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Outcome of Surgical Patients with Transfusion of Previously Deposited Autologous Blood in Elective Surgical Scenario

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Abstract: *This study was done to evaluate the outcome of surgical patients, who deposited blood for autologous transfusion[1], where blood transfusion is anticipated. 93 out of 321 patients who underwent major surgical procedures and who needed blood transfusion were taken up for the study.30 out of 93 patients donated blood preoperatively for intra operative and immediate post operative autologous transfusion. All the patients were informed of the study and taken consent for pre deposition of blood. Their hemoglobin and Hematocrit values were compared both in the preoperative period and at the time of discharge. Pre deposited autologous transfusion[2] eliminated the immunological reactions and risk of infections which are associated with homologous blood transfusion. Hemodilution reduces the viscosity and improves micro-vascular perfusion, accelerates erythropoiesis[3] leading to rapid recovery after blood loss during major surgery. Acceptable Hb% and ASA class I & II be counseled that the safest blood one can receive is his own.*

Key Words: *autologous blood, Erythropoiesis, Hemodilution, Infection, Predeposition.*

I. Introduction

Blood is the essence of life. Blood in the human being seems to carry in it the secrets of one's individuality. Oxygen carrying capacity is increased only with transfusion of blood especially in case of bleeding. Blood transfusion was established as a technically feasible procedure in 20thcentury. But it was the noble prize winning discovery of ABO blood groups by Karl Landsteiner in 1901 that laid the true scientific foundation for the safe blood transfusion and resulted in the birth of immuno-haematology as a speciality.

The next leap forward was the introduction of citrate as anti-coagulant and later on the observation of the stabilizing effects by adding Glucose. Then the beneficial effects of acidification on red cells preservation introduced to prevent caramelization as observed by Loutit Mollison in 1940's resulted in Acid-Citrate-Dextrose solution. However a homologous blood transfusion causes a variety of immunological reactions[4] and transfusion of various lethal infections. Potential complications of homologous transfusion include

(1) Acute hemolytic reactions
(2) Delayed hemolytic reactions
(3) Allo- immunization
(4) Allergic and febrile reactions
(5) Transfusion of infections like HIV, Hepatitis B[5], Hepatitis C and Cytomegalovirus. HIV is a tragic example Of lethal infectious agent which enters into blood and remains undetected due to long latency Period (Window period) [6].
(6) Several other infections have also been transmitted by homologous blood transfusion like Malaria, Syphilis, Yersinia Enterocolitica, Herpes, Epstein Barr Virus, Toxoplasmosis, Trypanosomiasis, Leishmaniasis, Brucellosis, Typhus, Filariasis, Measles and Salmonella.
(7) Other adverse effects of blood transfusion are
   a) Graft Vs Host reaction
   b) Acute lung injury
   c) Adverse ocular reactions
   d) Transfusion induced immune suppression

All these complications elucidate the necessity for alternative blood replacement method that is autologous transfusion.

The term Autologous blood transfusion describes any transfusion of blood that has originated within the intended recipient. In 1818 Blundell tried in the postpartum cases. Emendroff did some documented trials during First World War (1914- 1918) with encouraging results. After 1962 autologous transfusion was undertaken in large scale and from 1980's there has been a four-fold increase in its utilization in western

countries. Autologous blood transfusion is making a slow progress in India due to unfounded apprehension of patients and reluctance of the treating doctors.

Autologous blood transfusion may take the form of blood pre deposited in advance of scheduled surgery and transfused during the surgery and 1st post-operative day. Comparison of Hb%, Hematocrit, Pre-phlebotomy and Post-phlebotomy and also at the time of discharge is done.

II. Materials And Methods

The materials for this study were patients undergoing major surgical, Gynecological[7] and urological procedures in one year period. Permission from hospital ethical committee was obtained. Total number of elective surgeries during this period was 321 in which the study group constituted 93 who underwent major surgeries with expectant loss of blood. Routine blood order was placed. 30 patients among these predeposited autologous blood. Present study is based on them. Patients were informed of the diagnosis and the nature of surgery, the need for blood transfusion with the possible sources and risks of homologous transfusion.

30 patients who agreed for Predeposition of blood, phlebotomy was done at least 3 days prior to the proposed date of the surgery with the patient's written informed consent. All the patients received oral ferrous sulphate 200mg tablets thrice daily.

2.1 Inclusion criteria: 18-75 years with relaxed weight limits, Hemoglobin >10 gm%, Hematocrit 33%, ASA I and II were included.

Estimation of hemoglobin content, PCV, Rh typing, bleeding time, clotting time, screening for HIV, HbsAg and VDRL were routinely done for all patients. Phlebotomy was done and unit (300 ml) of blood collected, labeled "**for autologous transfusion"** and kept in refrigeration in a separate rack. Post phlebotomy Hemoglobin and PCV were recorded 24hrs and at the time of discharge. Blood was transfused intra operatively. Patients were observed for transfusion reactions and the results of the study were recorded and analyzed.

III. Results

Table 1: Major elective operation for which blood was predeposited

Operative procedure	Total number	%(n =30)
Abdominal hysterectomy	12	40
Mastectomy with axillary clearance	4	13.3
Prostatectomy[8]	4	13.3
Radical neck dissection	2	6.7
Parotidectomy	2	6.7
Wertheim's hysterectomy	2	6.7
Cholecystectomy	2	6.7
Excision of neurofibroma	1	3.3
Pyelolithotomy	1	3.3

Table 2: Comparison of Hemoglobin and Hematocrit values

The mean Hemoglobin and Hematocrit values are shown in the table:

	Pre phlebotomy	Post phlebotomy(24hrs later)	Postoperative (at discharge)
Hb (gm %)	10.84	10.50	10.28
PCV	33.6	31.73	29.73

None of the patients had adverse transfusion reactions. Only 2 patients experienced minor donor reactions (6.66%) in the form of giddiness and sweating immediately after phlebotomy and recovered in 30 minutes with bed rest. The data and observations of the present study were analyzed and compared with other studies.

IV Discussion:

An autologous blood transfusion involves collection, storage and reinfusion of patients own blood. The indication for autologous blood is simple and straight forward, any patient who is facing elective surgery where blood loss is expected and requires replacement of blood during intra-operative or postoperative period.

4.1 Benefits:

1. No transmission of diseases
2. No risk of immunization to erythrocyte, leukocyte, platelet or protein antigens.

3. Viscosity is reduced which improves tissue oxygen perfusion.
4. Erythropoiesis is stimulated.
5. In rare blood groups, Jehovah's Witness it is the only possibility.
6. Tests for compatibility are not necessary.
7. Reduces the demand for homologous blood supply in remote areas.
8. This may be used as homologous transfusion for other patients in need.
9. Homologous blood may be redirected for other purposes e.g. Research

4.2 Classification

Autologous transfusion may be broadly classified into 4 types
1. Predeposit type: phlebotomy before surgery
2. Acute normovolemic Hemodilution[9].
3. Intra-operative blood recovery.
4. Postoperative blood recovery.

Predeposited autologous blood transfusion is discussed in detail

4.3 Donation Criteria

1. Patients who are healthy enough to undergo elective surgery[10] will be able to donate blood preoperatively.
2. Hemoglobin levels should be 10-11gm% (never below 10gm %)
3. Hematocrit of the patient should be greater than 34%.
4. Donations are scheduled at weekly or 4 days interval but the last donation should be not less than 72 hours Prior to surgery.
5. There is no age limit. The lower age limit is the child's capacity to understand and co-operate for intra Vascular access.
6. Weight: 12%of estimated blood volume can be withdrawn from a healthy adult donor, where as patient Weighing <50kgs blood is drawn at a rate of 8 ml/kg.

4.4 Contraindications:

1. Bacterial infection.
2. Patients with cardiac disease[11], angina, CAD, CHF, MI, Hypertension, aortic Stenosis.
3. Impaired placental flow: Pregnant with PIH, toxemia, diabetes mellitus.

One or two units of blood are obtained at one week interval minimum of 24-72 hrs prior to surgery. Two units of colloid or crystalloid are given after phlebotomy to compensate the volume and protein deficit. The patient is supplemented with oral iron.

4.5 Processing of autologous units:

With CPDA1 Preservative the blood is stored as liquid whole blood; the shelf life is 35 days. Separation into plasma and RBC allows addition of preservative solution (adsol, nutricel) extends the shelf life of RBC to 42 days. The plasma can be frozen or retained in liquid state.

4.6 Testing autologous blood:

Predonated units are conspicuously labeled as AUTOLOGOUS and the patient's - donors name and identifying number are written on the attached tag. Blood group of the patient should be clearly mentioned on the bag. Cross matching is not necessary. These bags are put in the refrigerator in a separate rack with a tag of autologous blood.

Predonation stimulates erythropoiesis.RBC production in autologous donor depends on adequate iron stores and is influenced by the number of units donated and the frequency of donation. Twice weekly phlebotomy is associated with greater erythropoiesis than weekly donation.

4.7 Disadvantages:

1. Complex logistics for collection storage, and transfusion of the correct unit in the appropriate patient.
2. Tendency to over transfuse because it is there.
3. Surgery is delayed, blood may be outdated.
4. Patient may become grossly anemic by either too frequent donation or Hemodilution.

Table 3: Immunological Complications[4] of Homologous Blood Transfusion

Red cells	Hemolytic reactions 1.Immediate 2.Delayed	 0.02% 0.2%
White cells	Febrile reactions Pulmonary infiltrates	5-10% <0.01%
Platelets	Post transfusion Purpura	<0.01%

Table 4: Immune red cell destruction (Contreras.M.1990)

Site of destruction	**Predominantly Intra vascular**	**Predominantly extra vascular**
Characteristics of anti bodies	Potent , lytic anti – A and Anti - B	Anti bodies do not or only partially activate complement . (Anti – Rh), anti – JK and others)
Symptoms	Substernal pain , lumbar pain , restlessness	Nausea , shivering
Signs Immediate	Hypotension , fever, uncontrolled bleeding	Fever
Late	Haemoglobinuria	Jaundice

Incompatible transfusions are given when patient is wrongly identified because of
(1) Unconsciousness (During operation).
(2) Wrist band removed during operation.
(3) Human error.

Table 5: Frequency of symptoms from Hemolytic transfusion reactions in 40 patients. (Stehling. L. 1999)

Sign or Symptom	**No. of patients**
Fever	19
Fever and chills	16
Chest pain	6
Hypotension	6
Nausea	2
Flushing	2
Dyspnoea	2
Haemoglobinuria	1

4.8 Transfusion induced Immuno-depression: Homologous blood transfusion exerts a non specific immune-suppression on the recipient; this effect is therapeutic for kidney transplant recipients. However blood transfusion increases the susceptibility to infections and enhances the progression of malignant tumors. This is due to increased synthesis of Prostaglandin E, decreased Interleukin-2 generation and Fibrin degradation products. Transmission of HIV by transfusion is extremely rare since the introduction of screening, but possibility of transmission by "seroconverting "donor during window period (negative for HIV antibody but infectious because of recent infection).

Table 6: Infectious agents transmissible in blood

Virus	Post transfusion hepatitis	**Hepatitis -B, Hepatitis - C, Hepatitis-G and GB agents, TTvirus, cytomegalovirus, Epstein Barr virus**
	Cytomegalovirus	(Dangerous in immunocompromised)
	Epstein Barr Virus	Infectious mononucleosis
	Human immune deficiency virus	AIDS
	Parvo virus B19	
	HLTV -1	Adult T cell leukemia / lymphoma
Bacteria (rare)	Syphilis , Brucella, gram negative organisms (E coli, pseudomonas, Proteus etc)	
Protozoa	Malaria Toxoplasmosis Chagas disease African Trypanosomiasis Visceral Leishmaniasis	

Inspite of these advantages Predeposition of blood is not widely used due to the patient's ignorance and treating doctor reluctance.

V Summary:

A detailed account of risk of homologous transfusion and benefits of autologous transfusion with emphasis on "predeposited autologous blood transfusion" has been presented in the study.321 patients underwent various surgeries among these30 were counseled for Predonation, patients with rare blood groups like AB+ve, B-ve and O-ve predeposited their blood. Mean Hemoglobin %and Hematocrit preoperatively, Post phlebotomy and postoperatively were studied. There is very minimal difference in the values (10.84, 10.5 and 10.2 at the time of discharge), whereas Hematocrit values are 33.63%, 31.73%, 29.73%respectively. 23 Patients (76.7%) were transfused only with autologous blood. None of the patients experienced transfusion reactions.

VI Conclusion:

Predeposition of autologous blood should be encouraged when patients undergoing elective surgery require transfusion. Age, sex, weight do not exclude anyone from Predeposition of blood as proved in various studies. Incidence of post phlebotomy reactions was very minimal when compared among voluntary donors. This eliminates immunological and infectious risks. Therefore autologous blood transfusions lower morbidity, mortality and health care costs[12]. Predonation of autologous blood results in Hemodilution[13], reduction in blood viscosity and improves the Micro vascular perfusion per operatively. Predeposition stimulates the marrow which leads to rapid recovery of blood lost during surgery, by increased production of red cells and accelerates erythropoiesis postoperatively. The patients with acceptable hemoglobin level and ASA Class I and II be counseled that "**the safest blood a person can recieve is his own".**

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