

A Comparative Study Of Autologous Versus Homologous Blood Transfusion During General Surgery

D Udani, M Porecha, S Mehta, M Vaghela, D Doshi

Citation

D Udani, M Porecha, S Mehta, M Vaghela, D Doshi. *A Comparative Study Of Autologous Versus Homologous Blood Transfusion During General Surgery*. The Internet Journal of Surgery. 2008 Volume 19 Number 2.

Abstract

The objective of this study was to find out whether autologous blood transfusion will avoid homologous blood transfusion or not in our set-up during general surgery and to find out advantages and disadvantages of autologous blood transfusion. The aim was also to realize whether autologous blood transfusion can be introduced on a large scale in General Surgery.

INTRODUCTION

Autologous blood transfusion can be defined as 'Retransfusion of whole blood or its components which has been donated by intending recipient'. A recipient, who serves as his or her own donor, receives the safest possible transfusion. So, the autologous blood transfusion is one of the safest procedures to avoid the hazards of blood transfusions like HIV, HBV, HCV etc., immune-related problems, intravascular hemolysis and circulatory overload. This study is a sincere effort towards providing the data about predonated autologous blood transfusion in the clinical field.

CATEGORIES OF AUTOLOGOUS BLOOD TRANSFUSION

- Acute Normovolaemic Haemodilution (ANH) and short term storage of blood.¹
- Predeposited autologous blood donation.¹
- Intra-operative cell salvage method.¹³
- Post-operative cell salvage method.¹

ANH is preferred in the present study because it is convenient, as it is performed just before the time of surgery on the operation table, no help from the blood bank is required and we can also monitor hemodynamics as well as haematological changes before, during and after hemodilution.

MATERIAL AND METHODS

The study was performed by using one of the methods of

autologous blood transfusion, which is Acute Normovolaemic Haemodilution and short term storage of blood, in which blood is withdrawn just before the induction of anaesthesia with simultaneous infusion of crystalloids to maintain the blood volume.

Thirty patients, admitted from November 2007 to October 2008 in different surgical wards of G.G.Hospital, Jamnagar, were selected (group A).

Thirty control patients, admitted during the same period were selected who received homologous blood transfusion during surgery (group B). In both groups, expected blood loss was 350cc or more.

All the patients were screened for HIV, HBsAg, syphilis, etc., before the selection.

The criteria for patient selection were

- Age: 20-50yrs
- Weight: >45kg
- Hb%: >10g
- Haematocrit: >30%.

All the patients were explained the advantages of this method and written consent was taken from all the patients before surgery. Permission from the ethical committee was taken for this study.

Patients were premedicated for surgical operation whenever required. Patients were taken to operation theater and all

vital parameters were recorded.

THE TECHNIQUE WAS AS FOLLOWS:

A pre-operative blood sample was collected to measure Hb% and haematocrit values one day prior to surgery. Two blood pressure cuffs were applied on both arms, one for tapping the blood and other for blood pressure measurement. Before collection of blood CPD-A (Citrate Phosphate Dextrose-Adenine) bags were tested for patency and each bag was tilted to fill the system with CPD-A solution to avoid coagulation at the time of collection.

Equipments listed below were kept ready:

- CPD-A plastic bags with a capacity of 350ml containing 49ml of anticoagulant
- EDTA bulbs
- Sphygmomenometer, weight scale, syringes with needles
- Betadine, Spirit, Sevlon
- Sterile cotton swabs, bandages
- Emergency drugs, Oxygen cylinders, bag and masks, laryngoscope and trachea tubes

The antecubital area of the arm was selected for collection of blood. The blood pressure cuff was inflated just above the initial diastolic pressure and a selected vein was punctured with a 16G needle which is incorporated with the CPD-A bag. The bag was shaken gently at time intervals to avoid coagulation during tapping; 350ml of blood was withdrawn within 10min and simultaneously the solution of Ringer's Lactate (3 to 4 times more than the withdrawn blood) was infused fast. As soon as the required amount of blood was collected, the tubing was clamped with a plastic clip, the blood pressure cuff was deflated, the needle with the tubing was removed from the puncture site, a sterile swab was placed over the site and a tight pressure bandage was applied. Once haemodilution with Ringer's Lactate was completed, a second blood sample was taken for measurement of Hb% and Haematocrit. Before giving the autologous blood, again a sample of blood was taken to measure Hb% and Haematocrit. Once the autologous transfusion was over, another blood sample was taken for measurement of Hb% and Haematocrit. A fourth sample was collected 24hrs. after surgery, a fifth sample on the seventh

post-operative day. In the ward, all the patients were watched for development of post-operative complications.

OBSERVATIONS AND RESULTS

The present study of autologous blood transfusion includes 30 patients .A comparison was done with 30 patients in the control group, undergoing the same surgical procedure and receiving homologous blood transfusion.

Figure 1

Table 1: Demographic Data

	Group A	Group B
Total no. of patients	30	30
Age (yrs)	20-50	20-60
Sex	Male (%)	24 (80%)
	Female (%)	6 (20%)
Weight (kg)	>45	>45
Blood loss (ml)	403.33	443.33

The surgical procedures were as below:

Figure 2

Table 2: Surgical Procedures (Autologous Group)

Name of operation	No. of patients
Pyelolithotomy with rib resection	16
Nephrolithotomy	01
Exploratory Laparotomy	01
Amputation	03
Below Knee	03
Above Knee	03
Thyroidectomy	03
Right Hemicolectomy	03
Total	30

Figure 3

Table 3: Surgical Procedures (Homologous Group)

Name of operation	No. of patients
Pyelolithotomy with rib resection	15
Nephrolithotomy	02
Exploratory laparotomy	02
Amputation	03
Below Knee	02
Above Knee	02
Thyroidectomy	03
Right Hemicolectomy	03
Total	30

Figure 4

Table 4: Changes In Haemoglobin %

Hb%	Group A	Group B	P value	conclusion
Pre operative	12.46	10.64	<0.01	H.S.
After A.N.H.	11.56	-	<0.01	H.S.
Before B.T.	10.98	9.44	<0.01	H.S.
After B.T.	11.59	9.55	<0.01	H.S.
Post-op. 1 st day	11.40	9.53	<0.01	H.S.
Post-op. 7 th day	12.23	10.12	<0.01	H.S.

H.S. = Highly Significant

Figure 5

Table 5: Changes In Haematocrit %

Haematocrit %	Group A	Group B	P value	conclusion
Preoperative	38.21	32.80	<0.01	H.S.
After A.N.H.	33.69	-	<0.01	H.S.
Before B.T.	31.44	28.66	<0.01	H.S.
After B.T.	35.12	30.76	<0.01	H.S.
Post-op. 1 st day	33.93	29.54	<0.01	H.S.
Post-op. 7 th day	36.22	31.42	<0.01	H.S.

H.S. = Highly Significant

Figure 6

Table 6: Changes In ANH

	Before ANH	After ANH	P value	conclusion
Hb (g%)	12.47	11.53	<0.01	H.S.
Haematocrit (%)	38.25	33.69	<0.01	H.S.

H.S. = Highly Significant

Figure 7

Table 7: Post B.T. Reactions

	No. of patients	Hemolytic	Febrile
Group A	30	-	-
Group B	30	-	03

DISCUSSION

Normovolemic hemodilution and autologous blood transfusion has gained wide clinical acceptance in saving homologous blood in major surgical procedures. As long as normovolemia is maintained, moderate hemodilution to a hematocrit value of 25-30% is safe during surgery.⁴ In this study, the efficacy of this technique of pre-operative normovolemic hemodilution in the saving of homologous blood as well as comparison between homologous and autologous blood transfusion was observed. Comparison of our study with other studies is shown in the table below.

Figure 8

Table 8: Comparison With Other Studies

Name of authors	n	Age (yrs)	Sex (M:F)	Avg Blood Withdrawn	Avg. Blood Loss
Shah et al. ⁵	40	18-60	28:12	-	900 ml
Biboluzet et al. ⁶	20	18-55	-	926 ml	1000 ml
Khanma et al. ⁷	40	18-50	18:02	837 ml	1142 ml
Kaul et al. ⁸	20	18-60	14:06	855 ml	>1000 ml
Current study	30	20-50	27:03	350 ml	403 ml

Comparative table of Hb (g%) and Haematocrit, reported by various authors:

Figure 9

Table 9: Comparison Of HB (G%) And Haematocrit

Names of Authors	Hb (g%) before ANH	Hb (g%) after ANH	Haematocrit before ANH	Haematocrit after ANH
Shah et al.	12.25	10.53	-	-
Biboluzet et al.	12.40	09.56	38.00	29.00
Khanma et al.	13.08	09.19	-	-
Kaul et al.	11.46	09.00	34.30	27.13
Current study	12.45	11.53	38.21	33.87

The results above clearly show that the findings of Hb% of the current study are exactly in accordance with those reported by other workers. Also the changes in Haematocrit value during haemodilution are well comparable with the other studies.

THE ADVANTAGES OF AUTOLOGOUS BLOOD TRANSFUSION ARE:

- Elimination of risk of hemolytic, febrile and allergic reactions.
- It eliminates the risk of transfusion-transmitted

diseases like AIDS, hepatitis, syphilis, viral diseases, etc.

- It prevents allo-immunization of red cells, leucocytes, platelets, plasma proteins, etc.
- It provides “fully compatible” blood in immunized patients.
- It is useful in patients having rare blood groups.
- In patients having multiple allo-antibodies, autologous blood transfusion is the safest source of blood.
- It is also very helpful to the patients who deny homologous blood transfusion due to religious believes.
- It provides blood in the remote areas where facilities of a blood bank are not available.
- It decreases the load on blood banks.
- It improves microcirculation flow due to reduction in the viscosity of blood and also improves tissue oxygen perfusion.
- It minimizes the amount of homologous blood required during surgery.
- It stimulates erythropoiesis in the pre-operative period.
- Unused blood can be used as homologous transfusion to the other patients.
- No alteration in biochemical and haematological parameters like pH, potassium, diphosphoglycerate and other elements of blood.
- Auto-sterilization property of tapped blood is maintained because it contains opsonins and phagocytes which are unstable in stored blood.
- Non dependence on voluntary donors.

THE DISADVANTAGES OF AUTOLOGOUS BLOOD TRANSFUSION ARE:

- Complex logistics for collection, storage and transfusion of the correct unit to the appropriate patient.

- If the surgical procedure is delayed, blood may become outdated.
- When the patient requires multiple transfusions, it cannot be used as a sole means of transfusion.
- Bacterial contamination may be there, especially with the intra-operative blood salvage method.

CONTRAINDICATIONS OF AUTOLOGOUS BLOOD TRANSFUSION ARE:

- In severely anemic patients.
- In patients with severe cardiovascular and respiratory illness.
- In immunocompromised patients.
- In patients having bleeding and coagulation disorders.
- In active bacterial infection and advanced malignancy.

CONCLUSION

From this study, we can conclude that autologous blood transfusion by using acute normovolemic hemodilution is a safe, simple and easy procedure, especially when there is a shortage of blood for various surgical procedures. As already narrated above, it has the following advantages:

- Elimination of the risk of hemolytic, febrile and allergic reactions.
- It eliminates the risk of transfusion-transmitted diseases like AIDS, hepatitis, syphilis, viral diseases, etc.
- It prevents allo-immunization of red cells, leucocytes, platelets, plasma proteins, etc.
- It provides “fully compatible” blood in immunized patients.
- It is useful in patients having rare blood groups.
- In patients having multiple allo-antibodies, autologous blood transfusion is the safest source of blood.
- It is also very helpful to the patients who deny homologous blood transfusion due to religious

believes.

- It provides blood in the remote areas where facilities of a blood bank are not available.
- It decreases the load on blood banks.
- It improves microcirculation flow due to reduction in the viscosity of blood and also improves tissue oxygen perfusion.
- It minimizes the amount of homologous blood required during surgery.
- It stimulates erythropoiesis in the pre-operative period.
- Unused blood can be used as homologous transfusion to the other patients.
- No alteration in biochemical and haematological parameters like pH, potassium, diphosphoglycerate and other elements of blood.
- Auto-sterilization property of tapped blood is maintained because it contains opsonins and phagocytes which are unstable in stored blood.
- Non dependence on voluntary donors.

The WHO has already emphasized autologous blood transfusion and nowadays, autologous blood transfusion needs more awareness and promotion amongst doctors as well as patients: “BE YOUR OWN BLOOD DONOR”.

CORRESPONDENCE TO

Dr.Dhaval L. Udani “Matruchhanya” Paras Society 2. Plot No.26. Jamnagar.361002 Gujarat, India. Cell No. – 09879516191, 02882676191 E mail address - drudani_udani@yahoo.com

References

1. P.L.Mollison, C.P.Engelfriet, Marcola Contereras: Blood Transfusion in Clinical Medicine, 10th edition. Blackwell Science Ltd., Oxford, 1997:9-12.
2. Pinkerton PH, Covens A: Autologous blood transfusion. Transfusion Medicine 1996; 3:223-225.
3. Wylie and Churchill-Davidson's A Practice of Anaesthesia, 6th edition. Llyod Book Ltd., Great Britian 1995:89-92.
4. Sir John V. Dacie: Practical Haematology, 8th edition. Churchill Livingstone, Hong Kong 1994:50-52.
5. Damyanti Shah: Pre-operative hemodilution and autologous transfusion in major general surgery. Ind J Int Med 1991; 1:127.
6. Biboulet P, Capdevila X, et al.: Hemodynamic effects of

moderate normovolaemic hemodilution in conscious and anesthetized patients. Br J Anaesth 1996; 76:81-84.

7. Khanna M, Kaul HL, et al.: Autotransfusion using

normovolemic hemodilution in adult surgical patients. J Anesthesia Clin Pharmacol 1998; 14:11-16.

8. Kaul HL: Autotransfusion using normovolemic hemodilution. Journal of Anesthesia 1999; 14:23.

Author Information

Dhaval L. Udani, M.S.

Assistant Professor, Department of General Surgery, M.P.Shah Medical College and G.G.Hospital

M.M. Porecha, M.S.

Associate Professor, Department of General Surgery, M.P.Shah Medical College and G.G.Hospital.

S.G. Mehta, M.S.

Senior Professor and Head of Department, Department of Surgery, M.P.Shah Medical College and G.G.Hospital.

Mayur Vaghela, M.S.

Assistant Professor, Department of Surgery, M.P.Shah Medical College and G.G.Hospital.

Dimple Doshi, M.D.

Senior Consultant, Obstetrics and Gynaecology, M.P.Shah Medical College and G.G.Hospital.