



Original

1-Year of COVID-19 pandemic: changes in the epidemiology of maxillofacial trauma

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A B S T R A C T

Objectives: Due to COVID-19 pandemic, social distancing policies were enacted worldwide, including by the Portuguese official authorities. However, the impact of these measures on maxillofacial trauma and fracture surgical repair remains poorly understood. The aim of this study was to evaluate and compare the incidence and aetiology of facial fractures submitted to surgical repair during 1-year of COVID-19 pandemic versus the previous 4 years, in a level III Trauma Centre located in Lisbon, Portugal.

Materials and methods: All emergency episodes registered in our hospital between March 2016 and February 2021 that resulted in patient admittance for surgical treatment of facial fracture were included. Comparative analysis was performed for variables such as fracture type and aetiology.

Results: Analysis showed that surgeries performed during the 1st year of COVID-19 were reduced by 37.5 %. Considering only the 75-day lockdown period at the beginning of the pandemic, reduction was even more pronounced and reached -66.7 %. Significant differences in the aetiology were also found, with physical assault and sport accidents relative frequency decreasing. Moreover, despite being systematically the second most common cause of fracture, during lockdown, fall ranked first, over physical assault. The relative frequency of nasal fractures, the most common facial fracture treated in our hospital, decreased during both the 1st year of COVID-19 and the lockdown period, while mandible fractures ranked first during lockdown.

Conclusions: Our study shows that COVID-19 pandemic and enacted policies have significantly changed the epidemiology of maxillofacial trauma.

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1 año de pandemia de COVID-19: cambios en la epidemiología del trauma maxilofacial

RESUMEN

Palabras clave:

Trauma maxilofacial, fractura facial, COVID-19, epidemiología, confinamiento.

Objetivos: Debido a la pandemia por COVID-19, se establecieron políticas de confinamiento social mundial, incluso por parte de las autoridades oficiales portuguesas. Sin embargo, el impacto de estas medidas sobre la cirugía originada por traumatismo maxilofacial sigue siendo poco conocida. El objetivo del presente estudio ha sido evaluar y comparar la incidencia sobre la etiología de las fracturas faciales quirúrgicas, durante 1 año de pandemia de COVID-19 versus los 4 años anteriores, en un Centro de Traumatología (nivel III) ubicado en Lisboa, Portugal.

Materiales y métodos: Se incluyeron todos los registros de urgencia en nuestro hospital, entre marzo de 2016 y febrero de 2021, que cursaron con el ingreso de pacientes diagnosticados de fractura facial y su correspondiente tratamiento quirúrgico. Se realizó un análisis comparativo de variables cualitativas como el tipo de fractura y la etiología de las mismas.

Resultados: El análisis mostró que las cirugías realizadas durante el primer año por COVID-19 se redujeron en un 37,5 %. Teniendo en cuenta solo el periodo de confinamiento de 75 días al comienzo de la pandemia, la reducción fue aún más pronunciada y alcanzó el 66,7 %. Se encontraron diferencias significativas en la etiología: disminuyendo la frecuencia relativa de agresiones físicas y accidentes deportivos. A pesar de ser sistemáticamente la segunda causa más frecuente de fractura durante el confinamiento, la caída ocupó el primer lugar, por encima de las agresiones físicas. La frecuencia relativa de las fracturas nasales, fractura facial tratada con mayor incidencia en nuestro hospital, disminuyó tanto durante el primer año por COVID-19 así como durante el periodo de confinamiento, mientras que las fracturas maxilares ocuparon el primer lugar durante el confinamiento.

Conclusiones: Nuestro estudio muestra que tanto la pandemia por COVID-19 como las políticas establecidas al respecto han cambiado significativamente la epidemiología del traumatismo maxilofacial.

INTRODUCTION

The coronavirus disease (COVID-19) is an infectious disease caused by the novel coronavirus (SARS-CoV-2), first identified on December 2019 in Wuhan, Hubei, China¹. Three months later, on March 2nd, the first two cases of the disease were diagnosed in Portugal. On March 11th the World Health Organization (WHO) declared COVID-19 a global pandemic and in the same week, Portuguese official authorities imposed a temporary lockdown. Social distancing had been previously applied as a mitigation measure to reduce the transmission of respiratory virus and soon became a worldwide standard measure in response to COVID-19^{2,3}. Therefore, from March 18th to May 3rd all nonessential activities and schools were closed, teleworking was adopted whenever possible, and the circulation in streets was largely reduced as individuals were encouraged to stay home, avoiding social interactions.

The rapid implementation of these measures dramatically slowed the spread of COVID-19 in Portugal, particularly when compared to other Southern European countries, a phenomenon international media entitled as “a Portuguese miracle”⁴. Some of the imposed measures were gradually released from May 4th to June 1st, but unfortunately, the rampant growth in cases that followed suggested the miracle to be a short-lived mirage. From September 2020 to January 2021, number of daily cases exponentially increased, leading to a new partial lockdown starting on January 15th.

Our hospital is a level III Trauma Centre located at the heart of Lisbon, managing the facial trauma occurring in approximately half of the total area of the country. Facial fractures are frequently seen in the setting of social interactions, as the result of interpersonal violence or sports accidents^{5,6}. Although social distancing seems to be able to reduce the spread of respiratory diseases, including COVID-19, its impact in the incidence and aetiology of facial fractures is still not clear.

The purpose of this study was to analyse the impact of social distancing policies enacted during the first year of COVID-19 pandemic on the epidemiology of facial fractures submitted to surgical repair, specifically on aetiological distribution and fracture type.

MATERIALS AND METHODS

All emergency episodes registered in our hospital between March 2016 and February 2021 that resulted in patient admittance for surgical treatment of facial fracture were included. Episode records comprised the complete history of the incident, clinical and radiological findings, usually orthopantomography and computerized tomography (CT) scan. Patients were divided into 2 groups: “Pre-COVID-19” included cases from March 2016 to February 2020 and “COVID-19” comprised those from March 2020 to February 2021. Comparative analysis was performed for variables such as fracture type and aetiology. Aetiology was subdivided in physical assault, fall, sport

accident, road traffic accident and other causes (including domestic accidents, do-it-yourself accidents, accidents with animals, and other uncommon forms). Facial fractures were categorized as nasal, mandibular, zygomaticomaxillary, orbital (including at least one orbital wall fracture), zygomatic arch, LeFort (I, II and/or III) and other.

Categorical variables were presented as absolute and relative frequencies and differences between groups were calculated using a Chi-square test or Fisher's exact test when appropriate. Statistical significance was considered when $p < 0.05$. GraphPad Prism, version 9.0 (San Diego, CA, USA) was used for all statistical analysis and graphics designed.

RESULTS

Group Pre-COVID-19

This group included 1471 patients (78.0 % male vs. 22.0 % female, male-to-female ratio of 3.5:1), which translates into 368 surgeries/year (SD 50.8) (Table I). The most frequent aetiology was physical assault (567 patients, 38.5 %, 142/year, SD 22.6), followed by fall (382 patients, 26.0 %, 96/year, SD 7.9), road traffic accident (207 patients, 14.1 %, 52/year, SD 8.7), other causes (174 patients, 11.8 %, 44/year, SD 17.1) and sport accident (141 patients, 9.6 %, 35/year, SD 11.0). A total of 1646 fractures were repaired, averaging 412 fractures/year (SD 51.9). The most frequent fracture type was nasal (690 fractures, 41.9 %, 173/year, SD 30.1), followed by mandibular (382 fractures, 23.2 %, 96/year,

SD 13.5), zygomaticomaxillary (270 fractures, 16.4 %, 68/year, SD 9.9), orbital (148 fractures, 9.0 %, 37/year, SD 8.3), zygomatic arch (77 fractures, 4.7 %, 19/year, SD 7.4), LeFort (51 fractures, 3.1 %, 13/year, SD 1.9) and other (28 fractures, 1.7 %, 7/year, SD 2.9).

Group COVID-19

This group included 230 patients (75.2 % male vs. 24.8 % female, male-to-female ratio of 3:1) (Table I). The most frequent aetiology was physical assault (72 patients, 31.3 %), followed by fall (63 patients, 27.4 %), other causes (49 patients, 21.3 %), road traffic accident (35 patients, 15.2 %) and sport accident (11 patients, 4.8 %). A total of 278 fractures were repaired, the most frequent being nasal (90 fractures, 32.4 %), followed by mandibular (76 fractures, 27.3 %), zygomaticomaxillary (51 fractures, 18.3 %), orbital (22 fractures, 7.9 %), zygomatic arch (18 fractures, 6.5 %), LeFort (14 fractures, 5.0 %) and other (7 fractures, 2.5 %).

Comparison between groups

The number of patients submitted to surgery and the number of repaired facial fractures decreased during the first year of COVID-19 pandemic: 230 surgeries vs. 368 surgeries/year (-37.5 %), and 278 fractures vs 382 fractures/year (-32.5 %), groups COVID-19 vs. pre-COVID-19 (Table I). Considering only the timeframe of lockdown (between March 18th and May 31st),

Table I. Characterization of patients, aetiology and type of fractures occurred between March 2016 - February 2020 (group pre-COVID-19) and March 2020 - February 2021 (group COVID-19).

	Group pre-COVID-19		12-month	Group COVID-19		
	Total	Yearly mean		p	Lockdown*	p
Patients, n	1471	368	230		22	
Age (years) mean \pm SD	39.2 \pm 18.8		40.5 \pm 17.2		44.9 \pm 19.4	
Youngest - Oldest (years)	2 - 95		7 - 88		20 - 88	
Male, n (%)	1147 (78 %)	287	173 (75.2 %)		15 (68.2 %)	
Male:female ratio	3.5:1		3:1		2.1:1	
Physical assault, n (%), \pm SD	567 (38.5 %)	142 \pm 22.6	72 (31.3 %)	0,0350	5 (22.7 %)	0,1298
Self-fall, n (%), \pm SD	382 (26.0 %)	96 \pm 7.9	63 (27.4 %)	0,6480	9 (40.9 %)	0,1136
Road traffic accident, n (%), \pm SD	207 (14.1 %)	52 \pm 8.7	35 (15.2 %)	0,6438	4 (18.2 %)	0,5828
Sport accident, n (%), \pm SD	141 (9.6 %)	35 \pm 11.0	11 (4.8 %)	0,0176	0 (0.0 %)	0,1270
Other causes, n (%), \pm SD	174 (11.8 %)	44 \pm 17.1	49 (21.3 %)	< 0,001	4 (18.2 %)	0,3614
Repaired fractures, n	1646	412	278		35	
Fracture:patient ratio	1.1:1		1.2:1		1.6:1	
Nasal	690 (41.9 %)	173 \pm 30.1	90 (32.4 %)	0,0027	7 (20.0 %)	0,0092
Mandibular	382 (23.2 %)	96 \pm 13.5	76 (27.3 %)	0,1347	21 (60.0 %)	<0,001
Zygomaticomaxillary	270 (16.4 %)	68 \pm 9.9	51 (18.3 %)	0,4739	5 (14.2 %)	0,7149
Orbital	148 (9.0 %)	37 \pm 8.3	22 (7.9 %)	0,5581	0 (0.0 %)	0,0632
Zygomatic arch	77 (4.7 %)	19 \pm 7.4	18 (6.5 %)	0,2009	1 (2.9 %)	0,6123
LeFort	51 (3.1 %)	13 \pm 1.9	14 (5.0 %)	0,0982	0 (0.0 %)	0,2903
Other	28 (1.7 %)	7 \pm 2.9	7 (2.5 %)	0,1031	1 (2.9 %)	0,6032

SD, standard deviation. * from march 18th to may 31st

the decline was even more pronounced: 22 surgeries vs 66 surgeries on average (-66.7 %), groups COVID-19 vs. pre-COVID-19 (Figure 1).

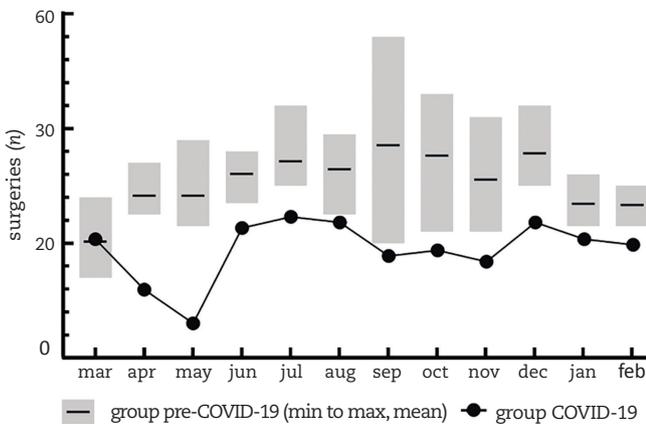


Figure 1. Monthly variation of surgeries performed for facial fracture repair in group pre-COVID-19 and group COVID-19. Floating grey bar limits represent the highest and lowest n of group pre-COVID-19 and the 4-year mean value is depicted as a horizontal black line.

Regarding the aetiology of facial trauma, this study showed statistically significant differences for physical assault (72 vs. 142 patients, 31.3 % vs. 38.5 %, groups COVID-19 vs pre-COVID-19, $p = 0.035$), sport accident (11 vs. 35 patients, 4.8 % vs. 9.6 %, groups COVID-19 vs. pre-COVID-19, $p = 0.018$) and other causes (49 vs. 44 patients, 21.3 % vs. 11.8 %, groups COVID-19 vs. pre-COVID-19, $p < 0.001$).

Regarding the type of fracture, statistically significant differences were found for nasal fractures (90 vs. 173 fractures, 32.4 % vs. 41.9 %, groups COVID-19 vs. pre-COVID-19, $p = 0.003$). The distribution of the other fracture types did not significantly differ between patients from each group. However, when analysing the timeframe of lockdown, significant differences were found for both nasal ($p = 0.009$) and mandibular ($p < 0.001$) fractures, the former declining and the latter increasing, becoming the most frequent fracture type (60 %) (Table I).

DISCUSSION

On March 2nd, the first two cases of COVID-19 were diagnosed in Portugal. According to the World Health Organization, on this day, the disease had already spread across more than 60 countries, infecting at least 90294 people worldwide, with a death toll of 3080. Portuguese authorities were swift in imposing a temporary lockdown, starting on March 18th. The full lockdown occurred until May 3rd, and from May 4th to June 1st some of the imposed measures were gradually released. We anticipated that social distancing would lead to a reduction in facial trauma, as many of the facial fractures repaired in previous years resulted from interpersonal violence and sport accidents. Surgical activity during the first year of COVID-19

pandemic was compared with all facial fractures repaired in our hospital in the previous 4 years. The analysis included 1701 patients in total, during a 5-year period (Figure 1, Table I). By using such an extended period of time, we were able to soften monthly fluctuations and increase statistical power.

During the 75-day lockdown period, only 22 patients were submitted to facial fracture surgical repair, reflecting a 66.7 % decrease versus the mean equivalent period of the previous 4 years. Fall was the main aetiology, representing 40.9 % of all admissions, followed by physical assault, road traffic and other causes. This contrasts with the observation of the equivalent period in the previous 4 years, where physical assault was the leading cause for facial fractures. During lockdown, no sports related fractures were submitted to surgery. In fact, the first fracture with this aetiology following the lockdown period was registered in June 11th, and was related to a surfing accident. The first fracture associated with a team sport (football) was registered in late September, approximately 6 months after the beginning of the lockdown. Overall, violence- and sports-related trauma predominantly affect young and middle-aged men^{7,8}. The relative decrease of these two aetiologies during lockdown may help to explain differences in the mean age and gender between pre-COVID patients vs. lockdown patients (39.2 years vs. 44.9 years; 78.0 % male vs. 68.2 % male, respectively). Mandible fractures were the most common during lockdown (60 %, $p < 0.001$), followed by nasal (20 %, $p = 0.0092$) and zygomaticomaxillary (14.2 %), while in the previous 4 years, nasal fractures (41.9 %) were the most frequent, followed by mandibular (23.2 %) and zygomaticomaxillary (16.4 %). A fracture occurs when the force applied during a blow exceeds the energy dispersion capacity of the facial skeleton. The breaking point ranges from approximately 30 g in the nasal bone, to 200 g in the superciliary arch of the frontal bone⁵. The mandible (70-100 g) and zygomaticomaxillary complex (50-100 g) present intermediate values. We hypothesize that many low-energy impacts associated with physical assault and sport accidents dropped during lockdown. Consequently, this resulted in a relative higher frequency of fractures associated with high energy impacts (road-traffic accidents and accidents with animals) or low-energy impacts in weakened facial skeletons (fall in the elder population).

Other studies published during 2021 focused on the changes in the epidemiology and aetiology of maxillofacial trauma during the COVID-19 pandemic lockdown periods (Table II). Interestingly, the reduction of 66.7 % in facial surgical activity observed in our hospital matched those described in other Western European countries: -65.5 % in France⁹, -69.1 % in Italy¹⁰ and -71.4 % in the United Kingdom¹¹. In contrast, reduction of surgical activity in Brazil and USA ranged only from -27.5 % to -52.3 % when compared to the equivalent period of the previous one or two years¹²⁻¹⁴.

Besides studying the incidence and aetiology of facial fractures submitted to surgery during the lockdown, we also proposed to analyse the remaining period of the first year of COVID-19 pandemic. During the 1st year of COVID-19 pandemic, 230 patients were submitted to facial fracture surgical repair in our hospital, which corresponds to a 37.5 % decrease versus the mean value of the previous 4 years. Figure 1 depicts the monthly variation of surgeries in group pre-COVID-19 and group COVID-19. The upper and lower limits of bars represent the highest

Table II. Comparison of facial trauma presenting during lockdown/social distancing in 2020, relative to equivalent periods in previous years: regional differences.

Location	Time period	Trauma variation	Author
Portugal (Lisbon)	75-day of lockdown vs equivalent period in previous 4 years	66.7 % reduction	This study
Portugal (Lisbon)	1-year of COVID-19 (including lockdown) vs equivalent period in previous 4 years	37.5 % reduction	This study
France (multicentre)	1-month of lockdown vs equivalent period in previous 2 years	65.5 % reduction	(9)
Brazil (Belo Horizonte, MG)	1-week lockdown vs equivalent period in previous year	52.3 % reduction	(12)
USA (Seattle, WA)	2-month of social distancing vs equivalent period in previous 2 years	27.5 % reduction	(13)
USA (Nashville, TE)	7-week lockdown vs equivalent period in previous year	35.6 % reduction	(14)
Italy (multicentre)	3-month of social distancing vs equivalent period in previous year	69.1 % reduction	(10)
United Kingdom (London)	6-week lockdown vs equivalent period in previous year	71.4 % reduction	(11)

and lowest number of treated patients, per month, in the 4-year pre-COVID-19 period. We noticed that as soon as the lockdown was released (June 1st 2020) the number of patients submitted to facial surgery approached the mean monthly value of the previous 4-year. Remarkably, however, the *n* value of each individual month from June 2020 to February 2021 was always lower than the *n* values registered in equivalent months of the 4-year pre-COVID-19 period. If we consider facial trauma an indirect measure of social interaction, this result suggests that even following the release of lockdown, social distancing measures were followed, at some degree, by general population.

Examining the aetiology of facial fractures during the 1st year of COVID-19 as a whole, physical assault ranked first (31.3 %), followed by fall (27.4 %), other causes (21.3 %), road traffic accidents (15.2 %) and sport accidents (4.8 %). Of these, physical assault and sport accidents relative frequency significantly decreased, probably as a result of social distancing, as previously discussed. On the other hand, a steep increase in the “other causes” group was observed. “Other causes” comprise patients with facial fractures of miscellaneous and uncommon aetiology. During the pandemic, however, these less frequent forms, including accidents with animals or related with do-it-yourself activities, became the third most common aetiology of facial fractures. Some of these patients reported at the time of hospital admission that their injuries resulted from engaging in an activity they only performed due to the stay-at-home policy and spare time. We hypothesize that, while social distancing reduces the risk of facial trauma related to interpersonal interaction, it may increase the risk of trauma developed in the setting of individual, solitary activities.

The data presented in this article refers only to facial fractures submitted to surgical repair. It would be interesting in a future study to include data from facial fractures submitted to conservative treatment and evaluate if the ratio surgical: conservative treatment changed during the pandemic.

CONCLUSION

COVID-19 pandemic and enacted social distancing policies had a profound impact on the epidemiology of maxillofacial trauma and facial fractures. The 1st year of COVID-19 pandemic

was characterized by a 37.5 % reduction of facial fracture surgical repair compared with the mean value of the previous 4 years. Considering only the lockdown period of 75 days, a reduction of 66.7 % was observed. Social distancing seemed responsible for a significant decrease of the relative frequency of violence- and sport-related facial fractures. However, we highlight that the stay-at-home policy may have led to a significant relative frequency increase of fractures associated with falls, particularly important in the elder, accidents with animals and do-it-yourself related injuries. We hope the information gathered in this study can be used to predict and prevent future facial fractures occurring at apparently safe environments such as home.

CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

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