2011

TRANSFUSION
Basic Guidelines, Principles and Practice

MINISTRY OF HEALTH JAMAICA

MINISTRY of Health

TRANSFUSION
Basic Guidelines, Principles and Practice

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ABBREVIATIONS

AHTR	Acute Haemolytic Transfusion Reaction
aPTT	Activated Partial Thromboplastin Time
DDAVP	Desmopressin Acetate
DHTR	Delayed Haemolytic Transfusion Reaction
DIC	Disseminated Intravascular Coagulation
FNHTR	Febrile Non-haemolytic Transfusion Reaction
G & S	Group and Screen
HELLP	Haemolysis Elevated Liver Enzymes Low Platelet
HBsAg	Hepatitis B Surface Antigen
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIT	Heparin Induced Thrombocytopenia
HIV	Human Immunodeficiency Virus
HTLV	Human T Lymphotrophic Virus
HUS	Haemolytic Uraemic Syndrome
INR	International Normalized Ratio
IVIG	Intravenous Immunoglobulin
JVP	Jugular Venous Pressure
LDH	Lactate Dehydrogenase
NBTS	National Blood Transfusion Service
NPHL	National Public Health Laboratory
PAHO	Pan American Health Organization
PT	Prothrombin Time
PTP	Post Transfusion Purpura
RHA	Regional Health Authority
TACO	Transfusion Associated Circulatory Overload
TA-GVHD	Transfusion Associated Graft vs. Host Disease.
TRALI	Transfusion Associated Lund Injury
TTP	Thrombotic Thrombocytopaenic Purpura
UHWI	University Hospital of the West Indies
vCJD	Variant Creutzfeldt-Jakob Disease
WHO	World Health Organization

GLOSSARY

ABO Blood Group:	Refers to the classification of blood groups based on the presence or absence of specific antigens (A & B) on the red blood cell membrane.
Albumin:	Principal protein in human plasma (60%); it is produced in the liver, water soluble and binds with cations (such as Ca^{2+}, Na^{+} and K^{+}), fatty acids, hormones, bilirubin and drugs - its main function is to regulate the colloidal osmotic pressure of blood.
Allogeneic Transfusion:	Transfusion of blood collected from someone other than the patient (recipient).
Anaemia:	Decrease in red cell mass or in number of red blood cells (RBCs) or less than the normal quantity of haemoglobin in the blood.
Autologous Transfusion:	Collection and reinfusion of a patient's own blood or blood components.
Blood:	Any red cell containing blood component.
Blood Component:	Product derived from fractionation of human whole blood or plasma.
Blood Donor:	Person who donates blood for therapeutic use.
Coagulopathy:	Syndrome involving abnormality of clotting process.
Congenital Factor Deficiency:	Genetic condition resulting in absence or decrease in one more factors of the coagulation cascade.
Cryoprecipitate:	Frozen blood component prepared from fresh frozen plasma and containing fibrinogen, von Willebrand factor, factor VIII, factor XIII and fibronectin.
Cross-Match:	Procedure to determine compatibility between donor and recipient blood for the purpose of transfusion.
Dilutional Coagulopathy:	Haemorrhagic syndrome occurring as a result of severe reduction in the concentration of platelets and or clotting factors following large volume replacement with blood and or substitutes.

Dysfunction:	Abnormal function.
Fibrinogen:	Also known as Factor I, is a soluble plasma glycoprotein produced by the liver. It plays a critical role in the blood coagulation process as it is converted by thrombin into fibrin, which later forms a gel to reduce blood loss.
Fresh Frozen Plasma:	Liquid component of whole blood which has been centrifuged, separated, and frozen below -30^0C within 6 hours of collection.
Haemoglobin	The iron-containing protein attached to red blood cells that transports oxygen from the lungs to the rest of the body. Haemoglobin bonds with oxygen in the lungs, exchanges it for carbon dioxide at cellular level, and then transports the carbon dioxide back to the lungs to be exhaled.
Hypersplenism:	Automatic removal of healthy cellular elements from circulatory blood by an overactive spleen.
Immunomodulation:	Change in the body's immune system, caused by immunosuppressive effect of allogeneic transfusion on immune competent cells.
Platelets:	Megakaryocytic derived, non-nucleated, fragmented, disc-like elements found in blood, and whose principal function is that of preventing bleeding.
Recipient:	Person who receives blood for transfusion.
Red Blood Cells:	Main cellular component of blood. It contains haemoglobin.
Rh Factor:	Like ABO, it refers to the presence or absence of D antigen on red cell membranes.
Thrombocytopenia:	Decreased circulating platelets.
Transfusion:	Medical procedure of infusing blood or blood components into an individual.
Transfusion Reaction:	Adverse occurrence as a result of a transfusion.

MESSAGE FROM THE CHIEF MEDICAL OFFICER

Blood or blood component transfusion is accepted as an integral facet of health care delivery. Their life-sustaining role extends beyond medical emergencies to routine surgical procedures and prolonged quality-of-life therapies. The degree, to which blood components are used in medicine, demands that in its application, legal and ethical considerations be borne in mind and their quality, safety, and efficacy be ensured in order to prevent the transmission of diseases. It is this basic fact that underpins the national effort to seek to collect blood from **only** voluntary non remunerated repeat donors; ensure the highest quality in testing, storage, transport and preparation of component units for transfusion; as well as, implementing highest standards at point of care through this guideline.

In keeping with the World Health Organization's (WHO) integrated strategy to promote blood safety while lessening risks associated transfusion, this learning tool has been developed to provide guidance in the practice of transfusion medicine in accordance with Good Clinical Practice. As such, better outcome in patient care and greater efficiency in blood and component use is anticipated in-keeping with implementation of improved clinical use of blood. While this manual does not attempt to replace textbooks, it provides readily available information on current recommended principles of transfusion in keeping with Good Clinical Practice. Use of the contained guidelines is expected to achieve the following objectives:

- Improve the consistency and appropriateness of transfusion practice in Jamaica;
- Promote the integration of quality management systems into transfusion practice;
- Minimize transfusion-related complications;
- Increase consumer awareness of the benefits and risks of blood component therapy; and
- Conserve on blood, a limited resource.

The Ministry of Health welcomes the opportunity to invite all point of care medical personnel to become familiar with and support the full implementation of this manual. I wish to express gratitude to all who contributed to its formulation and especially thank National Blood Transfusion Service (NBTS), National Public Health Laboratory (NPHL), University Hospital of the West Indies (UHWI), Ministry of Health (MOH), Regional Health Authorities (RHA), Members of the National Advisory Committee on Blood, and Pan American Health Organization (PAHO).

Sheila Campbell-Forrester
Chief Medical Officer
March 2011

GUIDING PRINCIPLES FOR THE TRANSFUSION OF BLOOD AND BLOOD COMPONENTS

General Principles

- Transfusion of blood and blood components is a medical procedure and should only be prescribed and issued under the supervision of a registered medical officer.
- Medical officers who prescribe blood and blood components for transfusion should be knowledgeable of the indications, benefits and risks associated with the procedure.
- Chronology of all events surrounding the transfusion process should be appropriately documented in the recipient's medical record.
- Alternatives to blood and blood component transfusions should always be discussed with patients.

Principles of Red Blood Cell Transfusion

- Red blood cell transfusion is one of several alternatives or adjunctive therapies for patients with clinically significant anaemia, or anticipated anaemia with scheduled surgery.
- Red blood cell transfusions should only be administered to prevent or minimize the onset of symptoms of hypoxia attributable to decrease in red cell mass (anaemia).
- As there is no consensus on a single haemoglobin value at which a patient must be transfused, the procedure should be guided by the clinical condition of a patient rather than the absolute haemoglobin level.
- In acute blood loss, red blood cells should not be used as volume expander when oxygen carrying capacity is adequate.
- In chronic anaemia, physiologic adaptation may be sufficient to allow time for use of transfusion alternatives.
- There are no well-defined criteria for red blood cell transfusion in children, and clinical assessment of tissue perfusion is required.
- Suitable alternatives must be considered whenever it is available.

Principles of Plasma (FFP) Transfusion

Indications for plasma transfusion include:

- Active bleeding as a result of multiple coagulation factor deficiencies, or risk of bleeding due to deficiency of multiple coagulation factors.
- Severe bleeding due to warfarin therapy, or need for urgent reversal of warfarin effect.
- Massive transfusion (usually > 1 patient blood volume in 24 hours) with dilution coagulopathy with microvascular bleeding associated with a significantly deranged PT, INR or aPTT (if PT, INR or aPTT cannot be measured quickly, plasma may be transfused in an attempt to stop diffuse nonsurgical bleeding).
- Bleeding or prophylaxis of bleeding for a known single coagulation factor deficiency for which no factor concentrate is available.
- Rare specific plasma protein deficiencies, such as C1- inhibitor.
- Clinically significant bleeding in patients with liver disease and significantly deranged PT, INR or aPTT.
- Acute disseminated intravascular coagulation (DIC) with active bleeding associated with abnormally elevated PT, INR or aPTT (the condition triggering the DIC **must** be the primary objective of treatment).
- Thrombotic Thrombocytopenic Purpura (TTP) or Adult Haemolytic Uremic Syndrome (**not recommended** in the classic form of Paediatric Haemolytic Uremic syndrome).
- Prepare for surgery or invasive procedures when the results of PT, INR, aPTT or other coagulation assays are abnormal due to causes other than warfarin, and the patient is likely to bleed excessively.

Plasma is **NOT INDICATED** for:

- Increasing blood volume or albumin concentration.
- Coagulopathy that can be corrected with administration of Vitamin K.
- Normalizing abnormal coagulation screen results, in the absence of bleeding.

Principles of Platelet Transfusion

- Bleeding due to critically decreased circulating platelet counts or functionally abnormal platelets.
- Prophylactically to prevent bleeding at pre-specified platelet counts.
- In general, maintain platelet counts:
  - >10 $x10^9$/L in stable non-bleeding patients;
  - >20 $x10^9$/L in unstable non-bleeding patients;
  - >50 $x10^9$/L in patients undergoing invasive procedures or actively bleeding.
  - $100x10^9$/L for ophthalmic or neurosurgical interventions with or without haemorrhage

EXCEPT for life-threatening haemorrhage, do not use in patients with:

- Immune thrombocytopenia
- Thrombotic thrombocytopenic purpura (TTP)
- Syndrome of Hemolysis, Elevated Liver enzymes and Low Platelet (HELLP)
- Heparin Induced Thrombocytopenia (HIT).
- Hypersplenism

Principles of Cryoprecipitate Transfusion

- Cryoprecipitate is indicated for bleeding associated with:
- Hypofibrinogenaemia (<115 mg/dL)
- Factor XIII deficiency (activity < 25%)
- Platelet dysfunction unresponsive to DDAVP
- Disseminated intravascular coagulation (DIC)
- Factor VIII deficiency (Haemophilia A) in the absence of commercially prepared factor replacement therapy
- vonWillebrand's disease (vWD)

ALTERNATIVES TO ALLOGENEIC TRANSFUSION

Autologous Blood Transfusion

Autologous transfusions have been used for decades worldwide to lessen the need for allogeneic transfusion. Using this technique, the patient is both the donor and the recipient of the donated blood; therefore, the patient is transfused with his own blood or blood components. Each individual's blood is unique in its composition; as such, an autologous unit is always a perfect match to which unwanted / harmful antibodies are not formed. In addition to the A, B, O and Rh groups, there are over 100 sub-types giving millions of possible blood group combinations; as such the chances of obtaining a perfect match for transfusion from an allogeneic donor is miniscule (< 0.00001%).

Predonation of autologous blood is a therapeutic option for appropriate patients undergoing elective surgery if the likelihood of transfusion is high. Autologous blood collection for use is not 100% safe, bacterial contamination; incorrect collection, storage and transportation; and clerical or human errors, including incorrect infusion may occur, but autologous transfusion offers the following advantages:

- Allogeneic transfusion in elective surgical intervention is lessened.
- Adverse reactions due to donor - recipient incompatibility eliminated
- Exposure to blood borne infections from allogeneic blood is removed
- Antibody formation due to exposure to foreign proteins in allogeneic blood is eliminated
- Immune mediated reactions (haemolysis, fever, and allergy) are eliminated
- Immunomodulation (postoperative infections and cancer recurrence) reduced
- Better clinical outcomes
- Greater cost effectiveness

Methods of Autologous Collection

There are five main methods used for autologous blood collection for transfusions and these include:

- Preoperative Autologous Blood Donation (PABD)
- Acute Normovolaemic Haemodilution
- Intraoperative Red Blood-Cell Salvage
- Postoperative Blood Salvage
- Autologous self stored blood

Preoperative Autologous Blood Donation (PABD)

At 3-5 weeks prior to an elective surgical procedure, up to 4 units of whole blood is drawn and stored for use during the perioperative period. Donations are at least a week apart; patient should be haemodynamically stable, haemoglobin not less than 11g/dl, and to allow for re-equilibration of the blood volume the final donation should take place at least 72 hours before surgery.

Acute Normovolaemic Haemodilution

This procedure is conducted in the operating room/anaesthetic area during the pre-operative period and is restricted to patients such as; cardiac valves replacement, revision of hip arthroplasty, and spinal reconstruction; in whom significant blood loss (>1 litre or 20% of blood volume) is expected. Under close monitoring, and simultaneously replacing intravascular volume with crystalloid and or colloid, up-to 1.5 litres whole blood is extracted, appropriately labelled, stored at room temperature and re-infused during or after surgery.

Advantages & Disadvantages of Haemodilution

Advantages:

- Technique unaffected by proposed surgical intervention
- Anaesthetic effect minimizes patient stress
- Controlled monitoring of the circulatory system during the process
- Clotting factors and cells are generally preserved, as the blood is stored for a short time only at room temperature
- Very low cost as routine donor testing is not required and blood is maintained at the point of care, incurring little or no administrative expense

- All blood is usually re-infused thus wastage is negligible
- Risk of ABO incompatibility is virtually eliminated because the unit is at the point of care and there is minimal administrative or clerical manipulation
- Systemic infection does not prohibit its use

Disadvantages:

- Patient's inability to tolerate lowered circulating red cell mass
- Time consuming (often inconvenient) preoperative procedure for anaesthetist
- Additional training and experience may be necessary for anaesthetist
- Not recommended for severely anaemic patients
- Not recommended for patients with allergy, as colloids may trigger allergic reactions or other haemostatic abnormalities

Intraoperative Red Blood-Cell Salvage

Red blood cells shed during surgical procedures are collected by aspiration from the operative field into a specially designed centrifuge, filtered to remove clots and debris, centrifuged and saline washed then reinfused. Intraoperative blood salvage is used extensively in cardiac surgery, trauma surgery and liver transplantation.

Advantages & Disadvantages of Intraoperative Red-Cell Salvage

Advantages:

- Safe and efficacious alternative to allogeneic red cell transfusion
- Similar advantages to those of haemodilution but without the need for preoperative preservation of blood volume with colloids or crystalloids
- Larger volumes of shed blood can be salvaged intraoperatively than with other autologous methods especially if there is prolonged bleeding

Disadvantages:

- Haemostatic quality of salvaged red blood cells is inferior to other autologous methods
- May contain elevated concentrations of various tissue materials, which may trigger unwanted reactions

- Complications associated with its use include:
  - pH disturbances and electrolyte imbalance
  - Systemic dissemination of malignant cells, infectious agents, non-sterile material
  - Air and or fluid embolism
  - Dilutional or localized consumptive coagulopathy
  - Multiorgan failure
- Usually restricted to procedures resulting in substantial blood loss (>1-2 litres)
- Salvaged blood should be used within six hours of initiating collection, as bacterial contamination cannot be excluded during collection
- Contraindicated where there is risk of bacterial, malignant cell, microfibrillar collagen or other foreign material dissemination from the operative field
- Blood collected by cell salvage should not leave the theatre environment; it must be re-infused in theatre or discarded
- Most costly of autologous techniques because expensive capital equipment and disposables are required

Postoperative Blood Salvage

Upon completion of a surgical procedure blood is collected by drainage from the operative site and re-infused. Postoperative blood salvage requires specialized equipment and maintains similar advantages and disadvantages to the intraoperative technology.

Autologous Self Stored Blood

Blood is preserved in a frozen state for use at a later time (up to 10 years), which is especially useful for the long-term storage of very rare blood groups (Bombay Phenotype). It is however expensive and not adequate for labile coagulation factor usage.

Alternatives to Transfusion

The novel concept of patient care termed “bloodless medicine and surgery” allows for greater tolerability of more extreme levels of anaemia. This process utilizes methods that stimulate the bone marrow to produce red cells; implementation of surgical techniques that minimize blood loss; minimal phlebotomy; and the use of drugs that lessen bleeding. This relatively

inexpensive method also complements autologous transfusion, does not require extra expertise and can be used in any setting. These options include:

- Haematinic supplements: Iron, Vitamin C, Folate, Vitamin B12
- Haematopoietic growth factors: Erythropoietin
- Antifibrinolytic agents: Tranexamic acid, Aprotinin, Fibrin sealant.
- Desmopressin (DDAVP) to lessen bleeding time
- Blood-less surgery
- Management of hypovolaemic shock with volume expanders [Normal Saline, Lactated Ringer's solution, albumin, Hydroxyethl Starch (HES), Dextrans, and Purified Protein Fractions (PPF)]
- Blood substitutes when available: Experimental models in use in some jurisdictions. Approved red blood cell substitute for human use currently unavailable

CHECKLIST FOR DECISION MAKING

Prior to making final decision on administration of blood and or blood components the following checklist should be implemented:

- Can allogeneic transfusion be avoided or minimized by use of alternatives (haematinics, erythropoietin, autologous methods)?

- Are the indications for transfusion explicitly clear and appropriately documented in the patient's notes?

- Have the risks been assessed and the benefits explicitly superior?

- Has the patient been provided with adequate information surrounding transfusion to make informed decision to accept or refuse?

- Has this informed decision been documented in the patient's notes?

- Has the laboratory been given an accurately completed request form and accompanying accurately labelled sample(s), indicating clearly the requirements and urgency?

- Has the nursing staff been notified of the intention to transfuse and has the necessary documentation of the planned transfusion been appropriately charted?

- Have adequate provisions been put in place for monitoring of the transfusion so as to facilitate immediate notification of any acute transfusion reaction?

POTENTIAL RISKS OF BLOOD TRANSFUSION

The introduction of more sophisticated and a wider range of tests to screen blood, especially for blood borne viruses have made blood supplies safer now than ever before. Nevertheless, blood transfusions can have a number of deleterious consequences.

While the goal standard for determining the safety of a blood supply seems (in the public view) to be associated with the incidence of transfusion-related HIV infection, other blood borne diseases of importance especially in the Region of the America's exist. These include malaria, Human T Lymphotrophic Virus (HTLV), hepatitis B and C, Chagas disease, syphilis, dengue, and West Nile virus. In addition, bacteria, parasites, and prions may also be transmitted through blood and blood component infusion.

Allogeneic transfusion means introduction of foreign proteins from one individual into another, very much transplantation of liquid tissue. As such, of concern, is the immunological status of individuals who have been transfused. It has been well described, that natural killer cell function is severely suppressed in multiply transfused patients. As well, chronic antigenic stimulation (as measured by HLA-DR expression on T cells) is markedly elevated in multiply transfused recipients. These findings indicate that chronic exposure to foreign antigens may be associated with the risk of immunomodulation or immunologic alterations, accounting for clinical syndromes associated with allergenic transfusions.

Transfused patients are therefore at risk for the development of immune related conditions such as: higher rates of cancer recurrence and decreased survival; transfusion-related acute lung injury (TRALI -A rare clinical syndrome of dyspnea, hypotension, pulmonary edema, and fever; caused by the interaction of white blood cell antibodies in donor plasma with biologically active lipids that accumulate in stored red blood cells and platelets). Transfused patients are also at risk for developing systemic inflammatory response syndromes or even multiorgan failure from increased circulating inflammatory cytokines such as interleukin-8. Some researchers also suggest that transfusion may precipitate microchimerism, a condition in which the blood recipient harbors and integrates small amounts of the donor's genetic material into its own. Microchimerism is a harbinger and increases the risk of autoimmune disease, non-Hodgkin's lymphoma and chronic lymphocytic leukemia.

Other risks (non infectious, non immune) associated with transfusion are linked with the capacity to handle volume being transfused or capacity to excrete excess iron in the multiple transfused. As such, it's important that the recipient's cardiopulmonary status be assessed with care prior to ordering transfusions, and that constant monitoring is in effect. For patients on chronic red-cell transfusion programmes such as those diagnosed with pure red cell aplasia, severe thalassemia and some with sickle cell disease, may not have the capacity to excrete excess iron, and are at risk of iron overload syndrome.

LEGAL & ETHICAL CONSIDERATIONS IN BLOOD & BLOOD COMPONENT TRANSFUSION

Blood or blood component transfusion is a medical procedure and is therefore legally permitted **only** after being prescribed by a registered medical officer; as such, prior to administering a transfusion the patient's informed consent should be obtained. This includes explaining to the patient the benefits and risks of receiving, and probable medical consequences of not receiving the blood component. As well, any reasonably viable alternatives should be discussed with and offered to the patient. It is prudent to have the patient clearly understanding the risks of receiving the blood component transfusion with other risks surrounding the medical treatment.

In such circumstance where the patient is incompetent, substitute consent must be obtained according to applicable National Laws. In general, during emergency situations where treatment is necessary to preserve the life or health of the patient and consent is not available (because the patient is unconscious or otherwise unable to consent) the attending medical officer may administer blood components (and any other treatment) necessary to preserve the life or health of the patient. This does not apply if it is known that the patient had expressed refusal for such treatment before becoming incompetent. A competent adult is entitled to refuse or cease any treatment including transfusion of blood and blood components; however, the medical officer has the responsibility to ensure that the refusal is truly informed and voluntary.

Parents ordinarily have the responsibility to provide consent on behalf of their young children; and attending medical officers cannot simply override parents' refusal; as such, recourse **must** be through the relevant applicable laws.

Many judgment calls arise in all day-to-day medical practice; however, actions by medical professionals require awareness and respect for legal and ethical considerations, and above all, they require an empathetic understanding of the patient and his or her situation.

Informed Consent for Transfusion

This is the process through which the medical officer communicates with the patient or guardian in terms they clearly understand about the transfusion of blood or blood components, necessity in the particular circumstance, probable complications, possible medical consequence of refusal, and available alternatives; and the patient or guardian after expressing satisfaction with information provided, asks pertinent questions with regards to the process, and agrees or not (in writing) to be transfused.

Informed consent for transfusion includes two main processes:

- Medical officer explains:
  - Indications for the transfusion
  - Benefits
  - Risks
  - Possible alternatives
  - Probable consequences of refusing the transfusion

- Patient /guardian being well informed:
  - Acknowledges understanding the need.
  - Makes decision to accept or refuse.

- In life-threatening emergencies when uncross-matched blood may be necessary or in the absence of serologically compatible components signed consent for their use must be obtained from the attending medical officer.

Approved Informed Consent Form

MINISTRY OF HEALTH/UNIVERSITY HOSPITAL OF THE WEST INDIES
CONSENT FOR TRANSFUSION OF BLOOD AND BLOOD PRODUCTS

Hospital_____Ward _____ Medical Records No._____

KINDLY READ THE CONTENTS OF THIS CONSENT FORM VERY CAREFULLY BEFORE AFFIXING YOUR SIGNATURE. THIS FORM MUST BE SIGNED IN ORDER TO GET A TRANSFUSION OF THE BLOOD OR BLOOD PRODUCTS. PLEASE NOTE:

1. **BLOOD PRODUCTS TRANSFUSION INCLUDES THE TRANSFUSION OF RED CELLS, PLASMA, PLATELETS, CRYOPRECIPITATE OR WHOLE BLOOD.**

2. **PATIENTS WHO REQUIRE TRANSFUSION NEED TO UNDERSTAND THE RISKS ASSOCIATED WITH RECEIVING BLOOD OR BLOOD PRODUCTS.**

I _____ patient/parent/guardian of _____
(strike out if not applicable)

DECLARE that:

1 **I understand that all blood and blood products are tested for the following viruses; Hepatitis B and C, HTLV and HIV (the virus that causes AIDS) as well as VDRL a test for syphilis.**

2 **I understand that, although the blood and blood products are tested according to approved international standards, there still remains a risk of contracting a blood borne infection if I accept blood products.**

3 **I also understand that this is due to the fact that these tests may fail to detect the presence of the infection, as the person donating the blood may be in a very early phase of the infection.**

4 **In addition, I acknowledge that there are other blood borne infections which are currently not identified or for which a screening test is either unavailable or not routinely performed, and also that these infections may also be transmitted by blood and blood products that I receive.**

5 **I further acknowledge that I have been informed about allergic reactions and other health problems that may occasionally occur as a result of the transfusion of blood and blood products.**

6 **I understand that there may be alternatives to receiving blood donated by other persons. The alternatives applicable to my condition have been discussed with me. The reasons blood products are necessary and the risks of refusing blood products have also been explained to me.**

My signature below confirms my acceptance of transfusion, the benefits and risks which have been explained to me.

Patient's signature_____ Date _____ Time _____
(patient/parent/guardian)

Witness: _____ Address & Tel: _____

CONSIDERATION FOR COMPONENT SELECTION

Identification of Recipient

It is extremely important that all recipients of blood and components be unequivocally identified by at least 4 markers. Whenever discrepancies arise only freshly drawn and correctly labeled samples will be accepted by the blood bank. Obligatory identifiers are:

- Complete name of recipient.
- Hospital registration number
- Name of Phlebotomist
- Name of requesting medical officer
- Gender
- Other supporting data includes patient's date of birth and or age.

Linking Recipient & Blood Samples

Blood samples of recipient should be uniquely and unequivocally identified as the recipients themselves. As such, all information accompanying the recipient's blood samples must undoubtedly link each recipient and the sample. Clerical errors are minimized by labelling blood tubes in the presence of each patient; and should have inscribed the exact obligatory identifiers as described above.

Efficient Blood and Blood Component Use

The process from recruitment, screening, storage and preparation of blood and components up to the issuing to be transfused is quite costly. As such, it is prudent to use each component as sparingly as possible, and **only** when indicated. When the blood bank is asked to cross-match and hold or issue units for specific patients, fewer units are available for other potential recipients who may be in greater need. As well, units being held are in jeopardy of expiring. ABO/Rh specific blood components are always more desirable; however, these may not be available at all times. In such instances substitutions for non-identical blood groups may be recommended for use.

Blood Components

Red Blood Cells

Shelf Life:	Vary according to anticoagulant. CPDA-1: 35 days
Storage Requirements:	Temperature monitored refrigerator at 1-6°C
Dosage & Administration:	Adult – one unit for each desired 1g/dl rise in haemoglobin. Paediatric patient 10-15ml/kg increases the haemoglobin by 2-3g/dl

Platelets

Shelf life:	3 or 5 days depending on bag type.
Storage Requirements:	Maintain constantly agitated 20-24°C
Dosage & Administration:	Adult 1 unit per 10kg and paediatrics 10 ml/kg. In paediatric patients one unit typically raises the count about 50 $x10^9$/L while in adults it is about 5-10x 10^9/L

Fresh Frozen Plasma

Shelf life:	12 months
Storage Requirements:	Store at < -30°C
Dosage & Administration:	Adults 10-15ml/kg and up to 10ml/kg in children

Cryoprecipitate

Shelf life:	12 months
Storage requirements:	< - 30°C.
Dosage & Administration:	One unit of cryoprecipitate contains approximately 80 Units of Factor VIII and150mg of Fibrinogen. Infuse as quickly as tolerated

Red Cell Selection

Table1: Red Blood Cell for Transfusion

Recipient Group	1st Choice	2nd Choice	3rd Choice	4th Choice
O -Positive	O-Positive	O-Negative	None	None
A-Positive	A-Positive	O-Positive	A-Negative	O-Negative
B-Positive	B-Positive	O-Positive	B-Negative	O-Negative
AB-Positive	AB-Positive	AB-Negative	A-Positive	B-Positive
O-Negative	O-Negative	O-positive*	None	None
A-Negative	A-Negative	O-Negative	A-Positive	O-Positive
B-Negative	B-Negative	O-Negative	B-Positive	O-Positive
AB-Negative	AB-Negative	A-Negative	B-Negative	O-Negative

*The transfusion of Rh (D) positive units into Rh (D) negative recipients can be lifesaving; however, such procedure is subject to the following guiding principles:

- Recipient must be anti-D negative
- There must be prior consultation with a haematologist
- Rh (D) negative women of child bearing age may be transfused with Rh (D) positive red cells only under extraordinary circumstances
- The attending medical officer must agree in writing to conduct this procedure
- In the case of massive transfusion (>7 units), Rh (D) positive red cells may be used early to conserve on Rh (D) negative units.

Plasma Selection

Table 2: Plasma for Transfusion

Recipient Group	1st Choice	2nd Choice	3rd Choice	4th Choice
O	O	A	B	AB
A	A	AB	B	O
B	B	AB	A	O
AB	AB	A	B	O

Rh is not considered, as AntiD is **not** naturally occurring and **only** develops on exposure. Since donated blood is always screened for **non ABO** antibodies, any plasma containing anti-D would have been otherwise discarded.

Platelets & Cryoprecipitate Selection

Table 3: Platelets & Cryoprecipitate for Transfusion

Recipient Group	1st Choice	2nd Choice	3rdChoice	4th Choice
O	O	A	B	AB
A	A	AB	B	O
B	B	AB	A	O
AB	AB	A	B	O

Group specific platelet or cryopreciptate is preferable (if unavailable), but it is usually safe to transfuse any group. Plasma reduced forms of these blood components are desirable for paediatric patients.

General Principles for Blood Component Infusion

- The intended recipient must be unmistakably identified by linking name and hospital registration number with the individual (use arm band, prior hospital records, and prior transfusion records, etc.), with that on the transfusion slip and unit to be transfused.
- Universal precautions should always be used when handling blood and blood components.
- Peripheral intravenous access (18-20 Gauge for adults and 22-24 Gauge or larger for children) should be sufficient to maintain an adequate rate for the transfusion without risk of haemolysis or stasis.
- A standard blood giving set (170-260 micron filter) should be used for the infusion of all blood components.
- Blood giving sets must be changed at least every 8 hours.
- Component should be carefully mixed and thoroughly inspected for clots, abnormal colour or leakage.
- Solutions such as glucose, calcium or Ringer's Lactate should not be added to the blood or component, or infused through the same line at anytime.
- Strict record of transfusion times (commencement / completion) should be inscribed in the recipient's medical record.
- Vital signs of recipient should be monitored throughout the transfusion process and documented.
- Daytime transfusions are more desirable as more staff is usually available for monitoring.

- All documentation of the transfusion process must remain as part of the permanent medical record of the recipient.
- Patient's blood group should be verified using previous records (if available).
- Time for commencement of infusion of blood and blood components should be within 30 minutes of arriving at point of care.
- Red cells should initially be infused at a slow rate for the first 15 minutes (50ml/hr), after which completed within 4 hours, while other blood components are infused more quickly depending on the haemodynamic status of the recipient.

The routine warming of blood is **NOT necessary;** as such, blood warmers should **only** be used when:

- There is significant risk of transfusion induced cardiac hypothermia (flow rates of >50mL/kg/hour in adults and >15mL/kg/hour in children, exchange transfusion in infants)
- Transfusing patients with clinically significant cold agglutinins.
- When blood warming is clinically indicated, a specifically designed commercial device **(Blood MUST NOT be warmed by any other method)** must be used with a visible thermometer and audible alarm that ensures that the blood is not warmed above 41°C.

Principle of Bedside Procedure

The bedside pre-transfusion check is vital for ensuring that the right blood is given to the right patient to prevent potentially fatal errors. Two staff members (nurses/midwives or medical officers, interns) should perform the bedside check, one of whom is responsible for the care of the patient during the transfusion. The Checklist includes:

- Patient correctly identified
- Consent for transfusion
- Written instructions for transfusion
- Verification that all requirements are met
- Type of blood component to be given
- Quantity to be given

- Duration of infusion
- Any special requirements

Patient Identification

The patient **MUST** be positively identified by:

- Checking the hospital identity band on the patient
- Asking the patient to repeat or spell name and state their date of birth
- Verify with the parent or legal guardian
- Blood must NOT be infused if recipient is not unequivocally identified
- Bed label must NOT be used as the principal means of identification

Patient Monitoring During Transfusions

It is essential that nurses are vigilant while monitoring patients during the transfusion process so any change to their condition can be detected and managed early. As such, acute transfusion reactions can be quickly recognized, with timely and appropriate interventions, thereby helping to minimize or prevent transfusion-associated morbidity or mortality.

Normally, such monitoring typically includes recording vital signs – temperature, pulse and blood pressure. However, there is no consensus and there is wide variation on frequency of such observations. Since, the most severe adverse reactions (haemolytic and anaphylactic) to transfusion usually occur within the first 15 minutes of starting transfusion, it is recommended that monitoring be especially close during that period. As well, it is critical that visual observations for signs such as restlessness, abnormal breathing patterns, sweating, anxiety, cry for discomfort, and discolored urine not be overlooked, as they may precede significant changes in vital signs in the early phase of an acute transfusion reaction.

Patients may be the first to be aware of any adverse effects of the transfusion; as such, during the process of obtaining an informed consent for, and at the time of setting up the transfusion they should be advised. Such patient empowerment lends support to the early diagnosis of adverse effects of transfusion. As well, it is vital, that patients who are being transfusion are in clear view so that the attention of nurses can be heralded if needed. In

addition, given the limited human resource to observe and respond to patient needs especially at nights, as far as possible, it may be prudent to transfuse patients during regular working hours.

Healthcare staff especially nurses have a critical role to play in patient care during the transfusion process. In order to ensure safe and appropriate monitoring of patients receiving blood transfusion and early detection of transfusion reactions, it is critical that all healthcare staffs monitoring patients are able to recognize early signs and symptoms so as to make early and appropriate intervention.

The following are specific recommendations:

- Vital signs observed, assessed, recorded and acted on as necessary, especially during the first 15 minutes of starting a transfusion.
- Patients who are unconscious or unable to communicate may need special attention.
- Patients receive transfusions in open wards where they can be easily observed visually.
- As far as possible, transfusions outside of routine hours should be avoided.
- Patients empowered to recognize symptoms of adverse transfusion reactions and to report on them immediately.

ADVERSE REACTIONS MANAGEMENT & REPORTING

Undesirable reactions may occur as a result of the infusion of blood or blood components. Generally, these reactions tend to be mild and short lived; however, many of the serious adverse events following blood transfusion are unpredictable. All adverse events are significant and should be reported immediately to the Blood Bank and/or Consultant Haematologist/Physician for advice on immediate management and investigation. There are different classifications of transfusion reactions, however classification based on time of onset (immediate/acute in which symptoms occur either during or within 24 hours of the transfusion or Delayed which is beyond the first 24 hours) and whether the cause is Immune or Non-immune (Table 4).

Table 4: Classification of Transfusion Reactions

Acute	**Immune**	Febrile Non-haemolytic (FNHTR)
		Acute Haemolytic (AHTR)
		Mild Allergic
		Anaphylactic
		Transfusion Related Acute Lung Injury (TRALI)
	Non-Immune	Bacterial contamination
		Transfusion Associated Circulatory Overload (TACO)
		Hypotension
		Non-immune Hemolysis
		Hypothermia
		Electrolyte imbalance (Hypocalcaemia, hyperkalaemia, hypokalaemia)
Delayed	**Immune**	Delayed Hemolytic Transfusion Reaction (DHTR)
		Transfusion Associated Graft Versus Host Disease (TA-GVHD)
		Post-transfusion Purpura (PTP)
		Alloimmunization – (Red cell antigens, HLA platelet antigens, neutrophil specific antigens)
		Immunomodulation
	Non-Immune	Iron Overload
		Transfusion Transmitted Infections (HIV, HBV, HCV, HTLV, Syphilis, Chagas,etc)

Acute Transfusion Reactions

FNHTR

These reactions usually occur during or within an hour of a transfusion. They are not life threatening and may last up to 8 hours. Signs and symptoms include:

- Rise in body temperature > 1°C (1.8^{o}F)
- Chills, Cold, Rigors
- Headache, Nausea, Vomiting

Clinical Management and Evaluation

Nurse

- Call the medical officer in-charge and proceed with the following:
- Stop Transfusion if not already stopped
- Start normal saline using a new intravenous line.
- Monitor vital signs.
- Acetominophen 325-500 mg
- Diphenhydramine 50mg IV
- Meperidine for severe rigors.

Medical Officer

- Rule out life threatening events such as: -AHTR, bacterial contamination and TRALI.
- Assess underlying disease as probable cause.
- Return Unit and Post-transfusion samples to Blood Bank for work-up
- Evaluate for other causes: underlying disease, drugs, infections
- If the reaction abates within an hour, the transfusion process may continue, provided it completes within 4 hours of initial commencement. There is a 1:8 chance of recurrence in a future transfusion; as such, premedication with antipyretics is advised.

Mild Allergic Reaction

- Most commonly due to infusion of plasma proteins, may occur in up to 1% of all transfusions and often seen with FNHTR. Signs and symptoms include:
- Pruritus, urticaria, erythema, cutaneous flushing
- Laryngeal edema, hoarseness, stridor
- Bronchoconstriction: wheeze, chest tightness, dyspnea
- Gastrointestinal distress (pain, diarrhoea, nausea and vomiting)

Clinical Management and Evaluation

- Very similar to FNHTR, however the medical officer needs to conduct an assessment to exclude other causes of allergy such as;
- Drugs, tape, latex gloves
- Ethylene oxide sensitivity (e.g. fiber sterilization for dialysis membranes)
- Underlying allergies – e.g. peanuts
- Need to– r/o TRALI or TACO. If symptoms resolve in an hour, transfusion may be restarted, provided the unit is completed within 4 hours of initial commencement. To prevent or minimize recurrence, premedicate with diphenhydramine.

AHTR

AHTR is one of the most common and most feared adverse transfusion reactions, yet it is most cases preventable. AHTR is usually as a consequence of the recipient's plasma containing antibodies to donor RBC antigens. ABO incompatibility is the most frequent cause of AHTR; however, antibodies against other blood group antigens can precipitate such a reaction. Mislabeling the recipient's pretransfusion sample at collection or failing to match the intended recipient with the blood component immediately prior to transfusion is the usual cause, and rarely it maybe laboratory error.

The clinical syndrome is characterized by intravascular haemolysis resulting in haemoglobinuria with varying degrees of acute renal failure and possibly DIC. The severity of the condition depends on the degree of incompatibility, the quantity of blood infused, the infusion rate, and the integrity of the liver,

cardiovascular and renal systems. There may be early onset within the first 15 minutes of initiation of transfusion, but like other acute reactions it may occur later during the transfusion or immediately afterward. Onset is usually abrupt, and the patient may complain of discomfort with severe lumbar pain and anxiety. Signs and symptoms include:

- Dyspnea, fever, chills, facial flushing.
- Hypotension, shock, tachycardia with feeble pulse.
- Cold and clammy skin
- Nausea and vomiting.
- Dark urine
- Jaundice and cyanosis.

Under general anesthesia some of these symptoms / signs may not be immediately visible; however, warnings include hypotension, uncontrollable bleeding from incision sites and mucous membranes caused by an associated DIC, or dark urine that reflects haemoglobinuria.

Clinical Management and Evaluation

On the open ward the nurses who are monitoring the patients are usually the first to recognize or be alerted to the situation. Immediate simultaneous actions of supportive care and summoning the “critical care crash team” are essential.

- Stop Transfusion
- Maintain IV saline and haemodynamic stability.
- Furosemide IV
- Trendelenberg position
- If necessary, Intubate and apply oxygen.
- Dopamine with caution (avoid pressor drugs like epinephrine which decrease renal blood flow)
- Bicarbonate.
- Constant monitoring of vital signs.
- Recheck unit and patient identification.
- Return unit and fresh samples to the blood bank.
- Measure free Hb in urine and plasma.

- Measure serum LDH, bilirubin, and haptoglobin
- Consider involving nephrology service early.

Prognosis depends on degree of renal impairment. Permanent renal failure is unusual, but prolonged oliguria and shock are poor prognostic signs. Important differential diagnosis should include TRALI, TACO, and Bacterial Contamination. Follow-up investigation is necessary to determine at which point the error had occurred, and corrective action taken.

Severe Allergic (Anaphylactic) Reaction

This is a life-threatening emergency that may occur from 1:20,000 to 1:50,000 transfusions. It may be associated with IgA Deficiency (circulating IgG or IgE anti-IgA antibodies). Prodromal signs and symptoms may be those of mild allergic reactions, but it can quickly become dramatic. Other signs and symptoms include:

- Cardiac instability (Hypotension, shock, tachycardia, arrhythmias, cardiac arrest).
- Severe respiratory compromise with stridor and dyspnea.
- Nausea, vomiting

Clinical Management and Evaluation

Early recognition by nurses is life saving. Immediate simultaneous actions include supportive care and summoning the “critical care crash team” is essential.

- Stop Transfusion
- Oxygen, Intubation, maintain IV
- Trendelenberg position
- Epinephrine, 0.3-0.5 mg (0.3-0.5 ml of 1:1000 solution) q20 minutes SC
- Diphenhydramine 50-100 mg IV
- Aminophylline 6 mg/kg loading dose IV
- Consider Solumedrol 125 mg IV, Consider H2 blockers (e.g. cimetidine), and bicarbonate.
- Constant monitoring of vital signs.

It is important to make the correct diagnosis thus in the differential, consider TRALI, TACO, AHTR and Bacterial Contamination. As well, return unit and post transfusion samples to the blood bank for further evaluation. Patients, who have known allergy to blood/blood products, should be premedicated with diphenhydramine 50mg IV, hydrocortisone 200mg IV, and antipyretics. Washed red cells may also help to prevent a reaction.

TACO

Blood and its components have a higher viscosity than fluids in the extravascular space, as such when transfused it creates higher intravascular osmotic pressure, thereby draws volumes into the intravascular compartment. Patients with small volume or already compromised circulatory and renal system are at risk for volume overload. As such it is recommended that red cells be infused slowly (over approximately 4 hours). Observation during and in the immediate post transfusion period is critical for the early recognition and management of this clinical syndrome. The signs are those of heart failure and include:

- Dyspnoea, wheezing, cough and rales.
- Hypoxemia, headache, cyanosis.
- Elevated JVP
- Tachycardia, pulmonary oedema, pedal oedema
- Restlessness and anxiety

Clinical Management and Evaluation

- Prompt recognition especially by nursing staff, with immediate simultaneous actions supportive care and summoning the medical officer reduces morbidity. The transfusion should be stopped if not already discontinued and specific management for heart failure commenced.
- Furosemide IV
- Oxygen
- Monitor vital signs
- Patients at risk (elderly and paediatric population) should always receive prophylactic diuretics prior to a transfusion, or the units split and administered over longer periods.

TRALI

This condition is quite infrequent but can be life threatening. After ABO incompatibility, this is the 2nd most common cause of transfusion-related death. The theory behind its cause is that the presence of anti-HLA and/or anti-granulocyte antibodies in donor plasma that agglutinate and degranulate recipient granulocytes within the lung.

During or early post transfusion, the patient develops acute respiratory symptoms, which may be clinically indistinguishable from cardiogenic causes; however, the chest x-ray has a characteristic pattern of non-cardiogenic pulmonary edema.

There is:

- Respiratory distress
- Non-elevation in cardiac pressure.
- Diffuse pulmonary infiltrate seen on chest x-ray.

Clinical Management and Evaluation

Mild to moderate cases may be missed and the patient recuperates spontaneously. Prompt recognition and management of severe cases may prevent death; as such the nursing staff must immediately commence supportive care and summon the medical officer. The transfusion should be stopped if not already discontinued.

- Have IV access open
- Intubate and administer oxygen
- Monitor vital signs
- Monitor blood gases
- Get urgent chest x-ray.
- Diuretics should be avoided.

With supportive care, this condition may resolve with spontaneously within 96 hours.

Bacterial Contamination

This is another acute life threatening emergency, which if misdiagnosed or not recognize early can be fatal. During phlebotomy, bacteria can enter the component bag, which provides the ideal environment for multiplication. Prior to administering a transfusion an important bedside procedure that may prevent such a reaction is to examine the unit carefully looking for clots, discoloration and foul smell. The onset is usually dramatic during or in the immediate post transfusion period; very rarely is it delayed for a few hours later.

Signs and symptoms include:

- High fever
- Chills and rigors
- Hypotension
- Nausea vomiting and abdominal cramps
- Dyspnoea
- Clinical complications – shock, renal failure, DIC and death

Clinical Management and Evaluation

As discussed previously, early recognition by nurses is life saving. Immediate simultaneous actions include supportive care and summoning the “critical care crash team” is essential.

Actions:

- Stop transfusion immediately if it had not already been discontinued
- Maintain IV
- Intubate and give oxygen
- Administer broad-spectrum antibiotics including Pseudomonas coverage if the patient had been receiving packed red cells
- Examine unit or bag for clots, foul smell or discoloration
- Send unit / bag and tubing along with samples for workup including gram stain, culture and sensitivity and cross match

Differential diagnosis should include TRALI, TACO, and AHTR.

Other Acute Transfusion Reactions

These include:

- Dilutional coagulopathy from massive transfusion when greater than patient whole blood volume is transfused in 24 hours and is associated with uncontrolled microvascular bleeding, deranged coagulation assays, and low platelets. If bleeding, the patient should be given specific blood components as the situation dictates.
- Hypothermia develops when large volumes of cold blood are infused rapidly. This increases the risk of arrhythmia. In such cases the rate of infusion should be slowed, and the patient kept warm. Blood warming (except using specialized equipment) is not advised as this may precipitate haemolysis and further complications.
- Electrolyte imbalance may occur, but are usually of minimal clinical significance

Steps to follow when an Acute Transfusion Reaction is suspected:

Firstly it is important to reiterate that early recognition and intervention will prevent morbidity and mortality, as well as, bringing comfort to the patient and confidence in the health system. As such both nursing staff and patients are critical at this stage.

Once a reaction is suspected the nurse must initiate supportive care and summon support from attending medical officer **immediately**.

Actions:

- Stop Transfusion IMMEDIATELY!
- Commence normal saline infusion (**except in suspected TACO**) using a new intra-venous administration set.
- Ensure; airways are open, vital signs are stable, oxygen and emergency supplies available (crash cart in ready).
- Verify identity of patient; make certain that the unit being infused was unmistakably meant for that patient (review obligatory identifiers).
- Notify the blood bank and return unused blood component (with all tubing).

- Collect blood and urine samples for the following:
  - Group and cross match
  - Complete blood count
  - Coombs Tests (Direct and Indirect Antiglobin Tests)
  - PT/aPTT
  - Blood culture and gram stain
  - Renal and liver chemistry
  - Urine for free haemoglobin
  - Arterial blood gas
- Management as clinical scenario dictates, such chest x-ray
- All observations, actions and treatment must be fully documented in the medical record
- Further investigations (by blood bank and medical staff) of probable cause and implementation of corrective actions where warranted

Delayed Transfusion Reactions

These reactions occur beyond two days of being administered a transfusion. Some conditions may be asymptomatic for very long periods and others may be mild and appear clinically insignificant, while others yet may cause severe clinical manifestations in the early period. Most patients would have been discharged from hospital by then, they or their caregivers would be first to notice delayed transfusion reactions. As such every transfused recipient should be so empowered with the basic knowledge to quickly recognized and seek medical attention.

DHTR

Patients who may have been previously sensitized and have low / undetectable red cell antibody test prior to transfusion may have a rise in antibody level post transfusion thus precipitating a sub-acute delayed haemolytic reaction. This usually occurs up to 4 weeks post transfusion.

Clinical manifestations may pass un-noticed, rarely are they severe. Some patients may have mild signs and symptoms including:

- Slight fever
- Falling haemoglobin to pretransfusion levels in a short period (1-2 weeks)

- Symptoms of worsening anaemia
- Mild to moderate rise in LDH and bilirubin
- Mild jaundice
- The patient or caregiver should contact the medical service for further assessment. The following tests should be conducted:
  - Complete blood count
  - Serum LDH and bilirubin
  - Direct Antiglobulin Test (DAT).
  - Antibody identification by the Blood Bank
  - Patient record both at the blood bank and the hospital is updated so that for future transfusions blood that is selected for that particular patient does not contain the offending antigen. In the unlikely event a delayed haemolytic reaction presents as an acute case it is treated accordingly.

TA-GVHD

This is a rare but grave condition that may develop within two weeks of a patient receiving a transfusion. It occurs when immunocompetent lymphocytes are transfused into an immunodeficient recipient. These donor lymphocytes recognize the recipient as foreign and start an attack against the host. Reticuloendothelial tissue including the bone marrow is attacked inducing widespread tissue damage, organ failure, bone marrow aplasia and sometimes death in 90% of cases. Patients and caregivers should recognize early warning signs and seek help. These include:

- Feeling unwell 8-10 days post-transfusion
- Severe weakness
- Fever
- Unexplained bleeding
- Jaundice
- Signs of multiorgan failure (confusion)
- GI problems (diarrhoea, bleeding, vomiting)
- Unexplained skin rash
- Investigations reveal severe pancytopenia and evidence of multiorgan failure.

TA-GVHD is unpredictable but the following types of patients are at increased risk:

- Transplant recipients
- Intrauterine transfusion
- Neonates undergoing exchange transfusion.
- Hodgkin's Disease with cellular immune deficiency
- As far as possible such patients should receive blood and components that have been leucoreduced and irradiated, especially if the unit is from a blood relative.

PTP

This is a rare condition similar in concept to DHTR. The patient would have been previously sensitized through a previous transfusion or pregnancy, developing antiplatelet antibodies (usually anti-HPA-1a) and upon being transfused has an immune response causing allogeneic and autologous (mechanism for the latter is unclear) platelet destruction, about 7-10 days post transfusion. Although this condition is usually self-limited, patients may experience unexplained bruising and mucosal bleeding, for which they usually seek medical attention. About 10 - 20% of patients may die. Patients present with:

- Profound thrombocytopenia (often $<10x10^9$/L) of abrupt onset.
- Purpura, bleeding
- Possible fever

Management of the condition includes:

  - High Dose IVIG
  - High Dose Steroids
  - Plasmapheresis (Category III indication - Refractoriness to IVIG and steroids) QOD until recovery of platelet count
  - Splenectomy
  - Platelet Transfusion in case of active life threatening bleeding (platelet which lack offending antigen is preferable).

Post Transfusion Infections

These include; viral infections (HIV, HBV, HCV, and HTLV), Malaria, Changes Disease, Syphilis and cud among others. They usually occur in situations where a donor may have been in the window period of an infection, thus was not

detected at post donation screen. On the other hand, in countries where 100% of collected blood is not screened for blood borne infections, recipients are at risk. These conditions may take many months or even years before the recipient becomes symptomatic. Such recipients however are themselves at risk of infecting other people (sexual or other intimate contact with blood and body fluids) or, becoming blood donors thus tainting the blood supply. Clinical manifestations are largely specific to the condition in question.

It is very important that a detailed history be collected from any patient who presents with any of the conditions that may be transmitted through blood. Once it is elicited that such persons had received prior transfusion, the blood bank should be informed and all efforts made to conduct a look-back so as to ascertain possible source through blood transfusion. This has to be handled with extreme caution and high ethical ideals.

Iron Overload.

Persons with underlying pathologies requiring chronic transfusion (pure red cell aplasia, thalassemia etc.) are at high risk of iron overload syndrome. They are just incapable of excreting the excess iron being transfused and broken down. It is important that the medical caregivers are cognizant of the complication and they regularly screen patients for this condition. As well, it is critical that such patients be maintained on iron chelation therapy.

Assessment and Management of Delayed Reactions and Complications

Patients or their caregivers most often recognize delayed reactions. It is therefore important that they be well informed of the possible adverse reactions of a transfusion, how to recognize them and what actions to take if there is such a suspicion. At the same time medical personnel must acquaint themselves with these conditions and be apt in early diagnosis and effective management.

ESSENTIAL DOCUMENTATION

When the transfusion of blood or blood components becomes necessary, a permanent record of the transfusion of all blood and blood components must be kept in the patient's medical notes in a manner that facilitates straight-forward and accurate review when required e.g. in the event that a transfusion-related adverse occurrence is being investigated; for the purposes of conducting quality improvement audits and blood utilization review; and support the management of legal risk. These records must include the following:

- The medical officer's prescription /instruction for transfusion
- Indications for transfusion
- Comments on whether the desired effect of the transfusion was achieved
- The peel-off compatibility label from the blood component affixed to notes
- The date and time each unit was commenced and completed
- The identity of the persons responsible for the performing the pre-transfusion checks
- Nursing observations recorded during the transfusion – at start of infusion, 15 minutes later, then hourly and at completion of transfusion
- Any undesirable effects and their management
- Record of 'Informed Consent' for transfusion
- The significant risks, benefits and alternatives to transfusion including the patient's right to refuse should have been discussed
- Medication(s) to be administered before or after transfusion clearly and appropriately transcribed in the medicines' order form and medical records
- Request forms for transfusion should contain the following information:
    - Full name of patient, Date of Birth, Age, Gender; Registration Number
    - Names of:
        - Hospital, ward, medical/surgical service
        - Requesting medical officer.
    - Indication for transfusion and haemoglobin level (if available).
    - Date and time for intended transfusion.
    - Type and quantity of required blood components.
    - Indicate modifications (irradiated, washed cells etc).

BLOOD ORDER SCHEDULES

The expected usage of blood and blood components for elective surgical procedures is well known and chronicled, thus a suggested schedule which lists the number of units of blood and components to be routinely prepared for each procedure preoperatively forms an integral part of the policy and guidelines for transfusions.

Advantages of a Surgical Blood Order Schedule

- Lessens needless compatibility testing.
- Minimize numbers of return of unused blood and components.
- Minimize wastage as a result of expiry or improper storage on hospital wards.
- Improved efficiency.

Implementation of such a system requires:

- Haemoglobin estimation and blood group be conducted at routine clinic visits of potential surgical patients.
- At one week prior to planned surgical intervention, surgical teams should submit their list to the blood bank, with the following information on patients:
  - Demographics: name, age, hospital registration number, admission ward
  - Diagnosis
  - Planned surgical procedure
  - Hb and Blood Group
  - Quantities of blood and blood components required
- At admission fresh blood sample is drawn and sent for compatibility testing / component preparation.

Recommended Red Cell Transfusions for Selected Surgical Procedures

The Recommended Surgical Blood Order Schedule [RSBOS] that follows was developed based on the principle of Good Clinical Practice and review of the literature. The blood service will use this as a guide to issuing the designated amount of blood, for elective surgical procedures and will provide no more than, although orders for fewer units will be followed. Should the patient's clinical condition warrant, additional units requested by the surgical service will be provided.

RSBOS for Selected Surgical Procedures

Cardiothoracic Surgery	RSBOS
Mediastinoscopy	G & S
Open Lung Biopsy	G & S
Wide Resection Lung	2 units
Lobectomy	2 units
Pleurectomy	2 units
Pneumonectomy	4 units
Thymectomy	2 units
Cardiac Tamponade	2 units

General Surgery	RSBOS
Liver biopsy	G & S
Vagotomy	G & S
Gall bladder	G & S
Splenectomy	G & S
Exploratory Laporatomy	G & S
Thyroidectomy &Parathyroidectomy	G & S
Colostomy	G & S
Gastrostomy	G & S
Rectoplexy	G & S
Incision hernia	G & S
Hiatus hernia without thoracotomy	G & S
Hiatus hernia with thoracotomy	2 units
Right and extended colectomy (unless anaemic)	G & S
Anterior resection and total colectomy	2 units
Gastrectomy	2 units
Triple Biliary bypass	2 units
Abdomino-perineal resection	4 units
Panproctocolectomy	4 units
Pancreatectomy	4 units
Oesophagectomy	4 units
Oesophagogastectomy	4 units
Skin grafting	Surgeon's call
Gunshot/stab wound to chest or abdomen	Surgeon's call
Multitrauma-crush injury	Surgeon's call

Vascular Surgery	RSBOS
Aorto-fem bypass	4units
Aorto-Iliac bypass	6 units
Carotid endarterectomy	G & S
Fem-pop bypass	4 units
Fem-tib bypass	3 units
Ileo-fem bypass	4 units
Renal artery repair	3 units

Otorhinolaryngology & Dental Surgery	RSBOS
Adenoidectomy	G & S
Ethmoidectomy	G & S
Tonsillectomy	G & S
Parotid and submandibular gland dissection	G & S
Tumour of palate	G & S
Caldwell-Luc	G & S
Partial glossectomy	G & S
Mastoidectomy	G & S
Radical neck dissection	2 units
Laryngectomy	2 units
Maxillary osteotomy /resection	2 units
Commando free-flap	4 units

Orthopaedics & Spinal Surgery	RSBOS
Leg amputation	G & S
Removal of hip in and femoral nail	G & S
Osteotomy	G & S
Removal of cervical rib	1 unit
Laminectomy	G & S
Internal fixation of tibia / ankle	G & S
Bone graft from iliac crest	G & S
Disc excision	G & S
Fractured head of femur	1 unit
Dynamic hip screw	1 unit
Arthroplasty orarthotomy elbow / shoulder	G & S
Total hip / knee replacement	G & S
Bilateral hip/knee replacement	2 units
Internal fixation femur	1 unit
Revision hip replacement	4 units
Fore/hind quarter amputation	4 units
APLD	G & S
Open disc surgery	G & S
Spinal biopsy	G & S
1 or 2 level spinal fusion	1 unit
Extensive multilevel laminectomy	2 units

Urology	RSBOS
Cystoscopy	G & S
Percutaneous renal surgery / Nephrolithotomy	2 units
Transurethral prostatectomy	1 unit
Reimplantation of ureter	G & S
Trans-urethral resection of bladder	1 unit
Ureteroplasty	G & S
Urethroplasty	2 units
Urethrolithotomy	1 unit
Radical nephrectomy	3 units
Partial nephrectomy	2 units
Suprapubic prostatectomy	2 units
Open pyelolithotomy	1 unit
Adrenalectomy	3 units
Radical prostatectomy	4 units
Radical cystectomy	4 units
Vesico-vaginal fistula repair	2 units
Other reconstructive procedures	2 -3 units

Neuro-Craniofacial Surgery	RSBOS
Augmentation procedure via bicoronal flap	2 units
Implant procedure via bicoronal flap	2 units
Bipartition	6 units
Calvarial bone grafting and remodeling	3 units
Fronto-Orbital	3 units
Lefort 1	2 units
LeFort II or III	3 units
Mandibular distraction	Surgeon's call
Monobloc	6 units
Vascular malformation	Surgeon's call
Vault expansion	3 units
Anterior cervical fusion	1 unit
Carotid endartectomy	G & S
Chronic subdural haematoma	G & S
Cordotomy	G & S
Cranioplasty (adult)	G & S
Cranioplasty (paediatric)	1 unit
Acute subdural and epidural haematoma	2-4 units
Aneurism	4 – 6 units
Brain tumours	4 units
Laminectomy for disc repair	G & S
Laminectomy for tumour	2 units
Odontoid resection	2 units
Temporal Artery MCA bypass	G & S
Thalamotomy	G & S
Transphenoidal pituitary removal (tumor<3cm)	G & S
Transphenoidal pituitary removal (tumour>3cm)	2 units
Vascular decompression	G & S
Ventriculostomy	G & S

Obstetrics & Gynaecology	RSBOS
Caesarian section	1 unit
Threatened abortion	G & S
Trial of scar	G & S
Placenta praevia	2 units (on stand-by, G & S weekly)
Retained placenta	G & S
Antepartum / postpartum haemorrhage	Surgeon's call
Termination of pregnancy	G & S
Cone biopsy of cervix	G & S
Tubal surgery: laparoscopy & clip sterilization	G & S
Hysterectomy	G & S
Ovarian cystectomy (small cysts) /wedge resection	G & S
Ovarian cystectomy (large cysts)	2 units
Vaginal repair / prolapse	G & S
Oophorectomy	G & S
Hydatiform mole	2 units
Ectopic pregnancy	Surgeon's call
Myomectomy	2 units
Volvectomy	2 units
Werthiem's hysterectomy	4 units

DISCLAIMER

This manual was developed by the National Blood Transfusion Service of the Ministry of Health Jamaica, from literature review of best practice and is intended for use within the inpatient wards and emergency department of Hospitals.

It does not constitute a textbook and therefore deliberately provide little, if any, explanation or background to the conditions and treatment outlined. It is however designed to rapidly acquaint the reader with the clinical problem and provide practical advice regarding assessment, management, and to promote better and safer Transfusion Practice.

The recommendations do not indicate an exclusive course of action, or serve as a standard of medical care. Variations, taking individual circumstances into account, may be appropriate.

The National Blood Transfusion Service has made considerable effort to ensure the information contained is accurate and up to date. Users of this manual are strongly recommended to confirm that the information contained within, is correct by way of independent sources.

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