
- If homeostasis and resolution of coagulopathy occur, stop MTP, notify blood bank, return any unused products ASAP and resume standard ordering practices.
- If no homeostasis and resolution of coagulopathy do the following, repeat FBC, INR, PTT & fibrinogen level if INR > 1.5 x control and platelet is <25 x109/L, do the following
- Request additional MTP pack and adjust accordingly as per laboratory investigation
- Give FFP 4 units until INR is controlled and 6 units of platelets or consider other drugs such as Tranexamic Acid 10 mg/kg IV followed by 1g over 8 hours.

Contact key personnel

- The key responsible staffs is clinician in charge attending patient who is required to:-
- Contact blood bank team and provides name of patient sex, age, name and location of patient.
- Record name of blood bank contact so that he/she can call him/her if patient location changes or more blood products are needed.
- Other involved key staff are duty anaesthetist, haematologist and surgeons

4.2.4 Complications of Massive Blood Transfusion

Massive blood transfusion of large volume blood is associated with clinical problems. The complications of massive transfusion are those of any blood transfusion plus:

- Volume overload
- Coagulation Factor Depletion

- Disseminated Intravascular Coagulopathy (DIC)
- Hypocalcaemia
- Hyperkalemia
- Hypothermia
- Acute Respiratory Distress Syndrome (ARDS)
- Acid/Base Disturbances

4.3 Maximum Surgical Blood Order Schedule (MSBOS)

This is a locally agreed tariff for blood ordering between the surgeon, the blood bank and the anaesthesia for elective surgical cases. It is just meant to guide on how much units of blood should be prepared for each case and which cases can be accommodated by type and screen only. Since blood is not taken out of the blood bank for the type and save cases, the blood bank must guarantee the surgical team that blood will be made available if the need arise during surgery. It is hospital dependant but this guideline aims to just provide a guide MSBOS.

4.3.1 The Importance of Maximum Surgical Blood Ordering Schedule (MSBOS)

- It discourages the practice of over ordering of blood for elective surgical cases.
- Makes blood more available to other emergency situations by avoiding over holding of blood.
- Wastage due to shelf life is reduced as blood is with the blood bank in ideal storage environment.
- It also allows for a more efficient management of blood inventory
- Saves hospital costs, in reagents, by reducing unnecessary cross-matching

4.3.2 *Prototype of MSBOS*

A guide to expected normal blood usage for surgical procedures in adult patients

General Surgery	
Cholycystectomy	G & S
Partial Gastrectomy	G & S
Mastectomy: simple	G & S
Thyroidectomy: partial/total	X-M 2
Partial Gastrectomy	G & S
Colectomy	X-M 2
Mastectomy: simple	G & S
Mastectomy: radical	X-M 2
Thyroidectomy: partial/total	X-M 2
Cardiothoracic Surgery	
Bronchoscopy	G & S
Open pleural/lung biopsy	G & S
Lobectomy/pneumonectomy	X-M 2
Oesophagectomy	X-M 2
Mediastinal tumor	X-M 2
Decortication	X-M 2
Open Heart Surgery	X-M 4
ENT Surgery	
Tonsillectomy	G & S
Laryngectomy	X-M 2
Epistaxis	G & S
Parotidectomy	G & S
Vascular Surgery	
Resection abdominal aortic aneurysm	X-M 6
Neurosurgery	X-M 6

Burr Hole Drainage	G & S
Laminectomy	G & S
Drainage of acute subdural haematoma	G & S
Craniotomy for aneurysm	G & S
Transphenoidal removal of Pituitary tumor	X-M 2
Craniotomy for AV malformation	X-M 2
Meningioma	G & S
Head injury,extradural haematoma	X-M 4
Urology Surgery	
Ureterolithotomy	G & S
Cystotomy	G & S
Ureterolithotomy & Cystotomy	G & S
Cystectomy	X-M 4
Open nephrolithotomy	X-M 2
Open prostatectomy (RPP)	X-M 2
Transurethral resection prostatectomy (TURP)	G & S
Renal transplantation	X-M 2
Scrotoplasty.	X-M 2
Obstetrics and Gynaecology Surgery	
Termination of pregnancy	G & S
Normal delivery	G & S
Caesarean section	G & S
Placenta praevia/retained placenta	X-M 4
Antepartum/postpartum haemorrhage	X-M 2
Dilation & curettage	G & S
Hysterectomy: Abdominal or vaginal:	G & S
Extended TAH	X-M 2
Myomectomy	X-M 2

Hydatidiform mole	X-M 2
Oophorectomy for cancer (radical)	X-M 2
Orthopaedic Surgery	
Above Knee amputation	G&S
Below Knee amputation	G&S
Disc surgery	G&S
Laminectomy	G&S
Removal hip pin or k nail	G&S
Total hip replacement	X-M 4
Osteotomy/bone biopsy (except upper femur)	G&S
Nailing fractured neck or femur	X-M 2
Internal fixation: Tibia or Ankle	G&S
Arthroplasty: total hip	X-M 3
Spinal fusion (scoliosis)	X-M 2
Spinal decompression	X-M 2
Peripheral nerve surgery	G&S
Total Knee replacement	X-M 2
Plastic Surgery	
Free Flaps	X-M 2
Breast reconstruction	G&S
Keloid Excision	G&S
Major de-sloughing procedure	G&S

KEY:

X-M = Cross match

G&S=ABO/Rh group and antibody screen

(+)= Indicates additional units may be required, depending on surgical complications.

2,3,4 = Indicate of number of units required and cross matched

Chapter Five

5.0 ALTERNATIVES TO ALLOGENIC BLOOD TRANSFUSION

There are a number of alternatives to allogeneic blood transfusion. Some of these options are conventionally offered by the blood transfusion services themselves, where as others such as acute normovolaemic haemodilution and auto transfusion of recovered blood is largely the domain of the anaesthetist and surgeon. The same is true for the use of haemostatic drugs and agents.

It is also important to note that many of the measures outlined below require careful planning and are not possible in emergency settings or at short notice. Since there is a lot more time and attention required for the extra clerical requirements, special handling (additional labels, separate storage in the blood bank etc.) and the fact that blood that is not transfused is generally wasted, the costs for autologous and similar procedures are significantly higher than for standard allogeneic components. Nevertheless, hospitals are encouraged to adopt most of this as they offer the safest means of maintaining patient's haemoglobin levels.

5.1 Pre-operative Autologous Donations (PAD)

This is an option for patients who are undergoing elective surgery and whose intra- operative blood requirements can be reasonably accurately predicted (e.g. knee and hip joint arthroplasty).

5.1.1 Indications to admission to the autologous programme include

- The patients should be in good general health and fall broadly within the criteria required for allogeneic blood donors.
- Suitable candidates must be able to tolerate the standard donation withdrawal of 450ml of blood and the longer term reduction in haemoglobin levels.
- They must weigh >50kgs
- Have a haemoglobin level >12g/dl for females and >13 g/dl for males

- Age between 18 and 65 years of age. Older or younger patients may be accepted after consultation and examination by the medical staff of the NBTS.
- It is recommended to collect up to 2 autologous units in a healthy donor.
- To obtain more than one unit, i.e. 4-5 units, draw units at weekly intervals, with the last unit drawn at least one week prior to surgery.
- Autologous donations may be collected up to 72 hours pre-operatively.
- Prescribe oral iron supplement before the first phlebotomy and continue until surgery

5.1.2 Contra-indications to admission to the autologous programme include

- Severe cardiac disease
- Severe pulmonary disease
- Bacteraemia
- Poorly controlled Insulin dependent diabetes mellitus

5.1.3 Management of autologous donated blood

- The patient's clinician should initiate requests for autologous donations and refer the patient to the local blood transfusion service in good time before the operation.
- The units **MUST** be reserved exclusively for the patient who donated them and will not be made available for another patient, document and discard the unit.
- All autologous donations are also tested for markers of transfusion transmissible infections and compatibility testing to ensure no error at the blood bank.

5.1.4 Advantages and Disadvantages of Autologous Blood Transfusion

Advantages

- Reduced risk of TTI's

- Allows safer transfusion in patients with rare blood groups and multiple auto-antibodies
- Indicated in Jehovah's Witness
- Reduces Haemolyticc, febrile or allergic transfusion reactions
- Reduces Alloimmunization to erythrocyte, leukocyte, platelet or protein antigens
- Decrease the demand on allogeneic blood supplies
- Increased erythropoiesis

Disadvantages

- Similar risk of bacterial contamination
- Similar risk of clerical error
- More costly
- Anxiety to some patients
- Higher incidence of adverse reactions in donation
- Perioperative anaemia and side effects of iron supplementation
- Complex logistics for collection, storage and transfusion of the correct unit to the appropriate patients may increase the potential for clerical error.

5.2 Acute Normovolaemic Haemodilution (Preoperative Isovolaemic Haemodilution)

This entails the removal of one or more blood units from a patient before or shortly after induction of anaesthesia and simultaneous replacement with equal volumes of intravenous fluid (Crystalloid 1:3; Colloid 1:1) so that there is no change in the circulating blood volume followed by the return of the blood as dictated by the intra-operative blood loss or be used post-operative. The preoperative Hb and PCV may fall without adverse effects, provided that the circulating volume is maintained at all time. Patients with cardiac diseases must be evaluated before their Hb or PCV is reduced by this means.

This procedure of preoperative isovolaemic haemodilution is the responsibility of the anaesthetist/Surgeons and the transfusion service will have little role to play other than possibly provision of suitable blood collection systems.

The units collected are properly labelled and stored at room temperature for up to 8 hours, unused units must be stored within 8 hours at 1-6oC and outdates in 24hours.

5.2.1 Indications for Acute Normovolaemic Haemodilution

- Good initial haematocrit
- Expected blood loss 900 to 1000mls
- Healthy young adults (special considerations for children and elderly)
- Vascular, orthopaedic, and some general surgical procedures
- Jehovah's Witness

5.2.2 Contraindications for Acute Normovolaemic Haemodilution

- Cardiac illness
- Impaired renal function
- Haemoglobin less than 11g/dl
- Low concentrations of coagulant proteins
- Lack of appropriate monitoring capacity
- Inadequate vascular access

5.2.3 Advantage of Acute Normovolaemic Haemodilution

- Convenient
- Patients easily monitored for complication of donation
- Blood near the patient.
- Relatively fresh blood

5.3 Intra-Operative Blood Salvage

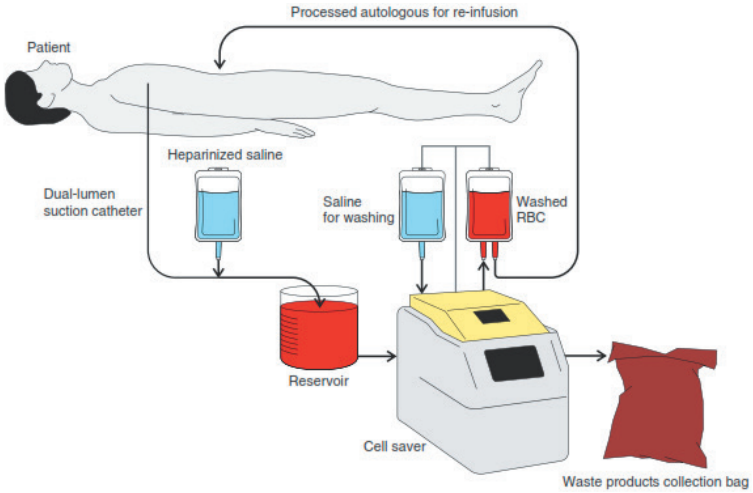
Intra-operative blood salvage should be practiced only in operating theatres with adequate facilities, appropriately trained staff and adequate quality assurance. The latter includes careful monitoring, and adherence to written standard procedures. The most commonly used technique is to employ so-called cell savers that aspirate the shed blood, saline wash the blood and return it to the patient.

There are three phases during intra operative blood salvage: Collection, Washing, and Re-infusion. Collection of red blood cells (RBCs): requires a double-lumen suction device. One lumen suctions blood from the operative field and the other lumen adds a predetermined volume of heparinised saline to the salvaged blood. The anticoagulated blood is filtered, collected and centrifuged. The RBCs are then washed and filtered across a semi-permeable membrane, removing free haemoglobin, plasma, platelets, white blood cells, and heparin. The salvaged RBCs are then re-suspended in normal saline (haematocrit of 50–80%). Salvaged RBCs may be transfused immediately or within 6 hours.

Suitable for any surgical procedure associated with significant blood loss from clean wounds e.g. abdominal, thoracic cavity, cardiac and vascular surgery, orthopaedic, gunshot or stab wounds procedures.

Blood must not be used if the estimated period of bleeding at the site is six hours or more or has contamination of bowel contents or by pancreatic juice or the presence of sepsis or malignancy topical haemostatic agents such as thrombin or microfibrillar collagen have been used. Recovered blood from these sites should not be used as microthrombi may embolise to critical organs.

Figure 2. A Diagram of the set up of a standard cell salvage circuit



5.3.1 *Indications for intraoperative Blood Salvage*

- Cell salvage eliminates the need for allogeneic blood transfusion and reduces the associated risks of infectious and non-infectious complications.

- Anticipated blood loss of 1000 ml or 20% estimated blood volume.
- Patients with low haemoglobin
- Patient with increased risk of bleeding
- Patients with multiple antibodies or rare blood types
- Patients with objections to receiving allogeneic blood

The technique is contraindicated in patients with sepsis, contaminated surgery (bowel surgery, malignant disease) and in obstetric cases.

5.4 Pharmacologic Interventions

These are topically applied agents and systemically administered drugs that may in specific settings, decrease blood loss.

5.4.1 Medications to reduce bleeding

Collagen haemostatic pads, thrombin sprays and fibrin glue: These products are applied directly to the wound (sprayed or in powder form).

Aminocaproic acid and Tranexamic acid: A couple of trials have been published demonstrating efficacy in reducing blood loss post-cardiac surgery when these antifibrinolytics agents have been administered. These agents are frequently used in Haemophilia care provided bleeding does not involve the urinary tract.

Aprotinin: This is aserine protease inhibitor that has been used successfully to reduce blood loss in cardiac surgery in a number of clinical trials. However, there are toxicity and other safety problems, hence careful monitoring is required.

5.4.2 Medications to stimulate red cell production

Erythropoietin: It is the recommended treatment for the anaemia of renal disease; also effective for the anaemia induced by anti-retroviral agents.

Parenteral Iron Preparation: It needs to be remembered that in patients who have documented iron deficiency but whom, for various reasons, cannot take or tolerate oral iron compounds, the option of parenteral iron is available before resorting to transfusion. There are two registered preparations: an iron polymaltose compound for intramuscular injection and an iron sucrose compound for intravenous use. Both can cause allergic reactions including anaphyla

Chapter Six

6.0 ORDERING AND ADMINISTRATION OF BLOOD

6.1 Steps in Blood Ordering and Administration

This chapter deals with the very important issue of ordering of blood on the standard blood request form, informed consent and patient identification. The importance of following standard operating procedures when administering blood is highlighted as well as care required when handling a unit of blood in the clinical setting.

Step 1: Prescription, informed consent and request for blood and blood products

Step 2: Patient identification, blood sampling and labelling

Step 3: Handling of blood units in the clinical area

Step 4: Administration of blood to the patient

Step 6: Management of adverse transfusion reactions.

Step 7: Ethical and Legal Aspects of Blood Transfusion

6.2 Blood Prescription and completion of blood request form

The patient's hospital medical records should contain the indication for the blood transfusion and the number of units required. All blood and blood components for transfusion should be prescribed by clinicians, preferably on a unit by unit basis. Individuals responsible for the prescription and request of blood components must be familiar with the special needs of their patients.

The prescription must specify:

- Patient's name, unique identification number, date of birth, location and gender: for unconscious/unidentified patient, the minimum information necessary on the request form is a unique identification number and gender of the patient
- 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 the details

- Patient diagnosis and indication for blood transfusion
- The blood or blood component to being requested
- Time and date the blood components are required
- The number of units required
- History of previous transfusions, obstetric history, red cell antibodies and any adverse reactions.
- Each request for blood must be documented on a laboratory request form and submitted to the laboratory with the blood sample for compatibility testing.
- The identity of the person making the request and the person receiving it should both be recorded.

6.3 Informed Consent

Blood transfusion is a medical treatment and therefore patients have a right to refuse this treatment. It is the responsibility of the clinicians to inform the patient of the benefits and risks of transfusion and of any alternatives to transfusion available. The medical practionner must also be aware of the rights of the patients to be treated with respect, and staff must be sensitive to their individual needs, acknowledging their values, beliefs and cultural background. The process of obtaining consent should be documented either in the patient notes or on a specific consent form. This discussion should enable the patient to:

» Understand what medical action is recommended

» Be aware of the risks and benefits associated with transfusion

» Understand the consequences of not receiving blood

» Understand available alternative therapy

» Have the opportunity to ask questions

In addition, adequate information should be made available to patients who do not accept transfusions like Jehovah's Witness group.

» Jehovah's Witnesses usually carry a document at all times which details their wishes about medical care and staff must take full note of this document.

» Individual Jehovah's Witnesses may accept treatments such as

dialysis, cardiopulmonary bypass, organ transplants or plasma derivatives.

» It is essential that each Jehovah's Witness patient who is competent is given the opportunity to discuss treatment options with a responsible doctor under a guarantee of strict clinical confidentiality.

» It is essential that any agreement to preserve total clinical confidentiality is strictly honoured.

6.4 Handling of the Blood Components in the Clinical Area

Once blood is issued to the ward or theatre, transfusion should commence as soon as possible i.e. within 30 minutes.

» If this is not possible, then red cell products and FFP should be placed in the ward fridge which is maintained at a temperature of 2-10oC.

» If the transfusion of FFP has not occurred within 6 hours of issue, the blood product must be discarded. Note: FFP needs to be transfused within 4 hours of thawing due to loss of heat sensitive clotting factors.

» A whole blood units should be transfused within 4 hours of the unit been spiked i.e. transfusion started while FFP and Platelets should be infused within 15-30minutes. If the product is not going to be used, it may be returned to the blood bank within 30 minutes and may be reissued to another patient.

» Platelets MUST NOT GO into the fridge, but should be kept at room temperature (20-24oC).

» It is good practice to return all unused blood and blood products to the blood bank so that the return and reissue or safe disposal can be recorded.

6.5 Administration of Blood to the Patient

No other infusions, solutions or drugs should be added to any blood component as they may result in haemolysis or clotting.

See administration principles under each blood component.

6.6 Management of Blood Transfusion Adverse Reactions

Transfusion adverse reaction is defined as undesirable response or effects temporally associated with the administration of blood and blood products. This can be:

- » Haemolytic or non haemolytic transfusion reaction
- » Immunologic and non-immunologic transfusion reaction
- » Immediate (acute) or delayed: occurs within 24 hours or occurs > 24hours respectively

They range from those which cause fatal life consequence to non life threatening, therefore all signs and symptoms of a suspected transfusion reaction are cause for immediate concern. It is essential that the blood component being investigated not to continue to infuse during the investigation. The transfusion should be discontinued, patient assessed, monitored, treated and investigation initiated.

Haemolytic Transfusion Reactions

A haemolytic transfusion reaction is one in which symptoms and clinical or laboratory signs of increased red cell destruction are produced by transfusion. Haemolytic transfusion reaction can be immediate (acute) or delayed. There are two Types of Haemolyticc Transfusion Reaction (HTR)

- Acute Haemolyticc Transfusion Reaction (AHTR)
- Delayed Haemolytic Transfusion Reaction (DHTR)

Case Definition of Acute Haemolyticc Transfusion Reaction (AHTR)

A blood transfusion reaction which occurs during or within 24hours of cessation of blood transfusion with new onset of ANY of the following clinical feature

- Chills/rigors
- Fever
- Back/flank pain
- Pain at IV line site
- Jaundice
- Hematuria (coca cola like urine)

- Hypotension
- Oliguria/Anuria which may complicate to renal failure

Laboratory Feature of AHTR

Two or more of the following features of hemolysis:

- Low Haemoglobin level
- Decreased fibrinogen
- Decreased haptoglobin
- Elevated Lactate Dehydrogenase
- Elevated unconjugated bilirubin
- Haemoglobinaemia
- Positive Direct Antiglobulin Test(DAT)
- Haemoglobinuria
- Spherocytes on blood film

Treatment of Acute Haemolytic Transfusion Reaction

- Stop the transfusion. Do not discard unit or infusion set, send back to laboratory.
- Assess patient and record vital signs (BP, HR, Temp, urine output and SO2) as well as a lung and skin assessment. Continue to monitor patient.
- Notify blood bank to perform a clerical check
- Take a blood samples and urine sample for investigation.
- Insert new IV set with 0.9% Normal Saline to keep line open.
- Pay attention to cardiac, renal and respiratory support.
- Micro vascular thrombosis and deposition of Haemoglobin in distal renal tubule can result Acute Renal Failure. Therefore give IV fluids, 2litres of Normal saline within 24hours
- Prevent/treat renal failure with diuretics such as IV frusemide 120mg and if required mannitol 1 gram.
- Monitor input output chart 100mls/hrs in adult for 18-24hrs or 0.5ml/kg/hr (adult), 1ml/kg/hr in paediatric patients

- If Blood Pressure is low give dopamine or dobutamine 50mg in 500mls of Normal Saline over 2-3hrs
- Complete transfusion reaction form

Delayed Haemolyticc Transfusion Reaction (DHTR)

A transfusion reaction that occurs in previously sensitized patients through a multiple transfusion or pregnancy and usually manifests between 24 hours and 28 days after a transfusion

Case definition for DHTR

History of previous blood transfusion or pregnancy

- Signs and symptoms of haemolysis
- Laboratory features of haemolysis
- Positive DAT test
- Positive allo-antibody screen and new antibody
- Reticulocytopenia

Treatment of Delayed Haemolytic Transfusion Reaction (DHTR)

- Delayed transfusion reactions are difficult to prevent as very low titres of antibodies in recipient's plasma are not easily detected
- Perform antibody screening and identification from patient serum
- Once you have established unexpected antibody in patient serum then perform extended phenotyping of blood donor and hence give antigen negative blood.

Febrile non-Haemolytic Transfusion Reaction (FNHTR)

Febrile non-Haemolytic Transfusion Reaction is defined as a rise in temperature of 1°C or greater from the baseline temperature taken before blood transfusion. It is very common, but not life threatening attributed to the presence of allo-antibodies in already sensitized recipient's plasma where by reactions occurs between the donor leucocytes antigens and antibodies in recipient plasma,

This type of transfusion reaction is more common with stored blood components such as platelets, where cytokines from contaminating leukocyte have accumulated in the bag during storage.

Case definition for Febrile non Haemolyticc Transfusion Reaction

- Occurs during or within four hours following blood transfusion
- Presence of fever > 390C
- A change of temperature of > 10C from pre transfusion value
- +/- Chills/Rigors
- +/- Myalgia/Headache/Nausea
- No features of hemolysis

Treatment of Febrile non Haemolyticc Transfusion Reaction

- Stop the transfusion, rule out haemolysis i.e. check clerical error, repeat type and cross match, Coombs test
- Give antipyretic acetaminophen or paracetamol for chills and rigors
- When the patient is calm restart the blood transfusion at a reduced rate.
- Prevention: Evidence has shown that Leukoreduction decrease a number of reactions.

Case definition of Allergic Transfusion Reaction (ATR)

- Occurs during or within four hours after blood transfusion
- Most frequent following transfusion of FFP or Platelets
- Presents with:
  - » Urticarial reaction with hives, itching and Pruritus
  - » Erythema (redness of skin)
  - » Localized angioedema, oedema of lips, tongue and conjunctiva
  - » Dyspnea due to bronchospasm

Treatment of Allergic Reaction:

- The transfusion should be stopped and anti-histamines administered.
- If there is oedema of the face, eyes, lips or tongue, give steroids.
- If symptoms resolve in <30min continue with blood transfusion

- For ongoing transfusion: An antihistamine can be given prior to transfusion or during transfusion
- Where the cardiovascular system is involved, monitor the patient closely, and treat with antihistamines and steroids.
- If there is bronchospasm treat with bronchodilators.

Case definition of Anaphylactic Transfusion Reaction

- Occurs within 24 hours after blood transfusion
- Seen typically in patients with hereditary IgA deficiency
- Previously sensitized during pregnancy or exposed to blood with foreign IgA
- Hypotension with one or more of urticaria, rash, dyspnoea, angioedema, stridor, wheeze or Pruritus

Treatment of Anaphylaxis

- Stop transfusion
- Treat with I.V fluid resuscitation, epinephrine reverse bronchospasm, antihistamines, corticosteroids and respiratory support.
- If subsequent BT are required, washed RBCs should be used (residual plasma and therefore IgA removed)

Case Definition of Transfusion-Related Acute Lung Injury (TRALI)

TRALI is defined acute transfusion reaction related to lung injury and fluid accumulation in alveoli following blood transfusion. It is caused by Ant-HLA (Abs) in donor plasma reacting with recipient HLA on leucocytes leading to leuko-agglutination in the pulmonary vasculature, activation of complement cascade and mobilization of cytokines. Both of these factors above leads to lung injury and fluid accumulation in alveoli.

All of these five diagnostic criteria for TRALI must be met

- Acute onset of Hypoxemia evidenced by
  - » Pa02 / Fi02 < 300 mmHg or

- » Oxygen saturation is < 90% on room air or
- » Dyspnea

- Chest x-ray with new bilateral infiltrates
- No temporal relation with other causes of acute lung injury such as (aspiration, pneumonia, toxic inhalation)
- Signs and symptoms occurs during or within 6 hours after completion of blood transfusion
- Absence of left atrial hypertension (i.e. non cardiogenic pulmonary oedema)

Treatment and Prevention of TRALI

- Mostly supportive with abrupt resolution in symptoms within a few days
- A majority of patients may require mechanical ventilation
- Treatment with diuretics play no role in management since it is microvascular damage and not due to volume. It has been shown to actually worsen TRALI. Treatment with IV steroids also may not work well.
- Prevention: Avoid donations from multiparous women and those who have received multiple transfusions.

Case definition of Transfusion Associated Graft-versus-Host Disease (TA-GVHD)

- Rare (0.002-0.005% incidence) but fatal condition that has a 90% mortality rate.
- Caused by engraftment and clonal expansion of donor T lymphocytes in susceptible host which attack recipient tissues
- Occurs commonly in immunocompromised patients such as Haematological malignancies or solid tumours receiving chemotherapy, radiation, stem cell transplant
- Not reported in AIDS patients yet
- Due to transfusion of Whole blood with competent donor T lymphocyte
- Symptoms appear within 2nd day to 30 days post transfusion

- » Diarrhoea, Fever and Rash
- » Pancytopenia without any other apparent cause
- » Bone marrow hypoplasia
- » Liver dysfunction 3-4 weeks post blood transfusion

Treatment of GVHD

- No effective treatment
- Patient will be supported with symptomatic treatment
- Any components that contain T-lymphocytes should be irradiated to prevent GVHD

Case definition of Transfusion Associated Circulatory Overload (TACO)

- TACO occurs within 6 hours of completion of transfusion when a patient is transfused too rapidly overloading the cardiopulmonary system
- Patients present with the following:
  - » Cyanosis, dyspnoea
  - » Severe headache
  - » Congestive heart failure (CHF)
  - » Acute respiratory distress
  - » Tachycardia
  - » Increased blood pressure
  - » Acute or worsening pulmonary oedema on chest x-ray
  - » Evidence of positive fluid balance

Treatment of TACO

- Place patient in upright position
- Treat the cardiac failure with diuretics.
- Give patients PRBC transfusions slowly with diuretic cover
- Monitor the patient for at least 24 hours post transfusion

Case definition of Post Transfusion Purpura (PTP)

Occur when platelet alloantibody IgG is directed against a high incidence platelet antigen (HPA-1a) resulting immune complex which are then cleared by reticuloendothelial system. It is characterized by abrupt onset of severe thrombocytopenia (< 10x 10^9/L) within an average of 9 days (range 1-24 days) after blood transfusion. This rare complication may occur with transfusion of PRBCs or whole blood but it has been reported in platelets and plasma.

Usually occurs in multiparous women who do not have the antigen.

Patients present with:

- Purpura eruption of the skin, appearing a week after a blood transfusion
- Abrupt thrombocytopenia arising 5-12 days following transfusion
- Bleeding
- Fever +/-
- Cerebral haemorrhage is a major concern +/-

Treatment of PTP

- Plasma exchange achieves platelet counts to 20 x 109/L in 1-2 days (up to 12 days)
- Treat with IV Immunoglobulin (IVIG), recovery of platelets counts of 100 x 109/L in 3-5 days as it block antibody-antigen mediated clearance
- Splenectomy in refractory pts, but high risk of life-threatening haemorrhage
- Platelet transfusion is not effective and not recommended
- Use of corticosteroids is controversial.

Blood Transfusion Reaction due to Bacterial Contamination

- Rare, if it occur, it is potential for fulminant sepsis associated with high mortality through contamination of the blood unit by venepuncture and asymptomatic bacteraemia donors.
- Usually symptoms set in during or shortly after blood transfusion and present with fever, rigors, nausea, vomiting, Erythema, shock,

& renal dysfunction (due to endotoxins), hence cardiovascular collapse.

- Common organisms for red blood cells at 40C are Yersinia Enterocolitica and Pseudomonas specie while common organisms with platelets stored at room temp are gram +ve *Staphylococcus aureus* and *S. epidermids*.
- Contaminated bag look unusual dark/greenish or contain gas bubbles or hemolysis.
- Diagnosis is based on culture of patient and blood bag sample
- Stop immediately and treat with antibiotics and hypotension can be treated with vasopressin.

6.7 Ethical and Legal Aspects of Blood Transfusion

Blood Transfusion is a cornerstone of modern medical practice. It is an essential component in the medical management of patients in almost every field of clinical practice. Medical practitioners who order blood for their patients are faced with the challenge of managing the blood transfusion needs of the patient in an evidence-based approach and balancing the expected clinical benefit with the medical and legal risks inherent in the transfusion of blood.

The practitioner's responsibility concerns patient's safety and this encompasses:

Correct Identification: It is the responsibility of the medical practitioner to perform ccorrect identification of the patient and units of blood to be transfused: Before blood transfusion, the following **MUST be** checked by the medical practitioner:

- » Full Names of Recipient
- » Hospital Registration Number
- » Blood Group
- » Blood Transfusion Number
- » Blood Unit Number
- » Blood Collection and Expiry date

- **Blood Compatibility:** It is the responsibility of the medical practitioner who transfuses a patient with blood and blood components to ensure that a suitable compatibility test has been

performed which should be verified before transfusion

- **Correct handling of the blood prior to and during transfusion:** The practitioner must ensure that cold chain is maintained during blood transportation. The blood transportation shall be maintained at appropriate temperature at all times until just before transfusion. The blood unit should remain sealed until transfusion or return to blood bank.
- **Reporting of untoward reactions:** Legal aspects of blood transfusion shall be handled by the hospital blood transfusion committee and hospital management In case of any transfusion reactions, or transfusion transmitted infections.
- **Informed consent:** As with any other medical treatment, patients have a right to decide whether or not they want the treatment. As far as possible the patient should understand the treatment and agree that the benefits, risks and alternatives to transfusion have been explained and that they consent to the treatment. It is a process which must be acknowledged and documented.
- **Assessing the benefits and the risks:** With improved testing the residual risk of transmitting HIV, HCV and HBV infection in the blood is low; However, doctors must assess the benefits and risks in each case and must be able to justify all requests for blood transfusions.

References

1. Guideline on the Clinical use of Blood and Blood Products, Ministry of Health and Social Welfare, 1st Edition (2006)
2. WHO Clinical Use of Blood Hand book (2005)
3. Clinical Guidelines for the Use of Blood Products in South Africa, 5th Edition (2014)
4. ISBT Working Party on Haemovigilance, Standard Definitions for Surveillance of Non Infectious Adverse Transfusion Reactions. http://www.ihn-org.com
5. AfSBT Step-Wise Accreditation Standards_ OMD-E-001-1
6. Ashworth A. and Klein A. A. Cell salvage as part of a blood conservation strategy in anaesthesia. British Journal of Anaesthesia 105 (4): 401–16 (2010)

APPENDICES

Appendix I: Emergency Blood Request Form

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL BLOOD TRANSFUSION SERVICE

EMERGENCY BLOOD REQUEST FORM

I have requested the release of blood components for the following patient without the completion of the routine pre transfusion testing and/or compatibility testing.						
Name of Patient				Age		
Hospital Medical record number				Sex		
Number of Units requested	On arrival of patient		Within 30 min		Within 60min	
Product type (*circle appropriate)*	RBC	FFP	Platelets	Cryoprecipitate	Whole Blood	
Blood Group type	O Negative			O Positive		
In my best judgment, immediate transfusion is needed and any delay necessitated by the completion of the requirement of the pre transfusion and/or compatibility testing may be detrimental to this patients						
Justification: Reasons for Emergency release as required by NBTS guidelines						
Name of the Physician			Signature			
Date			Time			

THIS PORTION TO BE COMPLETED BY THE HOSPITAL BLOOD BANK STAFF					
Tick appropriately the Pre transfusion testing requirements NOT completed					
ABO/Rh Group and Type		Antibody Identification			
Antibody Screen		Cross match compatibility testing			
Patient Identification		TTIs testing			
Product Unit ID Number	**Product Type**	**Issued by**	**Signature**	**Date**	**Time**

THIS PORTION TO BE COMPLETED BY THE HOSPITAL TRANSFUSING NURSE/CLINICIAN

Transfused by: Name **Signature:**

Verified by: Name **Signature:**

Appendix II: Sample Regular Transfusion request Form

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL BLOOD TRANSFUSION SERVICE

BLOOD TRANSFUSION REQUEST FORM

Background Information of the patient	
Patient Name_____ Age_____ Sex_____ Reg. No_____ Address_____ Occupation_____	(NEONATAL Specimen, please provide Mothers; Name _____ Delivery date _____ Doctor _____ Contact _____ Ward/Clinic _____ Date and time of request _____/_____
Indication for transfusion and Relevant History	
Patient clinical history _____ Current clinical diagnosis _____	Transfusion triggers _____
History of previous transfusion	
Has patient previously been transfused in the last 3 months? Yes Date _____ No I don't Know Any known transfusion reaction? Yes Date _____ No I don't know Pregnant in the last 3 months? Yes Date _____ No I don't Know Rh ID given in the last 3 months? Yes Date _____ No I don't Know	

Specimen Collector Declaration The patient details on the specimen tube MUST be hand written by the collector

Specimen collected by:_____ Date_____
Time_____

Specimen received by:_____ Date_____
Time_____

Status of Sample received_____ Sample type_____

Condition when received_____ Sample unique ID_____

Priority: Urgent/Routine_____

Please indicate Blood Bank Investigation required: tick where necessary

ABO & Rhesus grouping	Cross match
Direct Coombs (DAT)	Transfusion reaction
Indirect Coombs (IAT)	Baby's Cord Group
Haemolysin test	Antenatal Screen/Titre

Component / Product Requests

Tick blood component required	Number of Units required for each component	Date/Time Required
Packed Red blood Cell		
Fresh Frozen Plasma		
Platelets		
Cryoprecipitate		
Whole Blood		
Clotting Factor		

FOR LABORATORY USE ONLY

ABO & Rhesus grouping _____

Direct Coombs (DAT) _____

Indirect Coombs (IAT) _____

Haemolysin test _____

Cross match _____

Transfusion reaction _____

Baby's Cord Group _____

Antenatal Screen/Titre _____

Prepared by:_____ Date_____
Time_____

Verified by:_____Date_____
Time_____

For each unit issued please indicate the following

Unit number	Patient ABO & Rh group	Donor ABO & Rh group	BT Number	Date & Time of X-match		Compatibility test results
				Date	Time	

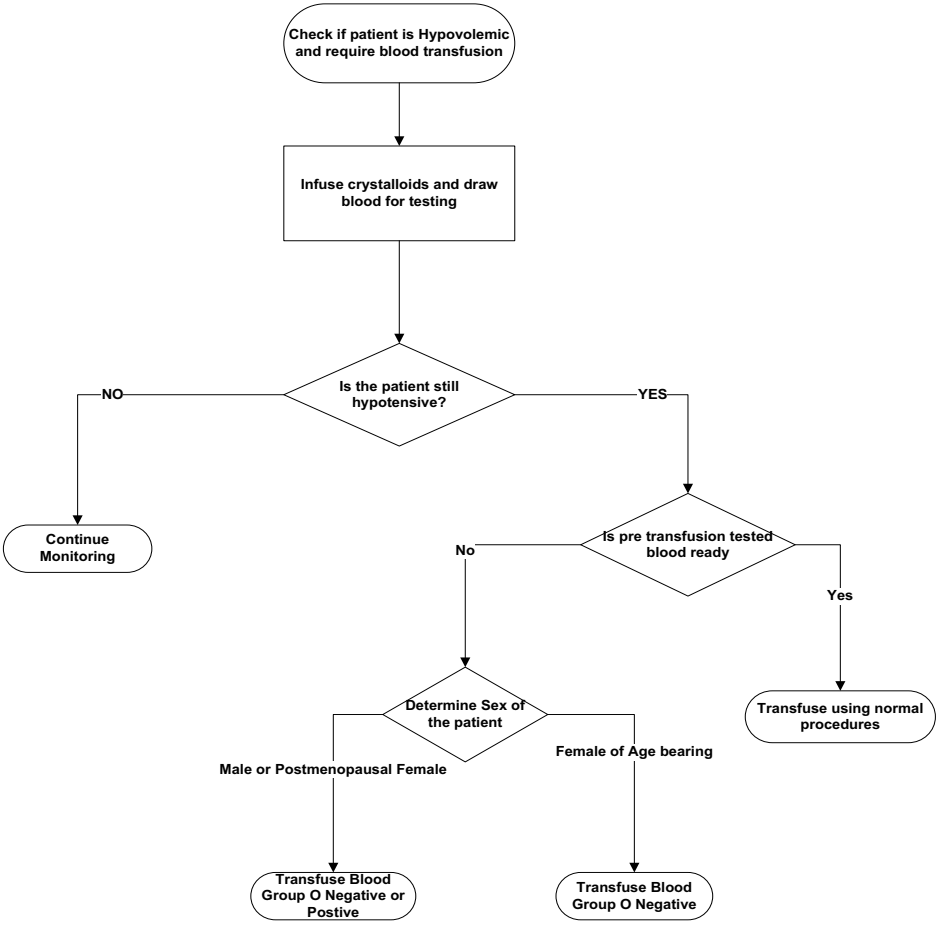
Performed by: Name	Signature:
Verified by: Name	Signature:

Appendix III: Protocol for Emergency Blood Release

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL BLOOD TRANSFUSION SERVICE

PROTOCOL FOR EMERGENCY BLOOD RELEASE



Appendix IV: Transfusion Consent Form

MINISTRY OF HEALTH, COMMUNITY DEVELOPMENT, GENDER, ELDERLY AND CHILDREN

NATIONAL BLOOD TRANSFUSION SERVICE

INFORMED CONSENT FOR BLOOD AND BLOOD PRODUCT TRANSFUSION

Name of Patient.....Age.....

Sex..... Hospital Medical record number.....

I understand that, it is my right to receive information about my health care and to make decisions about the proposed transfusion as part of my treatment with my doctor.

PROPOSED TREATMENT:

After discussing with the doctor, I understand that blood or its component transfusion is necessary as part of my treatment. In order for this to happen, a small blood sample will be collected from me and sent for processing. The transfusion will follow the best practice and that blood being transfused is safe and free from harm as much as is possible.

RISKS:

I understand that despite careful transfusion practices followed by my doctors and nurses, there is a chance that I may suffer a transfusion reaction. While most transfusion reactions are mild and easily treated, there is a small risk of death or permanent disability should I suffer a haemolytic transfusion reaction, a rare but serious form of reaction. I am also aware that there is a small risk for lung injury, known as transfusion related acute lung injury (TRALI), a serious and life threatening allergic reaction of my lungs to the donor blood product.

I have been informed that while there is a small risk of a life threatening transfusion reaction, my health care team is trained to recognize the symptoms, perform an appropriate medical evaluation, and provide treatment for the transfusion reaction in the unlikely event that a reaction should occur.

I understand that the blood and its components are voluntarily donated to the Blood Centre, which uses appropriate practices to select donors, collect and test individual units of blood for TTI. As a result, there is only a very small risk of an infectious disease being transfused to me. Despite this, there is a small risk of the following types of infection from transfusion:

Bacteria, Malaria, Hepatitis B&C and HIV or another infectious agent.

I understand should I need blood/blood components during an emergency, that the immediate need may make it necessary to use blood products that are not cross-matched to me. This blood or its products will be of the blood type that usually can be given with a low risk of allergic reaction or other unintended results.

ALTERNATIVE TREATMENT:

I am aware that there are treatment alternatives to transfusion, including the choice of not being transfused. Some options may include, but are not limited to:

- Infusion of non-blood products, such as vitamins, to help my bone marrow produce blood components
- Other drugs to either support my blood system or minimize the effects of the deficiency.

I understand that each of these options is less effective and less rapid acting than the direct transfusion of blood or its parts.

I understand that refusal of transfusion of blood may cause serious strain on my heart or other organs due to anemia, and could lead to heart attack, stroke, other life threatening medical conditions, as well as death. I understand that refusal of transfusion of platelets, plasma, or factor concentrates may lead to excessive bleeding which could lead to conditions including but not limited to injury to other organs, infection, heart attack, stroke, or death.

CONSENT or REFUSE TO CONSENT

I understand that I have the opportunity to speak to my treating doctor about transfusion of blood or blood products, and to discuss in more detail the risks and benefits of transfusion, and the alternative treatments and their likely consequences. By signing this document I certify that I understood the risks, benefits and alternatives for this procedure, and that I have had an opportunity to ask questions and to have them answered by my physician.

I **ACCEPT** to receive Blood Transfusion Service as described above

Name and Signature of patient or legal guardian:

.....

.....

Name and Signature of witness of patient:

.....

.....

Date: .....

I **REFUSE** to receive Blood Transfusion Services as described above

Name and Signature of patient or legal guardian:

.....

.....

Name and Signature of witness of patient:

.....

.....

Date: .....


NATIONAL BLOOD TRANSFUSION SERVICE-TANZANIA
Donate Blood. Save Lives.