



Epidemiological importance of motorcycle and bicycle crashes in the current context of oral and maxillofacial trauma in southern Brazil

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Abstract

Purpose: Epidemiological studies exhibit regional variation patterns as the result of local demographic and socioeconomic factors. This study assessed the epidemiology of maxillofacial fractures treated at a trauma center in Southern Brazil to identify the importance of motorcycle and bicycle crashes.

Methods: The records of 2261 patients admitted between April 2003 and March 2013 were reviewed.

Results: The male-to-female ratio was 5.6:1. The peak incidence occurred in the third decade of life. Bicycle and motorcycle crashes accounted for 20% of all reported etiologies. Mandibular and orbitozygomatic complex fractures were most prevalent. The most common treatments were open reduction with rigid internal fixation and conservative therapy. Overall, 1248 patients (55.9% of recorded admissions) had a length of stay of 7 days or less.

Conclusion: Countrywide prevention projects and the use of alternative transportation should be encouraged.

Key words: Epidemiology; Face; Wounds and injuries

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Importância epidemiológica de acidentes com motocicletas e bicicletas no contexto atual do trauma bucomaxilofacial no sul do Brasil

Resumo

Objetivo: Pesquisas epidemiológicas têm padrões de variações como resultado de fatores demográficos e socioeconômicos locais. Para identificar a importância dos acidentes de motocicletas e bicicletas, foram avaliadas as características epidemiológicas de fraturas maxilofaciais em um hospital público referência de trauma no sul do Brasil.

Metodologia: A avaliação foi realizada através da análise de 2261 prontuários de pacientes internados entre abril de 2003 e março de 2013.

Resultados: A razão entre homens e mulheres foi de 5,6:1. O pico de incidência foi observado na terceira década de vida e os acidentes de bicicleta e motocicleta atingiram 20% dentre os agentes etiológicos informados. As fraturas de mandíbula e do complexo zigomático-orbitário foram as mais prevalentes. Os tratamentos mais realizados foram: a redução cruenta com fixação interna rígida e o método conservador, sendo que 1248 pacientes (55,9% dos períodos de internação registrados) passaram até sete dias no hospital.

Conclusão: Concluiu-se que projetos de prevenção contra acidentes e uso de transportes alternativos em todo país são necessários.

Palavras-chave: Epidemiologia; Face; Ferimentos e lesões

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Introduction

Over time, trauma has been an extraordinarily important public health issue worldwide, as it remains to the present. Within this context, oral and maxillofacial injuries are among the most prevalent types of trauma seen in the emergency medicine setting, whether alone or combined with injury of other body systems and structures.

Road traffic collisions are one of the leading causes of facial fracture. Recently, there has been a significant increase in the use of bicycles and motorcycles as means of transportation. Unlike automobiles, these vehicles do not provide much in the way of protection for the physical integrity of their occupants; therefore, their growing use is contributing to the increasing number of cases of traffic-related facial injuries in Brazil.

Periodic reassessments of the epidemiology of facial trauma have a major role to play in reaffirming previously established patterns of injury or identifying new presentations of this disease [1]. Continuous collection of data on oral and maxillofacial fractures thus becomes an important aspect of the development and assessment of measures designed to prevent such injuries [2,3]. This is possible by prospective and retrospective gathering of information on facial trauma, by means of a detailed registry, and by periodic review of data on facial injury [4].

We conducted an epidemiological study of patients treated by the Oral and Maxillofacial Trauma and Surgery Service of a public trauma center attending the city and metropolitan area of Porto Alegre, in Southern Brazil, from April 2003 to March 2013, taking into account etiological agent, age, sex, affected bones, treatment, and length of hospital stay (LOS). Our primary objectives were to identify the relative importance of bicycles and motorcycles as etiological agents of oral and maxillofacial injury and to update databases of facial trauma for the city of Porto Alegre and its metropolitan region.

Materials and Methods

This study was approved by the Pontifícia Universidade Católica do Rio Grande do Sul Research Ethics Committee (protocol No. 0067/08) and conducted at Hospital Cristo Redentor, a trauma center located in Porto Alegre, state of Rio Grande do Sul, Brazil, and affiliated with the Brazilian Ministry of Health. Data on sex, age, etiology, affected bones, treatment, and LOS were collected from the medical records of 2261 patients, who were admitted and treated by the Oral and Maxillofacial Trauma and Surgery Service for facial fractures from April 2003 to March 2013.

Age was stratified into ranges as follows: 1-10 years, 11-20 years, 21-30 years, 31-40 years, 41-50 years, 51-60 years, and 61-90 years. Etiological agents were categorized as motorcycles, bicycles, other causes, or as not reported. The affected bones were stratified as mandible, maxilla, orbitozygomatic complex (OZC), naso-orbital-ethmoid complex (NOE), nasal bones, and frontal bone. Treatment was

classified as open reduction without fixation, open reduction with rigid internal fixation (ORIF), maxillomandibular fixation (MMF), and conservative therapy.

Collected data were tabulated in Microsoft Excel 10.0 (Microsoft Corporation – Redmond, WA, USA) and analyzed in SPSS Statistics 17. Qualitative variables were expressed as absolute and relative frequencies, and quantitative variables, as means and standard deviations. The chi-square test was used for statistical analyses. The level of significance was set at 5%.

Results

Of the 2261 charts reviewed, 84.8% (n=1918) were of male patients. The most commonly affected age range was 21-30 years, which accounted for 30.8% of cases (n=676); in 68 records, patient age was not reported.

Table 1 shows the frequency distribution of etiological agents. The mandible was the most commonly affected bone, with 957 fractures (42.3%), followed by the OZC, with 805 fractures (35.6%). Two records failed to note the affected bone. Table 2 reports the frequency of treatment modalities, and Table 3 shows length of hospital stay among the patients in the sample.

Table 1. Absolute and relative frequency of etiological agents.

Etiology	N (%)
Motorcycle accident	154 (15.3)
Bicycle accident	48 (4.7)
Other	806 (80.0)
Total	1008
Not reported	1253 of 2261 (55.4%)

Table 2. Absolute and relative frequency of treatment modalities.

Treatment modality	N (%)
Open reduction, no fixation	239 (10.9)
Open reduction/rigid internal fixation + maxillomandibular fixation	324 (14.8)
Open reduction/rigid internal fixation	721 (32.9)
Conservative therapy	587 (26.7)
Maxillomandibular fixation	322 (14.7)
Total	2192
Death or transfer to outside facility	52 of 2261 (2.3)
Not reported	16 of 2261 (0.7)

Table 3. Absolute and relative frequency of length of stay, stratified into categories.

Length of hospital stay	N (%)
Up to 7 days	1247 (55.9)
Up to 14 days	1881 (84.3)
Over 14 days	350 (15.7)
Total	2231
Not reported	30 of 2261 (1.33)

Table 4. Association between gender and etiological agent, N (%)

	Motorcycle	Bicycle	Other causes	Not reported
Male	134 (87.0)	44 (91.7)	683 (84.7)	1057 (84.3)
Female	20 (13.0)	4 (8.3)	123 (15.3)	196 (15.7)
Total	154	48	806	1253

Table 5. Association between age range and etiological agent, N (%)*

	Motorcycle	Bicycle	Other Causes	Not Reported	Total
0-10	0 (0.0)	1 (2.6)	18 (46.2)	20 (51.3)	39
11-20	21 (6.4)	10 (3.1)	123 (37.6)	173 (52.9)	327
21-30	74 (10.9)	5 (0.7)	227 (33.6)	370 (54.7)	676
31-40	29 (6.4)	8 (1.8)	159 (35.0)	178 (56.8)	454
41-50	17 (4.6)	12 (3.3)	121 (31.8)	219 (59.3)	369
51-60	9 (4.8)	5 (2.6)	63 (33.3)	112 (59.3)	189
61-90	1(0.7)	5 (3.6)	63 (45.3)	70 (50.4)	139

* Chi-square test, p<0.001.

Table 6. Association between affected bones and etiological agent, N (%)*

	Motorcycle	Bicycle	Other Causes	Not Reported	Total
Mandible	54 (5.6)	18 (1.9)	334 (34.9)	551 (57.6)	957
Maxilla	6 (7.1)	4 (4.7)	43 (50.6)	32 (37.6)	85
OZC	34 (4.2)	17 (2.1)	264 (32.8)	490 (60.9)	805
NOE + Nasal	3 (13.0)	1 (4.3)	9 (39.1)	10 (43.5)	23
OZC + Maxilla + Mandible	12 (9.0)	1 (2.2)	14 (30.4)	19 (41.3)	46
OZC + Mandible	9 (26.1)	1 (1.0)	40 (40.0)	50 (50.0)	100
OZC + Maxilla	24 (14.2)	6 (3.6)	77 (45.6)	62 (36.7)	169
Mandible + Maxilla	9 (32.1)	0 (0.0)	6 (21.4)	13 (46.4)	28
Frontal	2 (11.8)	0 (0.0)	5 (29.4)	10 (58.8)	17
OZC + Nasal	1 (4.8)	0 (0.0)	10 (47.6)	10 (47.6)	21
OZC + Frontal	0 (0.0)	0 (0.0)	4 (50.0)	4 (50.0)	8

* Fisher's exact test, p<0.001.

Tables 4, 5, and 6 show the results of cross-referencing for associations between etiological agent and gender, etiological agent and age, and etiological agent and affected bones, in an attempt to determine the prevalence rates of bicycle and motorcycle accidents in each of these categories.

Discussion

Of all patients whose records were reviewed for this study, 84.8% (n=1918) were male and 15.2% (n=343) were female, for a male-to-female ratio greater than 5:1. This distribution is consistent with several previous studies [5-10].

Patients ages 21 to 30 years were most commonly affected, accounting for 30.8% (n=676) of all recorded cases (Table 5), which also corroborates previous research [7, 9-14]. This distribution is attributable to the fact that young adults in this age range are legally old enough to drive and consume legal intoxicants, such as alcohol, but are not yet mature enough to enjoy these rights responsibly.

Due to its location and prominence, the mandible is the second most commonly fractured structure of the maxillofacial skeleton [15,16], preceded only by the nose. Once again in agreement with other studies [5,7,9,13,14,17-19], the mandible was the most common site of isolated facial fractures in this sample, accounting for 42.4% of all fractures observed, followed by the OZC with 35.6% [13]. It bears stressing that, at the study hospital, treatment of nasal fractures falls under the purview of the Plastic Surgery Department. Accordingly, the Oral and Maxillofacial Trauma and Surgery Service treat very few nasal bone injuries.

The most common treatment for maxillofacial fractures in this sample was ORIF, which was employed in 32.9% of cases (n=721). This is consistent with prior research [9, 10,14]. The second leading treatment modality was conservative therapy, which was employed in 26.7% of cases (n=587). It should be noted that the choice of conservative treatment is often made due to the severity of the patient's general condition; in victims of severe trauma, other needs are often prioritized over treatment of facial fractures.

Regarding LOS, 55.9% of patients in the sample spent up to 7 days in the hospital, and 84.3% were discharged within 14 days. Table 3 shows that LOS was generally brief in this sample, confirming the findings of Hwang et al. [11].

Overall, 55.4% of records contained no data on the etiology of injury (Table 1). To a lesser degree, data on variables such as affected bones, age range, and treatment were also missing. Over time, through modernization and implementation of electronic medical records, collection of such data – which are often neglected – is becoming increasingly complete.

Studies show that traffic collisions are among the leading causes of maxillofacial trauma [5,7-14,17,18,20]. Notable subtypes of this type of trauma are incidents involving bicycles or motorcycles, which are represented at a significant percentage as etiological agents. In our sample, these specific agents accounted for over 20% of reported causes of facial trauma, corroborating the findings of other studies [13,17-19,21,22].

The present study also showed that men are involved in more accidents than women, regardless of etiological agent (Table 4). Of the 202 patients in whom a bicycle or motorcycle crash was the cause of injury, 178 were male. Among these 202 cases, of the 154 patients involved in a motorcycle crash, only 20 were women; of the 48 bicycle accidents, only four involved women (Table 4). A study [22] of the epidemiology of bicycle crash in the United States between 2001 and 2008 found that 73% of cases involved men. Conversely, another study [19] showed that Dutch women accounted for nearly half of all cases of facial fractures secondary to bicycle accidents; in Italy, 26 of 105 victims were women.

In our sample, most motorcycle accidents occurred in the third decade of life (n=74). This corroborates the findings of other authors [13,23]. The frequency of bicycle accidents was highest in the second and fifth decades of life, with 10 and 12 cases respectively (Table 5), contradicting the findings of Paes et al., in a study also conducted in Southern Brazil [13].

As motorcycles reach greater speeds and are more integrated into vehicular traffic in Brazilian cities than are bicycles, motorcycle crashes were associated with a greater number of complex fractures (Table 6); the mandible was the most commonly affected bone in these patients, with 54 cases secondary to motorcycle and 18 secondary to bicycle collisions. This finding, in turn, corroborates those of Paes et al. [13].

Conclusions

The high rate of missing data in this sample precludes a broader and more precise epidemiological analysis, and provides evidence of the need for greater attention to data collection, from initial presentation to hospital discharge.

In conclusion, bicycle and motorcycle crashes play a significant role in the etiology of facial trauma in Southern Brazil. Strategies to encourage safer use of these vehicles and

reduce the rate of trauma, such as improvements in highway and bicycle route infrastructure, prevention campaigns, and special traffic laws, are warranted.

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