The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pandemic is challenging conventional medical services worldwide. The high burden of disease is not only a result of the direct deaths caused by the coronavirus disease-2019 (COVID-19) but also by its deleterious downstream effects [1-3]. Population quarantine, travel restrictions, and strict social distancing are impacting the patient population seeking medical care, as many patients deter from emergency medical services in fear of viral contagion [4].

Previous infectious disease outbreaks were also associated with a change in the trends of hospital attendance. Medical institutes in Hong Kong, Taiwan, and Toronto reported a 21–50% reduction in the number of visitors to the emergency department (ED) during the SARS outbreaks in 2003 [5,6]. It is safe to assume that significant changes in social and work-related behaviors due to the stay at home orders and the subsequent reduced road traffic have influenced motor vehicle related injuries (MVA) during the COVID-19 pandemic. However, to what extent is unknown. Furthermore, there is uncertainty regarding the pandemic’s impact on other types of traumatic injuries, including home-related accidents and penetrating trauma. Gauging the COVID-19 pandemic consequences on traumatic injuries and related morbidity and mortality is crucial considering the rapid spread of the pandemic, and its effect on healthcare systems [7].

Our aim in this study was to examine the impact of the COVID-19 outbreak on the number, proportion, and severity of ED visitors with trauma-related complaints during the COVID-19.

**ABSTRACT**

**Background:** The novel coronavirus disease (COVID-19) pandemic changed medical environments worldwide.  

**Objectives:** To evaluate the impact of the COVID-19 pandemic on trauma-related visits to the emergency department (ED).  

**Methods:** A single tertiary center retrospective study was conducted that compared ED attendance of patients with injury-related morbidity between March 2020 (COVID-19 outbreak) and pre-COVID-19 periods: February 2020 and the same 2 months in 2018 and 2019.  

**Results:** Overall, 6513 patients were included in the study. During the COVID-19 outbreak, the daily number of patients visiting the ED for acute trauma declined by 40% compared to the average in previous months ($P < 0.01$). A strong negative correlation was found between the number of trauma-related ED visits and the log number of confirmed cases of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) in Israel (Pearson’s $r = -0.63$, $P < 0.01$). In the COVID-19 period there was a significant change in the proportion of elderly patients (7% increase, $P = 0.002$), admissions ratio (12% increase, $P < 0.001$), and patients brought by emergency medical services (10% increase, $P < 0.001$). The number of motor vehicle accident related injury declined by 45% ($P < 0.01$).  

**Conclusions:** A significant reduction in the number of trauma patients presenting to the ED occurred during the COVID-19 pandemic, yet the percentage of admitted patients increased.  

**KEY WORDS:** acute-care surgery, coronavirus disease-2019 (COVID-19), emergency department, injury, trauma

**PATIENTS AND METHODS**

**STUDY DESIGN**

A retrospective cross-sectional analysis of patients attending the ED of the Sheba Medical Center, the largest hospital in the Middle East and a Level 1 trauma center, was conducted between 1 February and 31 March in the years 2018–2020. March 2020 was defined as the COVID-19 outbreak period. February 2020 and February–March 2019 were regarded as pre-Covid-19 periods with routine ED activity. Primary outcome was set as the numbers and proportions of ED visitors with traumatic injuries. Secondary outcomes were patient demographics, symptoms, co-morbidity, transport mode to the emergency department (ambulance or walk-in), vital signs, laboratory workup, diagnosis at presentation, disposition, and ED mortality. Primary outcome was compared between all the months reviewed, while the
secondary outcomes were compared between March 2020 and March 2018 and 2019.

Diagnoses in the EDs were set according to the International Classification of Diseases, 9th rev (ICD-9) format. Severity of the presentation was assessed using the Emergency Severity Index (ESI) [8], the numeric pain rating scale (NPRS), vital signs, laboratory workup (white blood count), need for admission, and mortality in the ED. For analysis of ED diagnoses, we used the Agency for Healthcare Research and Quality Clinical Classifications Software (CCS) [9], which organizes ICD-9 diagnosis codes into clinically homogeneous groups.

We included all patients with trauma-related complaints presenting to the emergency department, as reported by the triage nurse at arrival to the ED. These included falls, cuts, motor-vehicle accidents, burn injuries, electrical injuries, and stab and gunshot wounds. Patients under 18 years of age were excluded. Patient confidentiality was preserved by de-identifying health records. The study was approved by the Sheba Medical Center institutional review board.

ESSENTIAL BACKGROUND

Israel has universal health coverage, enacted under a National Health Insurance (NHI) law. Furthermore, emergency care is available to all individuals, including those without valid medical insurance [10]. The Sheba Medical Center is an academic tertiary center with approximately 1900 beds. The first known cases of SARS-CoV-2 in Israel were reported on 21 February 2020 [11]. They were travelers returning from the Diamond Princess Cruise ship off the coast of Japan [12]. After arrival, they were admitted at the Sheba Medical Center, which became the first health institution in Israel to treat COVID-19 patients [13]. In an effort to provide context in which the outbreak was occurring, we examined the number of confirmed SARS-CoV-2 infections in Israel and the government measures implemented during the COVID-19 outbreak [14,15].

STATISTICAL ANALYSIS

COVID-19 period and pre-COVID-19 periods were compared with Wilcoxon test and Fischer exact test. Pearson’s r test was used to determine the correlation. Effect size was referenced as following: very weak 0.00–0.19, weak 0.20–0.39, moderate 0.40–0.59, strong 0.60–0.79, and very strong 0.80–1 [16]. Statistical significance was set at P < 0.05. Data on ED attendance are presented as mean ± standard deviation. Data were analyzed using R software for statistical computing (R-Project, version 3.4.1, 2017).

RESULTS

Number of ED visits

A total of 6510 patients with trauma-related complaints were reviewed during February–March 2018–2020. The number of injury-related ED visits decreased by 40% in the COVID-19 period compared to the average patient volume before the outbreak. On average, 24 patients presented daily to the ED for trauma-related complaints (± 12) in March 2020 compared to 42 ± 11.8 and 39 ± 12.2 in March 2019 and 2018, respectively (P < 0.01). Figure 1 illustrates the changes in ED attendance in the 6 months reviewed in the study. There was a strong negative correlation (Pearson’s r = -0.63, P < 0.01) between the number of confirmed SARS-CoV-2 in Israel (in log scale) and the number of ED visits for traumatic complaints, as shown in Figure 2.

Demographics and presentation outcome

The clinical characteristics and outcomes of injury-related ED presentations in March 2020, compared to March 2018 and 2019, are presented in Table 1. A change in the age distribution of the patients presenting to the ED was noted because the proportion of patients above 70 years old was higher by 6.5% in the COVID-19 period (P = 0.002) and there was a 7% decrease in the proportion of younger patients (aged 18–30 years) (P = 0.0003). In addition, during the COVID-19 period a higher proportion of patients were transported to the hospital by an emergency medical service ambulance (10% increase, P < 0.001). Furthermore, self-assessed pain scores of presenting patients were higher (6% increase, P = 0.008). The proportion of patients admitted after ED evaluation increased by 12% (P < 0.001) in March 2020 compared to the average in 2019–2018. Additional significant changes included: higher proportion of patients with an oncologic co-morbidity (increase of 3%, P = 0.02), higher propor-
tion of patients presenting with tachycardia (3%, \(P = 0.03\)), and a higher proportion of patients with chronic disease such as hypertension (5% increase, \(P = 0.01\)), ischemic heart disease (3% increase, \(P = 0.008\)), and diabetes mellitus (5% increase, \(P = 0.0007\)). There was no statistical significance when comparing the following characteristics and outcomes: emergency severity index (\(P = 0.27\)), fever (\(P = 1\)), white blood count (\(P = 0.62\)), respiratory and renal co-morbidity (\(P = 0.88\)), and ED mortality (\(P = 0.99\)).

**ICD-9 diagnoses distribution**

There was a total of 466 different ICD diagnosis given to the patients after evaluation in the ED. Table 2 summarizes the distribution of the most common diagnoses of patients presenting with injury related complaints during the COVID-19 period compared to the same time period in March 2018 and March 2019. During the COVID-19 period, there was a 45% decrease in the number of patients presenting with injuries caused by motor vehicle accidents with an overall reduction of 6.5% compared to the 2018–2019 period (\(< 0.001\)). The proportion of cut injuries and accidental falls each increased by 4% (\(P = 0.01\) and \(P = 0.04\), respectively). The monthly number of patients diagnosed with a femoral neck fracture increased from 35.5 patients in March 2018 and March 2019 to 42 patients during the COVID-19 period (\(P = 0.002\)).

**DISCUSSION**

Our study shows that the COVID-19 outbreak in March 2020 had a considerable impact on the patient volume and presenting complaints in a large Level 1 trauma center. The total trauma-related presentations decreased by 45%, yet there was a 12% higher proportion of patients needing hospitalization. The trend in hospital attendance was strongly negatively correlated to the national number of diagnosed SARS-CoV-2 cases.

We can attribute the decline in trauma-related hospital attendance to a number of factors. First, the implementation of governmental measures for social distancing and quarantine affected the prevalence and distribution of injuries. Second, the perception of medical centers as SARS-CoV-2 hotspots might have deterred patients with minor injuries from attending the hospital. The high risk of disease contraction in the hospital was underscored by the Ministry of Health restriction on the general population to avoid visiting family members in medical facilities in mid-March 2020 [17]. Furthermore, our institution was the first and leading center activated in the beginning of the COVID-19 pandemic. Thus, we can postulate that at least in the beginning of the outbreak, patients were inclined to seek medical care at other hospitals.

The proportion of elderly patients (>70 years old) who visited the ED due to an injury-related morbidity increased during...
the COVID-19 period. A possible explanation might be the home quarantine order, exposing them to a higher risk of fall accidents and other household-related injuries. Mannocci and colleagues [17] showed that increasing age and spending more than 13 hours a day at home conferred an increased risk for home injuries (cuts, burns, and falls). This assumption is strengthened by the witnessed increase in the proportion of patients diagnosed with accidental falls, cuts, and femoral neck fractures.

Interestingly, the numbers of sprains and strains significantly decreased during the COVID-19 period. These injuries are related to physical activity, and the trend can be attributed to patients being quarantined at home and the reduction in leisure and professional sport activities. Not surprisingly, we found a significant decrease in MVA related injuries, secondary to the extreme reduction in traffic volumes, during the quarantine. The higher proportion of oncologic patients attending the ED during the COVID-19 period was quite surprising given that these patients might be at a higher risk of contracting SARS-Cov-19. We attribute the increase to the regular monitoring of these patients by their oncologist, who might have referred them to the ED.
We found several differences in the COVID-19 cohort that might infer an inclination toward patients presenting with more severe presentations. Our results showed a significant increase in the proportion of attendees arriving with emergency medical services, a higher rate of tachycardic patients, an increase in reported pain, and a higher rate of trauma-related admissions. These results imply that the patients with trauma cases arriving at our ED during March 2020 had a more severe presentation.

Several studies looked at the numbers of visits to EDs during outbreaks of similar respiratory infectious diseases [5,6]. Man and co-authors [5] reported a 50% decrease in the mean daily attendance to EDs at the peak of the SARS outbreak in 2003 in Hong Kong compared to a similar period in 2012, alongside a decline in trauma-related visits. A recent study from our group reported a drop of almost one-third in the patient volume visiting the ED with complaints necessitating surgical consult during the peak of the pandemic [18]. A similar decrease was reported in women seeking early pregnancy and emergent gynecological medical care [19].

LIMITATIONS

There are several drawbacks to this study, including the focus on a single center population. Furthermore, we cannot rule out possible residual confounders to the reported association, namely the known association between older age and higher co-morbidity. Our results warrant further investigations to better evaluate the downstream consequences of the COVID-19 outbreak, specifically looking into surgical results and long-term morbidity and mortality of acute care surgery and trauma.

CONCLUSIONS

A significant reduction in the rate of ED attendance during the COVID-19 pandemic is a major health risk. These findings should convince healthcare professionals to actively reach out to their patients at times of outbreaks, utilizing telemedicine modalities [20]. Furthermore, the significant reduction in ED volume should prompt health professionals to consider transferring healthcare workers to other departments, especially those that are overwhelmed at times of respiratory infectious outbreaks.

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Almog Yair from the Hebrew University, Jerusalem, Israel consulted regarding data analysis.

TRIAL REGISTRATION

ClinicalTrials.gov Identifier: NCT04338672

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The way to get started is to quit talking and begin doing.
Walt Disney (1901–1966), American entrepreneur, animator, writer, voice actor, and film producer.

**Capsule**

**A dsRNA detector in the immune toolkit**

Nod-like receptor (NLR) proteins recognize pathogen-associated molecular patterns within cells, which triggers the formation of signaling complexes called inflammasomes. These complexes then initiate pyroptosis, a highly inflammatory form of cell death. Recent work has shown that a rhinovirus protease can activate the human NLRP1 inflammasome, but it was unclear whether this was the only pathogen-derived trigger for NLRP1, Bauernfried and co-authors reported that long, double-stranded RNA (dsRNA) generated in the course of Squirrel Forest virus infection binds and activates NLRP1 in epithelial cells. dsRNA binding triggered NLRP1 to acquire adenosine triphosphatase (ATPase) activity, a common feature of activated NLR proteins. Thus, in addition to its ability to recognize viral protease activity, human NLRP1 can act as a genuine sensor of virus-associated nucleic acids.

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**Capsule**

**Randomized trial of a vaccine regimen to prevent chronic HCV infection**

A safe and effective vaccine to prevent chronic hepatitis C virus (HCV) infection is a critical component of efforts to eliminate the disease. In this phase 1–2 randomized, double-blind, placebo-controlled trial, Page et al. evaluated a recombinant chimpanzee adenovirus 3 vector priming vaccine formulation by a recombinant modified vaccinia Ankara boost. Both vaccines encode HCV nonstructural proteins. Adults who were considered to be at risk for HCV infection on the basis of a history of recent injection drug use were randomly assigned (in a 1:1 ratio) to receive vaccine or placebo on days 0 and 56. A total of 548 participants underwent randomization, with 274 assigned to each group. There was no significant difference in the incidence of chronic HCV infection between the groups. In the per-protocol population, chronic HCV infection developed in 14 participants in each group (hazard ratio [vaccine vs. placebo] 1.53, 95% confidence interval [95%CI] 0.68–3.55; vaccine efficacy -53%, 95%CI -255–34). In the modified intention-to-treat population, chronic HCV infection developed in 19 participants in the vaccine group and 17 in placebo group (hazard ratio 1.66, 95%CI 0.79–3.50; vaccine efficacy -66%, 95%CI -260–21). The geometric mean peak HCV RNA level after infection differed between the vaccine group and the placebo group (152.51×103 IU per milliliter and 1804.93×103 IU per milliliter, respectively). T-cell responses to HCV were detected in 78% of the participants in the vaccine group. The percentages of participants with serious adverse events were similar in the two groups. In this trial, the HCV vaccine regimen did not cause serious adverse events, produced HCV-specific T-cell responses, and lowered the peak HCV RNA level, but it did not prevent chronic HCV infection.

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