

Intraoperative Blood Loss in Maxillofacial Trauma Surgery

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Abstract

Background and Objectives: This study is aimed to assess the intraoperative blood loss of patients with maxillofacial bone fracture surgical intervention and to assess their need for blood transfusion. **Materials and Methods:** In this retrospective study, intraoperative blood loss of 206 patients with facial bone fractures, who underwent surgery between 2017 and 2018, was retrieved. The patient's demographic information, the amount of blood loss, the type of facial bone fracture, and the patient's requirement for blood products were evaluated. **Results:** The average amount of intraoperative blood loss was 77.6 ml, and none of the patients required a blood transfusion during the operation in this group of patients. maxillofacial bone fracture was most common in young males. The leading cause of fractures was motor vehicle accident. There was a reverse correlation between the patient's age and surgical blood loss, but there was no statistically significant relationship between the patient's gender and intraoperative surgical blood loss. **Conclusion:** The results of the present study show that preparation for blood transfusion in patients with maxillofacial traumatic bone fracture requiring surgery is uncommon if patients have no systemic disease or specific blood dyscrasias preoperatively.

Keywords: Mandible, maxilla, maxillofacial injury, nasal bone, surgical blood loss, traffic accident

INTRODUCTION

One of the reasons for death of patients during surgical procedures is intraoperative blood loss.^[1] The extent of maxillofacial surgical procedures varies widely, and excessive bleeding can occur during dissection of skin, subcutaneous, and muscle in the maxillofacial region from facial microvasculature and major blood vessels.^[2-4] Therefore, these procedures may cause significant blood loss.^[5,6] As one of the complications of maxillofacial fractures, excessive blood loss occurs in 1%–11% of facial bone fractures.^[7] Traumatic injuries and surgical interventions are the reasons that cause great blood loss, while blood loss during surgery is more common.^[8] The reasons are the vast vessel network on the face and jaw, in addition to limitations in surgical access to the site of bleeding to perform hemostasis.

Different factors can affect the amount of blood loss during surgery, such as surgery time, surgical method, anesthesia technique, method of hemostasis, and the surgeon's skill. Significant blood loss threatens the patient's life, and if the amount of wasted blood does not compensate, the insufficient bloodstream will cause an unreturnable deficiency in body functions.^[9] If a patient sustained a significant blood loss during

surgery, the lost blood volume should be replaced by injecting the appropriate amount of blood products. A "massive blood loss" is defined as the loss of 20% or more blood volume of the whole blood volume of the body.^[8]

Different approaches, such as using hypotensive anesthesia and tranexamic acid, have been applied to prevent excessive intraoperative blood loss and maintain hemostasis.^[3] It is also prudent to evaluate the average blood loss before, during, and after the surgery. Many studies assessed the causes and frequency of maxillofacial fractures.^[10-12] While blood loss during orthognathic surgery has been studied extensively, little attention has been given to other maxillofacial procedures.^[4,13-19] Therefore, the present study aimed to assess the average blood loss during the surgical treatment of isolated

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Received: 21-07-2019

Revised: 12-01-2020

Accepted: 10-03-2020

Published: 08-06-2020

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How to cite this article: Aliabadi E, Malekpour B, Tavanafar S, Karimpour H, Parvan M. Intraoperative blood loss in maxillofacial trauma surgery. *Ann Maxillofac Surg* 2020;10:164-7.

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10.4103/ams.ams_165_19

traumatic maxillofacial fractures. Evaluating the amount of blood loss during facial bone fractures can help predict the need for blood products in specific procedures.

MATERIALS AND METHODS

Sample size

The present study was a retrospective observational study approved by the Ethical Committee of the university (IR.SUMS.REC.1396.S1069). Patient records with maxillofacial fracture surgery were retrieved and the volume of blood loss during surgery and the type of facial fracture evaluated. Inclusion criteria was patients operated for maxillofacial fractures from 2017 to 2018. Exclusion criteria were patients with other systemic conditions, neurotic injury with decreased consciousness, intensive care unit admissions, multiple trauma, patients previously operated or incomplete patient documents.

We divided the facial fractures into seven groups to measure the amount of blood loss concerning facial bone fractures as following:

1. Maxilla fractures: Le Fort I, Le Fort II, and Le Fort III
2. Mandibular fractures: Symphysis, body, condyle, angle, and ramus
3. Zygomatic bone fractures: Isolated zygomatic arch fracture and zygomatic complex fracture
4. Nasal bone fracture
5. Forehead bone fracture
6. Naso-orbito-ethmoidal fracture
7. Dentoalveolar fracture.

The amount of intraoperative blood loss was calculated by measuring the amount of blood in a surgical suction container deducted by the amount of irrigation used during surgery. Surgical gauzes were weighted preoperatively and kept in an airtight container until the end of the procedure. Then, the blood-soaked gauze weights were deducted from the preoperative weight and added to the total amount of blood loss. Due to negligible differences between blood and water mass volume, measurements in grams were considered equal to the volume in milliliters. All of the surgeries had a similar patient position, which was in a supine position under hypotension control. All patients were anesthetized by an experienced oral and maxillofacial anesthesiology team using 0.1 mg/kg intravenous morphine, 2–2.5 mg/kg propofol, 2–3 mcg/kg fentanyl, and 0.5 mg/kg atracurium.

Statistical analysis

Describing quantitative and qualitative data have been done by mean and standard deviation and relative frequency using SPSS software 21.0 (IBM Corp, Armonk, NY, USA). A significant level for all statistical tests in this research is considered 0.05. Spearman correlation analysis was used to determine correlations between age and sex with blood loss.

RESULTS

This retrospective study investigated 206 patients, 159 men (77%) and 47 women (47%), who underwent maxillofacial surgical procedures in an Iranian subpopulation public hospital during 2017 and 2018. Mean age of patients who underwent surgery for maxillofacial trauma was 38.5 years [Table 1]. There was a reverse correlation between age and blood loss during surgery (nonparametric correlation = -0.23).

Motor vehicle accidents accounted for 78% of maxillofacial fractures, 15% were related to fall and sports injuries, and 6% were related to fights and assaults. Unilateral fractures of different categories was reported in 67.5% and 32.5% was bilateral [Table 2].

Mean age of patients who underwent surgery for maxillofacial trauma was 38.5 years [Table 1]. There was a reverse correlation between age and blood loss during surgery (nonparametric correlation = -0.23).

One hundred and fifty-nine patients were men (77%) and 47 were women (23%), and there is no significant correlation between sex and average blood loss.

The average intraoperative blood loss in patients with maxillofacial surgery was 77.6 ml, and none of them needed blood transfusion during surgery [Table 3].

DISCUSSION

This study was aimed to assess the intraoperative blood loss in maxillofacial surgery of traumatic patients to predict the need for preparing blood products. The findings of the present study showed that there is no need for blood transfusion in maxillofacial trauma patients who had no systemic disease, neurological injuries, loss of consciousness, or concomitant injuries in other parts of their bodies. It appears that the average blood loss in facial bone fracture surgeries is lower than other maxillofacial surgeries, such as orthognathic surgeries. Samman *et al.* study showed that in 27% of bimaxillary orthognathic surgeries, transfusion was required.^[19] Moenning *et al.* found that among 506 patients who underwent orthognathic surgery, there were only four patients (0.8%) who needed a blood transfusion.^[20] Ueki *et al.* concluded that the average blood loss in single- and double-jaw surgeries is lower than the required level for transfusion.^[21] Nath and Pogrel have also found that the average blood loss in maxillofacial surgeries is usually so less that blood transfusion is rarely required in these cases.^[22]

Table 1: The prevalence of maxillofacial fractures in different age groups

Age (years)	n/frequency (%)
<20	23 (11)
20-39	98 (47)
40-59	57 (27)
>60	28 (13)

When comparing the association of blood loss with males and females, Moenning *et al.* found more blood loss in males than females in a group of orthognathic patients.^[20] In the present study, there was no significant difference between blood loss in men and women during surgery. The difference might be due to the homogenous orthognathic sample population in Moenning *et al.*^[20] and a variety of maxillofacial fractures in our study, which makes the comparison difficult, and results should be used cautiously.^[20]

Brasileiro *et al.*^[23] had studied over 1000 patients with maxillofacial fractures, and the results showed that the most frequent fracture was mandible fracture (44.2%), followed by zygomatic complex fracture (32.5%) and nasal bone fracture (16.2%), while the present study revealed that the most common fracture was nasal bone fracture (25%), followed by mandible fracture (22.8%) and zygomatic fracture [19.5%, Table 2]. The difference in the results might be because of the number of patients evaluated, cultural differences, and the lifestyle differences between the two populations.

Allareddy *et al.*^[24] found that the mean age of patients with maxillofacial fractures was 37.9 years, and 68% of them were men. Other studies reported that most maxillofacial fractures occurred in the third decade of life, motor-vehicle accident was the leading cause, and males were affected more than females.^[10,12] This is consistent with the results of the present study.

In the present study, the highest average estimated blood loss was associated with maxillary surgeries (Le Fort II and Le Fort III) and mandible fracture (mandible angle and mandible body fracture), which is similar to previous studies that have found more blood loss during Le Fort and mandible fracture. However, the values were different [Table 3].^[25] The differences could be due to the method of measurements, surgical techniques, and duration of surgery. Other studies found that mandibulectomy is associated with the highest intraoperative bleeding.^[25,26] Olusanya *et al.* measured similar estimated blood loss to the present study, but they did not classify maxillofacial trauma into different bone fractures.^[26]

One of the limitations of the present study was that there might have been errors in recording an accurate amount of blood loss by the team of maxillofacial anesthesiology. Since the team member was the same in all of the procedures of the period of this study, we speculated that the difference was not significant. We have categorized the maxillofacial bone fractures into a specific types. It should be bear in mind that a facial bone might fracture with different patterns that might requires more manipulation. Another limitation of this study was the varieties of panfacial fractures. Thus, we have categorized the amount of intraoperative bleeding according to the isolated facial bone fracture to come up with a conclusion. Considering these limitations, the present study tried to associate the amount of blood loss during different facial bone fracture surgeries, which is scarce in the literature.

Table 2: The prevalence of different types of maxillofacial fractures

Fracture facial bone	Type of fracture	Prevalence (%)	Total (%)
Maxilla	Le Fort 1	5	15
	Le Fort 2	7	
	Le Fort 3	3	
Zygoma	Zygomatic arch fracture	10	19.5
	Zygomatic complex fracture	9.5	
Mandible	Body	4	22
	Angle	2	
	Condyle	7	
	Ramus	3	
	Symphysis	6	
Naso-orbito-ethmoidal		10	10
Frontal		6	6
Nose		25	25
Dentoalveolar		2.5	2.5

Table 3: Average blood loss (ml) in maxillofacial bone fracture surgeries

Place of fracture	Type of fracture	Average blood loss (ml)
Maxilla	Le Fort 1	87.2
	Le Fort 2	105.6
	Le Fort 3	135.8
Zygoma	Zygomatic arch fracture	40.2
	Zygomatic complex fracture	94.3
Mandible	Body	108.9
	Angle	108.7
	Condyle	59.7
	Ramus	90.6
	Symphysis	69.6
Naso-orbito-ethmoidal		77.1
Frontal		75
Nose		58.6
Dentoalveolar		30.5

Further studies are required to evaluate other maxillofacial surgeries, which might indicate preoperative preparation for blood products.

The results of the present study showed that most of the patients were men. Most of the maxillofacial fractures had occurred due to MVAs. The most common factors of causing maxillofacial fractures after vehicle accidents were falling, sports injuries, fight, and assault. Most of the fractures were unilateral. Average age of patients with maxillofacial fracture was 38.5 years, and average blood loss had an inverse relationship with age. It also showed that there is no significant relationship between the patient's sex and average blood loss. Average blood loss during surgery in patients with maxillofacial fractures was lower than previous studies, and none of them need a transfusion during operation.^[25]

CONCLUSION

Under the condition of the present study, preoperative blood product preparation is not required for most of the maxillofacial trauma surgeries unless other systemic diseases or the extent of surgery indicate otherwise.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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