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THE IMPACT OF THE COVID-19 PANDEMIC ON THE LENGTH OF MANAGEMENT OF POLYTRAUMATIZED PATIENTS IN THE EMERGENCY DEPARTMENT

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ABSTRACT

INTRODUCTION: The personal protective equipment used by healthcare workers and special institutional protocols during the COVID-19 pandemic could potentially slow down the usual management of trauma patients.

To examine the difference in the length of management of polytraumatized patients in the emergency department (ED) before and during the COVID-19 pandemic.

MATERIAL AND METHODS: The study was designed as a case-control study and included 52 polytraumatized patients who were admitted to the intensive care unit (ICU) after being managed in the ED of Osijek University Hospital. Data were collected from the hospital information system and included patients from March 2019 to February 2020 (pre-pandemic group) and from March 2020 to February 2021 (COVID-19 pandemic group).

RESULTS: Differences in the duration of diagnostics in the ED, the duration of surgery, and the time required for admission to the ICU before and during the COVID-19 pandemic were examined. The duration of diagnostics of polytraumatized patients in the ED before vs during the pandemic was 98 (76–120) and 92 (68–167) minutes, p = 0.79, respectively. 16 (64%) patients in the pre-pandemic and 18 (67%) in the pandemic group needed emergency surgery. The time required for admission to the ICU from the beginning of management in the ED, after accounting for the duration of surgery was 128 (91.5–208.5) and 145 (110–755) minutes, p = 0.09, in pre-pandemic vs pandemic group, respectively.

CONCLUSIONS: The COVID-19 pandemic did not have a significant impact on the length of management for polytraumatized patients admitted to the ICU.

KEY WORDS: COVID-19; pandemic; polytrauma; emergency medicine; intensive care

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INTRODUCTION

The COVID-19 pandemic has caused disruptions in the global healthcare system [1, 2]. In Croatia, during the first wave (April 2020 to May 2020) and the second wave (September 2020 to February 2021), there were recorded nearly 2,000 and over 13,000 SARS-CoV-2 positive patients, respectively. The high number of hospitalized COVID-19 patients exceeded the standard capacity of the healthcare system [3], resulting in a significant strain on the availability of hospital beds. Numerous studies have demonstrated an increase in non-COVID patient mortality during the pandemic, possibly attributed to factors such as limited healthcare availability, staff shortages, and the postponement of medical interventions due to lockdown measures [4–8]. Furthermore, as SARS-CoV-2 primarily spreads through droplets and contact with body fluids in the case of viremia, the use of personal protective equipment (PPE) is mandatory when in contact with positive patients [9, 10]. In our institution, all patients admitted to the ED underwent a nasopharyngeal swab sample for PCR detection of SARS-CoV-2. The recommended protocols by the CDC for donning and doffing PPE [11] were followed until a negative nasopharyngeal swab result was obtained. The PPE ensemble included an isolation gown, gloves, an N95 facemask, a protective cap, goggles, and a face shield. Additionally, radiological diagnostics for patients without a nasopharyngeal swab were conducted in a separate building located outside the ED. Since healthcare institutions are a suitable environment for the transmission of infectious diseases, including SARS-CoV-2, it is necessary to protect vulnerable patients who may be disproportionately affected by an outbreak of infectious diseases [12]. To ensure the safety of other patients, only patients with a negative nasopharyngeal swab were admitted to the ICU. Patients without swabs were treated in a dedicated area equipped with the same level of staffing and equipment as the ICU. The objective of this study was to examine whether the implementation of special care protocols in the ED during the COVID-19 pandemic resulted in the extended initial management of polytraumatized patients, delayed ICU admissions, and impacted ICU mortality rates in comparison to the pre-pandemic period.

MATERIAL AND METHODS

The study was designed as a case-control study, and conducted according to the STROBE guideline [13]. Study settings and participants: Medical data of polytraumatized patients admitted to the surgical ICU of Osijek University Hospital were collected for two periods: March 2019 to February 2020 (pre-pandemic group) and March 2020 to February 2021 (COVID-19 pandemic group). The collected data included demographic information, time elapsed from ED admission to radiographic findings (CT scan), duration of surgery, time elapsed from ED admission to ICU admission (adjusted for the duration of surgery), and ICU outcomes of the patients.

Categorical data were presented using absolute and relative frequencies, while numerical data were presented using median and interquartile range. The normality of the distribution for numerical variables was assessed using the Shapiro-Wilk test. Differences in categorical data were analyzed using Fisher's exact test, and continuous data were evaluated using the Mann-Whitney U test. The significance level was set at alpha < 0.05. Statistical analysis was conducted using IBM SPSS software, version 28.0.

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Faculty of Medicine University Josip Juraj Strossmayer Osijek, No 2158-61-07-21-104. The collection of retrospective data on hospitalized patients was permitted based on the decision of the Ethics Committee of Osijek University Hospital (No. 25-2852-4/2015), with the condition that patient personal data remains protected. In accordance with the retrospective nature of the study, patient consent was waived. Prior to accessing the database, patients included in the study were deidentified, and no personal information of the patients is stored within the database.

RESULTS

A total of 52 polytraumatized patients were included in the study, 25 pre-pandemic and 27 during the COVID-19 pandemic. There were no significant differences in demographic characteristics, mechanism of injury, and affected organ systems as shown in Table 1.

There were no statistically significant differences observed in the time from ED admission to the computed tomography (CT) scan between the pre-pandemic and pandemic groups, as well as in the time required for the validation of the CT scans by the radiologist. 16 (64%) patients before the pandemic

Table 1. General characteristics of patients, mechanism, and type of injury

	Median (IQR) or n (%)		
	Pre-pandemic (n = 25)	Pandemic (n = 27)	p value*
Age [years]	53 (27.5–64.5)	30 (23–52)	0.09
Sex [male/female]	20 (80%)/5 (20%)	21 (77.8%)/6 (22.2%)	0.56
Mechanism of injury Traffic accident Fall Other	 19 (76%) 3 (12%) 3 (12%)	 19 (70.4%) 6 (22.2%) 2 (7.4%)	 0.44 0.27 0.46
Injured organ system Neurotrauma Thoracic trauma Abdominal trauma Limb trauma	 18 (72%) 18 (72%) 9 (36%) 13 (52%)	 18 (66.7%) 22 (81.5%) 13 (48.1%) 11 (40.7%)	 0.45 0.31 0.27 0.30

* Mann-Whitney U test for continuous and Fisher's exact test for categorical data

Table 2. Duration of diagnostics in ED, surgery, ED to ICU admission time, and ICU outcome

	Median (IQR) or n [%]		
	Pre-pandemic (n = 25)	Pandemic (n = 27)	p value*
ED admission to CT-scan [minutes]	98 (76–120.5)	92 (68–167)	0.79
CT-scan validation [minutes]	37 (22–49.5)	42 (29–66)	0.23
Duration of surgery [minutes]	185 (111.2–263.7)	132 (65–173.7)	0.11
ED admission to ICU admission reduced for the length of surgery [minutes]	128 (91.5–208.5)	145 (110–755)	0.09
Outcome [survived/died]	21 (84%)/4 (16%)	23 (85.2%)/4 (14.8%)	0.60

ED — emergency department; ICU — intensive care unit; * Mann-Whitney U test for continuous and Fisher's exact test for categorical data

and 18 (67%) during the pandemic needed emergency surgery. The length of the surgery did not exhibit a statistically significant difference between these two patient groups, nor did the time from ED admission to ICU admission (adjusted for the length of surgery) (Tab. 2).

DISCUSSION

The results of this study indicate that the COVID-19 pandemic did not have an impact on the length of management for polytraumatized patients in the ED. As anticipated, larger trauma centers experienced a decrease of over 30% in polytrauma admissions during the pandemic [14, 15]. This decline in ED admissions can be attributed to government-imposed restrictive measures, stay-at-home orders, and reduced mobility of the population. Various studies have demonstrated a decrease in traumatic injuries caused by traffic accidents during the pandemic, while the incidence of off-road accidents and assaults has shown an increase [15–17]. In our institution, no differences were observed in the frequency of polytrauma ED admissions or injury mechanisms during the pandemic compared to the pre-pandemic period.

A study conducted by Aukstakalnis et al. [18] showed that during the pandemic, three times more patients required emergency surgery compared to the pre-pandemic period, and the time from ED admission to the CT scan was significantly longer, with durations of 33 minutes during the pandemic and 23 minutes before the pandemic. Similar findings regarding the time from ED admission to the CT scan were reported in the study by Halvachizadeh et al. [19], with durations of 23.8 minutes during the pandemic and 17.3 minutes before the pandemic. This prolongation from ED to CT-scan time may be caused by the loading of the CT room with COVID-19 patients, the need for disinfection and ventilation of the room, as well as the loss of valuable time on donning PPE. In our study, there

was no difference in the duration of radiographic diagnostics of polytrauma, even a CT for patients without a nasopharyngeal swab was in a building outside the ED. The same CT device was used for imaging of COVID-19 patients, with prior disinfection of the device and ventilation of the room. Nevertheless, our study revealed a significantly longer median time from polytrauma ED admission to CT scan compared to the studies. This extended duration may be attributed to the heterogeneity of the patient population included in our study. Hemodynamically unstable polytraumatized patients required stabilization of vital functions prior to undergoing whole-body CT scans [20]. However, in this study, patients were not stratified based on the severity of their injuries or their hemodynamic stability.

Although the pandemic led to the reorganization of the healthcare system, reduced hospital capacity, and a shortage of healthcare personnel, studies examining the impact of the pandemic on the outcomes of polytraumatized patients have yielded inconclusive results. A multicenter study conducted by Berg et al. [14] demonstrated a significant increase in mortality among polytraumatized patients during the pandemic compared to the pre-pandemic period, with mortality rates of 3.6% during the pandemic and 2.8% before the pandemic. Furthermore, the study also revealed a significant increase in the severity of injuries during the pandemic. A multicentric study by Sheets et al. [21] also showed higher mortality in polytraumatized patients during the pandemic. Conversely, a study conducted in Lombardy demonstrated no statistically significant difference in hospital mortality among polytraumatized patients before and during the pandemic, but there was a significant increase in pre-hospital deaths [22]. Additionally, Ojima et al. [23] found no significant difference in in-hospital mortality for major trauma patients before and during the pandemic. The varying impact of the pandemic on the mortality of polytraumatized patients is likely attributed to the different reorganization strategies implemented by trauma centers, changes in pre-hospital polytrauma management, varying levels of healthcare system overload due to COVID-19 patients, and differences in the availability of medical personnel. In our study, we found no difference in the ICU mortality rate among polytraumatized patients before and during the pandemic. The organization of work in the ICU involved a dedicated area for patients without a nasopharyngeal swab, which shared the same level of staffing and equipment as the main ICU. This contributed to the equally successful treatment of polytraumatized patients during the pandemic within our institution. The relatively higher overall mortality rate observed in our study, compared to the previously mentioned studies, can be attributed to the specific selection criteria of our patient population. Only patients who required ICU treatment, mechanical ventilation, and vital function support were included in our analysis. Similar or even higher mortality rates have been reported in other studies investigating the mortality of polytraumatized patients admitted to the ICU [24, 25].

Because critical illness of any cause and frailty is one of the most important risk factors for severe COVID-19 disease [26], policymakers have mandated PCR testing and isolation of all patients without a nasopharyngeal swab prior to ICU admission. Additionally, asymptomatic positive patients are often a source of infection, and testing and quarantine of these patients with often high viral load is necessary in order to protect the most vulnerable individuals [27, 28]. Although our institution's protocol mandated that patients could be admitted to the ICU only after obtaining a negative PCR result from a nasopharyngeal swab for SARS-CoV2, we did not observe a significant difference in the time from ED admission to ICU admission. This could be partially attributed to the utilization of rapid PCR tests for prompt virus detection. Therefore, the recommended strategy for protecting staff and patients, and preventing the spread of SARS-CoV-2, which includes technical, administrative, and environmental controls, as well as the application of personal protective equipment [29], will be implemented in the future in the ED and ICU in the event of new pandemics.

However, this study has several limitations, including the relatively small sample size and the significant heterogeneity of patients in terms of injury severity. Furthermore, the analysis only included patients who were admitted to the ICU, excluding those who did not require mechanical ventilation and those who died during ED treatment.

CONCLUSIONS

The re-organization of the ED and ICU during the pandemic did not have an impact on the duration of diagnostics for polytraumatized patients, nor did it affect the mortality rate in the ICU. A larger study with a homogeneous sample of patients, along with

the inclusion of all polytraumatized patients admitted to the ED, will be necessary to draw a valid conclusion regarding the impact of the pandemic on the overall mortality of polytraumatized patients in our institution.

Article information and declarations

Data availability statement

The data presented in this study are available on request from the corresponding author.

Ethics statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Osijek University Hospital No No 25-2852-4/2015. Patients included in the study were deidentified before access to the database, and personal information of the patient is not stored in the database.

Author contributions

Nenad Nešković: writing, visualisation, formal analysis, interpretation, final validation; Davor Klepo: writing, conception, formal analysis and interpretation; Tamara Janošević: writing, analysis and conception; Josip Kocur: writing, analisys and conception; Dino Budrovac: writing, analysis and conception; Ivana Haršanji Drenjančević: writing, conception, interpretation, final validation.

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Conflict of interest

The authors declare no conflict of interest.

Supplementary material

No.

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