

# Epidemiological characteristics of traumatic musculoskeletal injuries during the COVID-19 pandemic at a single tertiary hospital

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## ABSTRACT

**Background:** Musculoskeletal (MSK) injuries are common but can lead to devastating outcomes. During the COVID-19 pandemic in Saudi Arabia, it is thought that the burden of traumatic MSK injuries is minimized. **Objective:** This study aimed to assess the epidemiological characteristics of traumatic MSK injuries during the lockdown period in Saudi Arabia. **Materials and Methods:** This retrospective descriptive study included all patients who were admitted to the orthopedic department at a single tertiary hospital level 1 trauma center due to traumatic injuries from March 23 to June 21, 2020. **Results:** The study included 92 patients. The majority were male (68.5%). The most common comorbidity was hypertension (30.4%). Falls were the most common mechanism of injury (47%). The most common sites to be fractured were the proximal femur (22.8%) followed by the distal tibia/fibula (14%). Skull fractures (12%), rib fractures (6.5%), and pneumothorax (6.5%) were the most common associated injuries. Age and the number of injuries were significant predictors of increased length of hospital stay. **Conclusions:** Major considerations for primary prevention must be taken into account during long periods of time with no direct patient interaction. Patient education is important to help avoid any burden that might be caused by otherwise preventable injuries. Further studies should be conducted to assess this phenomenon more in depth and to establish the appropriate method of educating patients on primary prevention.

**Keywords:** COVID-19 pandemic, epidemiological characteristic, traumatic musculoskeletal injury

## Introduction

Musculoskeletal (MSK) injuries are common but damaging, and can lead to severe morbidity and mortality worldwide. In addition, it puts a high financial burden on hospitals and, most importantly, countries in general. MSK injuries are considered the leading cause of morbidity, with the lower back being the

most commonly affected site.<sup>[1]</sup> Therefore, several studies have been conducted to determine the methods for the prevention of MSK injuries. There are several causes of MSK injuries, and these can be categorized into two main types: traumatic and non-traumatic causes. Traumatic causes are attributed to a known situation or event, while non-traumatic causes are generally considered to be of unknown origin.<sup>[2]</sup> The concern is directed toward road traffic accidents (RTAs) as they are the leading cause of morbidity and mortality among children and young adults.<sup>[3]</sup> More than 500,000 RTAs occurred in 2015 in Saudi Arabia, costing billions in medical expenses.<sup>[4]</sup> The Ministry of Interior estimated that injuries caused by RTAs are six times more common locally than globally.

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Received: 15-12-2020

Revised: 28-02-2021

Accepted: 03-05-2021

Published: 05-11-2021

### Access this article online

#### Quick Response Code:



Website:  
www.jfmpc.com

DOI:  
10.4103/jfmpc.jfmpc\_2463\_20

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**How to cite this article:** Al Juhani WS, Alanazi AM, Aldusari RS. Epidemiological characteristics of traumatic musculoskeletal injuries during the COVID-19 pandemic at a single tertiary hospital. J Family Med Prim Care 2021;10:3882-7.

The distribution of MSK injuries in the literature is controversial, primarily depending on the cause, age, activity (workers or athletes), and anatomical sites. A study conducted by Wolfe *et al.*<sup>[5]</sup> assessed fractures in the pediatric population in the United States. They found that the highest incidence was among 4-year-old children (24.2 fractures per 1000 children annually). However, the overall incidence among all age groups was 11.7 fractures per 1000 children. The most commonly affected sites were the humerus and forearm. A systematic review published in 2017 regarding MSK complaints in the extremities among children and adolescents found that injuries in the lower limb were more common than in the upper limb mainly due to non-traumatic causes; however, traumatic causes were found to affect the upper limb more commonly.<sup>[6]</sup> Another study assessed MSK injury patterns and physical activity and found that the foot, ankle, and knee were, respectively, the most common sites affected by overuse.<sup>[7]</sup> In Saudi Arabia, Alraddadi *et al.*<sup>[8]</sup> assessed fractures caused by car accidents at King Abdulaziz Medical City, Riyadh. They found that the most common fracture site was the acetabulum and that patients who were admitted to a tertiary center were more likely to have an increased duration of hospital stay due to the severity of fracture with other associated injuries.

Recently, a study was conducted in China during the COVID-19 worldwide pandemic to examine the characteristics of traumatic fractures in the elderly; it was found that the population was predominantly female, and the most common fractures occurred in the hip due to falling from a standing position.<sup>[9]</sup>

MSK injuries are common and occur anywhere at any time, some of which require immediate intervention to preserve life and maintain the quality of life, especially during the implementation of quarantine measures in Saudi Arabia due to the COVID-19 pandemic. To the best of our knowledge, there are only few studies assessing the incidence of MSK injuries during the lockdown period. Therefore, we aimed to address this limitation by conducting our own study.

## Materials and Methods

The study was conducted using a retrospective cohort design at a single tertiary hospital that actively treats trauma and COVID-19 patients. The study included all patients who were admitted to the orthopedic department from March 23 to June 21, 2020, which was the lockdown period in Saudi Arabia. The coinvestigators started the data collection process after obtaining institutional review board (IRB) approval. The data sheet included age, sex, body mass index (BMI), comorbidities, mechanism of injury, fracture sites, associated injuries, and length of hospital stay. All patients were followed during their hospitalizations to assess if they acquired healthcare-associated infections such as COVID-19, surgical site infection, and urinary tract infection (UTI). Injuries were classified into two categories: open or closed fractures and dislocation that occurred in the spine, shoulder, upper limb, pelvis, and lower limb, which were considered MSK injuries. Skull and rib fractures, body

lacerations, pneumothorax, bowel injuries, and soft tissue injuries were considered associated injuries. Long bones were further classified into proximal, shaft, and distal bones. After completing the data collection process, all data were processed and analyzed. Descriptive statistics were summarized using numbers, percentages, mean, and standard deviation, whenever appropriate. For comparisons, Fisher's exact test (categorical variables) or the Kruskal–Wallis test (continuous variables) was applied. A value of  $P < 0.05$  was considered statistically significant. Normality tests were conducted using the Shapiro–Wilk test. All data analyses were performed using the Statistical Package for Social Sciences (SPSS) software program, version 21.0 (IBM, Armonk, New York).

In addition, the anonymity and confidentiality of patients has been ensured throughout the entire process. The data of all patients is secured in encrypted computers and only authors have been allowed access to data.

## Results

In our study, we included a total of 92 patients who were predominantly male (63 patients, 68.5%); nearly one-third consisted of females (29 patients, 31.5%). In terms of age, it can be observed that the population falls squarely in the middle-age category with a mean of 46.6 years and a standard deviation of approximately  $\pm 21.4$  years. More specifically, the majority of patients were in the 55+ age group (33 patients, 35.9%), while the minority of patients were in the 46–55 age group (8 patients, 8.7%). Furthermore, there were a good number of patients belonging to the younger group (21 patients, 22.8%). One important characteristic measured was the BMI. The mean BMI was 27.3 with a standard deviation of 7.03. Moreover, the majority of patients were in the normal and overweight categories, with an equal number of 29 (31.5%) patients in each group. On the other hand, the extremes, underweight, and obese categories had lower numbers at 7 (7.6%) and 27 (29.3%), respectively [Table 1].

**Table 1: Basic demographic characteristics of the patients (n=92)**

Study variables	n (%)
Age group (mean $\pm$ SD)	46.6 $\pm$ 21.4
14-25 years	21 (22.8%)
26-35 years	18 (19.6%)
36-45 years	12 (13.0%)
46-55 years	08 (8.7%)
>55 years	33 (35.9%)
Gender	
Male	63 (68.5%)
Female	29 (31.5%)
BMI Level (mean $\pm$ SD)	27.3 $\pm$ 7.03
Underweight (<18.5 kg/m <sup>2</sup> )	07 (7.6%)
Normal (18.5-24.9 kg/m <sup>2</sup> )	29 (31.5%)
Overweight (25-29.9 kg/m <sup>2</sup> )	29 (31.5%)
Obese ( $\geq$ 30 kg/m <sup>2</sup> )	27 (29.3%)

With regard to patients' comorbidities at the time of injury, the majority of patients presented with either hypertension (30.4%), diabetes mellitus (27.2%), dyslipidemia (16.3%), and chronic kidney disease (7.3%). Furthermore, atrial fibrillation (5.4%), ischemic heart disease (5.4%), epilepsy (4.3%), dementia (3.3%), hypothyroidism (3.3%), heart failure (3.3%), and asthma (2.2%), albeit having lower rates, were still common. The least common comorbidities were benign prostatic hyperplasia (1.1%), chronic obstructive pulmonary disease (1.1%), and end-stage renal disease (1.1%) [Figure 1].

More specifically, the lower limbs and pelvic bones had the majority of recorded injuries with proximal femoral fractures (22.8%), distal tibial/fibular fractures (14.1%), and

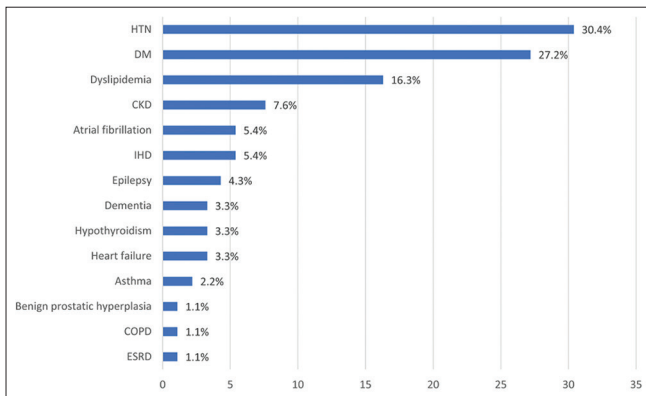


Figure 1: Comorbidities of the patients

vertebral fractures (13%) being the most common. Moreover, acetabular (9.8%), proximal humeral (9.8%), and clavicular (9.8%) fractures had a similar incidence throughout the whole patient population. There was a good proportion of injuries attributed to dislocations, and the hip (3.3%), elbow (2.2%), and ankle (1.1%) were the sites of dislocation most commonly found in our gathered data. Furthermore, it is notable that the regions with the least amount of injuries were small bones such as the carpal, tarsal, and phalangeal bones, where none of the injuries in our data exceeded 1% of the overall injury sites. There was a low proportion of distal humeral fractures (1.1%) and scapular fractures (1.1%) [Figure 2].

The most common associated specific traumatic injury was skull fracture (12%), followed by rib fracture (6.5%), pneumothorax (6.5%), arm laceration (2.2%), hand laceration (2.2%), knee laceration (1.1%), ulnar nerve injury (1.1%), degloving of the leg (1.1%), foot and ankle laceration (1.1%), thigh laceration (1.1%), head laceration (1.1%), forearm laceration (1.1%), and bowel injury (1.1%) [Figure 3]. As for the mechanism of injury, our patients mainly experienced falls with an incidence of 44 (47.8%), closely followed by motor vehicle accidents (MVAs) with an incidence of 39 (42.4%). The remaining injuries were caused by miscellaneous mechanisms with an overall incidence of 9 (9.8%). The majority of patients experienced solitary fractures (61 injured patients, 66.3%), while less than one-third experienced two concurrent fractures (21 patients, 22.8%). In addition, only 10 (10.9%)

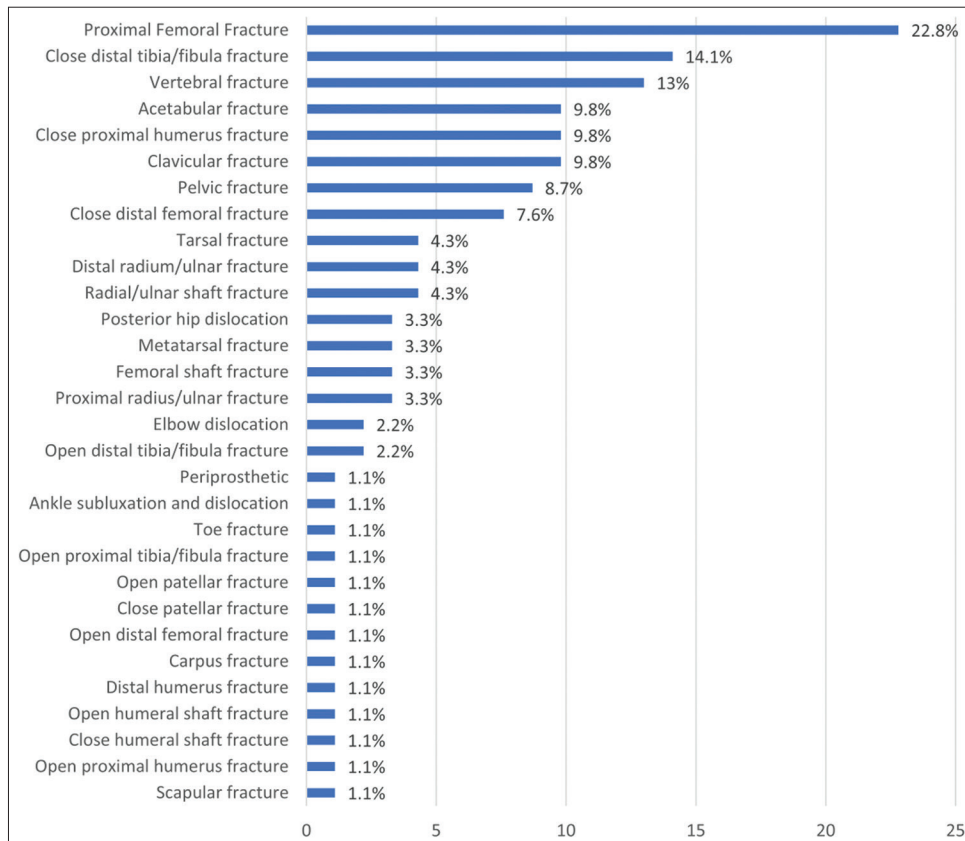


Figure 2: Specific type of injury

patients experienced three or more concurrent fractures. It is important to note that only 21 (22.8%) patients experienced injuries at multiple sites. Furthermore, a vast majority of our patients did not develop traumatic injuries that were associated with their fractures, with only 24 (26.1%) experiencing associated traumatic injuries. When examining patients who developed infection while being hospitalized, it can be noted that patients in our population had a very low incidence of infection with only 2 (2.2%) cases of COVID-19, 1 (1.1%) case of deep surgical site infection caused by *Enterobacter cloacae*, 1 (1.1%) case of UTI caused by *Escherichia coli*, and 1 (1.1%) other case of UTI caused by *Candida albicans* [Table 2].

Moreover, a significant association was found between age and the number of fractures ( $P < 0.001$ ). It was found that the higher the age of the patient, the more likely he or she will experience multiple fractures. Sex was also a significant factor as males ( $P < 0.004$ ) were more likely to experience multiple

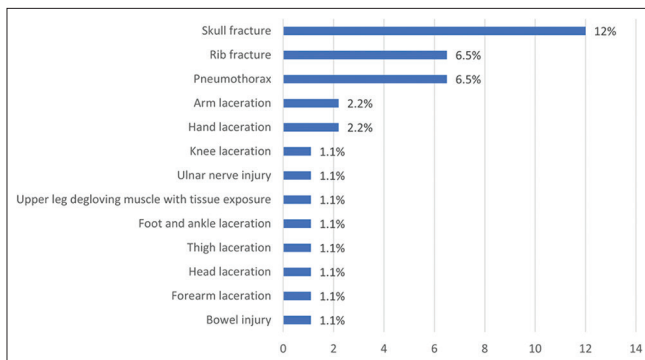


Figure 3: Associated specific traumatic injury

Table 2: Characteristics, Mechanism of injury, infection (n=92)

Study variables	n (%)
Mechanism of Injury	
MVA	39 (42.4%)
Fall	44 (47.8%)
Others	09 (09.8%)
Number of concurrent fractures	
One	61 (66.3%)
Two	21 (22.8%)
Three or more	10 (10.9%)
Associated Traumatic Injury	
Yes	24 (26.1%)
No	68 (73.9%)
Site of Injury	
Single	71 (77.2%)
Multiple	21 (22.8%)
Healthcare associated infection	
None	87 (94.6%)
UTI-Ecoli	01 (01.1%)
UTI-Candida Albicans	01 (01.1%)
Deep SSI-Entrobacter Cloacae	01 (01.1%)
COVID-19	02 (02.2%)

MVA - Motor Vehicular Accident; UTI - Urinary tract infection; SSI - Surgical Site Infection; COVID - Corona Virus Disease.

fractures in comparison to females. However, BMI ( $P = 0.308$ ) was not significantly associated with the number of concurrent fractures. In addition, healthcare-associated infections such as cases of UTI and COVID-19 ( $P = 0.349$ ) were not significantly associated with an increase or decrease in the number of concurrent fractures. Lastly, a significant difference was noted between the number of concurrent fractures and the mechanism of injury ( $P < 0.001$ ), associated traumatic injury ( $P < 0.001$ ), site of injury ( $P < 0.001$ ), and length of hospital stay ( $P < 0.001$ ).

## Discussion

MSK health is integral in sustaining a well-balanced and vigorous lifestyle for all individuals, especially to carry them well into old age. Any impact on the MSK system could lead to profound negative effects on the individual and the people surrounding him or her, leading to not only health effects but also social and economic detriments. During the period of March 23 to June 21, 2020, the lockdown in Saudi Arabia due to the global COVID-19 pandemic led to a decrease in the normal motor vehicle traffic, and consequently an increase in the incidence of elderly falls. In our study, this is supported by the fact that the majority of recorded accidents that led to admissions was falls (47.8%), while MVAs had a similarly high incidence but a slightly lower proportion (42.4%). This finding is in contrast with that of a study published prior to the pandemic by Abolfotouh *et al.*,<sup>[9]</sup> where it was found that the majority of traumas were caused by MVAs (52%). Nevertheless, our findings are also supported by a similar study conducted in China by Zhu *et al.*,<sup>[10]</sup> where it was found that there was an increase in the incidence of falls, surpassing that of MVAs.

Age was a major concern since most of the injured patients in our study were starting to enter older adulthood and seniority. This implies that an increase in falls during lockdown should be taken into consideration, especially due to the fact that most older adults require assistance for the prevention of self-injury during the isolation period. We found that the majority of falls involved the lower limbs and back, putting a great burden to their health at the time of injury and during recovery. This could also place additional burden on healthcare facilities as well as the patient's financial and social situation.

Furthermore, injured patients in our study presented with a variety of comorbidities that ranged from hypertension and diabetes to dementia and respiratory conditions. While not all of these comorbidities are known to cause an increase in the risk of falls, some studies have suggested this.<sup>[11]</sup> Due to isolation and the lack of regular checkups, there is a possibility of poor medication adherence or dosing. A study by Schwartz *et al.*<sup>[12]</sup> suggested that the use of some anti-diabetic medications to reduce glycosylated hemoglobin to  $\leq 6\%$  might cause an increase in the incidence of falls among the elderly. Moreover, another study that examined the effects of diabetic complications on the incidence of falls found an increased incidence of falls in patients with significant



diabetic retinopathy.<sup>[13]</sup> Additionally, a study that was conducted to assess the effects of hypertension on the occurrence of elderly falls found that patients with uncontrolled hypertension had a significantly high risk of falls, especially in patients having orthostatic hypertension as well.<sup>[14]</sup>

Patients who presented with associated traumatic injuries were also of great concern, and most of the associated traumatic injuries, including skull fractures, rib fractures, pneumothorax, and major lacerations, involved vital areas of the body. Appropriate management of these cases is important as some studies suggest a sharp decline in acute referrals during the pandemic.<sup>[15]</sup>

Fortunately, we only had very few cases of infections in our patient population: a couple of COVID-19 infections, a couple of UTIs, and one case of surgical site infection. In addition, the length of hospital stay had an average of 2 weeks with a standard deviation of approximately 2 weeks. In terms of the severity of patients' fractures and their demographics, all factors were found to be significant except for BMI, which might be related to the small sample size.

There are some limitations to this study. Firstly, the study is limited by its small sample size and its retrospective study design, which might affect the accuracy of the data collected; however, considering the low number of variables, this is likely to be minimal. Secondly, the study did not involve a control group for comparison. This is also a single-center study, which means bias cannot be ascertained to be minimal. Lastly, many variables are missing, such as detailed data on the patients' comorbidities as well as medications and their level of adherence.

Our study found that during the pandemic, there was a significant increase in the incidence of falls among elderly patients followed by MVAs. The primary prevention of falls is of paramount importance during periods of mass quarantine due to the unavailability of clinical checkups that render patients to rely only on themselves.<sup>[16]</sup> We hope that this study will shed light on the problem and aid family medicine physicians and primary care physicians in general to be aware of the problem not only to spread awareness, but to also play a vital role in detecting patients at risk and participate in their treatment programs. Furthermore, plans that aid in primary prevention of falls, especially in the elderly, such as fall surveillance programs and implementation of medication education programs to make patients aware of side effects are ought to improve overall quality of life in addition in preventing falls and their complications. We expect this study can aid healthcare professionals, administrators, and patients in the prevention of accidents and in their preparation for situations in which regular checkups are not possible.

## Conclusions

Major considerations for primary prevention must be taken into account during long periods of time with no direct patient

interaction. Patient education is important to help avoid any burden associated with preventable injuries, be it due to chronic illness or medication side effects. In addition, there should be some focus on programs like fall surveillance programs that aid in the process of fall risk assessment and prevention. Further studies should be conducted to assess this phenomenon more in depth and to establish effective methods of educating patients on primary prevention.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

1. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, *et al.* Global, regional, and national incidence, prevalence, and years lived with disability for 354 Diseases and Injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392:1789-858.
2. Fuller CW, Ekstrand J, Junge A, Andersen TE, Bahr R, Dvorak J, *et al.* Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Br J Sports Med* 2006;40:193-201.
3. Global status report on road safety 2018. Available from: <https://www.who.int/publications/i/item/global-status-report-on-road-safety-2018>. [Last accessed on 2020 Nov 09].
4. Traffic accidents site by Region | General Authority for Statistics. Available from: <https://www.stats.gov.sa/en/3465>. [Last accessed on 2020 Nov 09].
5. Wolfe JA, Wolfe H, Banaag A, Tintle S, Perez Koehlmoos T. Early pediatric fractures in a universally insured population within the United States. *BMC Pediatr* 2019;19:343.
6. Fuglkjær S, Dissing KB, Hestbæk L. Prevalence and incidence of musculoskeletal extremity complaints in children and adolescents. A systematic review. *BMC Musculoskelet Disord* 2017;18:418.
7. Almeida SA, Williams KM, Shaffer RA, Brodine SK. Epidemiological patterns of musculoskeletal injuries and physical training. *Med Sci Sports Exerc* 1999;31:1176-82.
8. Alraddadi A, Al Muklass A, Alhammad S, Alasmari A, Alhejji K, Alghathber N. Fractures caused by car accidents admitted to a tertiary care hospital: A cross-sectional study. *J Musculoskelet Surg Res* 2020;4:36-41.
9. Abolfotouh MA, Hussein MA, Abolfotouh SM, Al-Marzoug A, Al-Teriqi S, Al-Suwailem A, *et al.* Patterns of injuries and predictors of inhospital mortality in trauma patients in Saudi Arabia. *Open Access Emerg Med* 2018;10:89-99.
10. Lv H, Zhang Q, Yin Y, Zhu Y, Wang J, Hou Z, *et al.* Epidemiologic characteristics of traumatic fractures during the outbreak of coronavirus disease 2019 (COVID-19) in China: A retrospective & comparative multi-center study. *Injury* 2020;51:1698-704.
11. Carkci E, Polat B, Polat A, Peker B, Öztürkmen Y. The effect of the coronavirus 2019 (COVID-19) pandemic on the number and characteristics of orthopedic trauma patients in a

- tertiary care hospital in Istanbul. *Cureus* 2021;13:e12569.
12. Schwartz AV, Vittinghoff E, Sellmeyer DE, Feingold KR, de Rekeneire N, Strotmeyer ES, *et al.* Diabetes-related complications, glycemic control, and falls in older adults. *Diabetes Care* 2008;31:391-6.
  13. Azidah AK, Hasniza H, Zunaina E. Prevalence of falls and its associated factors among elderly diabetes in a tertiary center, Malaysia. *Curr Gerontol Geriatr Res* 2012;2012:539073.
  14. Gangavati A, Hajjar I, Quach L, Jones RN, Kiely DK, Gagnon P, *et al.* Hypertension, orthostatic hypotension, and the risk of falls in a community-dwelling elderly population: The maintenance of balance, independent living, intellect, and zest in the elderly of Boston study. *J Am Geriatr Soc* 2011;59:383-9.
  15. Park C, Sugand K, Nathwani D, Bhattacharya R, Sarraf KM. Impact of the COVID-19 pandemic on orthopedic trauma workload in a London level 1 trauma center: The “golden month.” *Acta Orthop* 2020;91:556-61.
  16. Alyami AH, Alyami AA, AlMaeen BN. Impact of COVID-19 on orthopedic surgery: Experience from Saudi Arabia. *Ann Med Surg* 2020;56:61-3.