International Journal of Advances in Medicine
*Saksena S et al. Int J Adv Med. 2018 Jun;5(3):536-541*
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: http://dx.doi.org/10.18203/2349-3933.ijam20182071

**Original Research Article**

# Comparison of the efficacy of autologious blood transfusion combined with preoperative hemodilution, with homologous blood transfusion in patients undergoing elective surgical procedure

**Sanjay Saksena[1], Namrata Jain[1]*, Alok Dixit[2]**

[1]Department of Anaesthesiology, CHRI Gwalior, Madhya Pradesh India
[2]Department of Pathology, Dixit Diagnostic Center, Gomati Nagar, Lucknow, Uttar Pradesh, India

**Received:** 11 April 2018
**Accepted:** 28 April 2018

***Correspondence:**
Dr. Namrata Jain,
E-mail: drsachinjainortho@gmail.com



## ABSTRACT

**Background:** To study the changes in haemogram and coagulation profile in patients undergoing autologous and homologous blood transfusion and suitability of the technique of autologous blood transfusion in routine blood bank management.
**Methods:** Patients who were waiting to undergo elective surgical procedures were randomly distributed in two groups, Group A: Autologous blood transfusion, with or without haemodilution: wherein pre-operative period a predicted volume of blood was collected and Group B: Homologous blood transfusion: where required blood was arranged from Blood Bank. The cardiovascular status, the haemogram and the coagulation profile were recorded at various stages.
**Results:** Out of 240 patients registered only 43 could fulfil the basic requirements only 25 could be motivated in each group. In Group A cases were of age group 51-60 years while it was 41-50 years in Group B. Male:Female ratio was 2:1. 47 Units were retransfused to Group A patients, Group B cases received 45 blood transfusions. In Group A patients 8% cases showed mild hypotention and 1% showed mild hypersensitivity to Haemacel. In Group B, 40% cases showed transfusion reactions. Fall in Hb was lesser in Group A (2.4) on first and (1.7) on second postoperative day compared to Group B (3.3) on first and (2.7) on second postoperative day. The haematocrit levels declined more sharply after operation in Group B (7) rather than Group A (10.4).
**Conclusions:** Advantage of avoiding transfusion reactions, major changes in blood parameters, entry of infections proves Autologous blood transfusion to be the safest, cost effective and easy form of transfusion therapy.

**Keywords:** Autologous blood transfusion, Homologous blood transfusion Haemodilution

## INTRODUCTION

Blood transfusion dates back to prehistoric times when Asclepius, the Greek god of medicine ventured blood transfusion into Athena, the goddess of wisdom. The scientist over the world have been working on various modalities of transfusion, its pros and cons so as to achieve a state of flawlessness in transfusion process. In spite of developments in transfusion medicine, several complications are directly related to homologous blood transfusion. ABT can avoid the serious harm caused by allogeneic blood transfusion, alleviate blood shortage and save blood resources, while lightening the burden of patients.[1-3] Therefore, ABT has gained more attention, has become a common demand in clinical practice, and is becoming widely used clinically.[4] Although infectious contamination has declined substantially, the most common risk remains viral hepatitis, with a transmission

rate of approximately 1 per 100,000 units transfused.[5] Autologous transfusion (preoperative blood deposit and retransfusion) has been proposed to overcome adverse effects of homologous transfusion. Advantages include elimination of viral infection, transfusion-related lung injury, anaphylaxis, graft-versus-host disease, alloimmunization, and Rh sensitization.[6]

Several blood conservation strategies have therefore evolved. Blood collected from a patient for retransfusion at later time into that same indivisual is autologous blood transfusion. There is decreased demand on the blood bank and cancellation of elective surgeries due to non-availability of blood are avoided. We have preferred to adopt the method of acute preoperative collection and haemodilution by infusion of crystalloids and colloids to make the loss of erythrocytes good.

A comprehensive study has been planned to gauge the sensitivity and safety of autologous blood transfusion, and an attempt to popularize it.

## METHODS

To study the changes in haemogram and coagulation profile in patients undergoing autologous and homologous blood transfusion and suitability of the technique of autologous blood transfusion in routine blood bank management. Patients who were waiting to undergo various elective surgical procedures in which blood requirement was expected provided material for the study.

Target patients selected at random were healthy adult of either sex with no history of any systemic disorder. Patients with hemoglobin less than 12gm % and haematocrite less than 36% or with history of TB, epilepsy, STD's hepatitis, coagulation or renal disorder were excluded. Patients were randomly divided into two groups. Ethics committee approval was obtained, and all patients signed a program consent prior to phlebotomy. Baseline investigations of pulse BP temperature ,respiratory rate, haemogram and coagulation profile were done beforehand.

Group A: Autologous blood transfusion, with or without haemodilution: Under all aseptic precautions phlebotomy was performed in the patient in acute pre-operative period, and a predicted (300,600,900ml) volume of blood was collected in citrate-phosphate-dextrose-adenine(CPDA) 'penpol' blood collecting bags. At the same time, as blood was withdrawn from one arm ,an equivalent volume of plasma volume expander (Haemaccel) or crystalloid (Ringer Lactate)was infused through other arm.

During and after blood collection the test patients were evaluated for signs and symptoms of donation reactions like lower blood pressure, tachycardia and postural hypotension. Patients signed each unit of blood and were transferred to operation theatre. Before induction, blood sample were again drawn for estimation of haemogram and coagulation profile.

Group B: Homologous blood transfusion: No phlebotomy was performed and required blood was arranged from Blood Bank and patients were directly shifted to the operation theatre.

- Stages of blood sample collection:
- Before phlebotomy (in Group A only)
- Before induction of anesthesia
- First postoperative day
- Third postoperative day
- At the time of discharge

Record of parameters: The cardiovascular status, the haemogram and the coagulation profile were recorded at various stages in a proforma. Complete records of number of units of blood withdrawn, volume of fluids transfused during blood collection, approximate blood loss and any complication throughout the study were recorded.

All the observations were analysed statistically using students t test and paired p test.

Time of transfusion: In the autologous group, all patients were administered blood after haemostasis was achieved and closure started, irrespective of the requirement. In the control group homologous blood was only transfused when the blood loss exceeded the tolerable limit.

## RESULTS

Out of 240 patients registered only 43 could fulfil the basic requirements for inclusion in the study. Of these 41.86% could not be motivated, only 6.97%cases were readily motivated, 4.65% were self-motivated, still 46.51% gave the consent for participation in the programme on repeated insisting. In Group A cases were of age group 51-60 years while it was 41-50 years in Group B. There was no case in <10 years and >70 years age group due to unsuitability for predonation.

**Table 1: Participation in Autologous blood donation: Availability of cases.**

| | Cases available | |
|---|---|---|
| | **No.** | **%** |
| Self-motivated | 02 | 4.65% |
| Readily motivated | 03 | 6.97% |
| Motivated on insisting | 20 | 46.51% |
| Could not be motivated | 18 | 41.86% |
| Total | 43 | 99.99% |

Male:Female ratio was 2:1, may be due to fact that Indian females are mostly undernourished and apprehensive about the method.

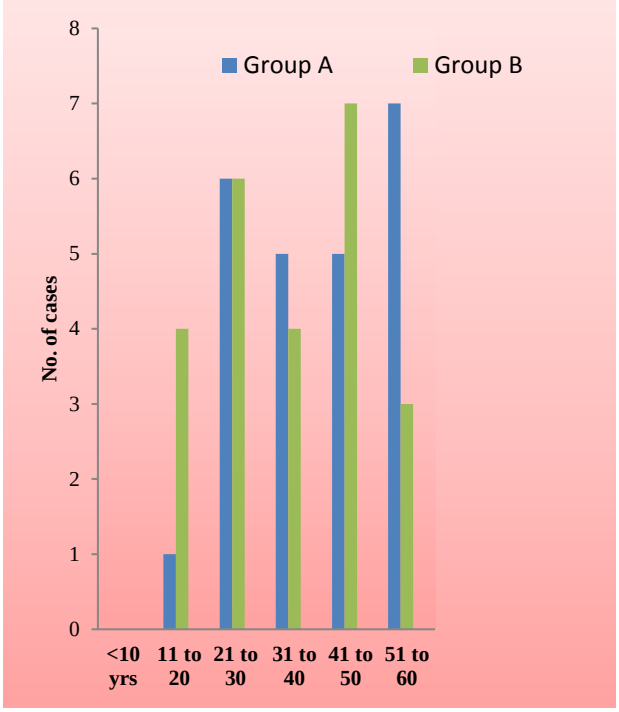


**Figure 1: Age distribution in two groups.**

**Table 2: Sex distribution in two study groups.**

| Sex | Group A | | Group B | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Male | 17 | 68 | 17 | 68 |
| Female | 08 | 32 | 08 | 32 |

A large proportion of cases in Group A (36%) had Rh- blood group compared to (16.5%) in Group B may be explained by the fact that some of the Rh- cases of Group A had no relative donor blood available.

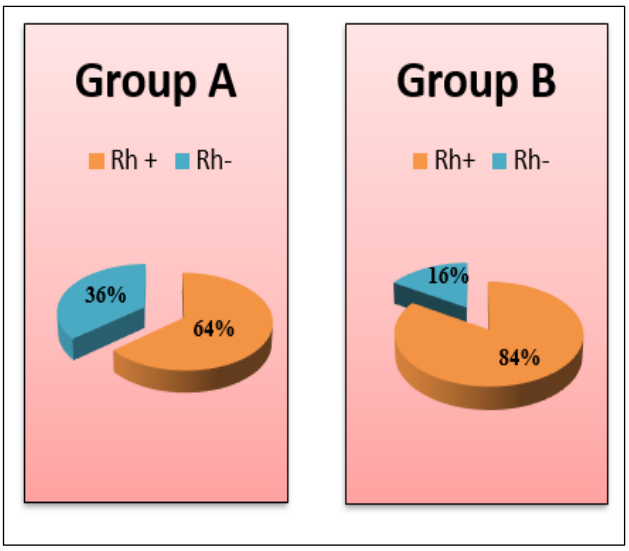


**Figure 2: Distribution of Rh factor in group A**

Majority of cases in Group A belonged to blood group B+ and O+(20% and 20%). Majority of cases in Group B also blood group B+ and O+ (36% and 20%).

**Table 3: Sex distribution in two study groups.**

| | Group A | | Group B | |
|---|---|---|---|---|
| | No. | % | No. | % |
| **Autologous Blood** | | | | |
| One | 09 | 36 | -- | -- |
| Two | 10 | 40 | -- | -- |
| Three | 06 | 24 | -- | -- |
| **Homologous Blood** | | | | |
| One | 02 | 08 | 11 | 44 |
| Two | -- | -- | 08 | 32 |
| Three | -- | -- | 06 | 24 |

In Group A 100% cases received their own blood, with only 8% requiring homologous blood in addition, thus reducing the work load on blood bank. Also, out of 50 autologous blood units collected 47 were retransfused to Group A patients.

So, a net gain of 3 extra blood units to the blood bank. Group B cases received 45 blood transfusions during and after operation. Complications in Group A patients 8% cases showed mild hypotention and 1% showed mild hypersensitivity to Haemacel.

**Table 4: Complication during procedure.**

| Complications | Group A | | Group B | |
|---|---|---|---|---|
| | No. | % | No. | % |
| Hypotension during phlebotomy | 02 | 08 | -- | -- |
| Hypersensitivity to haemaccel | 01 | 04 | -- | -- |
| Mild transfusion reaction | -- | -- | 08 | 32 |
| Severe transfusion reaction | -- | -- | 02 | 08 |

In Group B, 40% cases showed transfusion reactions. The mean values of Hb at the beginning of study was same in 2 groups.

The fall in Hb was lesser in Group A (2.4) on first and (1.7) on second postoperative day compared to Group B (3.3) on first and (2.7) on second postoperative day.This may be due to loss of diluted blood in Group A and also the precollected erythrocytes were replenished back to the Group A patients.

The haematocrit levels declined more sharply after operation in Group B (7) rather than Group A (10.4). Also, the recovery in Group A was also faster and better with the difference of 3.6 in Group A and 8 in Group B from day of operation to 7th postoperative day.

Fall in total RBC count of 0.8 million/cu.mm and 1.2 million/cu.mm in Group A and Group B on first

postoperative day. The total loss was a mere 0.5 in Group A and 1.0 in Group B, on 7th postoperative day. The trends in Leucocyte counts were quite non-specific and unpredictable in the two groups.

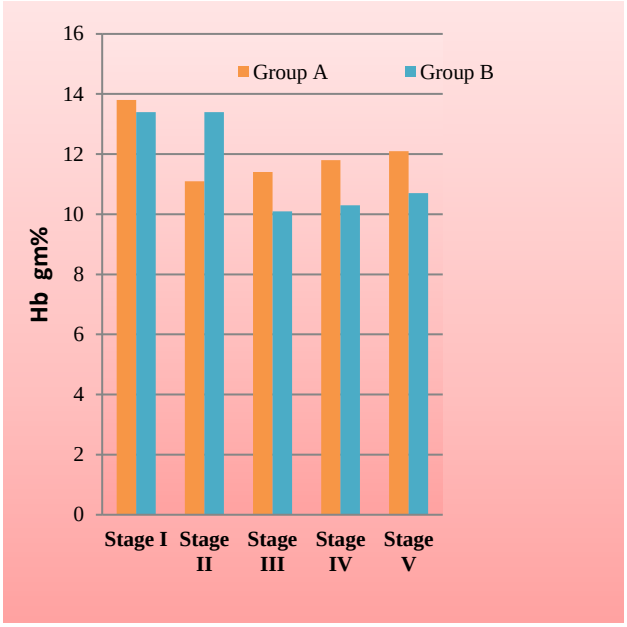


**Figure 3: Haemoglobin as estimated in two study group.**

But the mean values depict a steep rise in TLC on 3rd postoperative day in the case of Group B which may be explained by the risk of exposure to infection through homologous blood, be it from relative or voluntary professional donors.

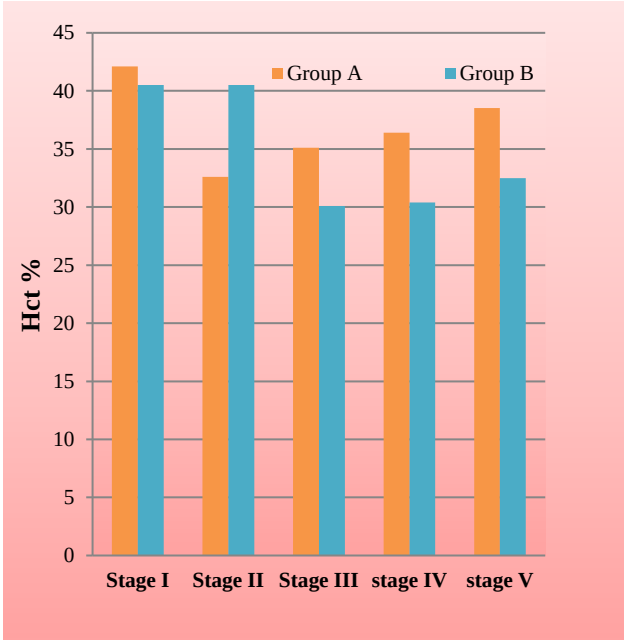


**Figure 4: Changes in haemocrite in two groups**

However, these values were insignificant statistically. The total thrombocyte count has been found to be non-specific and the differences in the levels of platelets are insignificant. There was not significant difference in the coagulation profile (Bleeding time, Clotting time and Prothrombin time) in the two groups.

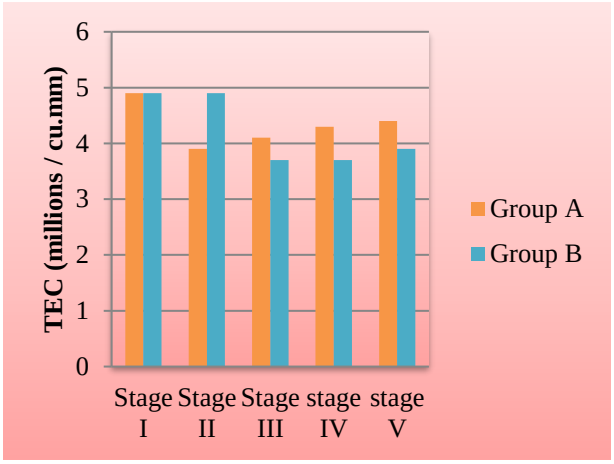


**Figure 5: Changes in RBC count in two groups.**

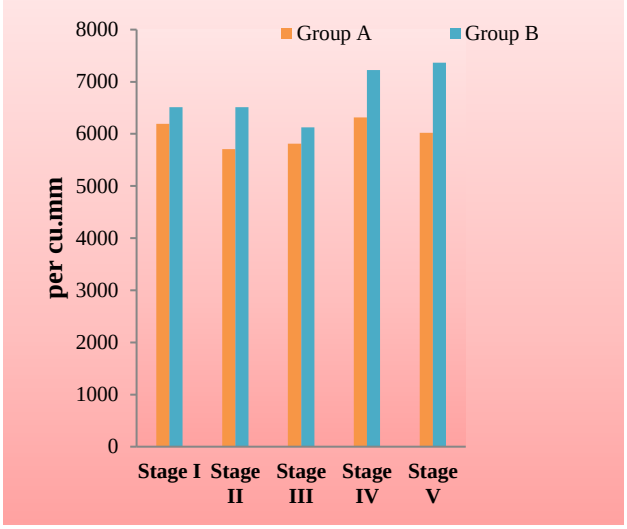


**Figure 5: Stages of sample collection.**

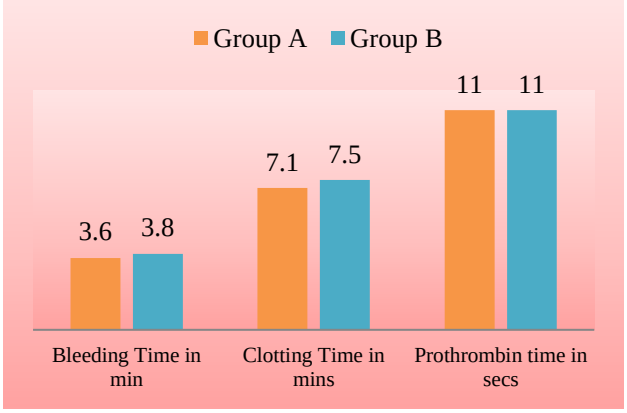


**Figure 6: Mean value of Bleeding time, Clotting time and Prothrombin time in each group.**

## DISCUSSION

Many studies have examined whether patients who donate and receive autologous blood fare better clinically than those who receive homologous blood only.[7] Repeated blood donations before surgery can stimulate bone marrow cell proliferation, stimulate erythrocyte regeneration, increase hematopoietic function in patients after surgery, accelerate the patient's hematopoietic recovery after surgery, is conducive for wound healing, and reduces the chances of infection caused by immunoreaction from allogeneic blood transfusion.[8,9]

Autologous transfusion along with Acute normovolemic hemodilution, avoids the changes seen in storage of blood, and proves to be the safest, cost effective and easy form of transfusion therapy.

These are the unique advantages of Preoperative Auotologous Blood Donations, compared with other methods. Thus, it has been widely used in clinical treatment and in the surgical field, achieving remarkable results.[10-12]

Autologous blood transfusion provides contentment to patient for active participation in his own health care. There are some, who have no donors, or those with rare blood groups have to wait for a long time. Patients have advantage of avoiding alloimmunization, transfusion reactions, entry of infections.[13]

Blood Bank is also benefitted as the stored blood, if unused, can be used for some other patients. Blood bank staff is saved from carrying out grouping, cross matching and serological tests of infection.[14] The patients receiving autologous blood is at a better haematological status at discharge. It can be said that autologous blood can be used very safely and effectively as a complimentary technique to homologous blood transfusion.

transfusions have been shown in most but not all studies to reduce the shortterm morbidity associated with allogeneic transfusions.[15-23]

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Chalfin HJ, Frank SM, Feng Z, Trock BJ, Drake CG, Partin AW, et al. Allogeneic versus autologous blood transfusion and survival after radical prostatectomy. Transfusion. 2014;54:2168-74.
2. Tesic I, Sekulic J, Arbutinov V, Popov D, Velisavljev D. Autologous blood transfusion in patients undergoing hip replacement surgery. Med Pregl. 2014;67:101-7
3. Dietrich W, Thuermel K, Heyde S, Busley R, Berger K. Autologous blood donation in cardiac surgery: reduction of allogeneic blood transfusion and cost-effectiveness. J Cardiothorac Vasc Anesth. 2005;19:589-96.
4. Tsuno NH, Nagura Y, Kawabata M, Matsuhashi M, Sone S, Ikeda T, et al. The current status of autologous blood transfusion in Japan- the importance of pre-deposit autologous blood donation program and the needs to achieve patient blood management. Transfus Apher Sci. 2013;49:673-80.
5. Klein HG. Allogeneic transfusion risks in the surgical patient. Am J Surg. 1995;170(6A) Suppl:21S-6S.
6. Goodnough LT, Brecher ME, Kanter MH, AuBuchon JP. Transfusion medicine. Second of two parts--blood conservation. N Engl J Med. 1999;340:525-33.
7. Karkouti K, McCluskey S. Pro: Preoperative autologous blood donation has a role in cardiac surgery. J Cardiothor Vasc Anest. 2003;17:121-5.
8. Xu YA, Zhang J, Zhou AG. Clinical study of predeposit autologous transfusion in total knee replacanent. J Traumatic Surg. 2009;11:331-3.
9. Jakovina Blazekovic S, Bicanic G, Hrabac P, Tripkovic B, Delimar D. Pre-operative autologous blood donation versus no blood donation in total knee arthroplasty: a prospective randomised trial. Int Orthop. 2014;38:341-6.
10. Long MY, Liu ZH, Zhu JG. Comparative analysis of autologous blood transfusion and allogeneic blood transfusion in surgical patients. Int J Clin Exp Med. 2014;7:2889-94.
11. Martin K, Keller E, Gertler R, Tassani P, Wiesner G. Efficiency and safety of preoperative autologous blood donation in cardiac surgery: a matched-pair analysis in 432 patients. Eur J Cardiothorac Surg. 2010;37:1396-01.
12. Kapadia BH, Banerjee S, Issa K, McElroy MJ, Harwin SF, Mont MA. Preoperative blood management strategies for total knee arthroplasty. J Knee Surg. 2013;26:373-7.
13. Barbara HD, Susanne A, Julian S, Reinhold E, Robert Z. Prevention and management of transfusion-induced alloimmunization: current perspectives. Int J Clinical Trans Med. 2014;2:59-63.
14. Birkmeyer JD1, Goodnough LT, AuBuchon JP, Noordsij PG, Littenberg B. The cost-effectiveness of preoperative autologous blood donation for total hip and knee replacement. Transfusion. 1993;33:544-51.
15. Newman JH, Bowers M, Murphy J. The clinical advantages of autologous transfusion. A randomized, controlled study after knee replacement. J Bone Joint Surg Brit. 1997;79: 630-2.
16. Spark JI, Chetter IC, Kester RC, Scott DJ. Allogeneic versus autologous blood during

abdominal aortic aneurysm surgery. Eur J Vascular Endovasc Surg, 1997;14:482-6.
17. Heiss MM, Mempel W, Jauch K-W, Delanoff C, Mayer G, Mempel M, Eissner H-J, Schildberg F-W. Beneficial effect of autologous blood transfusion on infectious complications after colorectal cancer surgery. Lancet. 1993;342:1328-33.
18. Murphy P, Heal JM, Blumberg N. Infection or suspected infection after hip replacement surgery with autologous or homologous transfusions. Transfusion. 1991;31:212-7.
19. Mezrow CK, Bergstein I, Tartter PI. Postoperative infections following autologous and homologous blood transfusions. Transfusion. 1992;32:27-30.
20. Triulzi DJ, Vanek K, Ryan DH, Blumberg N. A clinical and immunologic study of blood transfusion and postoperative bacterial infection in spinal surgery. Transfusion. 1992;32:517-24.
21. Fernandez MC, Gottlieb M, Menitove JE. Blood transfusion and postoperative infection in orthopedic patients. Transfusion, 1992; 32: 318-322.
22. Howard HL, Rushambuza FG, Martlew VJ, Satchi G, Bolton-Maggs B. Clinical benefits of autologous blood transfusion: an objective assessment. Clin Lab Haematol, 1993;15:165-71.
23. Busch ORC, Hop WCJ, Hoynck van Papendrecht MAW, Marquet RL, Jeekel J. Blood transfusions and prognosis in colorectal cancer. New Eng J Med. 1993;328:1372-76.

**Cite this article as:** Saksena S, Jain N, Dixit A. Comparison of the efficacy of autologious blood transfusion combined with preoperative hemodilution, with homologous blood transfusion in patients undergoing elective surgical procedure. Int J Adv Med 2018;5:536-41.