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RESEARCH ARTICLE

A COMPARISON OF PRE-OPERATIVE AUTOLOGOUS AND HOMOLOGOUS TRANSFUSIONS IN PATIENTS UNDERGOING ELECTIVE MAXILLOFACIAL SURGERY

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ABSTRACT

Background: Autologous blood transfusion is a proven method of blood conservation in elective surgical procedures. Moreover due to increasing concerns about the transmission of blood borne diseases through homologous blood transfusion, autologous blood donation has now become more popular among the patients. This study was conducted at the Department of Oral and Maxillofacial Surgery, Government Dental College, Kozhikode, Kerala, India to assess the feasibility of autologous transfusion in elective maxillofacial surgeries. **Objectives:** This study was designed to compare the efficacy of pre-operative autologous and homologous transfusions in restoring the blood parameters such as hemoglobin, hematocrit and platelet count in patients undergoing elective maxillofacial surgeries and to compare the post operative complications associated with both type of transfusions. **Methods:** Fifteen patients reported at the Department of Oral and Maxillofacial Surgery, Government Dental College, Kozhikode from March 2012 to September 2013 for elective surgical procedures were selected as the study group. Fifteen control patients reported during the same period were selected, who received homologous blood transfusion during surgery. The hemoglobin level, hematocrit and platelet count were measured pre-operatively and on 1st and 7th post-operative days. The present study assessed the mean change in hemoglobin, hematocrit and platelet count from the baseline values at two points of time: first post-operative day and one week following surgery. After the blood transfusion, temperature was also monitored and all the post-operative complications were registered in both groups of patients. **Results:** This study showed that there was no significant difference in the ability of two types of transfusions in restoring the pre-operative hemoglobin on the first and seventh post-operative days. Although the reduction in hematocrit was comparatively lesser in the study group, no statistically significant difference was observed between the two groups on the seventh post-operative day. The increase in platelet count was comparatively more in control group on the first and seventh post-operative days. It was also noted that none of the patients in the study group encountered any complications either during donation or after transfusion. But three patients in control group developed febrile reactions during the post-operative period. **Conclusion:** Autologous blood donation by using pre-operative autologous blood donation is a safe, simple and easy procedure, in elective maxillofacial surgical procedures with anticipated high intra-operative blood loss and in which blood transfusion is likely. Although pre-operative autologous blood donation reduces, it does not totally eliminate the need for homologous transfusion for elective maxillofacial surgery.

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INTRODUCTION

The autologous transfusion can be defined as any procedure for transfusing blood or blood components that have been donated by the intended recipient. When a person becomes his own donor, he receives the safest possible transfusion.

This simple concept is the most important justification for autologous transfusion (Washington, 1981). Transfusion of shed blood was a method used as early as 1818. Pre-operative donation of autologous blood was advocated in the 1930s when the first blood banks were established (Lawrence, 2005). The two main reasons for autologous transfusion are avoidance of complications associated with allogenic transfusion and

conservation of blood resources. The autologous blood transfusion avoids the hazards of blood transfusions like HIV, HBV, HCV etc., immune-related problems and intravascular hemolysis. Patients with rare blood groups can also benefit from autologous transfusion because compatible allogenic blood may not always be available. However the injudicious use of autologous blood donations involving the collection of excessive quantities of blood or the collection of blood prior to low-risk surgical procedures results in wastage of collected blood which is potentially hazardous (Axelrod, 1989). So the wastage of collected autologous blood should be minimized by closer anticipation of transfusion needs with different surgical procedures (Avantika Nath, 2005). This study was designed to compare the efficacy of pre-operative autologous and homologous transfusions in patients undergoing elective maxillofacial surgeries and to find out advantages and disadvantages of autologous and homologous blood transfusion. This study was conducted among patients who underwent treatment at the Department of Oral and Maxillofacial Surgery, Government Dental College, Kozhikode, Kerala.

Aims

- To compare the efficacy of pre-operative autologous and homologous transfusions in patients undergoing elective maxillofacial surgeries.
- To compare the advantages and disadvantages of autologous and homologous blood transfusion.

Objectives

- To assess the hemoglobin level, hematocrit and platelet count before and after autologous blood transfusion.
- To assess the post-operative complications associated with blood transfusion.

MATERIALS AND METHODS

The study was performed by using one of the methods of autologous blood transfusion, which is pre-donated autologous blood donation, in which blood is drawn from the patient 1 week before the scheduled surgery, stored and transfused during or after the surgery. Fifteen patients reported at the Department of Oral and Maxillofacial Surgery, Govt. Dental College, Kozhikode from March 2012 to September 2013 for elective surgical procedures were selected as the study group. 15 control patients reported during the same period were selected, who received homologous blood transfusion during surgery. In both groups, expected blood loss was 350 cc or more. All patients were screened for HIV, HBsAg and anti HCV before the selection. All the patients were explained the merits and demerits of the procedure and written informed consent was taken from all patients before surgery. The consent form and study protocol were previously approved by the Institutional ethics and research committee, Government Dental College, Kozhikode.

Inclusion Criteria

- Patients scheduled for elective maxillofacial surgical procedures with anticipated high intra-operative blood loss and in which blood transfusion is likely.
- Patients with written informed consent for autologous transfusion.

Exclusion Criteria

- Patients not willing for autologous blood donation.
- Haemoglobin level < 10 gm/dl at the time of blood donation
- Hematocrit < 30% at the time of blood donation
- Weight < 45 kg
- Systemic diseases like uncontrolled hypertension, angina pectoris, myocardial infarction, unstable cardiac conditions, insulin-dependent diabetes mellitus, infections predisposing to bacteremia.

All the patients were educated and motivated about pre-operative autologous blood donation. Each patient participated in the study was carefully evaluated by the physician of Transfusion Medicine department. One unit of blood was drawn from the selected patients 1 week before the surgery and stored for transfusion during or after the surgery. The whole blood was subsequently stored at storage temperature of 2 to 6 degree Celcius and subsequently allocated to the donor. All units collected were ABO and Rh grouped and screened for irregular antibodies, HBsAg, HIV, Anti-HCV and syphilis. Based on the amount of blood loss and post-operative hemoglobin level, the blood transfusion was carried out. Patient's hemoglobin level, hematocrit and platelet count were checked before the autologous blood donation and also pre-operatively in both study group and control group. A third sample was collected 24 hours after the surgery and a fourth sample on the seventh post-operative day. In the ward, all patients were closely observed for development of post-operative complications.

Statistical analysis

We assessed the change in hemoglobin, hematocrit and platelet count of both the groups on the first and seventh post-operative days and the mean difference of the same from the baseline value were calculated. Information on post-operative complications like fever, hemolytic reactions and post-operative infections was also collected in both groups of patients. Statistical analysis was performed using SPSS 16 software. The unpaired t test and univariate analysis of variance were used to compare the variables. P value less than 0.05 was considered significant.

RESULTS

A total of 30 patients who underwent major elective maxillofacial surgery between March 2012 and September 2013 were included in to this study. Out of which 17 patients underwent maxillary osteotomies, 8 patients bimaxillary osteotomies and 5 patients segmental resection of mandible. Patient's demographic data are summarized in Table-1. The mean age of the patients in the autologous group (study group) was 29.07 ± 10.1 years and that of homologous group (control group) was 25.27 ± 8.04 years. Out of 15 patients in the study group, 11 (73.33%) were males and 4 (26.67%) were females. In the control group, out of 15 patients, 8 (53.33%) were males and 7 (46.67%) were females. The mean weight of the patients in the study group was 60.53 ± 5.11 kg and that of control group was 57.67 ± 8.27 kg. The mean intra-operative blood loss was 381.33 ± 32.27 ml in the study group and 442.67 ± 33.05 ml in the control group. All patients were transfused 1 unit of blood.

Table 1. Demographic characteristics

	Autologous	Homologous
Age in years ((Mean ± S.D)	29.07 ± 10.10	25.27 ± 8.04
Gender Male (%)	11 (73.33%)	8 (53.33%)
Female (%)	4 (26.67%)	7 (46.67%)

Table 2. Mean blood loss and Mean weight

	Autologous	Homologous
Weight in Kg (Mean ± S.D)	60.53 ± 5.11	57.67 ± 8.27
Blood loss in ml (Mean ± S.D)	381.33 ± 32.26	442.67 ± 33.05

The hemoglobin level, Hematocrit and platelet count were measured pre-operatively and on 1st and 7th post-operative days (Table 3). The present study assessed the mean change in hemoglobin, hematocrit and platelet count from the baseline values at two points of time: first post-operative day and one week following surgery. After the blood transfusion, temperature was also monitored and all the post-operative complications were registered in both groups of patients.

Table 3. Hemoglobin, Hematocrit and Platelet count

	Autologous	Homologous
Baseline Hemoglobin (gm%)	14.18 ± 0.64	13.28 ± 0.46
Hemoglobin 1 day after surgery	11.38 ± 0.70	11.49 ± 0.63
Hemoglobin 7 days after surgery	12.22 ± 0.68	12.65 ± 0.49
Baseline Hematocrit (%)	40.41 ± 1.56	39.59 ± 1.35
Hematocrit 1 day after surgery	33.91 ± 1.78	32.96 ± 1.03
Hematocrit 7 days after surgery	36.26 ± 2.13	37.27 ± 0.76
Baseline Platelet count (×10 ³ /mm ³)	230.33 ± 11.17	241.07 ± 10.66
Platelet count 1 day after surgery	234.07 ± 14.51	246 ± 8.42
Platelet count 7 days after surgery	238.2 ± 14.42	250.67 ± 7.81

Change in hemoglobin level

The mean baseline hemoglobin level of the autologous group was 14.18 ± 0.64 gm% and 13.28 ± 0.46 gm% in the homologous group. On the 1st post-operative day, there was a decrease in hemoglobin level of 2.67 ± 0.16 gm% in the autologous group and the decrease in homologous group was only 1.91 ± 0.16 gm%. This change was found to be statistically significant when assessed using unpaired t test (P value 0.006; Table 4). On the 7th post-operative day, the mean decrease in hemoglobin level from the baseline value was found to be 1.74 ± 0.15 gm% in the autologous group and only 0.81 ± 0.15 gm% in the homologous group, which was again found to be statistically significant (P value 0.001; Table 4).

Table 4. Mean decrease in hemoglobin (in gm %)

	Autologous	Homologous	P value
Baseline to 1 day after surgery	2.67 ± 0.16	1.91 ± 0.16	0.006
Baseline to 7 days after surgery	1.74 ± 0.15	0.81 ± 0.15	0.001

Change in Hematocrit

The mean baseline hematocrit value of the autologous group was 40.41 ± 1.56 % and 39.59 ± 1.35 % in the homologous group. On the 1st post-operative day, there was a decrease in hematocrit of 6.49 ± 1.51 % in the autologous group and the decrease in homologous group was 6.63 ± 0.88 %. However this change was not statistically significant (P value 0.77; Table 5). On the 7th post-operative day, the mean decrease in hematocrit from the baseline value was found to be 4.15 ± 1.87 % in the autologous group and only 2.32 ± 1.14 % in the

homologous group, which was found to be statistically significant (P value 0.003; Table 5).

Table 5. Mean decrease in Hematocrit (in %)

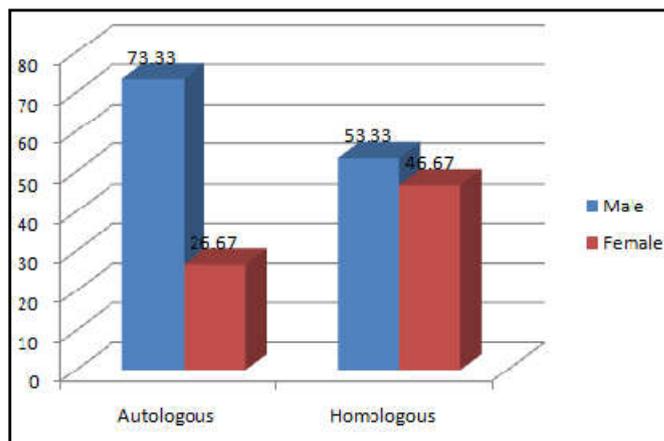
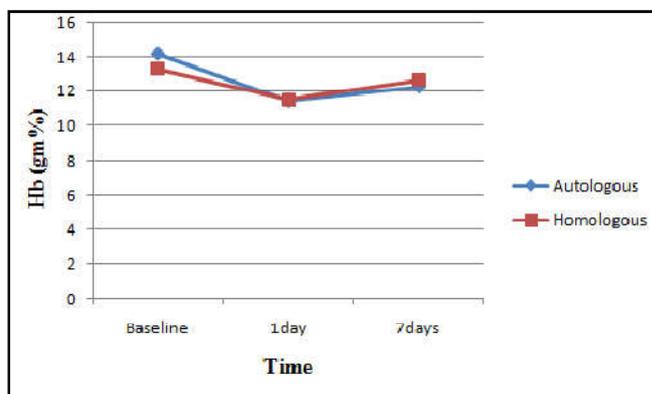
	Autologous	Homologous	P value
Baseline to 1 day after surgery	6.49 ± 1.51	6.63 ± 0.88	0.77
Baseline to 7 days after surgery	4.15 ± 1.87	2.32 ± 1.14	0.003

Change in platelet count

The mean baseline platelet count of the autologous group was 230.33 ± 11.17 ×10³/mm³ and 241.07 ± 10.66 ×10³/mm³ in the homologous group. On the 1st post-operative day, there was an increase in platelet count of 6.17 ± 3.06 ×10³/mm³ in the autologous group and the increase in homologous group was 8.05 ± 3.06 ×10³/mm³. However this change was not statistically significant (P value 0.115; table 6). On the 7th post-operative day, the increase in platelet count from the baseline value was found to be 4.66 ± 2.99 ×10³/mm³ in the autologous group and 12.81 ± 2.99 ×10³/mm³ in the homologous group, which was also not statistically significant (P value 0.08; Table 6).

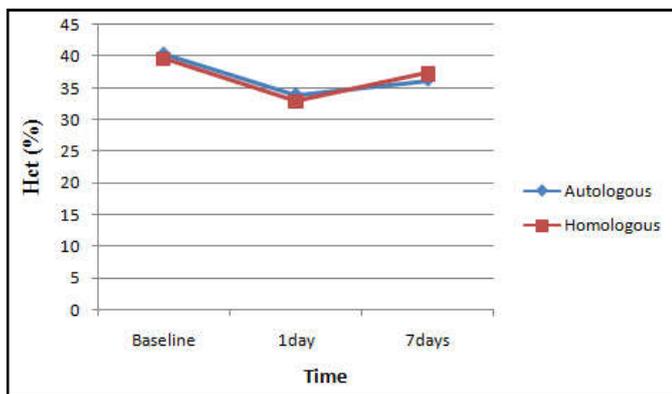
Table 6. Mean increase in platelet count (×10³/mm³)

	Autologous	Homologous	P value
Baseline to 1 day after surgery	6.17 ± 3.06	8.05 ± 3.06	0.115
Baseline to 7 days after surgery	4.66 ± 2.99	12.81 ± 2.99	0.08

**Graph 1. Gender distribution between two groups****Graph 2. Changes of mean hemoglobin between two groups**

Post-Operative complications

Post-operative complications were relatively less in both groups of patients.



Graph 3. Changes of mean hematocrit between two groups

The complications that are looked for were hemolysis and febrile reactions. In this study none of the patients developed hemolysis in both groups after the transfusion. Three patients of the homologous group developed febrile reactions.

DISCUSSION

The main priority in any surgical procedure is the conservation of blood. Autologous transfusions have recently emerged as an alternate method of blood conservation. Due to the increasing concerns about the transmission of HIV and Hepatitis by transfusion of homologous blood, autologous blood donation has now become increasingly popular among patients. Here in this study we employed one of the autologous transfusion methods, the pre-operative autologous blood donation (PABD), in which the patient donates his/her own blood prior to the scheduled surgery. Out of 15 patients in the autologous group, only four (26.67%) were females. Low hemoglobin level and underweight were the two factors which restricted many of the female patients to pre-donate the blood in our study. But the female patients thus excluded from the study group and underwent homologous transfusions were included in the control group. Among the 15 control patients, 8 (53.33%) were males and the remaining 7 (46.67%) females. The age of the patients in the study group ranged from 20 to 50 years with a mean age of 29.07 ± 10.1 years, whereas in the control group the age range was 19 to 44 years with mean age 25.27 ± 8.04 years.

According to Pineiro-Aguilar et al⁵, the average blood loss during an orthognathic procedure is 436.11 mL. In our study, the average blood loss was found to be 381.33 ± 32.26 mL in autologous group and 442.67 ± 33.05 mL in the homologous group. Wolfgang Puelacher et al⁶ did a follow up study of pre-operative autologous blood donation in patients underwent orthognathic surgery and he found out that the decrease and increase in hematocrit data were related to the Hemoglobin data. According to their study, mean hemoglobin prior to donation was 14.2 gm% and 11 gm% on the first post-operative day. At the long term control after the surgery, all patients demonstrated the blood levels prior to donation. Here in our study, the mean Hemoglobin prior to donation was 14.18 ± 0.64 gm%, 11.38 ± 0.7 gm% on the first post-operative day and 12.22 ± 0.68 gm% on the seventh post-operative day. This change in hemoglobin was comparable with the above study. According to the study of Maria Cristopoulou⁷, the mean pre-operative hematocrit in autologous donors was 37 ± 4 %. On the first post-operative day it decreased to 35 ± 4 % and then increased to 38 ± 3 % on the seventh post-operative day. They

also found that hematocrit of homologous group was higher than autologous group pre-operatively, but post-operatively hematocrit of autologous group was higher. In our study, the mean pre-operative hematocrit value of the autologous group was 40.41 ± 1.56 . The hematocrit value then decreased to 33.91 ± 1.78 % on the first post-operative day and then increased to 36.26 ± 2.13 % on the seventh post-operative day. Also on the first post-operative day, the hematocrit of autologous group was higher than that of homologous group (32.96 ± 1.03 %). There have been very few studies in literature that serves to compare the platelet count before and after the blood transfusion. Wolfgang Puelacher et al⁶ found out that, after an increase of 14% during autologous pre-deposition, the mean platelet count returned to the level prior to the donation. In our study, we checked platelet count before and after the blood transfusion. It was found that, in the autologous group, there was an increase of $6.17 \pm 3.06 \times 10^3/\text{mm}^3$ in platelet count on the first post-operative day and an increase of $4.66 \pm 2.99 \times 10^3/\text{mm}^3$ on the seventh post-operative day. But the increase was found to be higher in the homologous group. An increase of $8.05 \pm 3.06 \times 10^3/\text{mm}^3$ on the first post-operative day and $12.81 \pm 2.99 \times 10^3/\text{mm}^3$ on the seventh post-operative day was noted. But these changes were not statistically significant.

The aim of our study was to compare the efficacy of pre-operative autologous transfusion and homologous transfusion in terms of the blood parameters such as hemoglobin, hematocrit and platelet count. For this, we estimated these parameters at 3 points of time- pre-operatively (baseline), first post-operative day and seventh post-operative day. In the case of autologous transfusion, the value before the blood donation was taken as the baseline values for each parameter. Our intention was to find out whether the restoration of hemoglobin, hematocrit and platelet count to the pre-operative values, after autologous blood transfusion is comparable with that of routine homologous transfusion and to realize whether autologous transfusion can be introduced on a large scale in maxillofacial surgery. We found out that, on the first post-operative day, the mean reduction in hemoglobin from the baseline value was 1.91 ± 0.16 gm% in patients who underwent homologous transfusion and 2.67 ± 0.16 gm% in autologous patients, which was also found to be statistically significant. Thus it is clear that the hemoglobin level will be reduced on immediate post-operative day, in both autologous and homologous transfusions. It is found that the decrease in hemoglobin in both type of transfusions are comparable. Similarly the mean reduction in hematocrit on the first post-operative day was 6.63 ± 0.88 % in homologous group, whereas the reduction in autologous group patients showed a decrease in hematocrit of 6.49 ± 1.51 %. Although the reduction in hematocrit between two groups was comparable, the decrease was not statistically significant. On the seventh post-operative day, the mean reduction in hemoglobin was 0.81 ± 0.15 gm% in homologous group, whereas in autologous group, the reduction was found to be 1.74 ± 0.15 gm%. Similarly the mean reduction in hematocrit was 2.32 ± 1.14 % in homologous group and 4.15 ± 1.87 % in autologous group. Both these results were found to be statistically significant also. The comparison between the two groups showed that there was no significant difference in the ability of two types of transfusions in restoring the pre-operative hemoglobin on the first and seventh post-operative days. Although the reduction in hematocrit was comparatively lesser in patients who were transfused their own blood, no statistically

significant difference was observed between the two groups on the seventh post-operative day. The increase in platelet count, on the first and seventh post-operative days, was comparatively more in patients who underwent homologous transfusions. It was also noted that none of the patients who autodonated blood prior to surgery encountered any complications either during donation or after transfusion. But three patients who received homologous blood developed febrile reactions during the post-operative period. Due to the fact that pre-operative autologous blood donation is well accepted and tolerated by our patients; it is an excellent method of transfusion especially for higher blood loss in maxillofacial procedures. The present study although conducted on a small number of patients suggests that the pre-operative autologous blood donation technique is an effective method for reducing the need for homologous transfusions and thus avoids the complications associated with it, in patients undergoing elective maxillofacial surgery. It also emphasizes the need for proper organization, planning and communication between surgeons and transfusion specialists for its implementation. Studies suggest that while pre-operative autologous blood donation decreases, it does not totally eliminate the need for homologous transfusion for elective surgery.

Conclusion

An autologous blood transfusion programme must be reliable, effective and safe for patients and practitioners. The essence of success is motivation and communication. The relative risks and benefits of blood transfusion and blood conservation strategies should be discussed with all patients undergoing elective surgery with a reasonable likelihood of requiring a blood transfusion. It is quite likely that many of our patients will appreciate the value of autologous transfusion. Although there are considerable organizational problems to overcome, and the need for a strong sense of commitment, the setting up of an autologous blood transfusion service to meet this demand can only be beneficial. Our colleagues will have to be educated to promote the concept that the use of a person's own blood is safest. It will conserve donor blood for those who need it, and result in more effective use of blood supplies. An autologous blood donation programme should only be complementary to the established blood transfusion programme.

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Glossary of abbreviations

ABD - Autologous Blood Donation
HBV - Hepatitis B Virus
Hb - Hemoglobin
HCV - Hepatitis C Virus
Hct - Hematocrit
HIV - Human Immunodeficiency Virus

PABD - Pre-operative Autologous Blood Donation

SPSS - Statistical Package for Social Sciences

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