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Original Article

Factors affecting hospital discharge in maxillofacial trauma patients: a retrospective study

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Aim: To determine factors that may affect the time of discharge from hospital in patients who underwent maxillofacial trauma. **Methods:** The sample included 115 patients seen at a public hospital in Brazil, to whom surgical maxillofacial treatment was delivered. Data were obtained from patients' medical records and then followed by a statistical analysis using a 5% significance level. **Results:** The location of fractures and other clinical features such as the presence of edema and ecchymosis were found to be significantly associated with increased time of discharge from hospital ($P < 0.05$). When data were modeled using a GML approach, male gender was associated with a lower likelihood of prolonged hospital discharge (OR = 0.84; 95% CI: 0.72–0.98; $P < 0.05$), while the presence of edema was associated with greater time of hospital discharge (OR = 1.30; 95% CI: 1.14–1.49; $P < 0.001$). No significant association with age, etiology of trauma, and number of fractures was observed ($P > 0.05$). **Conclusion:** Female gender was associated with greater time of hospital discharge, and further concerns should be addressed to the management of lesions following maxillofacial trauma surgical interventions.

Keywords: Facial injuries. Medical records. Outcome assessment (health care).

Introduction

Maxillofacial fractures remain a major component of all traumas, representing a challenge for public health services worldwide due to the high incidence and significant financial cost[1-4]. Considering that these fractures may result in functional or cosmetic deformities, maxillofacial surgery aims at consistently restoring patients back to their pre-injury form and function[5-7]. In both developed and developing countries, despite seat belt and alcohol legislation, maxillofacial injuries are likely associated with traffic accidents, being the main cause of facial trauma. Other etiological factors often described include physical agressions, falls, interpersonal violence, sports or work-related activities, and animal-related accidents[3,7-16].

Although maxillofacial trauma is thought to be more prevalent in younger age groups, its incidence in the elderly has increased, likely due to an increase in life expectancy and active lifestyle among this population[12]. Factors such as geographic region, population density, socioeconomic status, education and culture affect the results of epidemiological investigations regarding the incidence, etiology, clinical presentation and length of stay in hospital[17]. Importantly, maxillofacial trauma exhibit extremely variable resulting injuries, often promoting severe morbidities, deformities and functional limitations, whose treatments involve long periods of removal of patients from their professional activities[6-7]. Nevertheless, data regarding the time of discharge from hospital of patients who have undergone maxillofacial trauma remains poorly investigated.

The significance of epidemiological research addressing maxillofacial trauma is on the search for strategies to improve the quality of care, prevention and treatment protocols, and identification of injuries' patterns[1,3,14]. Therefore, since there is a shortage of studies in this regard, we aimed at investigating factors that could affect the time of hospital discharge of maxillofacial trauma patients at a public hospital in Northeast Brazil.

Methods

Sample selection

Clinical records of 100 male and 15 female patients (n = 115), aged 11-59 years (mean: 30 years), were obtained from the Department of Medical Archives at the University Hospital of the Federal University of Maranhão (São Luís, Brazil). A retrospective study was carried out by collecting data from all available medical records of maxillofacial trauma patients that underwent surgical treatment in the period 2009-2013. The present study was approved by the local Research Ethics Committee (protocol #721873/14; Brazil).

Data collection

The following data collected were included and transcribed to a clinical record: gender, age, time when surgery was performed, etiology of trauma; location of the fracture (upper third, middle third and lower third), fractured bone(s) involved, signs and symptoms reported, and time of hospital discharge. The etiology of trauma comprised the following causes: car, motorcycle or road accidents; physical aggression; projectile injury; others.

Statistical analyses

Data regarding gender, age, etiology of trauma, location/number of fractures, clinical features, and time of hospital discharge were expressed as frequencies, and the Pearson's chi-squared test was then applied to investigate any associations between these variables. The Shapiro-Wilk test was used to compare numerical variables between the groups and was followed by the non-parametric Mann-Whitney test. When comparing more than one group, the Kruskal-Wallis test was utilized. In addition, Spearman's correlation was used to investigate correlations among numerical variables. The level of significance considered for all statistical analyses was 5%. Finally, we developed a generalized linear model (GLM) using a gamma with log link function to test the effects of several variables on the time of hospital discharge. Data obtained in this study were analyzed using the Statistical Package for Social Sciences – IBM SPSS Statistics 23.0 (SPSS Inc., IL, USA).

Results

In the present investigation, a predominance of male patients (86.95%) was observed. Motorcycle accidents, followed by car accidents were found to be the most prevalent causes of maxillofacial trauma. In regard to the fractured sites, the lower facial third was the most affected one, presenting with 100 cases of mandibular fractures, 54 of which linked to more than one injury in the same bone. It was followed by the middle third, where 58 fractures were observed, whereas the upper third was the less affected site (data not shown).

In terms of the treatment delivered, all patients underwent surgical procedures, 93.92% of whom waited up to one week for the surgery, while 6.08% waited up to one month for the definitive surgical procedure. Most of patients (79.13%) who underwent general anesthesia and surgery procedures were found to have a 1-2 day time of discharge. Nevertheless, there were patients who stayed longer in the hospital. The longest post-surgical stay period in hospital observed was 8 days, but there was no association between the number of fractures and time of hospital discharge (Fig. 1, $P > 0.05$).

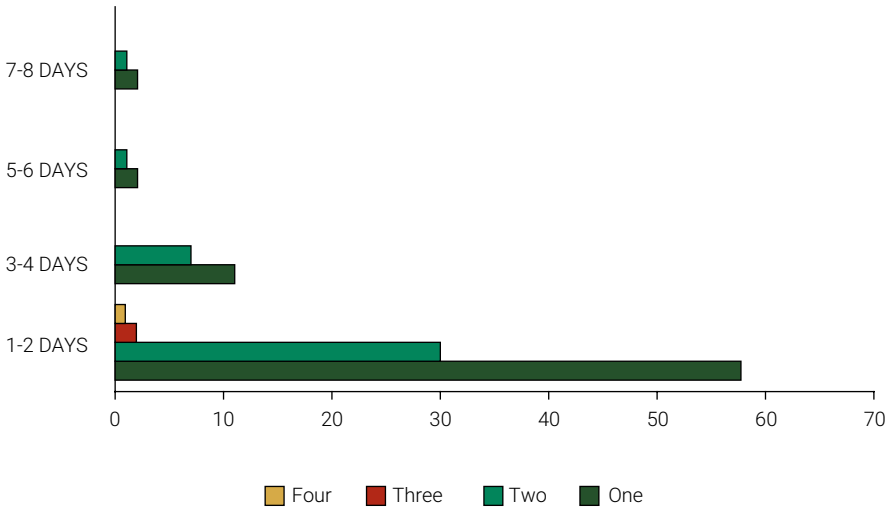

Figure 1. Distribution of fractures according to the number of fractures and the time of discharge from hospital (P > 0.05, according to the Pearson's chi-squared test).

The associations between the age, gender and clinical features of maxillofacial trauma patients are available in Table 1. None of the clinical features evaluated was found to be associated with either the gender or the age group ($P > 0.05$). Additionally, there was no statistically significant association between the etiology of trauma and either the gender or the age group ($P > 0.05$; data not shown).

Table 1. Association between gender, age group and clinical features in maxillofacial trauma patients.

Variable	Gender (n)		OR (95% CI)	*P* value	Age group (n)					*P* value
	Male	Female			10-19	20-29	30-39	40-49	50-59	
Facial asymmetry	72	11	0.935 (0.27–3.18)	0.91	7	34	24	12	6	0.53
Crepitation	10	2	0.722 (0.14–3.67)	0.69	1	7	3	1	-	0.63
Paresthesia	21	2	1.728 (0.36–8.26)	0.49	1	10	7	2	3	0.37
Malocclusion	71	11	0.89 (0.26–3.02)	0.85	11	35	24	10	2	0.06
Limited movement	79	11	1.368 (0.39–4.73)	0.62	9	35	30	11	5	0.45
Ecchymosis	14	2	1.058 (0.21–5.20)	0.94	1	7	4	3	1	0.91
Edema	26	3	1.405 (0.36–5.37)	0.62	1	13	10	3	2	0.53
Upper third fractures	4	-	- (−−)	0.43	-	2	1	-	1	0.45
Middle third fractures	38	9	0.409 (0.13–1.23)	0.10	4	18	14	8	3	0.89
Lower third fractures	66	8	1.699 (0.56–5.08)	0.34	9	34	20	8	3	0.20

CI: confidence interval; OR: odds ratio; Pearson's chi-squared test.

Interestingly, several variables evaluated related to the clinical features of patients and location of fractures had some level of association between each other (Table 2, $P < 0.05$; $P < 0.001$). Yet, the gender and number of fractures or time of discharge from hospital were not found to be associated (Table 3, $P > 0.05$). Furthermore, both the age group (Table 4) and the etiology of trauma (Table 5) did not demonstrated significant association with either number of fractures or time of discharge ($P > 0.05$).

Table 6 illustrates associations between several signs and symptoms demonstrated by the patients with both number of fractures and time of hospital discharge. A potential correlation between age, number of fractures and time of discharge was tested, but no statistically significant correlation was shown ($P > 0.05$; data not shown). Lastly, in Table 7, a GLM approach showed that male gender was associated with a lower likelihood of prolonged hospital discharge ($P < 0.05$), and the presence of edema was associated with greater time of hospital discharge ($P < 0.001$).

Discussion

In the present study, there was higher prevalence of men affected by maxillofacial trauma. This is in agreement with prior research that shows male patients within second and third decades of life to be the most affected by maxillofacial injuries, mainly

Table 2. Association and risk among clinical features in maxillofacial trauma patients, presented with OR (95% CI).

	Facial asymmetry	Crepitation	Paresthesia	Malocclusion	Limited movement	Ecchymosis	Edema	Upper third	Middle third
Crepitation	0.74 (0.20–2.67)	-							
Paresthesia	1.49 (0.50–4.43)	5.05* (1.45–17.57)	-						
Malocclusion	0.36 (0.12–1.04)	4.95 (0.61–40.05)	0.90 (0.33–2.44)	-					
Limited movement	2.58* (1.02–6.53)	0.81 (0.20–3.26)	0.55 (0.19–1.55)	1.22 (0.46–3.19)	-				
Ecchymosis	0.82 (0.26–2.59)	2.30 (0.55–9.64)	2.89 (0.92–9.04)	0.45 (0.15–1.35)	2.11 (0.44–10.01)	-			
Edema	1.28 (0.48–3.39)	1.56 (0.43–5.62)	0.78 (0.26–2.35)	0.20** (0.08–0.49)	2.97 (0.82–10.81)	5.07* (1.68–15.30)	-		
Upper third	1.16 (0.11–11.60)	- (––)	4.28 (0.57–32.20)	0.38 (0.52–2.87)	0.26 (0.03–1.95)	2.13 (0.20–21.87)	3.11 (0.41–23.15)	-	
Middle third	1.21 (0.52–2.80)	0.11* (0.01-0.90)	1.42 (0.56–3.57)	0.38* (0.16–0.87)	0.36* (0.14–0.91)	2.79 (0.93–8.31)	1.02 (0.43–2.41)	4.56 (0.46–45.33)	-
Lower third	0.92 (0.39–2.17)	6.98* (0.86–56.19)	0.83 (0.32–2.12)	3.07* (1.58–8.62)	2.97* (1.19–7.37)	0.50 (0.17–1.45)	0.87 (0.36–2.09)	- (––)	0.003** (0–0.02)

CI: confidence interval; OR: odds ratio; * $P < 0.05$, ** $P < 0.001$, according to the Pearson's chi-squared test.

Table 3. Difference of medians of the number of fractures and time of hospital discharge between male and female maxillofacial trauma patients.

Variable	Gender								*P* value
	Male				Female				
	n	Mean	Median	SD	n	Mean	Median	SD	
Number of fractures	100	1.4	1	0.58	15	1.4	1	0.5	0.83
Time of discharge		2.37	2	0.9		2.8	2	1.93	0.15

SD: standard deviation; Mann-Whitney test.

Table 4. Difference of medians of the number of fractures and time of hospital discharge according to the age group in maxillofacial trauma patients.

Variable	Age group										*P* value
	10-19		20-29		30-39		40-49		50-59		
	n	Median (95% CI)	n	Median (95% CI)	n	Median (95% CI)	n	Median (95% CI)	n	Median (95% CI)	
Number of fractures	13	1 (1.14 – 1.77)	45	1 (1.26 – 1.66)	34	1 (1.13 – 1.51)	16	1 (1.1 – 1.64)	7	1 (0.83 – 1.73)	0.80
Time of discharge		2 (1.53 – 3.54)		2 (2.04 – 2.44)		2 (2.09 – 2.84)		2 (1.91 – 3.08)		2 (1.22 – 4.77)	0.83

CI: confidence interval; OR: odds ratio; Kruskal-Wallis test.

Table 5. Difference of medians of the number of fractures and time of hospital discharge according to the etiology of trauma in maxillofacial trauma patients.

Etiology of trauma	n	Number of fractures		Time of discharge	
		Median (95% CI)	*P* value	Median (95% CI)	*P* value
Accidental fall	14	1 (1.07–2.06)	0.81	2 (1.91– .22)	0.23
Car Accident	24	1 (1.2–1.7)		2 (2.13–3.61)	
Motorcycle accident	48	1 (1.16–1.46)		2 (2.11–2.68)	
Road accident	7	1 (0.72–2.08)		2 (---)	
Physical aggression	14	1 (1.07–1.64)		2 (1.83–2.45)	
Projectile injury	3	1 (-0.1–2.76)		2 (-0.2–5.53)	
Other	5	2 (1.07–2.06)		(2 1.84–3.29)	

CI: confidence interval; OR: odds ratio; Kruskal-Wallis test.

due to higher risk-taking behavior[1,3,8,14,17]. Our findings also showed motorcycles accidents to be the most prevalent etiology of maxillofacial injuries.

Motorcycle is the mean of transportation used by the majority of population living in Northeast of Brazil, and these statistics corroborated with other studies conducted in Brazilian cities[3,16]. In a cross-sectional study, Leles et al.[3] (2010) reported that the commonest etiology of facial fractures was related to motorcycle accidents, in which 76% of victims were using helmets; however, 60.5% of them were not full-face helmets. It is important to stress out that most of motorcycles users in low-income communities in Northeast Brazil are not used to wear helmets, thereby leading them to experience severe maxillofacial injuries.

Table 6. Difference of medians of the number of fractures and time of hospital discharge according to the clinical features in maxillofacial trauma patients.

Clinical feature	Status	n	Number of fractures	*P* value	Time of discharge	*P* value
			Median (95% CI)		Median (95% CI)	
Facial asymmetry	Yes	83	1 (1.28–1.53)	0.79	2 (2.23–2.77)	0.59
	No	32	1 (1.17–1.57)		2 (2.04–2.39)	
Crepitation	Yes	12	1 (0.99–1.84)	0.93	2 (1.79–2.53)	0.28
	No	103	1 (1.28–1.5)		2 (2.23–2.67)	
Paresthesia	Yes	23	1 (1.1–1.59)	0.55	2 (2.13–2.91)	0.2
	No	92	1 (1.29–1.53)		2 (2.16–2.63)	
Malocclusion	Yes	82	1 (1.26–1.53)	0.79	2 (2.14–2.51)	0.45
	No	33	1 (1.21–1.56)		2 (2.12–3.2)	
Limited movement	Yes	90	1 (1.3–1.55)	0.28	2 (2.22–2.72)	0.78
	No	25	1 (1.09–1.46)		2 (2.02–2.45)	
Ecchymosis	Yes	16	1 (1.1–1.64)	1.0	2 (2.10–4.02)	0.04*
	No	99	1 (1.28–1.52)		2 (2.14–2.5)	
Edema	Yes	29	2 (1.36–1.87)	0.01*	2 (2.34–3.65)	0.01*
	No	86	1 (1.21–1.43)		2 (2.08–2.37)	
Upper third fractures	Yes	4	2 (0.95–2.54)	0.12	3.5 (2.22–5.27)	<0.001**
	No	111	1 (1.27–1.49)		2 (2.17–2.57)	
Middle third fractures	Yes	47	1 (1.19–1.48)	0.53	2 (2.28–3.11)	0.01*
	No	68	1 (1.28–1.59)		2 (2.05–2.41)	
Lower third fractures	Yes	74	1 (1.31–1.60)	0.18	2 (2.04–2.36)	0.02*
	No	41	1 (1.14–1.43)		2 (2.35–3.30)	

CI: confidence interval; OR: odds ratio; * $P < 0.05$, ** $P < 0.001$, according to Mann-Whitney test.

Table 7. Generalized linear model showing predictors for the time of hospital discharge, which was used as a dependent variable.

Variable	OR (95% CI)	*P* value
Male	0.84 (0.72–0.98)	0.02*
Female	1	
Asymmetry	1.06 (0.95–1.20)	0.25
Crepitation	0.88 (0.73–1.05)	0.18
Paresthesia	1.06 (0.92–1.21)	0.38
Malocclusion	1.07 (0.94–1.22)	0.25
Ecchymosis	1.11 (0.94–1.30)	0.20
Limitation	1.08 (0.95–1.23)	0.23
Edema	1.30 (1.14–1.49)	<0.001*
Upper third fractures	1.34 (0.99–1.81)	0.05
Middle third fractures	0.95 (0.76–1.18)	0.65
Lower third fractures	0.82 (0.65–1.04)	0.11
Age	1 (0.99–1.00)	0.12
Number of fractures	0.93 (0.85–1.02)	0.17

CI: confidence interval; OR: odds ratio; *$P < 0.05$; *$P < 0.001$.

Regarding fractures' patterns, the lower third (mandible) accounted for most frequent location of fractures in our study, specifically with high incidence of angle and body sites isolated or associated. The major clinical features related to these injuries were crepitation, malocclusion and limited movement. In a Greek population study, it has been found mandible fractures to be more prevalent (56%), mostly related to motorcycles vehicles crashes, though condylar and symphysis/parasymphysis were the most prevalent sites of injuries[8].

Importantly, the fact that most patients surgically treated for maxillofacial trauma underwent general anesthesia might directly affect the time of treatment and hospital length of stay. In a 5-year study with 394 patients, Van Hout et al.[14] (2013) found a mean of discharge time within one to four days; however, when other injuries were present it was nearer 22 days. Additionally, Al-Dajani et al.[1] (2015) reported a mean length of hospital stay lasting 2 to 7 days, addressing longer stay periods to older patients (>7 days) and shorter to children (< 2 days).

Kostakis et al.[8] (2012) accounted longer mean periods of hospital stay of 12.1 days (work-related accidents), 11.7 days (motorcycles accidents), and 7.3 days for assaults. These authors mention that besides serious concomitant injuries associated with maxillofacial trauma, patients experienced prolonged waiting between hospital admission and definitive treatment due to lack of infrastructure[8].

In the present study, the length of hospitalization was similar for all age groups (mean: 2 days). This relatively short period that patients victims of maxillofacial fractures stayed in hospital might reflect the implementation and availability of rigid internal devices and trained residency programs. In fact, adequate use of plates, miniplates and screws can greatly benefit patients with a proper maintenance of reduced bones segments, eliminating longer maxilo-mandibular blockage periods, providing thus better esthetics outcomes and early functional return[16,18]. Other comorbidities aspects that could increase the length of stay in hospital, such as leg fractures or systemic complications were not analyzed in this study. These aspects could be correlated with maxillofacial fractures by increasing the length of patients' hospital discharge.

In conclusion, we found gender and some clinical features such as the location of trauma and the presence of edema and ecchymosis to be associated with increased time of discharge from hospital. Conversely, no association was observed between age, etiology of trauma, number of fractures, and time of hospital discharge in maxillofacial trauma patients. Hence, we emphasize that female patients that underwent maxillofacial trauma should receive special care as well as further attention should be given to the management of lesions towards reducing the time of hospital discharge in the population.

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