Ministry of Health

GUIDELINES FOR THE APPROPRIATE USE OF BLOOD, BLOOD COMPONENTS AND BLOOD PRODUCTS

Kenya Tissue And Transplant Authority

DamuKE
The Kenya Blood Banking Management System

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MOH/KNBTTS/APPR/GUID/001

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TABLE OF CONTENTS

ACRONYMS

PRBCs	Packed Red Blood Cells
RBCs	Red Blood Cells
SAGM	Saline Adenine Glucose Mannitol
KBTTS	Kenya Blood Transfusion and Transplant Service
FFP	Fresh Frozen Plasma
PT	Prothrombin Time
DIC	Disseminated Intravascular Coagulopathy
NICU	Neonatal Intensive Care Unit
CCF	Congestive Cardiac Failure
APTT	Activated Partial Thromboplastin Time
ABO	Blood Group system
HMW	High Molecular Weight
vWF	Von Willebrand Factor
GBS	Guillain Barre Syndrome
MG	Myasthenia gravis
MS	Multiple Sclerosis
ITP	Immune Thrombocytopenia
HTC	Hospital Transfusion Committee
TRALI	Transfusion Related Acute Lung Injury
TACO	Transfusion Associated Circulatory Overload
ATRF	Adverse Transfusion Reaction Form
HMT	Hospital Management Team
CME	Continuous Medical Education
SCD	Sickle Cell Disease
CPDA	Citrate Phosphate Dextrose Adenine

DEFINITION OF KEY TERMS

Blood component: Any therapeutic constituent of blood that is separated by physical or mechanical means (e.g. red cells, platelets, plasma). It is not intended to capture plasma derived products.

Blood product - Any therapeutic substance prepared from human blood

Whole blood - Unseparated blood collected into an approved container containing an anticoagulant-preservative solution

Plasma derivatives - Plasma proteins prepared under pharmaceutical manufacturing conditions., these include: albumin; coagulation factor concentrates; and immunoglobulins.

Blood component - A constituent of blood, separated from whole blood, such as:

- Red cell concentrate
- Red cell suspension

Plasma

- Platelet concentrates - Plasma or platelets collected by apheresis
- Fresh Frozen plasma

Cryoprecipitate - prepared from fresh frozen plasma rich in Factor VIII and fibrinogen

Plasma derivative

- Human plasma proteins prepared under pharmaceutical manufacturing conditions.

FOREWORD

The Government of Kenya is focused on availing safe and accessible blood and blood components to the Citizenry as per Article 43 of the Kenyan Constitution. Furthermore, the Government is aligning the transfusion services to Universal Health Coverage (UHC) goals of equity in access and quality services. Blood is a lifesaving medical therapy that is donated by fellow humans and have no medical substitute. It thus prudent to ensure that blood is used appropriately and rationally and that transfusions remain safe and efficacious.

The Ministry of Health through Kenya Blood Transfusion and Transplant Service (KBTTS) is progressively working to diversify the number and range of blood components and products available to the clinicians. This is to ensure that Kenyans have access to a wide range of safe and efficacious blood components and products.

The Guidelines for the Appropriate Use of Blood, Blood Components and Products is designed, in a more expanded form, to assist and guide clinicians in the prescription and monitoring of blood transfusions.

We urge the health care workers in all transfusing facilities in the Public, Private and Faith Based Organizations who are involved in transfusion of blood and blood components to adhere to this guideline for quality services to our populace.

Dr. Patrick Amoth EBS
Ag. Director General for Health

ACKNOWLEDGEMENTS

The Ministry of Health (MOH) shall continue investing in transfusion services and ensure that Kenyans in need are able to access blood, blood components and products.

Blood transfusion is an essential component of quality medical care. Blood, blood components and products provide unique and life-saving therapeutic benefits to patients. Prescription of specific blood components to address different patient needs is therefore advised as opposed to transfusion of whole blood for better patient outcomes.

These guidelines on the Appropriate Use of Blood, Blood Components and Products were developed to guide health care workers in the prescription of blood, blood components and products and monitoring of blood transfusions. The Hospital Transfusion Committees (HTCs) are recommended as institutional avenues for the implementation of these guidelines.

On behalf of the Ministry of Health, we acknowledge and sincerely appreciate the commitment depicted by the Technical Working Group (TWG) Members from different sectors, individuals and organizations who have contributed towards the development of these guidelines on Appropriate use of Blood, Blood components and Blood products.

Special thanks to the Council of Governors (COG) leadership and staff, Faith Based Organizations (FBOs), Kenyatta National Hospital (KNH), Moi Teaching and Referral Hospital (MTRH) Eldoret, Health Professional Regulatory bodies, Professional Associations and Kenya Blood Transfusion and Transplant Service (KBTTS) staff for their input and guidance in developing of these guidelines.

Finally, we thank the Word Bank for the financial support in the review and validation of this guideline.

Dr. Julius Ogato
Ag. Head, Directorate of Health Care Services

EXECUTIVE SUMMARY

The Ministry of health is strengthening transfusion services as an important pillar in the delivery of quality health care services through the Universal Health Coverage (UHC) to all Kenyans. The 2nd edition of the guidelines on appropriate use of blood, blood components and products was necessitated by the need to align to the current practice and to include additional plasma components. The objective of this guidelines is to guide health care workers in the prescription of blood, blood components and products and monitoring of blood transfusions in all transfusing facilities in Kenya. These guidelines will guide clinicians in the transfusion of various blood, blood products and components in various disease and conditions. In addition, guidance on transfusion of cellular components, plasma and autologous transfusion as well as transfusion in pregnancy, and neonates as guided by the principles of appropriate transfusion practices. The implementation of these guidelines will be through hospital transfusion committees.

The guidelines have been compiled from contributions of hematologists, transfusion medicine experts and prescribers of blood, blood components and products within Kenya, and as a result of a review of guidelines found in published literature. The document is organized into 13 chapters addressing the various thematic areas in the practice of transfusion of Blood, Blood components and products. The chapters address specific transfusion requirements for the different groups of patients.

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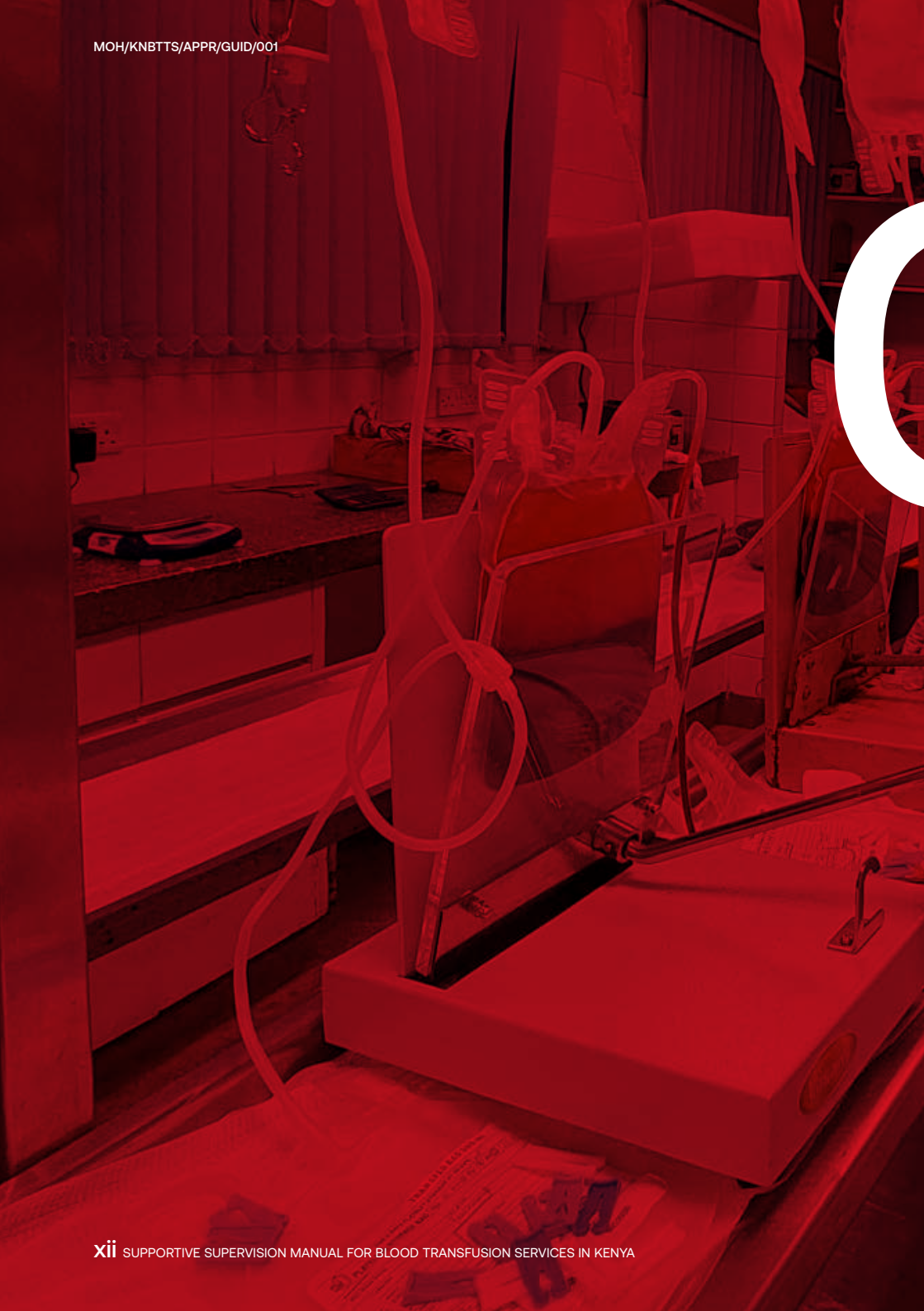
Head, Kenya Blood Transfusion and Transplant Service



01.

INTRODUCTION

1.1 Background

Blood transfusion is an essential component of quality medical care. Blood transfusion is a treatment or therapy that may involve some risk to the patient. Consequently, each hospital should have a performance monitoring and quality management program that addresses the use of blood, blood components and blood products. The hospital medical staff, therefore, have the responsibility for taking a lead role in monitoring and improving transfusion practices as per these guidelines.

1.2 Rationale

Blood, blood components and products provide unique and life- saving therapeutic benefits to patients. These guidelines on appropriate use of blood, blood components and products have not been revised in the past 11 years and hence need for revision to align to the current practice and to include additional plasma components.

1.3 Situation analysis

Current blood management is a result of the World Health Assembly recommendation of 1975 where all countries had to develop a national blood policy. All WHO member countries, including Kenya, prescribed the policy of screening all blood meant for transfusion for Transfusion-Transmissible Infections.

The recommendations ensured the development of policy guidelines on Blood Transfusion in Kenya, fundamental blood safety guidelines for the collection, processing, storage and distribution of blood and blood products had been established. Six regional blood transfusion centers were established to run the above functions. To enhance sufficiency of blood 39 satellites centers have been established primarily for collection, storage and preparation of blood products.

The Kenya Blood Transfusion and Transplant Service has made great strides in enhancing the capacity of all blood centers to separate donated blood to the various blood components with the aim to achieve an 80% separation of donated blood to components. Currently, about 60% of the whole blood collected throughout the country is converted to blood components.

Training of staff and acquisition of blood components preparation equipment is ongoing to achieve this target.

1.4 Goals

To ensure that scarce blood, blood components and products are used appropriately and rationally for better patient outcomes following transfusion and that transfusions remain safe and efficacious. Limiting transfusion to patients whose chance of survival or quality of life is improved by receiving blood will help to decrease the high

demand for blood, components and products. It will also reduce unnecessary exposure of patients to the risks associated with transfusion.

1.5 Objectives

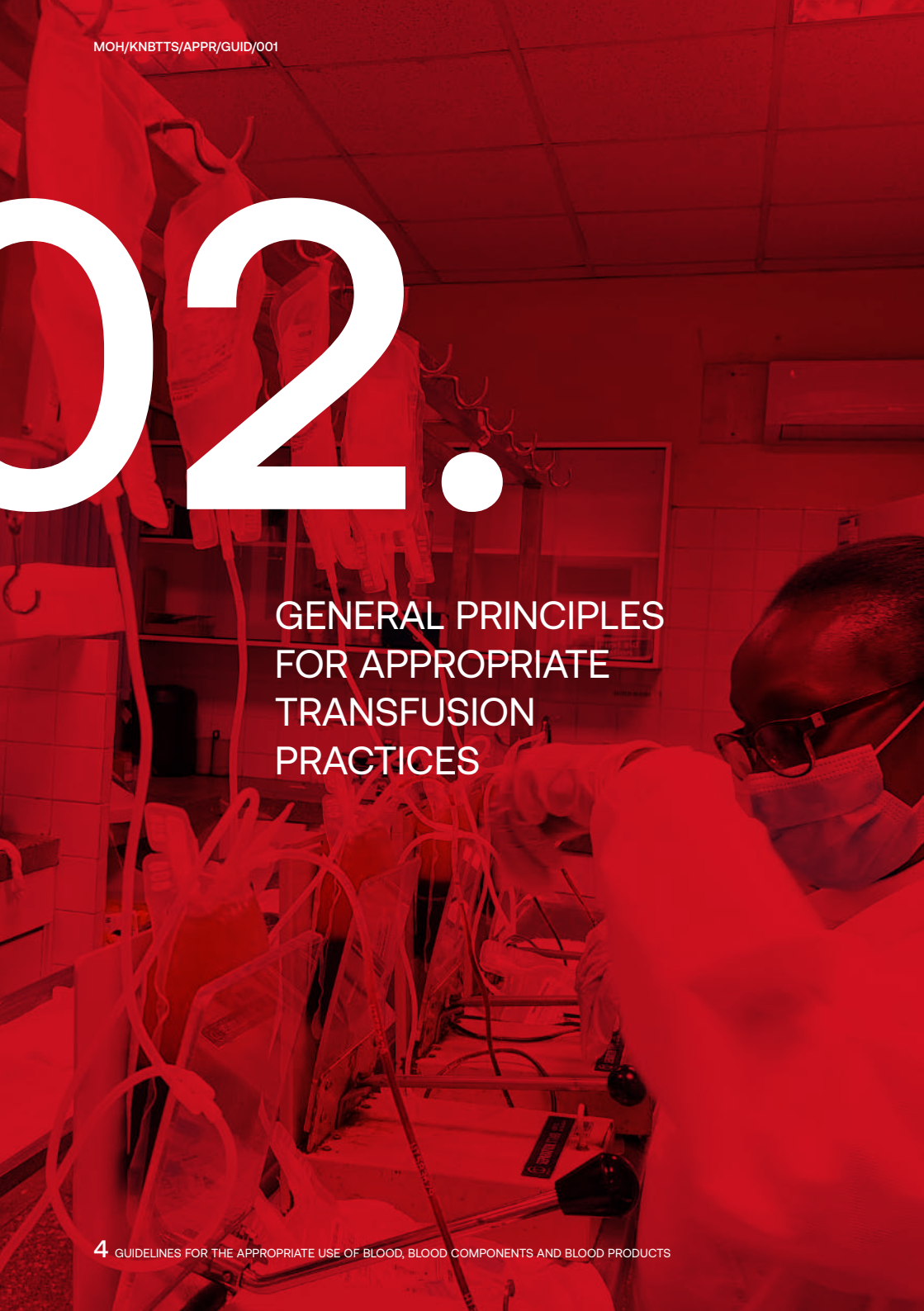
To guide health care workers in the prescription of blood, blood components and products and monitoring of blood transfusions. The Hospital Transfusion Committees (HTCs) have been retained as institutional avenues for the implementation of these guidelines.

1.6 Scope

These guidelines are for use in all transfusing facilities in Kenya and Health care workers involved in transfusion of blood and blood components.

1.7 Structure

The guidelines have been compiled from contributions of hematologists, transfusion medicine experts and prescribers of blood, blood components and products within Kenya, and as a result of a review of guidelines found in published literature. The document is organized into 13 chapters addressing the various thematic areas in the practice of transfusion of Blood, Blood components and products. The chapters address specific transfusion requirements for the different groups of patients.



02.

GENERAL PRINCIPLES FOR APPROPRIATE TRANSFUSION PRACTICES

Blood, blood components and blood products should be administered only when required to save a life. The decision to transfuse should be based on an estimate of the patient's risk for developing complications of inadequate tissue-oxygen delivery. Therefore, the decision to transfuse must be based on BOTH the haematologic AND the clinical status of the patient. Red blood cell transfusion should not be initiated in response to a hemoglobin determination alone, or to an increase in heart rate and/ or respiratory rate, as these may be normal compensatory mechanisms for anemia. Studies have also shown that blood transfusion improves survival only if given immediately at the time when needed.

The indications for blood transfusion in Kenya are frequently urgent conditions. Efforts should first be made to stabilize 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.

As much as possible, ABO and Rhesus compatibility should be ensured for all blood components.

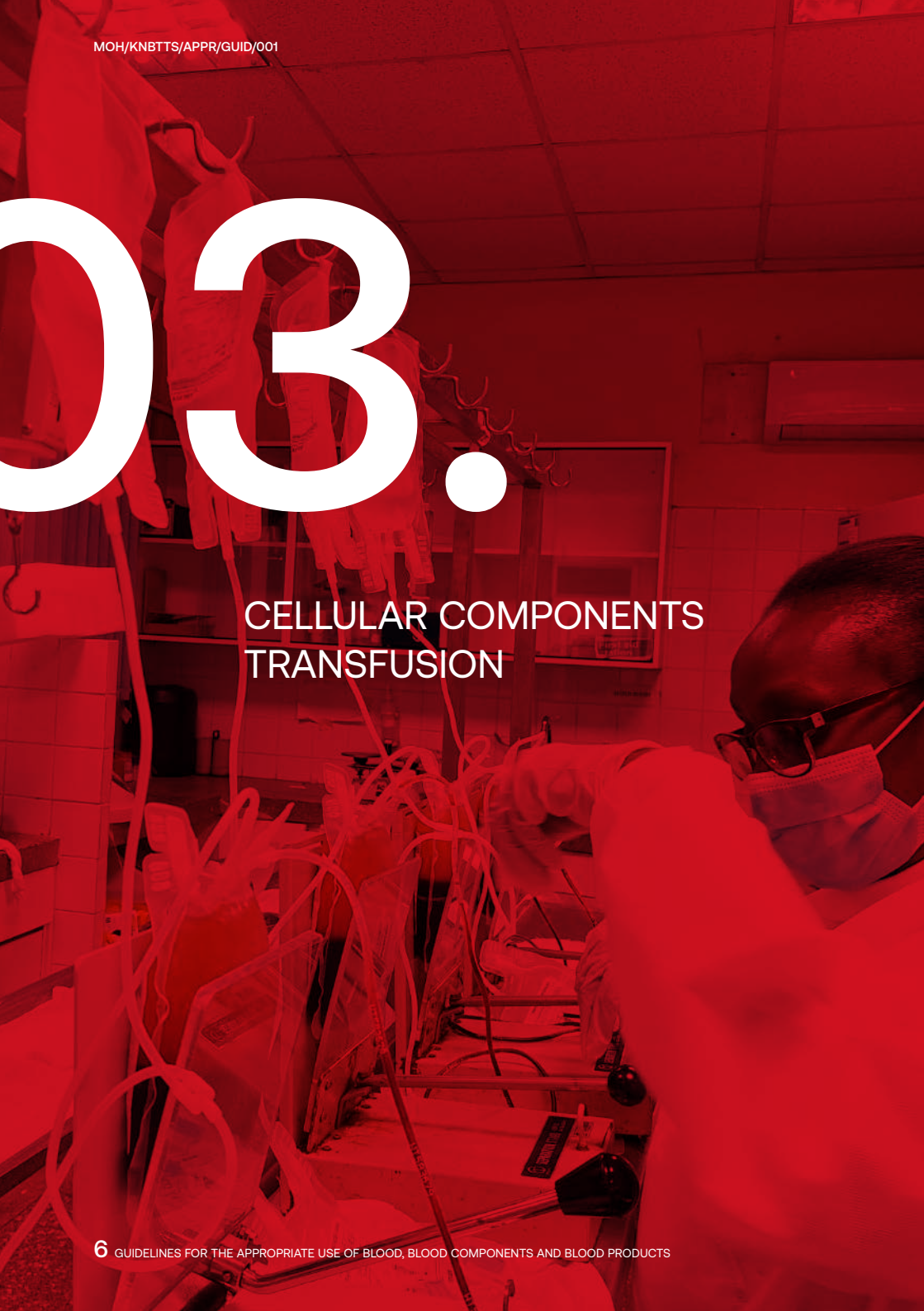
A patient should be re-evaluated by clinical and nursing staff immediately prior to blood transfusion to ensure that the transfusion is still required. The patient may have stabilized with supportive measures and may no longer need transfusion. The patient should not be transfused purely because compatible blood is available.

Effective transfusion may require a minimum of 1 unit of blood for an adult or 20ml/kg whole blood (10-15ml/kg packed cells) body weight for a child. New evidence has shown that transfusion related morbidity and mortality is dose dependent and recommend restrictive transfusion strategy and transfusion of 1 RBC unit at a time, followed by reassessment of the Hb level and patient status.

As for single unit transfusion, the recommendation is that for nonbleeding, hemodynamically stable patients who require a transfusion, transfuse a single RBC unit and then reassess the Hb level before transfusing a second unit.

The post-transfusion hemoglobin level should be compared to the pre transfusion value to assess the efficacy of the transfusion.

Blood transfusion is not a cure for anemia. Blood transfusion is used to relieve the clinical signs of cardiac or respiratory distress, but the underlying cause of the anemia still needs to be investigated and treated. Public health measures and community health programmes should be strengthened to prevent anemia in high-risk groups, especially in children, and women of childbearing age. Clinicians need to actively screen for anemia in all patients they see.



03.

CELLULAR COMPONENTS TRANSFUSION

3.1 Red Blood Cell Transfusion.

Red Blood Cell Transfusion is intended to increase the delivery of oxygen to the tissues. Red Blood Cells (RBCs) can be transfused as either whole blood or as packed red blood cell concentrate, also known as Packed Red Blood Cells (PRBCs). A unit of whole blood has a volume of approximately 450 ± 10% ml, with hematocrit range of 38 to 54%. A unit of PRBCs consists of the red blood cells concentrated from a unit of whole blood. Each unit of PRBCs contains approximately 230 to 330 ml of red blood cells and may have additive solution. The haematocrit of PRBCs is 65% to 75%. Each unit of blood contains approximately 60 g of hemoglobin and 250 mg of iron, predominantly in the form of hemoglobin. Both whole blood and PRBCs contain a small amount of citrate anticoagulant and may have additional solutions. Blood units, both whole blood and PRBCs that are collected in CPDA-1 anticoagulants can be stored for up to 35 days and 42 days for PRBCs with additive solution (Saline Adenine Glucose Mannitol).

3.2 Whole Blood

- Exchange transfusions.
- Massive hemorrhage.

3.3 Packed Red Blood Cells

- Acute onset decreased oxygen carrying capacity with hemodynamic instability.

When hypoxia is due to an inadequate red cell mass, PRBCs should not be used to treat long-standing anemia that can be corrected with non-transfusion therapy such as iron. PRBCs should not be used to increase blood volume, oncotic pressure, coagulation factors or platelets.

Red blood cells must be compatible with the ABO antibodies present in the recipient patient's serum, and a major cross match must be conducted to confirm compatibility. In case of emergencies, minor cross-match can be conducted. Unless the patient is actively bleeding or is haemolysing, the post-transfusion hemoglobin can usually be accurately predicted.

One unit of PRBCs (or the equivalent volume in a child) usually increases the patient's hemoglobin by 1g/dl.

Rapid infusion of large volumes of cold blood with excess extracellular potassium, reduced pH, and excess citrate may have undesired effects on cardiac rhythm and hemostasis. In cases where large volumes of transfusion are required, the massive Transfusion Protocol should be initiated.

3.4 Transfusion Trigger

- Perioperative patients.
  – 8g/dl.

- Chronic Anemia.
  – 7g/dl.

- Acute blood loss.
  – >30% blood loss.

A higher threshold should be considered if the patient has symptomatic anemia or impaired cardiorespiratory function.

3.5 Acute Blood Loss

3.5.1 Acute Blood Loss (Hemorrhage)

Classification of Hemorrhage

Class I Hemorrhage: A loss of up to 15% of total blood volume usually has little hemodynamic effect other than vasoconstriction and mild tachycardia.

Class II Hemorrhage: A loss of 15-30% of blood volume produces tachycardia, decreased pulse pressure, orthostatic hypotension and anxiety.

Class III hemorrhage: A loss of 30-40% produces increasing signs of hypovolemia, including marked tachycardia, tachypnea, systolic hypotension and altered mental status.

Class IV hemorrhage: Loss of more than 40% of total blood volume is life-threatening and accompanied by marked tachycardia and hypotension, very narrow pulse pressure, low urine output and markedly depressed mental status.

- In a patient with acute blood loss, an early hemoglobin level will not accurately reflect. The severity of blood loss until there has been adequate plasma volume replacement. Serial hemoglobin levels are required to determine the need for red blood cells transfusion. Evaluation of the clinical status of the patient is extremely important.

- Initial treatment for hypotension, shock, and acute blood loss consists of volume expansion with normal saline (without dextrose), infused in a volume up to/50 ml / kg is recommended for initial volume replacement.

- Colloid solutions e.g. 6% dextran, 6% Hydroxyethyl Starch may be given at doses equivalent to estimated blood loss. It should be noted that there is no difference in outcomes between crystalloid and colloid based resuscitation. (ref)The clinician should be aware of adverse effects of colloid infusions that include hypersensitivity reactions, renal failure and coagulopathy.

3.6 Massive Transfusion

Definitions:

- Replacement of one entire blood volume within 24 hours.

- Replacement of 50% of blood volume in 4 hours.

- Ongoing blood loss of > 10% Total Blood Volume/min.

3.6.1 Massive Transfusion Protocol(MTP)

Each hospital needs to develop their own standard protocol and disseminate it to all users.

Initiation shall be done by the attending consultant during evaluation of a patient with ongoing hemorrhage.

Once the MTP is initiated, the blood transfusion unit will release the first round of components immediately. These may need to be type specific or O negative. The BTU will continue delivering the units according to the protocol until it is inactivated.

	PRBCs	FFPs	Platelets	Cryoprecipitate
Round 1	6 U	6 U	6 U	
Round 2	6 U	6 U	6 U	10 U
Round 3	Tranexamic Acid 1 g over 10 min			
Round 4	6 U	6 U	6 U	10 U

NB:

- Transfuse one single donor apheresis or random donor platelet pool (6 packs) for each six units of PRBC.
- After the first 6 PRBCs, check fibrinogen levels. If ≤200 mg/dL, give 10 units cryoprecipitate (2 g fibrinogen). Repeat as needed, depending on fibrinogen level, and request appropriate amounts of cryoprecipitate. Prothrombin time(PT) and Activate Partial Thromboplastin Time(aPTT) may be used as a guide.

3.7 Perioperative Transfusion

- In the perioperative patient, transfusion decisions are based on a hemogram and clinical signs and symptoms.
- Prior to elective surgery, all efforts should be made to correct anemia without the use of blood. Patients with a Hb level less than 8 g/dl may need transfusion prior to surgery if anemia cannot be corrected by other means.
- Major cross-match should be conducted and the blood made available for immediate use during surgery for patients with a high likelihood of needing a transfusion.
- In the case of post-operative or post-partum hemorrhage, the source of bleeding must be identified and arrested.

3.8 Chronic Anemia

1. Do not transfuse above 7g/dl Hb unless the patient is symptomatic.
2. Treat nutritional and mild blood loss anemia with specific therapeutic agents as indicated (iron, folic acid, B12).
3. Use specific strategies for congenital anaemias including sickle cell disease.

3.9 Granulocyte Transfusion

This component is also known as the Buffy coat. Currently it is rarely used due to:

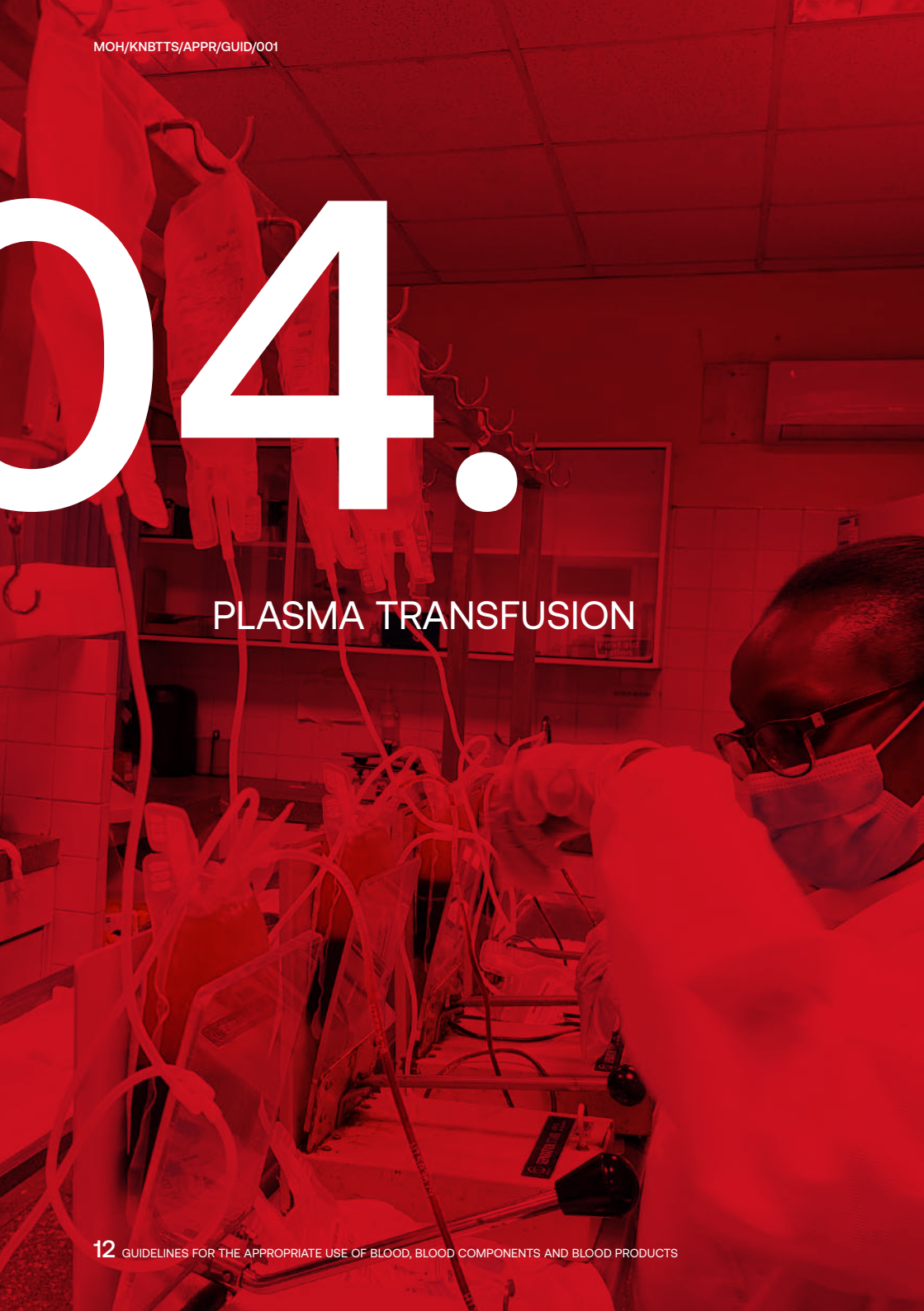
- availability of newer generation antibiotics.
- Use of recombinant myeloid growth factors (GF).
- variable efficacy.

Indications for the use of Granulocyte include:

- Grade IV Neutropenia (Absolute Neutrophil Counts of <500/uL).
- Fever for 24-48 hours, with positive blood cultures or progressive parenchymal infection.
- Myeloid Hypoplasia.
- Neonates with sepsis.

04.

PLASMA TRANSFUSION



4.1 Platelet Rich Plasma

- Platelet rich plasma (PRP) is separated from whole blood within 6 hours of donation and before refrigeration of the unit of blood.
- Extra centrifugation with removal of more plasma yields Platelet Concentrate (PC).
- Each unit contains greater than 5.5 x 1010 platelets in approximately 50 – 70 ml of plasma.
- Platelets can also be processed as a single donor, pooled or through apheresis. One unit of apheresis platelets is equivalent to 5-6 units of random donor platelets.

4.1.1 Indications of Platelet Transfusion

- Patients undergoing major invasive procedures with platelet counts < 50,000/mm^3.
- Patients undergoing neurologic and ophthalmic surgeries with platelet count <100,000/mm^3.
- Prophylactic platelet transfusion is given for patients undergoing chemotherapy when the platelet count is <20,000 m^3.
- Thrombocytopenic patient with bleeding tendencies.
- Qualitative platelet disorders with bleeding tendencies.

Platelet transfusion is generally not indicated for patients with immune platelet disorders like ITP.

Four to eight units of concentrated platelets are the usual adult dose for profound thrombocytopenia. Each unit of platelet concentrate increases the platelet count of an average adult by 5-6,000/mm^3. Response to platelet transfusion may be adversely affected by fever, sepsis, severe bleeding, splenomegaly, consumptive coagulopathy and antiplatelet drugs.

4.1.2 Refractoriness to platelet transfusion

Definition;

- 3 platelet transfusion over two weeks that yield inadequate post transfusion count.

  Or

- 2 consecutive 1hour post-transfusion platelet Cellular Count Increment(CCI) of <5000 platelet x body SA(m^2) /uL.

4.1.3 Causes of platelet refractoriness:

- Immune - auto-antibodies e.g. in ITP.
  - alloantibodies against class I HLA antigens.
- Non – immune - infection,
  - splenomegaly,
  - drugs (e.g. amphotericin B),
  - accelerated consumption.

4.1.4 Prevention of platelet refractoriness

- Transfusion of HLA matched apheresis platelets.
- Leucoreduction may assist.

4.2 Apheretic Blood Components

4.2.1 Definition

Apheresis is a process that involves selective removal of blood components from blood donors or patients. The desired component is collected and the remainder of the blood is returned to the donor or patient. This avoids taking components that are not needed.

The following are apheretic components;

- Red Blood Cells.
- Platelets.
- Plasma.
- Granulocyte.

4.2.2 Benefits of apheresis

- The required component is collected directly avoiding further processing.
- The component is ready to use immediately after collection.
- It is an effective closed system.
- The components collected are of higher yield compared with those prepared from whole blood.

- The cell count of the component is already determined before the procedure.
- The donor can donate more frequently compared to whole blood donation.
- For a patient who requires frequent transfusion e.g. Sickle Cell Disease, it minimizes the risk of allo-immunization.

4.2.3 Disadvantages of Apheresis

- The cost of production is higher.
- Need for specially trained staff.
- Lowers capacity to collect large volumes of blood for manufacturing of plasma products.
- Possible risk of bleeding to the donor due to citrate toxicity.

4.3 Fresh Frozen Plasma (FFP)

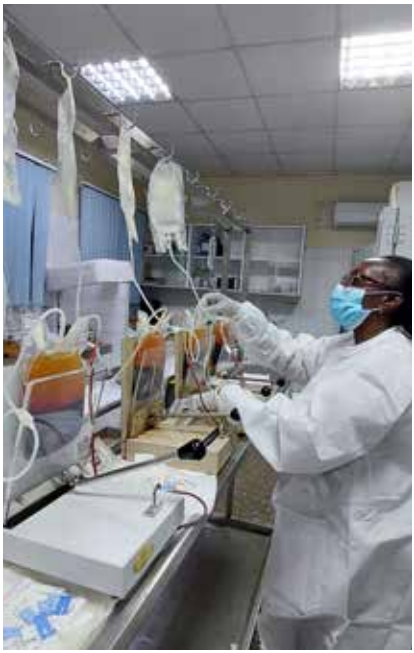
FFP is the acellular portion of blood that is frozen within 8 hours of donation. FFP must be ABO-compatible with the recipient's red blood cells.

4.3.1 Indications for FFP transfusion

- Correction of coagulation abnormalities with bleeding e.g Hemophilias and coagulation factor deficiencies.
- Massive transfusion.
- Bleeding due to warfarin therapy refractory to vitamin K.

The dose is 10-20ml/kg of group specific plasma transfused over 2-4hrs.

The amount of FFP to be given should be pegged on normalization of PT and aPTT.



4.4 Cryoprecipitate

Is a concentration of high molecular weight plasma proteins including Fibrinogen, Fibronectin, Factor VIII, von Willebrand's factor (vWF) and Factor XIII.

4.4.1 Indications for Cryoprecipitate transfusion

- Hemophilia A.
- Von Willebrands disease.
- Fibrinogen deficiency.
- Massive transfusion.
- As a topical hemostat in surgeries.

4.5 Plasma derivatives & indications

Many blood products can be manufactured through several methods when there is available excess plasma. The commonest include the following:

- Individual coagulation factor concentrates e.g. factor VIII, IX
- Human albumin at different concentrations (5%,25%) eg severe burns of >50%., removal of ascitic fluids of > 2 L, severe necrotizing pancreatitis, severe liver disease.
- Immunoglobulins in Myasthenia Gravis (MG), Guillian Barre Syndrome (GBS), Multiple Sclerosis (MS) etc.
- Colloid solutions eg hemorrhage.

Many other products can be made that are outside the scope of this guideline e.g Blood grouping sera.

4.6 Special Blood Components

4.6.1 Irradiation

Radiation is done on components that have viable lymphocytes in order to prevent Graft Versus Host Disease (GVHD).

Indications for irradiated components include: -

- intrauterine transfusion.
- patients who receive multiple transfusions e.g sickle cell disease.
- transfusion of patients who are immunosuppressed including transplant and cancer patients.
- platelets selected for HLA compatibility.

4.6.2 Leucoreduction

Several blood components contain WBCs;

- Whole blood - 1 x 109.
- PRBCs- 1 x 108.
- Platelet - 1x 107 in pooled unit,
  - <8.3x 105 WBCs for single donor units.

Leukoreduced components contain residual donor WBCs in the final products that is <5 x 106 (US) or <1 x 106 (UK)

Leucoreduction reduces the risks of;

- Febrile Non-haemolytic Transfusion Reactions(FNHTR).
- CMV transmission.
- HLA alloimmunization that would lead to platelet refractoriness.

4.6.2 CMV -reduced- risk components

Indications include;

- Low Birth Weight premature infants.
- Recipients of hematopoietic progenitor cells or organ transplants.
- Pregnant women.
- Intrauterine transfusion.

05.

TRANSFUSION IN PREGNANCY

5.1 Introduction

Every health care worker taking care of pregnant mothers should be aware that hemorrhage during pregnancy and delivery can be unpredictable and massive. All staff members should be familiar with protocols for managing hemorrhage in pregnancy. When DIC is suspected, treatment should be immediate and should not wait for a coagulation profile.

The decision to transfuse should not be based on hemogram alone but also on the mother's clinical status which includes:

- stage of the pregnancy.
- evidence of cardiac failure.
- presence of infection (pneumonia, malaria etc.).
- obstetric history.
- anticipated mode of delivery.

5.2 Anemia in pregnancy

Anemia in pregnancy is defined as first trimester hemoglobin (Hb) less than 11.0 g/dl, second/third trimester Hb less than 10.5 g/dl, and postpartum Hb less than 10.0 g/dl.

For normocytic or microcytic anemia, a trial of oral iron should be considered as the first step and further tests should be undertaken if there is no demonstrable rise in Hb at 2 weeks and compliance has been checked.

Pregnant women should be offered screening for anemia at first antenatal visit and at 28 weeks. Women with multiple pregnancies should have an additional full blood count done at 20–24 weeks.

Treatment and Management of Anemia in pregnancy

- Oral iron should be the preferred first-line treatment for iron deficiency.
- Parenteral iron is indicated when oral iron is not tolerated or absorbed or patient compliance is in doubt or if the woman is approaching term and there is insufficient time for oral supplementation to be effective.
- Women should receive information on improvement of dietary iron intake and factors affecting absorption of dietary iron.
- The role of recombinant human erythropoietin (rHuEPO) for non-end-stage renal anemia is still to be established and it should only be used in the context of a controlled clinical trial or on the expert advice of the hematologist.

- Active management of the third stage of labor is recommended to minimize blood loss.

- Women at high risk of hemorrhage should be advised to deliver in hospital.

- Optimization of hemoglobin in the antenatal period reduces the risk of transfusion in pregnancy.

Requirements for grouping and screening samples and cross-matching

- All women should have their blood group and antibody status checked at first encounter and at 28 weeks of gestation.

- Group and screen samples used for provision of blood in pregnancy should be less than 3 days old.

- In a woman at high risk of emergency transfusion, e.g. placenta Previa, and with no clinically significant allo-antibodies, group and screen samples should be sent once a week to exclude or identify any new antibody formation and to keep blood available if necessary. Close liaison with the hospital transfusion laboratory is essential. Women should have a group and screen sample taken in line with clear locally agreed protocols for provision of blood

5.3 Blood product specification in pregnancy and the puerperium

- ABO-, rhesus D- (RhD-) and K- (Kell-) compatible red cell units should be transfused.

- If clinically significant red cell antibodies are present, then blood negative for the relevant antigen should be cross-matched before transfusion; close liaison with the transfusion laboratory is essential to avoid delay in transfusion in life-threatening hemorrhage.

- Cytomegalovirus- (CMV-) seronegative red cell and platelet components should be provided for elective transfusions during pregnancy.

5.4 Autologous blood transfusion

- Pre-delivery autologous blood deposit is not recommended.

- Cell salvage is recommended for patients where the anticipated blood loss is great enough to induce anemia or expected to exceed 20% of estimated blood volume.

Management of obstetric hemorrhage with blood components

5.5 Red blood cell transfusion

- There are no firm criteria for initiating red cell transfusion. The decision to provide blood transfusion should be made on clinical and hematological grounds.

- In an extreme situation and when the blood group is unknown, group O RhD-negative red cells should be given.

5.6 Fresh frozen plasma (FFP) and Cryoprecipitate transfusion

- Used to treat coagulopathies as per general adult population.

- Are used in the Massive Transfusion Protocol.

5.7 Platelet Transfusion

- Aim to maintain the platelet count above 50 x 109/l in the acutely bleeding patient.

- A platelet transfusion trigger of 75 x 109/l is recommended to provide a margin of safety

- .The platelets should ideally be group compatible. RhD-negative women should also receive RhD negative platelets.

Intrapartum and postpartum anemia

- In the patient who is not actively bleeding, the threshold of 7g/dl is used, guided by patient clinical status.

All Rhesus negative women, with no evidence of alloimmunization, delivering a Rhesus positive foetus (or who have had pregnancy loss) should be given Rh immunoglobulin (RhoGAM} in a dose of 300mg IM within 72 hours of delivery or abortion.

06.

PEDIATRIC AND NEONATAL TRANSFUSION

6.1 Hemoglobin Reference Ranges in pediatrics and neonates

The reference ranges of pediatric and neonatal hemoglobin levels are given below:

Age group	Hemoglobin
Term and preterm neonate at birth	14.5-22.5 g/dl
Term neonate 4 weeks	10-18 g/dl
Preterm neonate at 4 weeks	8 g/dl
2 months	9-14 g/dl
6-12 months	9.5-13.5 g/dl
2-12 yrs	11.5-15.5 g/dl
12-18yrs	13-16 g/dl

The hemoglobin of preterm neonate at birth is as the term baby but at 3-4 weeks drops to 8g/dl.

6.2 Acute Blood Loss in pediatrics

Shock appears with loss of 25% of blood volume.

A child's blood volume is 80ml/kg. Note that what appears as a small bleed may be substantial in a young child especially the neonate for example 25% loss in a 1kg baby is 25ml, and in a 3kg baby is 75ml.

6.3 Chronic Non-Haemolytic Anemia

Many are clinically stable despite Hb < 7g/dl. In these cases, do not rely on Hb for transfusion. Remember to identify and treat the cause.

Management

Transfusion volume = bodyweight (kg) x Hb deficit (g/dl) x 3 (packed RBC) or 5 (whole blood)

- Transfusion over 4-hours.
- Give furosemide to reduce fluid overload.
- Assess carefully during transfusion to avoid overload and any other complications of transfusion.

6.4 Transfusion in a severely malnourished child

In this population, consider giving blood in smaller aliquots over 4 hrs.

6.5 Haemolytic Anemia

An episode of acute hemolysis can produce severe anemia within a very short time. Children are often hypovolaemic at the same time hence concomitant furosemide should NOT be given.

Children with congenital anemias such as sickle cell diseases (HbSS, HbSC, Hb S/ thalassemia,) like all other children ,should only be transfused when they develop cardio-respiratory symptoms from severe anemia, or the indications listed below;

6.6 Indications for transfusion in sickle cell disease(SCD)

- stroke.
- acute chest syndrome.
- Aplastic crisis when Hb<4g/dl.
- Hyperhemolysis when Hb<4 g/dl.
- Pre-surgery raise Hb>10g/dl.
- Splenic sequestration.

NB: Consultation with appropriate specialists is recommended.

6.7 Transfusion considerations Neonates

The total blood volume of neonates is small, although the volume is higher per kg of body weight than that of older children or adults (85 ml/ kg for full-term and 100 ml/kg for pre-term). Demand for investigations is high in these babies.

It is recommended to use special low volume collection tubes if available to minimize need for transfusion.

Indications for RBC transfusion

Postnatal Age	Suggested transfusion Threshold Hb(g/dl)		
	Ventilated	On Oxygen/CPAP	Off Oxygen
First 24 hrs	<12	<12	<10
≤ Week 1(days 1-7)	<12	<10	<10
Week 2 (days 8-14)	<10	<9.5	<7.5-8.5 depending on clinical situation
≥Week 3 (day 15 onwards)	<8.5		

NB: For acute blood loss, follow the same principles as in older children.

Anemia of prematurity

Transfuse if:

- Hb < 8g /dl & baby requires O_2.
- or < 7g / dl with the baby not on O_2.

Transfusions for any neonate

- Use ABO and Rh D compatible with mother and baby.
- Preferably use blood < 7 days' old.
- Packed red cells are preferred.

Specific Precautions

Baby's blood may have maternal anti A or anti B. Therefore, always send the mother's blood sample together with the baby's sample for group and cross-matching. Avoid using blood donated by biological parents to transfuse neonates.

- If the baby is on IV fluids, only count blood as part of the day's needs in which case no furosemide will be needed.

6.8 Exchange Blood Transfusion

6.8.1 Indications of Exchange Transfusion

- Neonatal hyperbilirubinemia due to
  - Rh incompatibility- Use Rh negative ABO compatible blood.
  - ABO incompatibility - Group O Rh compatible.
  - Neonatal Polycythemia.

Recommendations

- Whole blood is preferred.
- Blood preferably < 7 days old.

Note: In blood group incompatibility, use twice the baby's blood volume. In polycythemia use half the baby's blood volume.

6.9 Transfusion of Fresh Frozen Plasma (FFP)

The guidelines are the same as the adult population.

6.10 Platelet Transfusions.

- The guidelines are the same as the adult population.

Indications for platelets transfusion

Excessive bleeding due to low or dysfunctional platelets

- Infants and children:
  - Indications are the same as guidelines for the adult population.
  - Neonates.

Platelet Count	Indication for transfusion
Platelets <20 x 10 ^9/L	Absence of bleeding
Platelets <50 x 10 ^9/L	Bleeding, current coagulopathy, planned surgery or exchange transfusion
Platelets <100 x 10 ^9/L	Major bleeding, major surgery

Dose of Platelet transfusion:

General: 1 unit/l0kg will raise count by 40-50,000/m^3.

- Infants and children: give 5-10 ml/kg.
- Neonates: give 10-20 ml/kg.

Patients with DIC/sepsis may require more. If autoantibody is mediated, do not transfuse unless bleeding. Given platelets get destroyed very fast, aggressive treatment of the cause is recommended. For neonatal alloimmune thrombocytopenia, use washed and/or irradiated maternal platelets where possible.

6.11 General considerations in Pediatric Anemia

Malaria:

- Early and effective treatment of malaria.
- Use insecticide-treated bed nets which must be encouraged to prevent malaria and anemia.

Nutritional deficiencies (iron, folic acid, and protein):

- Nutritional counseling should always be emphasized as part of routine proper child care.

- It is recommended that children should be routinely screened for anemia and a hemogram performed.
- Prophylactic iron 2 mg/ kg elemental start from 4 weeks for all preterm / low birth weight babies.

Helminthic infections

Regular deworming from the age of 12 months. Therapy for helminths, including hookworm, should be included as part of the treatment of anemia in children 18 months of age or older. Public health education is important to encourage wearing of shoes and to promote other sanitary measures such as the use of latrines. Schistosomiasis screening should be performed in endemic areas.

07.

AUTOLOGOUS BLOOD TRANSFUSION

7.1 Definition

- Autologous transfusion is the use of one's own blood. It should be encouraged and health institutions that undertake elective/planned surgery should endeavor to practice it. However, every case should be assessed on its own merit following the standard operating procedures of blood transfusion and use of blood and blood products.

- Autologous transfusion plays a significant role in the blood transfusion service and should be managed by Hospital Transfusion Committees(HTCs). In all instances, the doctor attending to the potential recipient shall clinically assess the individual case and discuss the clinical condition with all those involved in the recipient's management. It is important to note that all requirements for the storage and labeling of blood should be observed at all times.

7.2 Advantages of Autologous Blood Transfusion

1. Avoids transmission of TTIs like Hepatitis, HIV, syphilis and malaria.

2. Reduces the demand for allogeneic blood.

3. It removes the risk of allo-immunization.

7.3 Techniques of autologous donation

1. **Cell Salvage:** This can be done intraoperatively or postoperatively. Blood is collected from suction, surgical drains or both and re-transfused back to the patient after filtration. Cell salvage is the most important and commonly used technique. It is widely used in cardiothoracic, vascular, orthopedic treatment, neuro and transplantation surgery. This technique should be used when blood loss is expected to be > 1 liter.

2. **Pre– Operative Autologous Donation (P.A.D.):** It allows you to collect 3-4 units of blood. Oral or IV iron supplementation may be required to maintain erythropoiesis. Last donation should take place 48-72 hours before surgery to allow for equilibration of blood volume. The blood is collected into citrated phosphonate dextrose blood bags and stored in the blood bank.

3. **Acute Normovolemic Hemodilution (A.N.H.):** A.N. H. is performed in the anesthetic room shortly before or after induction of anaesthesia. 15 to 20 ml/kg of blood is collected prior to surgery. Blood volume is restored with crystalloid or colloid. Collected blood is labeled and kept in the operating room without refrigeration and transfused back to the patient when required.

Contra indication for P.A.D & A.N.H:

- Pre-existing anemia.
- Heart disease.
- Uncontrolled Hypertension.
- Extremes of age.

Handling of unused autologous blood units

Those units that were not used to transfuse the donor in pre-operative donation, can be released to the general pool to be used by other needy patients in that facility, since they have been screened like the others. This will avoid discarding them and assist in improving availability of blood.

08.

TRANSFUSION REACTIONS

8.1 Introduction

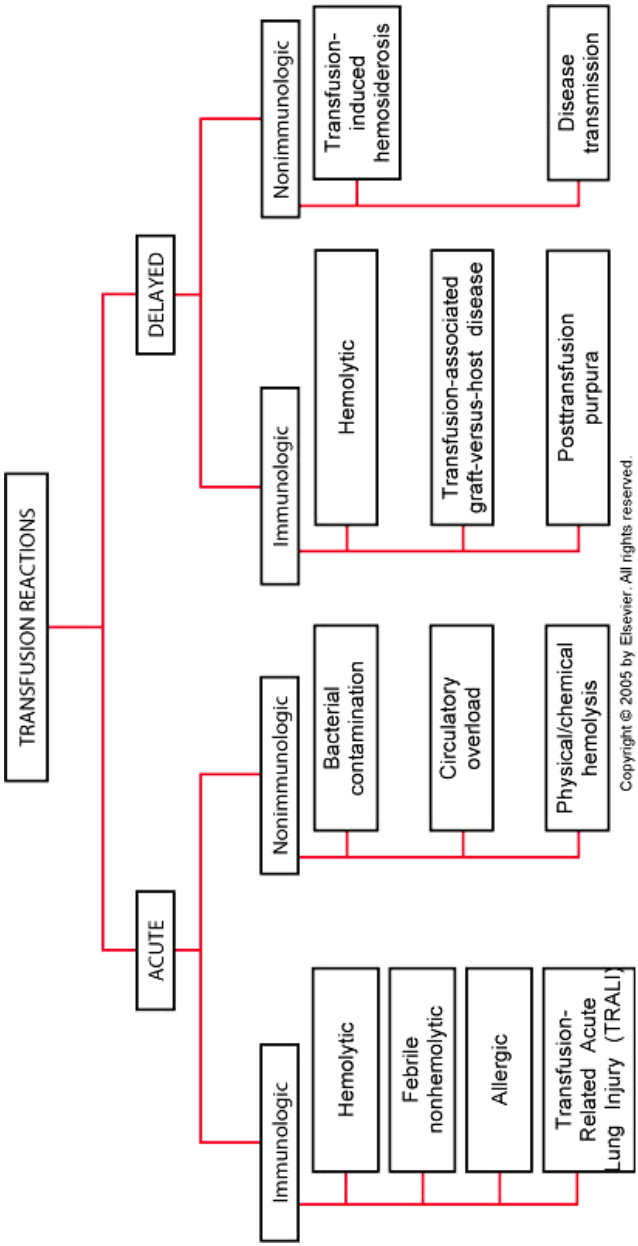
Although transfusion can be a life-saving therapy, it can result in many adverse effects. Approximately 1% of all transfusions lead to some type of adverse reaction. Although many measures have been taken to reduce transfusion related risks, including donor risk screening and laboratory testing of blood products, it is not possible to provide a blood supply with zero risk. Therefore, physicians must carefully weigh the benefits of transfusion against the risks.

Transfusion reactions can be caused by immunological or non-immunological mechanisms, and may be immediate or delayed for some time after the transfusion. The majority of immediate serious reactions are immunological and caused by clerical errors, such as incorrect recording of blood type, or wrong cross-match results, or wrong patient's name resulting in transfusion of the wrong unit to the wrong patient. The importance of proper patient identification and specimen labeling cannot be over-emphasized.

All transfusions should be given under the supervision of a clinician. The patient should be monitored closely for the first 15 minutes of the transfusion since it is during this period that serious haemolytic transfusion reactions can first be detected. The transfusion should be regulated to infuse for a maximum of four hours, with monitoring of the vital signs by the nursing staff every 30 minutes. Any change in the vital signs such as temperature, pulse, respiratory rate, blood pressure or level of consciousness may be an indication of a transfusion reaction.

Blood should be set up for transfusion within 30minutes of leaving the laboratory. Unused blood from the theater or wards should be returned immediately (within 30 minutes) to the laboratory.

The following flow chart lists common types of transfusion reactions:



The majority of transfusion reactions are febrile reactions, characterized by a mild temperature elevation without other clinical signs or symptoms. These can be managed with antipyretics without having to stop the transfusion. The most common cause of serious haemolytic transfusion reaction is the administration of ABO incompatible blood.

Signs and symptoms of Acute Haemolytic Transfusion Reactions

General:

- Fever, chills, flushing.
- Nausea, vomiting.
- Headache.
- Pain at infusion site.
- Back or loin pain.
- Pruritus.
- Altered levels of consciousness.

Cardiac/respiratory:

- Chest pain.
- Dyspnea and tachypnoea.
- Hypotension.
- Tachycardia.

Renal:

- Hemoglobinuria.
- Oliguria.
- Anuria.

Hematological:

- Anemia.
- Unexplained bleeding (Disseminated intravascular Coagulation - DIC).
- Thrombocytopenia.

09.

MANAGEMENT OF A TRANSFUSION REACTION

- STOP the transfusion.
  - Fix a new IV line with normal saline as far as possible from the earlier transfusion line.
  - Alert the clinician to assess the patient and fill the Adverse Transfusion Reaction Form(ATRF).
  - Monitor the vital signs of the patient.
- Check the clerical information to ensure that the patient was receiving the correct blood.
  - Inform the laboratory about a possible transfusion reaction.
- Take the following blood samples from the patient (from the opposite arm).
  - 10 ml of blood into a plain tube and check the color of the serum for haemolysis.
  - 2 ml of blood into an EDTA tube.
  - Collect a sample of the first voided urine.
- Send the following to the laboratory:
  - All samples correctly labeled.
  - Blood that reacted together with the attached transfusion set plus the cannula.
  - All empty blood bags of already transfused units.
  - Adverse Transfusion Reaction Form.
  - Report results of the investigations to the Hospital Transfusion Committee.
  - Arrange for gram stain is bacterial contamination is suspected.
  - collect peripheral blood specimen for culture from different IV site.

10.

IMPLEMENTATION, MONITORING AND EVALUATION

10.1 Implementation and Compliance

Effective implementation of guidelines for the appropriate use of blood and transfusion services requires that each hospital establishes a Hospital Transfusion Committee (HTC). This committee will be a subcommittee of and will draw its authority from the Hospital Management Team(HMT). The committee will serve to ensure that the quality of blood transfusion services and practices is maintained at a high level.

10.2 Monitoring and Evaluation

The HTC should oversee all policies and procedures relating to blood utilization for the hospital. These include the selection of patients for transfusion, ordering, distribution, handling and administration of appropriate blood, blood components and products and the monitoring of the effects of blood transfusion on patients, especially its reactions. The committee should monitor the hospital's blood transfusion practices and blood bank services through regular audits of hospital charts and transfusion records. The committee should prepare a quarterly report in a standardized format to the hospital and send a copy to the KBTTS.

This report should be forwarded through the established communication channels. The committee is responsible for ensuring staff education and training on proper blood transfusion practices. It should be composed of representatives of the departments that do the majority of blood ordering and transfusion in the hospital. These include pediatrics, medicine, surgery, obstetrics and anesthesia. In addition, a pathologist, blood bank technologist, pharmacist, nursing officer, management representative, hospital engineer and a physician or technologist from the blood collection Center should ideally be on the committee. KBTTS should also send a representative if possible.

Composition of the Hospital Transfusion Committee

The Chairperson of the committee should be an obstetrician, surgeon, internal medicine, medical superintendent or clinical officer where there is no doctor. He / she can be deputized by a nurse or a doctor. The Secretary can be from the laboratory or any other discipline.

The HTC should develop transfusion practice guidelines with the approval of the medical staff. These guidelines should serve as the basis for all transfusion practices review.

11.3 Tasks of the Hospital Transfusion Committee (HTC)

- Review the number of transfusions (monthly or quarterly) and sources of blood (BTS or hospital collection).

  Investigation of transfusion reactions

- Ensure maintenance of blood storage records and facilities (cold chain maintenance, refrigerator temperature records).

- Establishment of measures to prevent occurrence of adverse events.

- Annual review of policies and procedures relating to blood transfusion.

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APPENDICES

1. Clinical Transfusion Procedures

1. Assess the patient's need for blood transfusion
2. Record the indications for transfusion in the patient's notes
3. Complete physical or electronic request form accurately and legibly and include:
    - Patient identification (3 patient names, gender exact age and number)
    - Reason for transfusion
    - Component and amount required
    - Date required and the urgency
4. A written informed consent from the patient or next of kin.
5. Collect and correctly label blood samples (4 cc in a plain and coagulant tube) for grouping and compatibility testing
6. Send blood request form and sample to the laboratory
7. Collect or receive blood or blood products from the laboratory
8. Confirm blood or plasma is compatible by checking the blood group on:
    - Patients notes
    - Label on blood bag
9. Check expiry date of blood or plasma
   Check blood for:
    - Clots.

- Haemolysis.
- Appearance of red cells.
- Signs of contamination.

10. Check for leakage of blood bag

11. Warm blood, using the recommended blood warmer, when indicated.

12. Start transfusion of whole blood and red cells within 30 minutes of removal from the refrigerator.

13. Rate-Total Volume divided by time(minutes)multiplied by the drop factor of 60gtts/ml which equals to 42 drops per minute.

14. Return unused blood or blood products to the laboratory within 30 minutes of removal from the refrigerator.

15. Complete infusion of whole blood and red cells within 4 hours, and platelets and plasma within 30 minutes.

16. Monitor patient before, during and after transfusion of blood product:
    - Before starting the transfusion.
    - As soon as the transfusion is started.
    - 15 minutes after starting the transfusion.
    - At least every half-hour during transfusion.
    - On completion of transfusion and 4 hours after completing transfusion.

17. Record the following:
    - Patient's appearance.
    - Pulse.
    - Temperature.
    - Blood pressure.
    - Respiratory rate.
    - Fluid balance: input and output.

18. In the patient's notes record:
    - Date of transfusion.
    - Time transfusion started and finished.
    - Volume and type of blood or products given.
    - Blood or plasma unit numbers.
    - Any adverse effects.

19. Sign the patient' s notes.
20. Report any adverse reactions immediately to the laboratory.
21. Return used/ partially used blood bags to the laboratory.

Recommended Blood groups for transfusion

Patient's ABO Group	Compatible Red Blood Cells (RBCs)	Compatible Plasma
Group O	Group O	Group O, A, B, AB
Group A	Group A and O	Group A and AB
Group B	Group B and O	Group B, AB
Group AB	Group O, A, B, AB	Group AB

Indications of warming blood and blood components

- Massive transfusion .
- Trauma situations in which core-rewarming measures are indicated .
- Administration rate>50mL/min for 30 minutes or more (Adult.)
- Administration rate>15mL/kg/ hour (Children).
- Exchange transfusion of a newborn.
- Patient rewarming phase during cardiopulmonary bypass surgical procedures.

Other clinical situations where blood warming may be considered are;

- Potent, high-tittered, cold autoantibodies, reactive at body temperature and capable of binding complement, thus causing hemolytic anemia.
- Raynaud's syndrome or other cold-induced vasoactive effects.
- Neonatal and Pediatric transfusions.
- Therapeutic plasma apheresis or red cell exchange procedures.

Administration of Platelets, Cryoprecipitate, or Granulocyte suspensions does not require warming as they are produced at room temperature. Warming may render these products less effective and encourage the growth of bacteria.

2. Blood Requisition Form

Ministry of Medical Services National Blood Transfusion Service

Blood Requisition Form (1)

Name: _____ Age: Sex: M F Ward: _____ IP number: _____ Body weight kg (if under 12 years) _____	Date of blood transfusion (planned)	Time Day Month Year / / /
	Blood group	ABO ( ) Rh ( ) : Not known
	History of blood transfusion	Yes No Not known
		Last Day / Month / Year time:
	History of adverse reaction of blood transfusion	Yes No Not known
		Day Month Year If yes, / /
	History of pregnancy	Yes No Not applicable
Diagnosis	Reasons for blood transfusion	

Blood Group of this patient:			**ABO ()**			**Rh ()**			
Blood bag number	**Blood group**	**volume**	**Expiry date**	**Result of X- match**	**Date and time of issue**	**Lab tech**	**Person collected**	**Date and time of transfusion**	**Volume transfused**
1									
2									
3									
Date of x-match and Blood Group examination:					Day /	Month /	Year	Sign (Lab)	
Any transfusion reactions observed:			Yes	No	Day /	Month /	Year	Sign (Nurse/ Doctor)	

In case of any transfusion reaction, send following samples to Laboratory: 10mL of blood into a plain tube, 2mL of blood into an EDTA tube, the first voided urine, the blood that reacted together with the attached transfusion set, all empty blood bags of already transfused units.

(1) Original keep in a patient's file with Observation Chart, (2) Leave in Laboratory

3. Adverse Transfusion Reactions Form

ADVERSE TRANSFUSION REACTION FORM

In event of a severe reaction following transfusion of blood or blood products please complete this form and send it to the laboratory with the specimens listed below.

Date_____

PATIENT INFORMATION

Patient name:_Male Female _

Age

IP No._____Diagnosis ____

Ward_____ Patient's Dr._

Pre-transfusion HB_

Reason for transfusion: Current Medications: _

Obstetric History N/A Gravid _

Para _____

Previous Transfusion: Yes No Comment:

Previous Reactions: Yes No Comment:

REACTION INFORMATION:

Type of reaction

General: Fever Chills/Rigors Flushing Nausea/ Vomiting

Dermatological: Urticaria, Other skin rash

Cardiac/Respiratory: Chest pain Dyspnoea Hypotension Tachycardia

Renal: Hemoglobinuria- Dark urine Oliguria Anuria

Haematological: Unexplained bleeding Others: (Specify)

Vital Signs: At Start: BP_____

T _____

P _____

R _____

During (15min) BP _____

T _____

P _____

R _____

At stop: BP _____

T _____

P _____

R _____

COMPONENT INFORMATION

Type of component	Pint No.	Expiry Date	Volume Transfused

Name of Nurse/Doctor_____ Signature_____

Specimens required by the laboratory

Specimens required by the laboratory.

1. 10mls post transfusion whole blood from patient from plain bottle.
2. 2mls of blood in EDTA bottle.
3. 10 mls First Void Urine.
4. The blood that reacted together with the attached transfusion set.
5. All empty blood bags of already transfused unit.

LAB INVESTIGATION: (Transfusion manager)

Results

1. Recipient's blood supernatant:

Hemolysis Present If present Mild Moderate Marked Absent Equivo-

cal

2. Recipient's blood Agglutination Present Absent

3. Hematological results:

WBC HB RBC HCT MCV

MCH MCHC PLT

Film Rbc:

Wbc:

PLt:

4. Donor blood supernatant

Hemolysis Present Absent

5. Age of donor pack _____

6. Culture donor pack

Results: _____

7. Culture recipient blood

Results: _____

8. Compatibility testing recipient serum (pretransfusion sample) and donor cells (pack)

Compatible Incompatible

Saline Rt

Saline 37

AHG

Albumin 37

9. If negative (inconclusive results in 8) set up compatibility with enzyme treated cells Result

10. In case of blood group O transfused to A or B or AB individual: Establish from the donor unit

Anti A titres _____

Anti B titres _____

11. Urinalysis

12. Evaluation: Diagnosis

13. Was the adverse reaction related to transfusion Laboratory Technologist

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