Sultan Qaboos University Med J, August 2023, Vol. 23, Iss. 3, pp. 297–302, Epub. 28 Aug 23
Submitted 9 Feb 22
Revisions Req. 9 May & 18 Jul 22; Revisions Recd. 23 Jun & 27 Sep 22
Accepted 16 Oct 22
https://doi.org/10.18295/squmj.12.2022.065

CLINICAL & BASIC RESEARCH

The Impact of the COVID-19 Pandemic on the Pattern of Trauma Presenting to a Tertiary Care Trauma Centre in Oman

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abstract: ***Objectives:*** This study aimed to investigate the change in the pattern of the presentation of trauma cases at the Sultan Qaboos University Hospital, before the COVID-19 pandemic and during its two waves/phases. ***Methods:*** This retrospective study was carried out from January 2019 to October 2021. Data on all trauma patients were collected from the hospital information system after ethics committee approval. The pattern of trauma was divided into paediatric, adult and geriatric age groups. The location of trauma was described as either outdoors, at home or on roads. This information was collected along with the details of the mechanism of trauma. Patients with incomplete data were excluded. ***Results:*** Based on the inclusion criteria, 589 records were analysed. The mean age of presentation was 29 years. The majority were male (71%) with 54.2% adults, 34% paediatrics and 11.9% geriatrics. There was a gradual increase in the percentage of paediatric trauma during pre-COVID, COVID phase one and phase two, which were 29%, 32% and 51%, respectively. A significant decline (almost 50%) in the number of geriatric trauma cases was observed between pre-COVID and COVID phase two. Trauma at home increased by 65.9% during COVID phase two and penetrating trauma increased by 16.5% during COVID phase two. Intensive care unit admissions increased during the first phase of the pandemic by 10.5%. ***Conclusion:*** A significant change was found in the pattern of trauma cases before and during the COVID-19 pandemic. These observations could lead to better safety guidelines for the paediatric age group and steps could be taken to reduce penetrating trauma.

Keywords: Trauma; Coronavirus; COVID-19; Epidemiology; Oman.

Advances in Knowledge

- *The rate of paediatric trauma increased during the COVID-19 pandemic.*
- *The rate of trauma decreased overall during the pandemic.*
- *The rate of motor vehicle crashes (MVCs) was not affected by the restrictions implemented during the pandemic.*

Applications to Patient Care

- *Public awareness should be raised to prevent trauma during pandemics, with a special focus on the most vulnerable demographic groups.*
- *With the overwhelming load of pandemics on the health systems and healthcare workers, understanding trauma patterns during a global pandemic will aid in preparing and planning strategies to deal with such issues.*

The COVID-19 pandemic had a significant impact on the social, economic, educational and health systems all over the world. Many adjustments and restrictions were implemented in an attempt to curb the spread of the virus and minimise the burden of the disease.

Oman is situated on the south-eastern coast of the Arabian Peninsula and has a population of 4.5 million people.[1] The first two cases of COVID-19 infection in Oman were registered in late February 2020.[2] The number of cases related to travel gradually increased and community transmission was noted by the end of March 2020. A Supreme Committee (SC) was formed to manage the pandemic response and released several directives to control the outbreak at regular intervals, based on the caseload, morbidity and mortality within the nation.[3]

During the pandemic, tertiary hospitals in Oman announced a temporary suspension of all routine non-emergency services such as elective surgeries and procedures and outpatient appointments; the Sultan Qaboos University Hospital (SQUH) was one such hospital.[4,5] SQUH is located in the capital city of Muscat and has a capacity of 600 beds.[6] It is considered one of the two major trauma centres in Muscat that accepts cases from all across the country.

Several studies conducted around the world showed that the pandemic led to significant reductions in trauma caseload and changed the pattern of injuries.[7,8] However, no national-level studies were conducted to evaluate this issue. The study found a change in the pattern of presentation of trauma cases at SQUH, before the pandemic and during the two phases. The objective of this study was to assess

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the overall trend—increase or decrease—in trauma cases presenting to a major trauma centre in Oman. Moreover, it looked at identifying the groups that were at a higher risk of trauma and the most common mechanisms of injuries. This will help in raising public awareness and thus prevent trauma injuries in such overwhelming situations as well as provide baseline data for stakeholders to prepare healthcare services to deal with such problems.

Methods

This retrospective, cross-sectional study was carried out at SQUH. It included all trauma cases that were presented to SQUH from 1 January 2019 to 30 October 2021. To make the comparison between different periods, the study divided the dates of data collection into three phases: pre-COVID (1 January 2019–29 February 2020), COVID phase one (1 March 2020–28 February 2021) and COVID phase two (1 March 2021–31 October 2021). The patients were divided as per age groups into paediatrics (≤13 years), adults (14–64 years) and geriatrics (≥65 years).

Electronic medical records (EMRs) of patients were reviewed. Data collected included demographics (age and gender), date of presentation to the emergency department (ED), location of trauma, type of trauma (penetrating or blunt), mechanism of trauma, list of injuries, outcomes including disposition from the trauma bay, admission (ICU/ward) and discharge, transfer to another hospital or death and the length of hospital stay in days.

Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS) Version 28.0 (IBM Corporation, Armonk, New York, USA). Continuous variables were presented as mean, median and standard deviation. Categorical variables were presented as frequency and percentage. The association/difference between two categorical variables was assessed by using a Chi-squared test (Fisher's exact/Likelihood ratio). Appropriate graphs were used to show trends over time. A *P* value less than 0.05 was considered statistically significant. All the analyses were carried out in SPSS (IBM Corporation).

This study was conducted after the approval of the ethics committee at SQUH.

Results

The study reviewed 594 files and excluded five as the data were incomplete, leaving a total of 589 cases.

The demographic data of this study showed that the majority of the patients were male (n = 421, 71.5%) and the median age was 29 years (the age range was 7 weeks to 96 years). More than half of the cases were adults (54%), a third were children (34%) and 12% were elderly [Table 1].

Phase-wise analysis revealed a falling trend in the total number of trauma cases presenting to ED (n = 288, 49%; n = 210, 36%; n = 91, 15%) across the adult and geriatric age groups [Figure 1]. However, a rising trend was noted for the paediatric age group (29.5%, 32% and 51.6%), which was statistically significant (P <0.05). The gender distribution between the three phases was not statistically significant (P = 0.061).

The majority of trauma occurred at home (n = 344, 58%), followed by outdoors (n = 184, 31%) and on roads (n = 46, 8%). These differences were not statistically significant (P = 0.43). Only 10 cases occurred at work or school and these were equally divided between the pre-COVID phase and COVID phase one.

Blunt trauma was significantly higher than penetrating trauma (81% versus 11%), with decreasing frequency during the three phases (87%, 79% and 71%). However, the percentage of penetrating trauma increased (7%, 15% and 17%). This change in trend was statistically significant (P <0.05).

As for the mechanism of trauma, falls accounted for 57% of the total number of cases, followed by motor vehicle crashes (MVCs) accounting for 11% and penetrating trauma and others accounting for 8.8% each. Lastly, sports-related injuries, crush injuries, assault, drowning and suicide attempts accounted for the remaining cases (4.4%, 3.7%, 3.6%, 1.5% and 0.7%, respectively). The study found a decreasing trend in falls and sports-related injuries through the three phases. Interestingly, penetrating injuries and drowning saw an increase in numbers. The rate of MVCs remained stable throughout the three phases. No particular trend was noted for the remaining

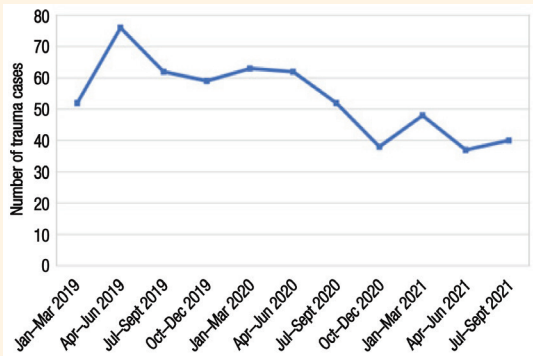

Figure 1: The number of trauma cases presented to the Emergency Department of the Sultan Qaboos University Hospital from January 2019 to September 2021 (N = 589).

Table 1: Demographic data of the trauma cases presented to the Emergency Department of the Sultan Qaboos University Hospital from January 2019 to September 2021 (N = 589)

Parameter	n (%)			
	Pre-COVID (n = 288)	COVID phase one (n = 210)	COVID phase two (n = 91)	Total (N = 589)
Gender				
Male	193 (67)	160 (76)	68 (75)	421 (71.5)
Female	95 (33)	50 (24)	23 (25)	168 (28.5)
Age groups				
Paediatric	85 (29.5)	68 (32)	47 (51.6)	200 (34)
Adult	161 (55.9)	121 (58)	37 (40.7)	319 (54)
Geriatric	42 (14.6)	21 (10)	7 (7.7)	70 (12)

Table 2: Mechanism of injury of the included cases (N = 589)

Mechanism	n (%)			
	Pre-COVID (n = 288)	COVID phase one (n = 210)	COVID phase two (n = 91)	Total (N = 589)
Fall	175 (61)	115 (55)	48 (53)	338 (57)
MVC	32 (11)	23 (11)	10 (11)	65 (11)
Penetration	14 (5)	27 (13)	11 (12)	52 (8.8)
Sports	19 (6.6)	5 (2)	2 (2)	26 (4)
Crush	11 (4)	7 (3)	4 (4)	22 (3.7)
Assault	10 (3.5)	9 (4)	2 (2)	21 (3.6)
Drowning	4 (1)	1 (0.5)	4 (4.4)	9 (1.5)
Suicide attempt	2 (0.7)	1 (0.5)	1 (1)	4 (0.7)
Others	21 (7)	22 (10.5)	9 (10)	52 (9)

MVC = motor vehicle crash.

Table 3: Anatomical location of the injuries reported (N = 504)*

Location of injury	n (%)			
	Pre-COVID (n = 252)	COVID phase one (n = 182)	COVID phase two (n = 70)	Total (N = 504)
Head and neck	62 (21.5)	58 (28)	34 (37)	154 (26)
Lower limbs	80 (28)	44 (21)	13 (14)	137 (23)
Upper limbs	49 (17)	32 (15)	9 (10)	90 (15)
Polytrauma	26 (9)	26 (12)	6 (7)	58 (10)
Spine	13 (4)	10 (5)	4 (4)	27 (5)
Thorax	9 (3)	5 (2)	2 (2)	16 (3)
Genitourinary	4 (1)	4 (2)	2 (2)	10 (1.7)
Abdomen	3 (1)	3 (1)	0 (0)	6 (1)
Pelvis	2 (0.7)	0 (0)	0 (0)	2 (0.3)
Others	4 (1)	0 (0)	0 (0)	4 (0.7)

**There were excluded data for patients who had no or minimal injury from the pre-COVID, COVID phase one and phase two (n = 36, n = 28 and n = 21, respectively).*

mechanisms of trauma [Table 2].

Injuries to the extremities were the most common at 38% (lower limbs = 23% and upper limbs = 15%). These included bone fracture/dislocation, soft tissue injuries and neurovascular injuries. Secondly, head and neck injuries accounted for 26% of cases and included traumatic brain/ophthalmic/soft tissue injuries to the scalp, face and neck, and maxillofacial fractures. This was followed by polytrauma (10%), spinal injuries (5%), thoracic injuries (3%), genitourinary injuries (2%), abdominal injuries (1%) and pelvic injuries (0.3%). In 14% of the cases, which included those with falls with late presentation to the ED and foreign body ingestions, the study found no injury acquired [Table 3].

Overall, 95% of the patients studied required admission. Of these, 88% were admitted to the ward and 7% required admission to the ICU. Four percent of the cases were discharged, while 0.3% were transferred to a different hospital. No patients were declared dead in the trauma bay. The admission duration varied between one day and 155 days (median duration = 2 days). There was no significant difference in trauma outcome during the three phases.

Discussion

The COVID-19 pandemic shook the social and medical realms amongst others. This retrospective study investigated the impact of this pandemic on trauma patterns presented to SQUH, a major trauma centre in Oman's capital city of Muscat. This was done by comparing all trauma presentations to ED over three distinct periods of time—one-year pre-COVID and the first and second phases of COVID.

A total of 589 cases made it to the final analysis. The study found an overall decrease in the total number of trauma cases presenting to ED. When comparing the three phases, the total number of cases dropped by a third between the pre-COVID phase and COVID phase one (n = 288, 49% to n = 210, 36%), respectively. This trend continued in the second phase, where a further drop of two-thirds (n = 91, 15%) was observed. The latter was possibly an overestimation as data were collected until October 2021, which makes it a shorter period compared to the two other phases. Several international studies found a similar trend. A multicentre study by Berg *et al*. found a 32% decrease in the number of trauma cases during the pandemic.[7] Other studies showed a decrease ranging from 22% to 57%.[8,9] These observations could be attributed to the precautions that were implemented during the pandemic. This included the closure of all international borders for non-residents, restriction of inter-governorate travel to only the absolutely essential, reduction of 70% in the number of employees at workplaces (work-from-home policy), suspension of classes in schools and universities, ban on all public gatherings, closure of retail outlets and recommendation of social distancing.

The first lockdown in Muscat Governorate was implemented on 10 April 2020, which was subsequently extended during the holy month of Ramadan and finally lifted on 29 May.[10,11] Alongside this was a staged lockdown between governorates in June. Night curfew was implemented from 28 March to 8 April 2021, between 8 PM and 5 AM. The implementation of a lockdown/curfew led to a significant reduction in public and traffic movement. In this study, no significant drop in trauma cases was observed during the first lockdown. The number of cases remained stable. On the contrary, a drop was noted in the following year during the partial lockdown or night curfew.

As for demographics, males predominated the study, with a male-to-female ratio of 3:1. This male predominance was consistent with trauma epidemiology overall and no significant change in the sex distribution was observed during the COVID pandemic.[12] This was true for this study as well as in other international studies.[7,13,14] Regarding age, adults (13–64 years) formed the majority of the study population (54%), which was expected as this age group was the most active. Although the number of trauma cases for both the adult and the geriatric age groups significantly dropped during the pandemic, the percentage of paediatric trauma cases rose significantly and exceeded the percentage of adult trauma cases in COVID phase two (52% versus 41%). This finding was contrary to what was found in other studies, which showed a decline in overall paediatric trauma of up to 50%.[15,16] The rate was expected to decrease, considering the shutdown of schools, parks, public playgrounds, etc. However, a rise in home-related injuries could explain this rise. This was possibly due to the increase of stressors to families resulting from a number of new changes such as working from home, supervising online teaching, lack of professional childcare services as well as restrictions in seeking extended family support. This, in turn, led to reduced direct and expert supervision and care of children.

More than half of the trauma cases originated at home, followed by a third taking place outdoors. There was no statistically significant difference in the distribution of trauma location between pre-COVID and the two phases of COVID. The relative proportion of blunt and penetrating injury, however, changed during the pandemic. A significant decrease

in blunt trauma was noted at the same time as a rise in penetrating trauma. This change was also demonstrated in studies conducted in the USA and the UK.[8,17,18] The increase in penetrating injuries reached up to 21% in a multicentre retrospective study from southern California, USA.[19] This was attributed to the socio-economic stress that resulted from the pandemic such as cutting down working staff and a rise in unemployment rates.[7,8,19] Others attributed this to the rise in homicide, sales of firearms, self-harm and domestic violence.[19,20] However, this study cannot relate these findings to the studied population, as only three cases of penetrating injuries were attributed to assault and all of them were stabbing injuries. Another explanation is that more do-it-yourself work was done at home, resulting in these injuries. This rising trend should alert healthcare professionals to be prepared to deal with penetrating injuries as they are usually more severe. Moreover, such injuries are usually associated with more blood loss and often require blood transfusion. There was shortage in blood supply during the pandemic due to a reduction in donations.[21] The health system should, therefore, be prepared to overcome such problems in the future.

Different mechanisms of injury were noted in the group, but the majority was due to falls (57%), followed by MVC (11%) and penetrating traumas (8.8%). During the different periods, a decreasing trend in falls and sports-related injuries was noted. Other studies also found a similar trend, which was statistically significant and was attributed to social gatherings being banned, and sports centres being shut down, during COVID phase one and two.[19] The trend of MVCs remained unaffected during the pandemic, while it was expected to drop given the implemented restrictions that reduced road travel in general. Larger studies showed a significant reduction of MVCs, while a no-change trend in MVCs was also noted in other studies.[7,8] A possible explanation for the finding is that less severe MVC-related injuries were dealt with in regional or non-trauma centres before the COVID pandemic. Although the overall trend was a reduction, the severity of injuries increased during the pandemic and such cases could only be managed in a major trauma centre such as SQUH. Drowning incidents increased in COVID phase two. This is probably because private properties with swimming pools were more utilised during the pandemic in an attempt to ensure entertainment for families and thereby help reduce the stress associated with the lockdown.

The distribution of injuries was classified by anatomical location. Cumulative upper and lower limb injuries accounted for 38% of all acquired injuries. Head and neck injuries were the second most common and accounted for a quarter of the cases. These injuries are usually blunt injuries, which were more common in the study cohort.

The study explored the short-term outcome of these cases and found that 95% required admission and only 4% were safe enough to be sent home. There was no noted effect of the pandemic on the disposition of the patients from the trauma bay. There was a median length of hospital stay of two days, which was also not affected by the pandemic. The median seems to be shorter than seen in the other studies, which varied between 4 days and 5.5 days.[17–19] This might be due to less severe injuries seen in the study population.

This study aimed to look at the trend of trauma patterns before and after the COVID pandemic and not to compare particular blocks of time or absolute dates. As this was a retrospective study, there were a number of limitations associated with this type of study such as recall bias, missed data and mis-documentation. Moreover, this was a single-centre study in the capital of Oman, whose results might not reflect the pattern of trauma in the other areas of Oman before or during the pandemic. A number of new implementations had also been imposed by the SC to control the pandemic, and the exact direct cause of a change in the trauma pattern could not be specifically identified.

Conclusion

The COVID-19 pandemic influenced the frequency and pattern of trauma in Oman. There was an overall decrease in the total number of trauma cases presenting to SQUH. However, the proportions of paediatrics and penetrating injuries showed an increase. Despite the limitations of the study, the findings can be taken into consideration when formulating safety guidelines for the paediatric and geriatric age groups, with special attention to penetrating trauma, in case there is another pandemic situation in the future.

AUTHORS' CONTRIBUTION

ES conceptualised and designed the study. RH conducted the literature review. RH, MH, MA and AM collected the data. RH analysed the data and drafted the manuscript. MH prepared the ethical approval application. ES and HQ supervised the work. All authors approved the final version of the manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

No funding was received for conducting this study.

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