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Epidemiological Analysis of 736 Patients who Suffered Facial Trauma in Brazil

Análisis Epidemiológico de 736 Pacientes que Sufrieron Trauma Facial en Brasil

Renato Marano ; Manoel Jadjisky; Aguimar Bourguinon de Mattos filho; Gabriela Mayrink; Stella Araújo; Laisa Oliveira; Iolanda Zanoteli Lemos; Nicolas Souza de Souza; Rayssa Gomes Margato & Danielle Barbosa Ribeiro Brandão

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ABSTRACT: The etiology of facial fractures is directly related to the studied country, varying according to the socioeconomic, cultural condition of the population, besides the period of investigation. The objective of the present study is to evaluate the epidemiological characteristics of the prevalence, treatment modalities and complications rates of maxillofacial fractures in a hospital in the state of Espírito Santo, over a period of 5 years. A total of 428 patients presented a facial fracture, with a prevalence of males (436), with a mean age of 40 years. Regarding the number of fractures, 291 individuals suffered fractures only in the fixed skeleton, 97 only in the mandible, and 48 suffered fractures in both fixed and mandibular skeletons. The predominant anatomical site in fixed skeletal fractures was zygomatic complex (56.6 %), orbit (31.9 %) and nose (29.2 %); while in the mandible the condyle (33.8 %), body (17.9 %) and angle (13.1 %). The frequent etiology was falls, physical aggression, sports accidents. Regarding the type of treatment, in fixed skeleton 192 fractures were treated conservatively and 303 by surgery. Already in the mandible, the numbers were 43 and 143, respectively. In addition, 24 patients progressed with some type of complication in one or more operated sites. It is worth mentioning that epidemiological assessments provide important support in the creation of legislation in the attempt to reduce important for the establishment of clinical and research priorities, since risk factors and patterns of presentation can be identified. Accordingly in an attempt to reduce these rates.

KEY WORDS: epidemiology, facial injuries, facial bones.

INTRODUCTION

When evaluating different epidemiological studies involving facial trauma, it is important to remember that the etiology of the trauma will be directly related to the country studied and will thus vary based on local socioeconomic conditions and even the year of investigation. Even so, etiology tends to be consistent across studies, with traffic accidents, falls, violence, sports injuries, and workplace injuries being reported in most studies (Shankar *et al*., 2012).

It is known that the more resources that are invested in facial trauma prevention campaigns, the lower the rates of these fractures are. These efforts come in the form of initiatives such as laws that require the use of seat belts, drunk driving laws, campaigns against domestic violence, and campaigns against the use of firearms (Adebayo *et al*., 2003; Brasileiro & Passeri, 2006).

Meanwhile, various issues in society, such as migrations of populations from rural to urban centers, increases in the number of high-speed vehicles traveling in urban centers without the infrastructure to support them, drunk driving accidents, society's intolerance toward underrepresented groups that experience violence, and the ease with which firearms are acquired in some countries, make it challenging for government organizations or institutions to reduce rates of facial injuries (Chrcanovic *et al*., 2004; Al-Khateeb & Abdullah, 2007; Shankar *et al*.). These factors force us to question whether the government should not play a more active role in prevention through

Dr. Jayme Santos Neves State Hospital; Address: Avenida Paulo Pereira Gomes, s/n, Morada de Laranjeiras, Serra/ES - CEP 29.166-828, Serra, Espírito Santo, Brazil.

public policy, since the cost of prevention campaigns will be always lower than the cost of treatment (Boffano *et al*., 2014).

The parts of the face most commonly subjected to fractures are the mandibular bone, the zygomatic complex, and the nasal bones, though the anatomical regions involved in a given injury vary according to the mechanism and energy of the trauma (Brook & Wood, 1983: Thorn *et al*., 1986; Lindqvist *et al*., 1986).

This study was developed to evaluate the epidemiological characteristics of the prevalence, treatment modalities, and complication rates of maxillofacial fractures in the Brazilian state of Espírito Santo from 2013 to 2017. The results are also compared to those from similar studies in other countries.

MATERIAL AND METHOD

This was a retrospective and longitudinal study of patients with maxillofacial traumas treated by the Department of Oral and Maxillofacial Surgery and Traumatology of Jayme Santos Neves Hospital in the city of Serra, Espírito Santo State, Brazil, over a five-year period (February 1, 2013 to December 31, 2017). Data on patient age, sex, and socioeconomic status, as well as on the etiology, nature, and type of injury plus data on any concomitant lesions (skull, neck, thorax, upper limb, lower limb, abdomen) were collected from electronic medical records. Maxillofacial fractures were distributed according to their etiological factors: traffic accidents (accidents involving automobiles, motorcycles, bicycles, and pedestrians), gunshot wounds, falls, sports injuries, workplace injuries, and other factors. The fractures were divided into two groups: the mandible and the middle and upper thirds of the face. The injuries involving the middle and upper thirds of the face were divided into zygomatic complex fractures (those involving the body, arch, or the body + arch), maxillary fractures (those involving a LeFort I, II, and III fractures, sagittal bones, or other maxillary fractures), fractures of the nasal bone, frontal bone fractures, pure orbital fractures (superior, lateral, and medial), and nasoorbitoethmoid (NOE) fractures. Fractures involving the mandible were divided into condyle, coronoid, angle, ramus, body, symphysis, parasymphysis, and dento-alveolar fractures.

The data obtained also included information on treatment, follow-up results, and complications. Patient management style was divided into conservative (no surgical reduction) or surgical (requiring at least one intervention for reduction and/or fixation of facial fractures). The surgical interventions used were closed reduction (Erich arch bars or intermaxillary fixation screws combined with steel wires) or open reduction and fixation of bone segments with plates, miniplates, and/or screws, depending on the case. The complications studied included infection, malocclusion, and nonunion.

Patients whose medical records were not properly completed were excluded from the study, as were patients who had refused treatment and patients who were not evaluated by the hospital's oral and maxillofacial surgery and traumatology team. Data are presented as part of a descriptive statistical analysis.

RESULTS

Over the five years of the study, 1,534 patients who with maxillofacial injuries were treated at the study site. After 488 were excluded, a total of 736 patients were included. Of these, 428 patients presented with some type of facial fracture, 346 of whom were men and 82 of whom were women (Table I). The patients' age distribution is provided in Table II. The mean age was 40 years, and age ranged from 3 to 105 years. The mean age of the male patients was 38.3 years, while the mean age of female patients was 45.1 years.

The facial fractures were divided into two groups: those involving the middle and upper thirds of the face and those involving the mandible. Of the 428 patients with facial fractures, 291 individuals had fractures only in the middle and upper thirds of the face, 97

Table I. Number of patients with facial fractures.

Number of patients with facial trauma	Male		Female	
	n	%	n	%
None	204	37.1	104	55.9
One	187	34.0	50	26.9
Two	99	18.0	25	13.4
Three	38	6.9	5	2.7
Four	11	2.0	-	-
Five	8	1.5	1	0.5
Six	1	0.2	1	0.5
Eight	1	0.2	-	-
Nine	1	0.2	-	-
Total number of patients	550	100.0	186	100.0

individuals had fractures only in the mandible, and 48 suffered fractures in both the mandible and the middle and upper thirds of the face (Table III). In the middle and upper thirds of the face, the fractures most frequently involved the zygomatic complex (192 patients; 56.6 %), followed by orbital bone fractures (108 patients; 31.8 %), nose fractures (99 patients; 29.2 %), maxillary fractures (54 patients; 15.9 %), frontal bone fractures (29 patients; 8.5 %) and NOE fractures (13 patients; 3.8 %) (Table IV). The mandibular fractures were reported in 145 patients. The highest incidences of mandibular fractures occurred as follows: 33.8 % in the condyle, 17.9 % in the body, 15.9 % in the angle, 13.1 % in the ramus, 13.1 % in the symphysis, 9.7 % in the parasymphysis, and 4.1 % represented dento-alveolar and coronoid fractures (Table V).

Traffic accidents were associated with the highest number of fractures, 90 of which involved the zygomatic complex, 51 of which involved the orbital bone, 27 of which involved the nose, 20 of which involved the maxillary bone, 14 of which involved the frontal bone and 5 of which represented a NOE fracture (Table VIa). Out of the traffic accidents that caused fractures in the mandibular bone, 22 patients experienced

Table II. Age of the patients with facial fractures.

Variable	n	%
Sex		
Male	550	74.7
Female	186	25.3
Age Range		
0 to 10 years	1	0.1
11 to 20 years	54	7.3
21 to 30 years	205	27.9
31 to 40 years	160	21.7
41 to 50 years	136	18.5
51 to 60 years	84	11.4
61 to 70 years	53	7.2
71 years or older	43	5.8
Total	736	100.0

Table III. Patients with facial fractures.

Type of Facial Fracture	n	%
None (non-facial fracture)	300	40.8
Middle and upper thirds of the face	291	39.5
Mandible	97	13.2
All thirds of the face	48	6.5
Total	736	100.0

Table IV. Comparisons between variables and fracture type – middle and upper thirds of the face.

Variable	Type of Fracture – Middle and Upper Thirds of the Face																Total number of patients with fractures in the middle and upper thirds of the face	
	Fracture of the zygomatic complex		Orbital fracture		Nasal fracture		Maxillary fracture		Frontal bone fracture		NOE fracture							
	n	%	n	%	n	%	n	%	n	%	n	%					n	%
Sex																		
Male	159	82.8	86	79.6	78	78.8	45	83.3	26	89.7	12	92.3					272	80.2
Female	33	17.2	22	20.4	21	21.2	9	16.7	3	10.3	1	7.7					67	19.8
Etiology of fracture																		
Traffic accident	90	46.9	51	47.2	27	27.3	20	37.0	14	48.3	5	38.5					132	38.9
Fall	49	25.5	28	25.9	25	25.3	12	22.2	5	17.2	3	23.1					84	24.8
Physical aggression	25	13.0	18	16.7	26	26.3	12	22.2	7	24.1	3	23.1					66	19.5
Gunshot wound	9	4.7	2	1.9	1	1.0	6	11.1	0	0.0	0	0.0					15	4.4
Sports injury	11	5.7	5	4.6	11	11.1	3	5.6	2	6.9	1	7.7					26	7.7
Workplace injury	6	3.1	3	2.8	6	6.1	1	1.9	1	3.4	1	7.7					11	3.2
Other	2	1.0	1	.9	3	3.0	0	0.0	0	0.0	0	0.0					5	1.5
Traffic Accidents																		
Motorcycle accident	46	51.1	25	49.0	13	48.1	8	40.0	6	42.9	3	60.0					65	49.2
Car accident	24	26.7	13	25.5	10	37.0	8	40.0	4	28.6	2	40.0					40	30.3
Pedestrian accident	12	13.3	9	17.6	3	11.1	2	10.0	3	21.4	0	0.0					16	12.1
Bicycle accident	8	8.9	4	7.8	1	3.7	2	10.0	1	7.1	0	0.0					11	8.3
Total number of patients	192	100.0	108	100.0	99	100.0	54	100.0	29	100.0	13	100.0					339	100.0

Table V. Comparisons between variables and fracture type – Mandible.

Variables	Type of Fracture – Mandible																			
	Condylar fracture		Mandibular body fracture		Mandibular angle fracture		Ramus fracture		Symphysis fracture		Parasymphysis fracture		Dento-alveolar fracture		Coronoid fracture		Other		Total number of patients with mandibular fractures	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex																				
Male	40	81.6	23	88.5	21	91.3	16	84.2	16	84.2	14	100.0	3	50.0	4	66.7	20	83.3	124	85.5
Female	9	18.4	3	11.5	2	8.7	3	15.8	3	15.8	0	0.0	3	50.0	2	33.3	4	16.7	21	14.5
Etiology of fracture																				
Traffic accident	22	44.9	10	38.5	7	30.4	7	36.8	8	42.1	5	35.7	4	66.7	0	0.0	9	37.5	55	37.9
Fall	13	26.5	4	15.4	2	8.7	2	10.5	1	5.3	2	14.3	0	0.0	0	0.0	3	12.5	22	15.2
Physical aggression	6	12.2	2	7.7	6	26.1	4	21.1	5	26.3	4	28.6	1	16.7	3	50.0	3	12.5	27	18.6
Gunshot wound	5	10.2	8	30.8	3	13.0	5	26.3	4	21.1	1	7.1	0	0.0	3	50.0	6	25.0	26	17.9
Sports injury	3	6.1	2	7.7	2	8.7	1	5.3	0	0.0	1	7.1	0	0.0	0	0.0	0	0.0	6	4.1
Workplace injury	0	0.0	0	0.0	0	0.0	0	0.0	1	5.3	1	7.1	0	0.0	0	0.0	1	4.2	3	2.1
Other	0	0.0	0	0.0	3	13.0	0	0.0	0	0.0	0	0.0	1	16.7	0	0.0	2	8.3	6	4.1
Traffic Accidents																				
Motorcycle accident	13	59.1	5	50.0	5	71.4	2	28.6	6	75.0	2	40.0	2	50.0	0	0.0	3	33.3	28	50.9
Car accident	4	18.2	4	40.0	1	14.3	2	28.6	0	0.0	2	40.0	2	50.0	0	0.0	6	66.7	17	30.9
Pedestrian accident	2	9.1	1	10.0	1	14.3	1	14.3	1	12.5	1	20.0	0	0.0	0	0.0	0	0.0	6	10.9
Bicycle accident	3	13.6	0	0.0	0	0.0	2	28.6	1	12.5	0	0.0	0	0.0	0	0.0	0	0.0	4	7.3
Total number of patients	49	100.0	26	100.0	23	100.0	19	100.0	19	100.0	14	100.0	6	100.0	6	100.0	24	100.0	145	100.0

condyle fractures, 10 experienced mandibular body fractures, 8 experienced fractures of the symphysis, 7 experienced angle and ramus fractures, 5 experienced fractures of the parasymphysis, and 4 experienced dento-alveolar fractures. When the types of traffic accidents were considered, motorcycle accidents were the most common type to be associated with a fracture in both groups, followed by car accidents, bicycle accidents, and accidents in which the patient was run over. However, when patients were separated by *sex*, car accidents were found to be more prevalent among women than motorcycle accidents (Tables VIa and VIb).

Falls (24.8 %), physical aggression (19.5 %), sports injuries (7.7 %), gunshot wounds (4.4 %), and workplace injuries (3.2 %) were the other etiologies reported to involve the middle and upper thirds of the face (Table IV). As for the etiologies of fractures involving the mandibular bone, physical aggression was the most common (18.6 %), followed by gunshot wounds (17.9 %), falls (15.2 %), and sports injuries (4.1 %).

In this study, 99 patients (13.4 %) were under the influence of drugs or alcohol. Of these patients, 38 (42.4 %) were injured in traffic accidents, 31 (37.9 %) had experienced falls, and 15 (12.1 %) had experienced physical aggression (Table VII).

When type of treatment was considered, 437 patients received a conservative treatment and 299 received a surgical treatment. When the type of treatment was separated by group, 43.1 % received a conservative treatment in middle and upper thirds of the face, while 56.9 % received a surgical treatment. In the mandible group, these numbers were 24.8 % and 75.2 %, respectively (Tables VIIIa and VIIIb).

When complications were considered, 24 patients were reported to have experienced some type of complication in one or more of the operated sites. Of the cases with complications, 12 were cases of traffic accidents, 3 were cases of physical aggression, 2 cases each of gunshot wounds and falls, and 1 was a case of a sports injury. Infection and malocclusion were the most frequent complications (Table IX).

Table VI a.Traffic accidents – middle and upper thirds of the face.

Variable	Type of Fracture – Middle and Upper Thirds of the Face													
	Fracture of the zygomatic complex		Orbital fracture		Nasal fracture		Maxillary fracture		Frontal bone fracture		NOE fracture		Total number of patients with fractures in the middle and upper thirds of the face	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex														
Male	159	82.8	86	79.6	78	78.8	45	83.3	26	89.7	12	92.3	272	80.2
Female	33	17.2	22	20.4	21	21.2	9	16.7	3	10.3	1	7.7	67	19.8
Traffic Accidents														
Motorcycle accident	46	51.1	25	49.0	13	48.1	8	40.0	6	42.9	3	60.0	65	49.2
Car accident	24	26.7	13	25.5	10	37.0	8	40.0	4	28.6	2	40.0	40	30.3
Pedestrian accident	12	13.3	9	17.6	3	11.1	2	10.0	3	21.4	0	0.0	16	12.1
Bicycle accident	8	8.9	4	7.8	1	3.7	2	10.0	1	7.1	0	0.0	11	8.3
Total number of patients	192	100.0	108	100.0	99	100.0	54	100.0	29	100.0	13	100.0	339	100.0

Table VI b. Traffic accidents – Mandible.

Variable	Type of Fracture – Mandible																			
	Condylar fracture		Mandibular body fracture		Mandibular angle fracture		Ramus fracture		Symphysis		Parasymphysis fracture		Dento-alveolar fracture		Coronoid fracture		Other		Total number of patients with mandibular fractures	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex																				
Male	40	81.6	23	88.5	21	91.3	16	84.2	16	84.2	14	100.0	3	50.0	4	66.7	20	83.3	124	85.5
Female	9	18.4	3	11.5	2	8.7	3	15.8	3	15.8	0	0.0	3	50.0	2	33.3	4	16.7	21	14.5
Traffic Accidents																				
Motorcycle accident	13	59.1	5	50.0	5	71.4	2	28.6	6	75.0	2	40.0	2	50.0	0	0.0	3	33.3	28	50.9
Car accident	4	18.2	4	40.0	1	14.3	2	28.6	0	0.0	2	40.0	2	50.0	0	0.0	6	66.7	17	30.9
Pedestrian accident	2	9.1	1	10.0	1	14.3	1	14.3	1	12.5	1	20.0	0	0.0	0	0.0	0	0.0	6	10.9
Bicycle accident	3	13.6	0	0.0	0	0.0	2	28.6	1	12.5	0	0.0	0	0.0	0	0.0	0	0.0	4	7.3
Total number of patients	49	100.0	26	100.0	23	100.0	19	100.0	19	100.0	14	100.0	6	100.0	6	100.0	24	100.0	145	100.0

Table VII. Classification of the sample: relative and absolute numbers by sex.

Variable	Under the influence of alcohol		Under the influence of drugs		Under the influence of drugs and alcohol		No drug use		Total number of patients	
	n	%	n	%	n	%	n	%	n	%
Etiology of fracture										
Traffic accident	33	41.8	-	-	5	50.0	210	33.0	248	33.7
Fall	28	35.4	1	10.0	2	20.0	156	24.5	187	25.4
Physical aggression	10	12.7	4	40.0	1	10.0	109	17.1	124	16.8
Gunshot wound	2	2.5	5	50.0	2	20.0	40	6.3	49	6.7
Sports injury	2	2.5	-	-	-	-	34	5.3	36	4.9
Workplace injury	1	1.5	-	-	-	-	17	2.7	18	2.4
Other	3	4.5	-	-	-	-	71	11.1	74	10.1
Total number of patients	79	100.0	10	100.0	10	100.0	637	100.0	736	100.0

Table VIII a – Type of treatment – Mandible.

Variable	Type of Fracture – Mandible																			
	Condylar fracture		Mandibular body fracture Mandibular		Mandibular angle fracture		Ramus fracture		Symphysis		Para-symphysis fracture		Dento-alveolar fracture		Coronoid fracture		Other		Total number of patients with mandibular fractures	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex																				
Male	40	81.6	23	88.5	21	91.3	16	84.2	16	84.2	14	100.0	3	50.0	4	66.7	20	83.3	124	85.5
Female	9	18.4	3	11.5	2	8.7	3	15.8	3	15.8	0	0.0	3	50.0	2	33.3	4	16.7	21	14.5
Surgical																				
Conservative treatment	16	32.7	6	23.1	3	13.0	4	21.1	0	0.0	3	21.4	0	0.0	4	66.7	7	29.2	36	24.8
Surgical treatment	33	67.3	20	76.9	20	87.0	15	78.9	19	100.0	11	78.6	6	100.0	2	33.3	17	70.8	109	75.2
Total number of patients	49	100.0	26	100.0	23	100.0	19	100.0	19	100.0	14	100.0	6	100.0	6	100.0	24	100.0	145	100.0

Table VIII b - Type of treatment – middle and upper thirds of the face.

Variable	Type of Fracture – Middle and Upper Thirds of the Face													
	Fracture of the zygomatic complex		Orbital fracture		Nasal fracture		Maxillary fracture		Frontal bone fracture		NOE fracture		Total number of patients with fractures in the middle and upper thirds of the face	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex														
Male	159	82.8	86	79.6	78	78.8	45	83.3	26	89.7	12	92.3	272	80.2
Female	33	17.2	22	20.4	21	21.2	9	16.7	3	10.3	1	7.7	67	19.8
Surgical														
Conservative treatment	72	37.5	34	31.5	52	52.5	16	29.6	16	55.2	2	15.4	146	43.1
Surgical treatment	120	62.5	74	68.5	47	47.5	38	70.4	13	44.8	11	84.6	193	56.9
Total number of patients	192	100.0	108	100.0	99	100.0	54	100.0	29	100.0	13	100.0	339	100.0

Table IX - Complications of the patients with facial fractures.

Variable	Postoperative Complications					
	No Complications		Complication		Total	
	n	%	n	%	n	%
Etiology of Trauma						
Traffic accident	236	33.1	12	50.0	248	33.7
Fall	185	26.0	2	8.3	187	25.4
Physical aggression	121	17.0	3	12.5	124	16.8
Gunshot wound	47	6.6	2	8.3	49	6.7
Sports injury	35	4.9	1	4.2	36	4.9
Workplace injury	18	2.5	0	.0	18	2.4
Other	70	9.8	4	16.7	74	10.1
Total	712	100.0	24	100.0	736	100.0
Traffic Accident						
Motorcycle accident	108	45.8	7	58.3	115	46.4
Car accident	69	29.2	3	25.0	72	29.0
Pedestrian accident / other	34	14.4	2	16.7	36	14.5
Bicycle accident	25	10.6	0	.0	25	10.1
Total	236	100.0	12	100.0	248	100.0

DISCUSSION

Epidemiological studies vary according to geographic region, population density, socioeconomic status, and regional governance, as well as by the period and the type of facility where the study was performed. A comparison of the data requires that these factors be considered (Chrcanovic *et al*.; Shankar *et al*.). Our study was performed between February 2013 and December 2017 in a trauma reference hospital in the Brazilian state of Espírito Santo. A majority (75 %) of the patients were from the city of Serra, the population of which is approximately 500,000. Though it is part of greater Vitória (the capital city of Espírito Santo State), 32 % of its residents make half of Brazil's monthly federal minimum wage or less. Serra can therefore be considered a predominantly urban and poor city. The most commonly used means of transportation are automobiles, motorcycles, and public transportation. It is also important to note that all the main municipal highways are paved and that the average speed limit is 60 km/h (https://cidades.ibge.gov.br/brasil/es/serra/panorama).

Demographic data on maxillofacial fractures in this region indicate that there was a prevalence of men who were injured (4:1). These results are consistent with those of other studies in different countries, including the United Kingdom, New Zealand, Norway, Iran, Jordan, and India (Karyouti, 1987; Torgersen & Tornes, 1992; Down *et al*., 1995; Kieser *et al*., 2002; Ansari 2004; Bali *et al*., 2013).

In our study, almost 70 % of the patients were between 21 and 60 years of age. Many studies on maxillofacial fractures reported the same results in relation to age (Thorn *et al*.; Down *et al*.; Kieser *et al*.; Hächl *et al*., 2002; Ansari; Al Ahmed *et al*., 2004; Brasileiro & Passeri; Shankar *et al*.; Boffano *et al*.). The most obvious explanation for this finding is that this age group is the largest economically active group, which makes people in this group more active participants in social activities, sports, and transportation, and which also makes them more susceptible to issues such as violence (Morris *et al*., 2015; Instituto Brasileiro de Geografia e Estatística, 2017).

Despite these consistencies between studies, age group is an important factor to consider. Iida *et al*. (2003) found that fractures caused by falls exhibited the highest incidence among patients older than 61 years of age; falls came in second only to traffic accidents, as was also demonstrated observed in our study. Other studies have reported falls as being the third most common cause of fractures, coming in behind physical aggression and traffic accidents; however, falls are consistently most common among older patients (Chrcanovic *et al*.; Buchanan *et al*., 2005).

In our study as well, almost 80 % of patients with facial fractures caused by falls were older than 60 years of age. This leads us to affirm that, regardless of location, falls as an etiological factor are more highly correlated with age-related fragilities than with local or cultural conditions (Iida *et al*.; Chrcanovic *et al*.; Brasileiro & Passeri; Lee, 2009).

When we evaluate the other etiologies, traffic accidents continue to be the main cause of facial fractures in both developed and developing countries (Oji, 1999; van Beek & Merkx, 1999; Iida *et al*.; Ansari).

Although, recently many changes have been made in traffic laws in many countries, including the introduction of safety equipment (helmets and seat belts), increased traffic control, stricter punishments for traffic law violations, and increased awareness campaigns by government agencies aiming to reduce traffic accidents, traffic still remains a major cause of maxillofacial fractures (Fasola *et al*., 2003). Our results were consistent with those of other studies in that traffic accidents were the most prevalent cause of facial fractures regardless of *sex*, affecting 279 patients (38 %).

Within the category of traffic accidents, automobile and motorcycle accidents had substantially higher rates of fractures when compared to cycling accidents and pedestrian-related accidents, a finding which has also been reported in other studies. This finding can be explained by the fact that motorcycles are more affordable than cars in Brazil—according to Brazil's National Association of Motor Vehicle Manufacturers (ANFAVEA), the cost of buying a car in Brazil is almost double that of other countries, including the United States. This factor is combined with the fact that almost 80 % of the patients in this study come from regions with a low per capita income (2.6 times the Brazilian federal monthly minimum wage or lower), which means that motorcycles are often the more accessible option (Instituto Brasileiro de Geografia e Estatística).

However, it is important to report that, when patients are separated by *sex*, there is a numerical inversion between motorcycle accidents and automobile accidents, with male patients being more prevalent in motorcycle accidents and female patients being more prevalent in car accidents. The ratio of male to female motorcycle riders and car drivers is also relevant. In the case of motorcycles, men drive them at a 3:1 ratio, while in the case of cars, men drive them at a ratio of 2:1. This difference may explain why the rate of facial fractures associated with motorcycle accidents is higher than the rate associated with cars among male patients.

Physical aggression was found to be the third most common cause of facial fractures, behind traffic accidents and falls. In a retrospective study between 2002 and 2006, Parulska *et al*. (2017) found that, in all of the years analyzed, aggression was consistently the most common cause of maxillofacial fractures. The authors argued that the age group of their study patients (18 to 25 years of age) and by their patients' drug abuse explained this finding (Parulska *et al*.). However, they did not determine whether their were any correlations between facial trauma and alcohol or drug use in their data. Schneider *et al*. (2015), also reported aggression as the most common cause of facial injuries (45 %), but in their study, they found that 70.8 % of their victims of physical aggression were under the influence of alcohol. Despite the high number of physical aggression cases in our study, this etiology was not significantly correlated with the influence of alcohol and/or drugs.

In cases of fractures associated with physical aggression, it is crucial that female patients be analyzed separately from male patients. Of the 36 female victims of physical aggression in this study, more than 80 % had suffered this aggression by men simply because they were women; these cases were considered attempted femicide. When this analysis is expanded to consider all of Brazil, data from the World Health Organization (WHO) states that the number of murders reaches 4.8 for every 100,000 women. Between 1980 and 2013, 106,093 women died because of their *sex*. Between 2003 and 2013 alone, the number of femicides recorded increased from 1,864 to 2,875 (a 54 % increase). These numbers are even more disturbing when we include the cases of attempted murder in these analyses. In December 2018 alone, more than 90,000 attempted femicides were reported in Brazil (Pan American Health Organization & World Health Organization, 2018). The UN also estimates that, every day throughout the world, 137 women are victims of murders committed by their partners, ex-husbands, or relatives, who are almost always men.

As for the location of the fractures in the middle and upper thirds of the face, the most commonly affected sites in our study were the zygomatic complex, followed by orbital bone and nose. The high incidence of these types of fractures occurs not only because of the greater anterior exposure of these structures in the face (which makes them more susceptible to trauma), but also because of the etiology of the trauma, since, in our study, traffic accidents and falls were the most common causes of fractures. When the face is projected against the site of impact in medium- and high-energy traumas, there is insufficient time for the face to be protected, and the

first contact is therefore, most likely to be between the object in question and the anatomical regions of greater prominence, such as the zygomatic complex and the nasal bones, especially in cases of high-speed trauma (Arangio *et al*., 2014).

When we analyzed the locations of the mandibular fractures, the mandibular condyle region was found to be the site with the highest incidence, followed by the mandibular body, the mandibular angle, the symphysis, and the parasymphysis, all of which exhibited the same incidence. The literature presents different results regarding the etiology and incidence of mandibular fractures. In the study by de Andrade Filho *et al*. (2000) mandibular body fractures accounted for 28.5 %, while condyle fractures represented 26.6 %, symphysis fractures represented 19.9 %, angle fractures represented 14.2 %, dento-alveolar fractures represented 1.9 %, and coronoid process fractures represented 1.15 %. In the study by Vasconcelos *et al*. (2005) mandibular body fractures were also the most representative at 38.3 %, followed by angular fractures at 34 %, condyle fractures at 27.7 %, parasymphysis fractures at 17.7 %, and dento-alveolar fractures at 14.9 % (Montovani *et al*., 2006) also found the highest percentage of fractures in the mandibular body (30.9 %).

Condylar fractures were the most common in the study by Krause *et al*. (2004) (83.3 %), but in the 2009 study by Bormann *et al*. (2009) these fractures represented 42 % of cases. Sawasaki *et al*. (2010) reported 317 condylar fractures in 2010. Yamamoto *et al*. (2010) also found a high frequency of condylar fractures in 2010, with 64.5 % seen in victims of falls from their own height and 41.9 % in victims of falls from other heights.

Fractures involving the middle and upper thirds of the face were most commonly treated by surgery with the exception of frontal bone fractures (16 conservative vs. 13 surgical) and nasal bone fractures (52 conservative vs. 47 surgical). Although this difference is not statistically relevant, this difference can be explained by the fact that, in most cases, low- and medium-energy fractures in these bones do not generate functional or aesthetic repercussions that negatively impact the patient's quality of life (Al-Khateeb & Abdullah; Conforte *et al*., 2016).

When surgery was performed on fractures of the middle and upper thirds of the face, synthetic materials such as plates and screws were used when necessary. Mandibular fractures were mostly treated through open surgeries, particularly in regions providing tooth support. The explanations are obvious: this is an area of great occlusal load on a moving bone, which could lead to unfavorable movements (Hogg *et al*., 2000; Morris *et al*.).

The exception was in the treatment of condylar fractures, which depended on the type of fracture, as described by Loukota *et al*. (2005). All of these cases were surgically treated as a condylar or condylar neck fracture associated with at least 10 degrees of displacement and a shortening of the mandibular ramus greater than 2 mm. In a meta-analysis, Berner *et al*. (2015) conclude that, despite the difficulty in comparing closed and open treatments, open surgery has tended to present superior results relative to the closed treatment by means of maxillomandibular block, particularly in relation to laterality and mandibular protrusion. In a prospective study, Shiju *et al*. (2015) concluded that both treatments are satisfactory. However, the open treatment was significantly superior to the closed treatment in terms of the reduction of the bony fragments and the lack of mandibular deviation at maximum opening of the mouth.

The complications observed in our study were infections, malocclusion, and maladjustment, and 3.3 % of the patients with facial fractures experienced complications.

In the study by Al-Khateeb & Abdullah, the most common complications were dental fractures or avulsions, followed by substantial scarring and lost teeth in the line of fracture. Surprisingly, their rate of infection was relatively low given the high number of cases treated with open reduction; the authors reported infections in 5 cases (1.7 %).A study from Greece (Zachariades *et al*., 1993) compared rates of infection between different treatment approaches and found the highest rate in cases involving fixation with steel wire (13 %); their rate of infection in cases involving plates was 3 %, and it was 3.5 % in cases involving intermaxillary fixation. According to Brasileiro & Passeri, maxillofacial fracture complications were found in 7.4 % of the patients, a rate lower than those presented by other authors, which ranged from 11 % to 12.8 % (Parulska *et al*.). Local infections were the main type of complication in their study and occurred in 3.7 % of cases. These findings corroborate the results obtained by Torgersen & Tornes who reported a 4 % rate of infection in Norway, as well as those published by Zachariades *et al*., 3.3 % of whose patients developed infection after rigid internal fixation in Greece.

Because our study was retrospective, it is limited by a lack of data in the patients' medical records. We were unable to determine any correlations between complications and the access made or the fixation material used. Despite this factor, our rates of complications were similar to those described in the other studies (Thorn *et al*.; Down *et al*.; Hogg *et al*.; Montovani *et al*.; Brasileiro & Passeri; Al-Khateeb & Abdullah; Bormann *et al*.).

The results of this study support the argument that regular epidemiological evaluations of maxillofacial fractures allow for a detailed analysis of these lesions and provide important support for the establishment of priorities in research and clinical practice, since these evaluations identify risk factors and patterns of presentation. According to these data, it seems reasonable to assume that compliance with traffic laws and continued campaigns supporting occupant protection laws should be encouraged. We also believe that stricter public policies should be put in place in order to reduce rates of physical aggression, particularly those against women. In addition, it is important to emphasize that these patients require postoperative care and assistance and should be monitored closely, particularly in cases of facial fractures treated via open reduction and rigid fixation in any region of the world.

MARANO, R.; JADJISKY, M.; FILHO, A. B. M.; MAYRINK, G.; ARAÚJO, S.; OLIVEIRA, L.; LEMOS, I. Z.; DE SOUZA, N. S.; MARGATO, R. G. & BRANDÃO, D. B. R. Análisis epidemiológico de 736 pacientes que sufrieron trauma facial en Brasil. *Int. J. Odontostomat., 14(2)*:257-267, 2020.

RESUMEN: La etiología de las fracturas faciales está directamente relacionada con el país estudiado, variando según la condición socioeconómica y cultural de la población, además del período de investigación. El objetivo del presente estudio fue evaluar las características epidemiológicas de la prevalencia, las modalidades de tratamiento y las tasas de complicaciones de las fracturas maxilofaciales en un hospital en el estado de Espírito Santo, durante un período de 5 años. Un total de 428 pacientes presentaron fractura facial, con una prevalencia de varones (436), con una edad media de 40 años. Con respecto al número de fracturas, 291 individuos sufrieron fracturas solo en el esqueleto fijo, 97 solo en la mandíbula y 48 sufrieron fracturas tanto en el esqueleto fijo como en el mandibular. El sitio anatómico predominante en las fracturas esqueléticas fijas fue el complejo cigomático (56,6 %), la órbita (31,9 %) y la nariz (29,2 %); mientras que en la mandíbula el cóndilo (33,8 %), el cuerpo (17,9 %) y el ángulo (13,1 %). La etiología frecuente fue caídas, agresión física, accidentes deportivos. En cuanto al tipo de tratamiento, en el esqueleto fijo se trataron 192 fracturas de forma conservadora y 303 mediante cirugía. Ya en la mandíbula, los números eran 43 y 143, respectivamente. Además, 24 pacientes progresaron con algún tipo de complicación en uno o más sitios operados. Cabe mencionar que las evaluaciones epidemiológicas brindan un apoyo importante en la creación de legislación en estos casos, para establecer prioridades clínicas y de investigación, debido a que se pueden identificar factores de riesgo y patrones de presentación. En consecuencia, en un intento de reducir estas tasas.

PALABRAS CLAVE: epidemiología, lesiones faciales, huesos faciales.

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Corresponding author:
Laisa Oliveira
Rua José Ludgerio,327,Centro
Alto Rio Novo-ES
BRASIL

Email: lkindely@gmail.com

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