Blood Products Use in Bimaxillary Orthognathic Surgeries: A Retrospective Study

Hamidreza Eftekharian[1], Shourangiz Dadain[2], Ehsan Aliabadi[3], Reza Tabrizi[4]

[1] *Associate Professor, Department of Anesthesiology AND Department of Oral and Maxillofacial Surgery, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran*

[2] *Under-graduate Student, Student Research Committee, School of Dentistry, Shiraz University of Medical Science, Shiraz, Iran*

[3] *Assistant Professor, Department of Craniomaxillofacial Surgery AND Department of Oral and Maxillofacial Surgery, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran*

Received: 22 Oct. 2015; Received in revised form: 16 Apr. 2016; Accepted: 10 Jul. 2016

Abstract

Background: The purpose of this study was to determine the consumption of blood products during orthognathic surgeries by age, sex, blood group, operation time, and the amount of blood loss.

Methods: This is a retrospective cohort study. Patients who underwent bimaxillary osteotomy were studied. The study focused on types and amount of blood loss, blood products used, and change in patient's hemoglobin (Hb) and hematocrit (HCT). Patients' demographic data, blood type, and duration of surgery were variables of the research.

Results: A total of 133 patients (52 males and 81 females) with a mean age of 22.950 ± 4.241 years formed the study population. Average blood loss was 556.32 ± 245.05 ml and the average operating time was 259.96 ± 51.56 minutes. Results demonstrated that duration of the surgical and blood loss in males was higher than females. The mean of Hb and HCT levels before surgeries was 13.56 ± 1.30 and 40.47 ± 4.30, respectively, which significantly ($P < 0.001$) decreased to 11.969 ± 1.200 and 35.782 ± 3.800 1 day after the operations. The transfused blood products consisted of packed cells (5.4%), fresh frozen plasma (37.3%), and hydroxyethyl starch (57.3%). The percentage of patients who did not receive any transfusion was generally higher in the positive blood types than negative ones, with the highest percentage being in the AB+ group.

Conclusions: A risk of using blood products particularly packed cells may increase if blood loss was above of 800 ml and surgical duration more than 300 minutes. The duration of orthognathic surgery may have a significant effect on blood loss and blood transfusions. It seems subjects with positive blood types may have a lower risk for transfusion.

Citation: Eftekharian H, Dadain S, Aliabadi E, Tabrizi R. **Blood Products Use in Bimaxillary Orthognathic Surgeries: A Retrospective Study.** *Acad J Surg*, 2016; 3(1-2): 2-6.

Keywords: Blood transfusion; Blood products; Orthognathic surgery; Osteotomy

Introduction

The need for blood transfusion during surgical operations has increased during recent decades due to the increased number and expansion of types of surgeries. Blood transfusion, if properly used, can be lifesaving. On the other hand, the precipitous increase in the use of blood products is considered as a serious problem to patients.

Adequate and safe blood supply is one of the major concerns of contemporaneous health systems. Some initiatives have been done to reduce the potential hazards of blood transfusions to the lowest level. However, the irrational transfusions can still influence the prevalence of blood-borne infections. Even studies published in the past 10 years, during which excessive precautions have been taken in producing safe blood products, indicate a considerable risk of death (1,2) and an increase in the rate of post-operation infections as results of blood transfusion (2,3). Autotransfusion of the patient's own blood (4) and use of blood and colloid solutions such as albumin, gelatin, dextran, hydroxyethyl starch (HES), and fresh frozen plasma (FFP) are considered as safer substitutes for hetero blood transfusion (5). Hetero blood transfusion is now suggested only to save lives, not for faster recovery (6).

Orthognathic surgeries are often associated with blood loss. Blood cross matching routinely is performed for all patients undergoing such operations, in case excessive blood loss happens during operation. However, only a small proportion of patients undergoing these operations would really need blood

Corresponding Author: Hamidreza Eftekharian
Department of Oral and Maxillofacial Surgery, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran.
Tel: +98 917 1114148/Fax: +98 71 36248980, E-mail: eftekharhr@sums.ac.ir

transfusion as human body can compensate a loss of up to 20% of blood (7). The risk of blood transfusion in orthognathic surgeries was controversial according to various reports. Samman et al. (8) indicated that single jaw operations and 63% of double jaw surgeries do not need blood transfusion. Flood et al. (9) also remarked that less than one-third of those undergone bimaxillary or sagittal split osteotomies surgeries required blood transfusion in their study. Moenning et al. (10) reported that only 4 out of 506 (< 1%) of bimaxillary surgery in their study needed blood transfusion. More recent studies indicate that even bimaxillary surgeries do not require blood transfusion in healthy adults (11,12) and that blood transfusions performed in many maxillofacial surgeries are unnecessary or in excess of actual required amount (13).

The purpose of this study was to determine the consumption of blood products during orthognathic surgeries by age, sex, blood group, operation time, and the amount of blood loss.

Materials and Methods

This is a retrospective cohort study. Data from all patients undergone bimaxillary orthognathic surgery in Shahid-Chamran Hospital affiliated to Shiraz University of Medical Sciences, regardless of the reason for surgery, were used in this study. The study was performed from September 1, 2010, to October 31, 2011. The research committee of the medical ethics group of Shiraz Medical Sciences University approved this study. The patients eligible for the study if they had maxillofacial deformity and undergone bimaxillary osteotomy and were in ASA 1 category. Those with bleeding problems, high blood pressure, recent history of taking anticoagulant medicine, allergy to anesthetic drugs, condition preventing the use of controlled hypotensive anesthesia, and recent history of smoking or use of opiates were excluded.

All patients underwent hypotensive anesthesia. Pre-operative patient assessment and selection, appropriate positioning and monitoring, and adequate fluid therapy are used for the patients undergoing induced hypotension during orthognathic surgery. Hypotensive anesthesia is corrected in relation to the patient’s pre-operative blood pressure and be adjusted to the necessary level for blood loss reduction in the surgical field. A mean arterial blood pressure (MAP) 30% below a patient’s usual MAP. The anesthesiologists were blinded to the type of irrigation fluid. Anesthesia was induced with intravenous propofol 2 mg/kg and fentanyl 0.5 mcg/kg and was maintained using total intravenous anesthesia with propofol infusion 100 mcg/kg and remifentanil 0.2-0.3 mic/kg/min. Atracurium 0.5 mg/kg was used for endotracheal intubation. Baseline hemoglobin (Hb) and hematocrit (HCT) were measured on the day before the surgery. Blood loss was measured according to the amount of blood (ml) accumulated in the suction canister at the end of the case, after subtracting the amount of irrigation fluid that was used intraoperatively. In addition, all pieces of 4 cm × 4 cm gauze were weighed at the end of the case and each one gram increase in the weight of the gauze was considered 1 ml blood loss. All pieces of gauze were kept in a Beex container to prevent evaporation of fluids and obtain an accurate estimation of blood loss. Total operative and hypotensive times were recorded for each patient. Similarly, blood product transfusion and the volume of irrigation solution used were recorded.

Subject’s demographic data, blood type, patient’s Hb, and HCT before and 24 hours after surgery duration of surgery, blood loss, and the amount and type of blood products used were recorded. Blood products used in these surgeries consisted of packed red cells, FFP, and HES.

The incision was made over the anterior portion of the vertical ramus, extending to the mesial aspect of the first molar. Subperiosteal dissection was carried out down to the inferior border of the mandible, where a lateral channel retractor was placed. A long bur was used to make a horizontal bone cut through the medial cortex of the ramus, just above, and approximately posterior to the lingula. The vertical cut was made through the buccal cortex, distal to the second molar or further anteriorly. The two osteotomies were then connected with a 701 fissure bur. The vestibular incision in maxilla was made from the first molar to the contralateral first molar. The superior tissues were reflected subperiosteally, first at the pyriform aperture margins. Then, lateral nasal and infraorbital regions were exposed and extended posteriorly to the zygomatic-maxillary buttress. Two internal reference points intraorally were marked to determine anterior-posterior and vertical movements in each side of the maxilla. Osteotomy lines were made 5 mm superior to the apex of the teeth roots. After ending osteotomies and down fracture, maxilla was mobilized and positioned in the desirable position using an intermediate splint. Bone interferences were removed and maxilla was fixed using four miniplates. A spreader and a narrow osteotome were used to lift the lateral cortex of the sagittal osteotomy gently, and the osteotome was used to step along the connecting cut to ensure that the split stayed close to the lateral cortex. Finally, the mandible was positioned in the final position and the condyle was positioned manually by a superior and posterior pressure during fixation using a miniplate and monocortical screws in each osteotomy site.

The statistical analyses were performed using SPSS for Windows (version 19; IBM Corp., Armonk, NY, USA). Independent t-test, paired t-test, z-test, chi-square, bivariate correlation, and linear regression were used to analyze the data.

Results

Among the 133 patients who had bimaxillary orthognathic surgery in Shahid-Chamran Hospital affiliated to Shiraz University of Medical Sciences, during the period of this study, 133 had the desired conditions to be included for data analysis. 61 (61%) of them were females and 52 (39%) were males. Their average age was 22.95 ± 4.24 years.

The average operation time was 260 minutes. The operations took slightly longer for males (P = 0.012). In average, 556 ml blood was lost during each surgery (Table 1). Males lost markedly more blood than females (P < 0.001). The mean Hb and mean HCT of each patient 24 hours after surgery were, respectively, 1.6 g/dl and 4.7% lower than those measured before surgery (Table 2). The falls in both Hb and HCT were statistically significant regardless of blood infusion (P < 0.001 for both).

Table 1. Average operation time and blood loss by sex

Operation time and blood loss	Sex	Average
Operation time (min)	Males	274.23 ± 53.66
	Females	250.80 ± 48.30
	All	259.96 ± 51.56
Blood loss (ml)	Males	703.85 ± 293.11
	Females	461.60 ± 145.19
	All	556.32 ± 245.05

About 39 males (75.0% of males) and 37 females (45.7% of females) needed some sort of blood transfusion. No platelet was given. No one received packed cells alone. 10 patients (7.5% of all patients) were given only FFP with an average of 375 ml each. 16 people (12.0% of all) received 531 ml HES in average. 40 patients (30.0%) received a mixture of two blood products. 10 patients needed the three types of blood product (packed cell).

About 1375 ml blood product was transfused to each of the latter group, in which the number of males was significantly higher than females (P < 0.001). On the whole, an average of 803 ml blood was used for each patient that needed transfusion. The average transfused blood product decreased to 459 ml, when those who did not need any transfusion were included (Table 3).

Among blood types, O+ and B+ were more frequent (41.4% and 21.8% respectively). No one was AB− and only a few patients had a blood type of A− or B−. The percentage of subjects who did not receive any transfusion was generally higher in the positive blood types than negative ones, with the highest percentage being in the AB+ group. Figure 1 compares the frequency of those who received each type of blood product within sexes and blood type groups.

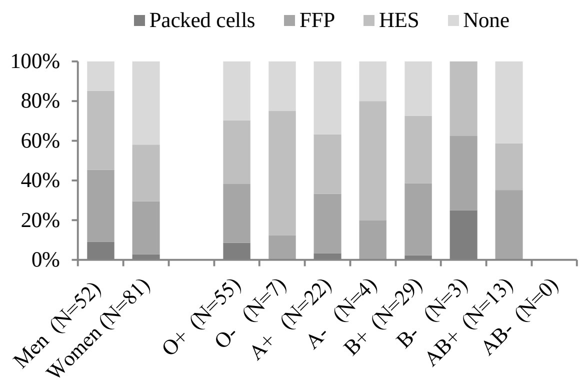

Figure 1. Frequency of blood products used within the two sexes and each type of blood

The amount of transfused product was significantly correlated with duration of operation and blood loss (P < 0.001 for both). After adjustments, both correlations remained significant, although the P value for the duration of surgery increased to 0.008. The average of blood loss for those who received blood products during surgery (674.08 ± 258.35 ml) was significantly (P < 0.001) higher than those who did not receive any blood product (399.30 ± 90.77 ml). The average duration time of surgery in those who received blood products during surgery (283.55 ± 49.10 minutes) was also significantly (P < 0.001) higher than those who did not receive any blood product (228.51 ± 35.70 minutes). The probability for the need for transfusion significantly increased in those who lost more than 800 ml blood and those whose operation took longer than 300 minutes (P < 0.001 for both).

Table 2. Changes in Hb and HCT of blood of patients 24 hours after surgery comparing with those just before operation

Hemoglobin and hematocrit	Sex	Before surgery	After surgery	Difference (Mean ± SD)
Hb (g/dl)	Males	14.65 ± 1.14	12.69 ± 1.18	−1.96 ± 0.99
	Females	12.86 ± 0.82	11.50 ± 0.92	−1.35 ± 0.59
	All	13.56 ± 1.30	11.97 ± 1.18	−1.59 ± 0.82
HCT (%)	Males	44.83 ± 3.03	38.93 ± 3.55	−5.90 ± 2.05
	Females	37.67 ± 2.22	33.76 ± 2.22	−3.90 ± 1.50
	All	40.47 ± 4.34	35.78 ± 3.78	−4.69 ± 1.99

Hb: Hemoglobin; HCT: Hematocrit

Table 3. Number of males and females received blood products and average amount they received, by type of blood product

Blood product	Sex	Number	Average amount (ml)
No transfusion needed	Males	13	0
	Females	44	0
	Both sexes	57	0
Packed cell	Males	0	0
	Females	0	0
	Both sexes	0	0
FFP	Males	4	438
	Females	6	333
	Both sexes	10	375
Platelet	Males	0	0
	Females	0	0
	Both sexes	0	0
HES	Males	7	571
	Females	9	500
	Both sexes	16	531
Two products (packed cell + FFP)	Males	0	0
	Females	1	800
	Both sexes	1	800
Two products (packed cell + HES)	Males	0	0
	Females	0	0
	Both sexes	0	0
Two products (FFP + HES)	Males	20	875
	Females	19	881
	Both sexes	39	878
Three products (packed cell + FFP + HES)	Males	8	1456
	Females	2	1050
	Both sexes	10	1375

HES: Hydroxyethyl starch; FFP: Fresh frozen plasma

Discussion

This study tried to address using blood products, which kind of, and how much in orthognathic surgeries. The results of this study confirm that blood transfusion is common during orthognathic surgeries due to the timely nature of these surgeries and usual massive blood loss.

Our study was not an exception among similar studies and more than half of the subjects, who underwent bimaxillary surgery in our target hospital, were transfused. Flood et al. (9) in a study conducted, in 1990, stated that almost one-third of patients who underwent orthognathic bimaxillary surgery needed blood transfusions. Samman et al. (8) expressed in 1996 that blood transfusions in a single jaw surgery is not necessary but is necessary in bimaxillary surgeries.

Ash and Mercuri (14) mentioned that in 75% of bimaxillary surgeries transfusion is needed. The percentage is usually far lower in single jaw surgeries.

Our findings are in line with findings of Moenning et al. (10), Ueki et al. (11), and Rummasak et al. (15), who all mentioned that the need for blood transfusions in their studies increases with increased blood loss during orthognathic surgery. Faverani et al. studied on 45 subjects who underwent orthognathic surgeries .They reported only two subjects needed blood transfusion. However, there was a substantial individual variation in pre- and post-operative Hb values (16).

Despite the previous reports (8,9,14,17), Garg et al. (18) suggested grouping and saving blood with antibody or coagulation screening are not necessary before orthognathic operations in ASA Grade I patients who have no history of bleeding disorders or previous blood transfusion. A recent study showed no significant factor was associated with blood loss and reduced blood ingredients among patients in orthognathic surgery with hypotenstive anesthesia.

Improvements in anesthesia provided surgeons with more time to promote hemostasis during surgery. Hypotensive anesthesia was a well-accepted method to reduce blood loss during orthognathic surgery (19). Another study concluded the factors that influence blood loss includes patient gender, experience of the surgeon, and operative time. Blood preparation should be considered in women, especially small individuals in whom a long operative time is expected and who are being operated on by an inexperienced surgeon. Because of the low rate of transfusion, a group-and-save policy is appropriate (15). It was demonstrated that type and screen testing and verification of ABO/Rh status seems to be an adequate precaution to manage blood loss. As severe hemorrhage that requires transfusion of allogeneic blood has become the exception rather than the rule in bimaxillary orthognathic operations (20).

Pineiro-Aguilar et al. (21) emphasized that the intraoperative bleeding observed in patients during Le Fort I or mandibular ramus osteotomies or both combined was less than the limits set for blood transfusion. However, bleeding was occasionally heavier and surgeons should be prepared for heavier bleeding by reserving blood at a blood bank or by preparing an autotransfusion. Posnick et al. (22) suggested that only a small percentage (6%) of individuals undergoing complex orthognathic and intranasal surgery received blood replacement. We believe that close collaboration between the surgical and anesthesia teams and the recovery of patients in a safely monitored environment will continue to reduce the need for transfusion in the orthognathic patient.

Conclusion

The risk of using blood products particularly packed cells may increase if blood loss was above of 800 ml and duration of the surgery more than 300 minutes. The duration of orthognathic surgery may have a significant effect on blood loss and blood transfusions. It seems subjects with positive blood types may have a lower risk for transfusion.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

This manuscript was extracted from the thesis written by Dr. Shourangiz Dadain. The authors would like to thank grateful for the maxillofacial nursing staff in Shahid-Chamran Hospital affiliated to Shiraz University of Medical Sciences for their cooperation.

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