

BLOOD TRANSFUSION-1



DR. GEORGE MUGENYA
MBCHB, M.MED, FCS (ECSA)

INTRODUCTION

- Blood transfusion is the process of transferring blood or blood based products from one individual into the circulation system of another person.
 - This is referred to as homologous transfusion.
 - In autologous transfusion the donor and recipient is the same person.
- Earlier transfusions used whole blood but current practice uses only deficient blood components separately (component therapy).

...INTRODUCTION

- The history of practice of blood transfusion can be traced as way back as 15th century.
- It has evolved through a lot of controversies and sometimes ridiculous experiences into a specialized medical science of today; eg.
 - Giving blood orally.
 - Transfusion of animal blood to human.
 - Transfusion of milk.
 - Direct transfusion from donor's vein to recipient's vein, etc).

...INTRODUCTION

- ❑ Some of the landmarks in the development of modern transfusion science include:
 - Description of blood circulatory system by Harvey in 17th century.
 - Discovery of ABO blood groups in 1901
 - Discovery of anticoagulants in 1910s (sodium citrate) and refrigeration to prolong blood storage.
 - Soviet Union set up first national blood bank in 1930s.
 - Discovery of Rhesus group system in 1940 as major cause of transfusion reactions.

...INTRODUCTION

- ❑ ...Some of the landmarks...
 - Discovery of Acid-Citrate-Dextrose (ACD) solution in 1940s to help reduce amount of anticoagulant needed to preserve blood.
 - Introduction of plastic bags to replace glass bottles in 1950.
 - Adoption of WHO policy of voluntary blood donation in 1975.
 - Introduction of CPDA-1 anticoagulant in 1979 to increase shelf life to 35 days.
 - Emergence of HIV in 1980s brought up new challenges in management of blood transfusion services.

KENYAN BLOOD TRANSFUSION POLICY

- Kenya is a signatory to World Health Assembly Resolution (WHA 28.72) of 1975 and Regional Commonwealth Ministers of Health Resolution of 1989 which requires:
 - Each member state to develop a comprehensive, well coordinated blood transfusion service, based on voluntary, non-remunerated blood donation.
 - Each member state to make provision for safe blood to the people a national priority.

...KENYAN BLOOD TRANSFUSION POLICY

- In different countries the mandate to coordinate national blood transfusion services are entrusted to specific organizations, eg. Red Cross, Red Crescent, AABB, etc.
- In Kenya this mandate has been given to National Blood Transfusion Services (NBTS):
 - It is a unit under National Public Health Laboratories Services (NPHLS).

...KENYAN BLOOD TRANSFUSION POLICY

- The GOAL of NBTS is to provide safe blood whenever it is needed, through creating a strong, efficient, and self sustaining national blood transfusion service capable of meeting all the needs of the country.

...KENYAN BLOOD TRANSFUSION POLICY

- ❑ NBTS is managing the blood transfusion program through:
 - National Blood Transfusion Centre (NBTC), located in Nairobi.
 - Regional Blood Transfusion Centres (RBTC), located in Mombasa, Embu, Nyeri, Nakuru, Eldoret and Kisumu.
 - Satellite Centres—Naivasha, Eldama-Ravine, Kericho, Kisii, etc.
 - Primary Hospital Blood Banks—though being discouraged/phased out.

...INTRODUCTION

- ❑ The STRATEGY of NBTS to fulfill its mandate include the following:
 - Proper organizational structures of the blood transfusion services.
 - Recruitment of safe blood donors.
 - Screening of units of blood for Transfusion Transmissible Infections (TTIs).
 - Ensuring appropriate clinical use of blood and blood products;
 - eg. issue transfusion guidelines.

BLOOD DONOR RECRUITMENT

- The following are the different types of blood donors (sources):
 - Family / replacement donors — donate blood for a specific/ known recipient.
 - Voluntary / unpaid donors—donate blood to be given to whoever needs it.
 - Commercial / paid donors—donate blood in exchange for money or favours.
 - Autologous donors—donate blood for his / her anticipated use / need.

...BLOOD DONOR RECRUITMENT

Criteria for qualification as a blood donor are:

- Healthy individual: normal BP and Pulse, not on medications, no history of exposure to TTIs.
- Age: 16 to 65 years.
- Weight: 50 kg and above (45—50 kg may be allowed in exceptional circumstances).
- Haemoglobin level: 12.5 g/dl and above (for Autologous 10 g/dl and above).
- Donated blood last not less than 3 months ago (in special circumstances 2 months interval may be allowed).
- Willing to declare his/her health status both present and past.

...BLOOD DONOR RECRUITMENT

Safe Donor: That person who knows that she/he is at a low risk of TTIs and is willing to give blood voluntarily on a regular basis.

Advantages:

- Are not under pressure to give blood therefore are more likely to meet the national criteria for low risk donors.
- Are willing to donate blood on a regular basis which is important in maintaining adequate supply of blood.
- Are at low risk of TTIs because they have been educated about the importance of safe blood and are screened each time they attend to give blood.
- Are more likely to respond to an appeal for blood donation during an emergency because they have already expressed commitment to voluntary blood donation.

BLOOD COLLECTION, PROCESSING AND STORAGE

Methods of blood donations are:

- Whole blood donation (commonest):
 - All blood components are collected together.
- Apheresis donation:
 - Only required component(s) is/are donated /collected.
 - Uncommon and requires expensive equipment.

BLOOD COLLECTION

- Donor is screened to ensure normal criteria set for low risk donors is met:
 - verbal interview.
 - through questionnaire.
- After disinfecting the skin:
 - wide bore needle (G.18) is inserted into a forearm vein.
 - blood is collected by gravity through the connecting tubing into a plastic bag containing anticoagulant.

...BLOOD COLLECTION

- Commonly used anticoagulant:
 - CPDA-1 (Citrate Phosphate Dextrose with Adenine).
 - Previously it was ACD and CPD (Acid Citrate Dextrose & Citrate Phosphate Dextrose).
- CPDA-1 preserves blood for 35 days while ACD and CPD do it for 21 days.
- When SAGM (Sodium Adenine Glucose Mannitol) solution is added to CPDA-1 blood can be preserved for up to 42 days.

...BLOOD COLLECTION

Actions of ingredients of anticoagulant solutions:

- **Citrate** :- Prevents coagulation by chelating calcium.
- **Dextrose** :- Supports ATP generation by glycolytic pathway.
- **Sodium di-phosphate** :- Prevents fall in pH.
- **Adenine** :- Synthesizes ATP, increases level of ATP, and extends the shelf life of red blood cells to 35 days.

...BLOOD COLLECTION

- Each donation is 450 mls to 500 mls.
 - Half filled bags are normally discarded.
- The donated blood is immediately placed in a transport box which is maintained at a temperature of +20 to +24 degrees Celsius for not more than 6 to 12 hours.

BLOOD PROCESSING

Testing /laboratory screening for TTI:

- HIV (1 &2)
- Hepatitis B virus (HBV)
- Hepatitis C virus (HCV)
- VDRL for Treponema pallidum (Syphilis)
- Others : Malaria, Chaga's disease (T. cruzi), Leishmaniasis, CMV (Cytomegalovirus)

Blood Grouping:

- A B O
- Rhesus

...BLOOD PROCESSING

Separation of Whole Blood (Hct 40%) into blood components:

- Packed Red Blood Cells (PRBC) :-
 - 250 mls adult packs (Hct 70%).
 - 125 mls paediatric packs (Hct 70%).
- Platelets :- 50 mls packs.
- Fresh Frozen Plasma (FFP) :-
 - 220 mls; contains all coagulation factors.
- Cryoprecipitate :-
 - 15mls; has fibrinogen, factor VIII, XIII and von Willebrand.

BLOOD STORAGE

Whole blood and blood components are required to be maintained at specific temperatures (cold chain) for them to be useful when transfused.

□ Whole blood :-

Stored at +2 to +8 deg. C :-

*Up to 21 days in ACD or CPD.

*Up to 35 days in CPDA-1.

*Up to 42 days when SAGM is added to CPDA-1.

...BLOOD STORAGE

- Packed Red Blood Cell :-
 - +2 to +8 deg. C and duration as for whole blood.
- Plasma :-
 - +2 to +8 deg. C for up to 5 days.
 - minus-18 deg. C or below for up to 5years.
- Fresh Frozen Plasma :-
 - minus-18 deg. C or below for up to 1 year.
- Platelets Concentrate :-
 - Room Temp. with agitation for up to 5 days.
- Cryoprecipitate :- minus-18 deg. C for up to 1 year.

AUTOLOGOUS BLOOD DONATION

Donation can be done as whole blood or by apheresis in one of the following ways:

- Pre-operative:
 - Blood is drawn before a planned surgery and stored until needed.
- Intra-operative haemodilution:
 - Blood is collected at the start of surgery and then infused during or at the end of the procedure.
- Blood salvage:
 - Blood is salvaged from the surgical field and infused during or after the surgical procedure.

...AUTOLOGOUS BLOOD DONATION

Advantages Autologous blood donation:

- Prevents transmission of TTIs.
- Prevents blood transfusion reactions.
- Provide reassurance to donor—recipient.
- To stockpile rare blood groups.

Disadvantages of Autologous blood donation:

- Adverse reaction to donation.
- Unnecessary loss of blood units if operation is postponed or transfusion is not needed.
- Increased work load to blood bank: ie needs special labeling and storage facilities.

THE FUTURE

Due to increased demand for blood which outstrips the supply:

- **Blood Substitutes (artificial blood or blood surrogates)** are being developed.
 - Being used to fill fluid volume and/or carry oxygen and other blood gases in the cardiovascular system.
 - The preferred and more accurate terms are :-
 - Volume expanders for inert products.
 - Oxygen therapeutics for oxygen carrying products

...THE FUTURE

Volume expanders: -

- Inert and merely increase blood volume.
 - Crystalloids: eg. Ringer's lactate, normal saline, D5W
 - Colloids:-eg. Haemacel, Dextran, Voluven, Gelofusin.

Oxygen therapeutics: -

- Mimic human blood's oxygen transport ability.
 - Per fluorocarbon based: eg. Oxygent, Oxycyte, Perftoran, etc.
 - Haemoglobin based: eg. Hemopure, Oxyglobin, PolyHeme, Dextran-Haemoglobin, etc.

...THE FUTURE

Stem Cell: -

- Recently the scientific community has begun to look at the possibility of using stem cells as a means of producing an alternative source of transfusable blood.

SPECIAL CONCERN

- Jehovah's Witnesses cannot accept donor packed red cells, platelets, white cells or plasma, and cannot accept autologous or cell-cycled intraoperative transfusion.
- The sect leadership used to be militantly anti-immunization, anti-germ theory, and anti-transplantation as well.

