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Evaluation of Sensorimotor Nerve Damage in Patients with Maxillofacial Trauma; a Single Center Experience

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ABSTRACT

Objective: To evaluate sensorimotor nerve damage in patients with maxillofacial trauma referring to Taleghani hospital, Tehran, Iran
Methods: This cross-sectional study was conducted during a 2-year period from 2014 to 2012 in Taleghani hospital of Tehran. We included a total number of 495 patients with maxillofacial trauma referring to our center during the study period. The demographic information, type of fracture, location of fracture and nerve injuries were assessed and recorded in each patients. The frequency of sensorimotor injuries in these patients was recorded. Data are presented as frequencies and proportions as appropriate.
Results: Overall we included 495 patients with maxillofacial trauma with mean age of 31.5±13.8 years. There were 430 (86.9% men and in 65 (13.1%) women among the patients. The frequency of nerve injuries was 67.7% (336 patients). The mean age of the patients with nerve injuries was 33.4±3.7 years. Marginal mandibular branch of facial nerve was the most common involved nerve being involved in 5 patients (1%). Regarding trigeminal nerve, the inferior alveolar branch (194 patients 39.1%) was the most common involved branch followed by infraorbital branch (135 patients 27.2%). Mandibular fracture was the most common injured bone being reported in 376 patient (75.9%) patients followed by zygomatic bone in 100 patient (20%).
Conclusion: The most frequent fracture occurred in mandible followed by zygoma and the most injured nerve was inferior alveolar nerve followed by infraorbital branch of trigeminal nerve. In facial nerve the marginal branch was the most involved nerve. The frequency of nerve injury and the male to female ratio was higher in the current study compared to the literature.

Keywords: Maxillofacial fracture; Sensorimotor impairment; Trauma; Epidemiology.

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Introduction

Maxillofacial traumas are common injuries in patients referring to emergency departments and need special attention because of potential injuries to several important systems including ocular, vestibulococlear, olfactory, respiratory, ingestion and vocalization [1,2]. Maxillofacial trauma

may occur on the upper face, midface including LeFort I, LeFortII, LeFort III, nasoethmoidal complex (NOE) or zygomaticomaxillary complex (ZMC) and on the orbital floor. Based on the type of accident the most common bone fractures are nasal bones, mandible, and the zygoma [3-5]. In developed countries the leading cause of maxillofacial trauma is assault followed by motor vehicle accidents, crash, stumbling, sports and industrial accidents, however in developing countries the most common cause of maxillofacial is traffic accident [6-9]. Maxillofacial fractures may involve nerves and lead to some complications such as paresthesia and neurosensory dysfunction (NSD) [10,11]. The NSD may be persistent because of surgical manipulation, surgical dissection, or a combination of these factors [12]. Previous studies indicated that NSD occurs in near to 8-66.7% of patients with mandibular fracture and 15-46% with midface fracture [11]. Moreover, other studies signified persistent maxillofacial traumas lead to sustained NSD that associated to functional sequel and complications in daily activities [13]. The aim of this current study was to evaluate the sensorimotor nerve damage in patients with maxillofacial trauma that were referred to Taleghani hospital, Tehran, Iran.

Materials and Methods

Study Population

This retrospective cross-sectional study was conducted in emergency department of Taleghani hospital during a 2-year period from 2012 to 2014. We included all the patients who referred to our emergency department with maxillofacial trauma during the study period. Those whose medical chart included incomplete information were excluded from the study. We also excluded those in whom the evaluation of sensorimotor was not applicable. The study protocol was approved by institutional review board and medical ethics committee of Shahid Beheshti University of Medical Sciences. As this was a retrospective study, we did not need to obtain informed written consents.

Study Protocol

Information of the patients was extracted from their records including the demographic data such as age, sex and the type of fracture, the location of fracture and the injured nerve. In order to evaluate the sensorimotor injuries, the neurosensory testing (NST) had been performed by resident of oral and maxillofacial surgery at the time of admission and hospitalization for all patients and response to static 2-point discrimination, localization of stimulus, light touch, and moving brush strokes had been assessed and the results of all tests had been recorded. During the testing, subjects were asked to close their eyes and separate their lips comfortably so that they could concentrate on the perception. The lower lip and the mental area were divided into 4 zones. The testing was performed over a 1-cm area above and beneath the labiomental fold on both sides of the chin, and each zone was measured separately by a battery of neurosensory tests: light touch (LT), 2-point discrimination (2-P), localization of stimulus, moving brush strokes. Each of the 4 facial zones was stimulated3 times, and the response was classifiedas correct if there were at least 2appropriate answers to each test. Two-point discrimination was measuredwith a sharp millimeter ruler. The subject indicated whether he or she felt 2distinct points of contact. The test was conducted by beginning with the tips closed and by progressively opening them at 1-mm increments until the subject felt 2 distinct points of contact. This distance was then recorded. Care was taken to ensure that the tips touched the cutaneous surface at the same time. The intra- and inter-examiner variation as well as the inter-interval difference between measurements was estimated to be significant if they were more than 2 mm. 0.3 g and 15 g. The needles pressed the skin of each of the 4 zones through a loop (in the framework, through which the needles could move freely) by their own weight. The lightest needle that the subject perceived as sharp was recorded. The intra-examiner, inter-examiner, and inter-interval differences between measurements were estimated to be significant if they were greater than 1 g. For the thermal test, 2 small glass tubes containing water at 50°C and 15°C were used. The subject's perception of each stimulus (ie, cold versus hot) was recorded. To evaluate the facial nerve, examiner asked patient to do facial animation (eyes squeezing, whistling, smiling, raising the brow and nose).

Statistical Analysis

All the statistical analysis was performed utilizing statistical package for social sciences (SPSS Inc., Chicago, USA) version 21.0. Data are reported as mean±SD and proportions as appropriate. The frequency and types of fractures and sensorimotor injuries were reported.

Results

Overall we included records of 495 patients with maxillofacial trauma referred to our center during years 2012-2014 with mean age of 31±13.8 (ranging from 10 to 70). Among the patients 430 (86.9%) were men and 65 (13.1 %0) women. The male to female ratio was 6.6 to1.Motor vehicle accidents were the most common mechanism of injury for maxillofacial fractures followed by assault trauma, fall and sport trauma. The demographic and clinical characteristics of the patients are summarized in Table 1.

Frequency of nerve injuries was 67.7% (336 patients). The mean of duration hospital stay was 2.77±2.52 (ranging from 1 to 24) days. In 338 patients (73.6%) hard tissue and in 121 patients (26.4%)

Table 1. The characteristics of 495 patients with maxillofacial trauma referred to maxillofacial surgery department of Taleghani hospital duringa 2-year period from 2012 to 2014.

Variable	Frequency (%)
Gender	
Men (%)	430 (86.9%)
Women (%)	65 (13.1%)
Age (years)	31.5±13.8
<20 (%)	73 (14.7%)
20-39 (%)	307 (61.9%)
40-59 (%)	89 (17.9%)
≥60 (%)	14 (2.8%)
Mechanism of injury	
Motor Vehicle Accident (%)	265 (53.5%)
Assault (%)	124 (25%)
Fall (%)	76 (15.3%)
Sport trauma (%)	30 (6.0%)
Fractures	
Mandible (%)	376 (75.9%)
Multiple (%)	213 (43%)
Body (%)	64 (13%)
Angle (%)	47 (9.5%)
Symphysis (%)	18 (3.7%)
Parasymphysis (%)	15 (3%)
Subcondyle (%)	10 (2%)
Condyle (%)	9 (1.8%)
Zygoma (%)	100 (20.2%)
Orbit (%)	1 (0.2%)
LeFort (%)	
I (%)	10 (2%)
II (%)	7 (1.4%)
III (%)	2 (0.4%)
Treatment	
Open reduction	306 (61.7%)
Close reduction	111 (22.4%)
Both	64 (12.9%)

soft and hard tissue were involved. Regarding facial nerve the most common involved branch was marginal mandibular nerve reported in 5 (1%) patients. Regarding trigeminal nerve the inferior alveolar branch was the most common involved branch reported in 194 patients (39.1%) followed by infraorbital branch in 135 (27.2%). The most prevalent fracture occurred in mandible followed by zygomatic bone. There was no significant difference regarding the frequency of sensorimotor nerve injury between men and women (Table 2). The majority of patients with nerve injury were 20-39 years old (Table 3). Open reduction was performed in 306 (61.8%) patients and close reduction in 111 (22.4%) and 15 (3.03%) left the hospital without any treatment (Table 1).

Discussion

Maxillofacial trauma increases the risk of nerve impairment and some studies indicated 48% facial nerve injuries in patients with maxillofacial trauma [14,15]. In the current study we evaluated 495 patients with maxillofacial trauma and found 67.7% incidence of nerve injuries that is more than previous reports [14,15]. The male to female ratio was 6.6to 1 that was in comparable with previous reports that showed maxillofacial traumas are more prevalent in men than women; however the male to female ratio in the current study was more than previous reports [16-21]. The mean age of patients in our study was 31.6 ±13.8 years and the majority of patients were 20-39 years old that was in line with previous studies [16,17,22] and showed people in third decade of life are more prone to maxillofacial trauma due to vehicle accident, assault, sport, work and etc.

In our study the most prevalent fracture occurred in mandible followed by zygomatic bone, moreover the most common fracture in mandible occurred in the body of mandible although the most of patients suffer from multiple fractures. Similar to our study, a retrospective study by Ascani and colleagues in Italy indicated that the most frequent fracture were mandible followed by zygoma, harmoniously they indicated that fractures were more frequent in male than female and most common cause of fractures were traffic accident followed by assault [23]. Conversely another study in Iran by Kezemi *et al*. in 2003 indicated that the most common fracture in mandible was in condyle and the body of mandible was the second site, moreover they

Table 2. The frequency of sensorimotor injury according to gender in 495 patients with maxillofacial trauma referred to maxillofacial surgery department of Taleghani hospital during a 2-year period from 2012 to 2014.

Nerve injury	Branches	Frequency (%)	Men (n=430)	Women (n=65)	*p*-value
Facial nerve (motor)	Marginal	5 (1%)	4 (0.93%)	1 (1.53%)	0.462
	Buccal	1 (0.2%)	1 (0.23%)	0 (0.0%)	
	Temporal	1 (0.2%)	0 (0.0%)	1 (1.53%)	
	Zygomatic	1 (0.2%)	0 (0.0%)	1(1.53%)	
	Total	8 (1.6%)	5 (1.2%)	3 (4.61%)	
Trigeminal nerve (sensory)	Inferior alveolar	194 (39.1%)	162 (84%)	32 (16%)	0.733
	Infraorbital	135 (27.2%)	113 (84.5%)	22 (13.5%)	
	Auriculotemporal	5 (1%)	5 (1.2%)	0 (0.0%)	
	Supraorbital	1 (0.2%)	1 (0.23%)	0 (0.0%)	
	Mental	1 (0.2%)	1 (0.23%)	0 (0.0%)	
	Total	325 (65.5%)	271 (63.1%)	54 (83.1%)	

Table 3. The distribution of sensorimotor injuries according to age group in 495 patients with maxillofacial injury referred to maxillofacial surgery department of Taleghani hospital during a 2-year period from 2012 to 2014.

Nerve injury	Branches	>20 (n=73)	20-39 (n=307)	40-59 (n=89)	>59 (n=14)	*p*-value
Facial nerve (motor)	Marginal	0 (0.0%)	3 (0.97%)	2 (2.2%)	0 (0.0%)	0.221
	Cervical	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Buccal	0 (0.0%)	1 (0.3%)	0 (0.0%)	0 (0.0%)	
	Temporal	0 (0.0%)	0 (0.0%)	1 (1.12%)	0 (0.0%)	
	Zygomatic	0 (0.0%)	0 (0.0%)	1 (1.12%)	0 (0.0%)	
	Total	0 (0.0%)	4 (1.3%)	4 (4.5%)	0 (0.0%)	
Trigeminal nerve (sensory)	Inferior alveolar	30 (41.1%)	130 (42.4%)	26 (29.2%)	8 (57.2%)	0.004
	Infraorbital	10 (7.5%)	85 (27.7%)	37 (41.5%)	3 (21.4%)	
	Auriculotemporal	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Supraorbital	0 (0.0%)	0 (0.0%)	7 (7.8%)	0 (0.0%)	
	Total	40 (54.8%)	215 (70.1%)	70 (78.5%)	11 (78.6%)	

emphasized that the most prevalent involved nerve was marginal branch of facial nerve and they showed paresthesia during 6 month after operation was the most important nerve injuries that improved after one year of treatment [24]. These findings were in concordance with our results in present experience. We found that the most common involved branch was marginal mandibular of facial nerve. In a study in Turkey by Arslan *et al*. fractures in male were more than female but as opposed to our study and previous reports the most common cause of fracture was interpersonal assault and mean age was more than our study. Conversely the most common reported fractures were maxilla followed by nasal bone [25,26]. The inferior alveolar branch (194 patients 39.1%) was the most common involved branch of trigeminal nerve followed by infraorbital branch (135 patients 27.2%) consistent with our experience. Bagheri *et al*. in Atlanta indicated the most prevalent injured nerve was the inferior alveolar nerve and the most common fracture was mandibular angle fracture [27]. In the current study we detected one patient with orbital fracture but ophthalmic nerve injury was not detected in this patient. In contrast to our study Urolagin *et al*. indicated that of 354 patients 8 patients (2.25%) showed ophthalmic nerve injury [28].

In this study, motor vehicle accident, similar to the most of studies around the world was the most common cause followed by assault, however in Iran Kazemi *et al*., [23] detected the leading cause of maxillofacial trauma was vehicle accident that is in keeping to previous reports from third world. Moreover we did not evaluate the level of nerve injuries, for example we did not show which patients suffer from paresis or numbness. The lack of follow up was another important limitation so, we could not show whether these nerve impairments are transient or permanent. However this was a study with large series (495 patients) that is considered the strength of current survey.

In conclusion, the most common fracture in patients with maxillofacial trauma is mandible followed by zygoma and the most injured nerve is inferior alveolar nerve followed by infraorbital nerve. In facial nerve the marginal branch is the most frequent involved nerve. Further investigations are recommended with longer follow-up to validate the findings reported here.

Conflict of Interest: None declared.

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