



Increased Lengths of Stay, ICU, and Ventilator Days in Trauma Patients with Asymptomatic COVID-19 Infection

The American Surgeon
2022, Vol. 88(7) 1522–1525
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DOI: 10.1177/00031348221082290
journals.sagepub.com/home/asu


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Abstract

Background: The SARS-Cov-2 coronavirus has varying clinical effects—from asymptomatic patients to life-threatening illness and death. At the only Level I Trauma Center in a rural state, outcomes appeared worse in trauma patients who tested positive for COVID despite these patients presumably being asymptomatic or only mildly affected before their traumatic event. This study compares all trauma admissions that were COVID-positive to those who were not.

Methods: The institutional database was queried for all level 1 and 2 trauma activations from March 2020–July 2021. The analysis consisted of a multivariate regression between COVID-negative and the COVID-positive group controlling for age, injury severity score (ISS), and Glasgow Coma Score (GCS). Outcomes compared were hospital length-of-stay (LOS), ICU LOS, ventilator days, days to discharge to a facility, and in-hospital mortality.

Results: Hospital LOS was 2.7 days longer in the COVID-positive group ($P < .0005$). ICU LOS was 2.9 days longer for patients admitted to the ICU in the COVID positive-group ($P = .017$). Ventilator days were 4.7 days longer for patients requiring mechanical ventilation in the COVID-positive group ($P = .002$). Discharge to a post-acute facility required 6.1 more days in the COVID-positive group ($P = .005$).

Conclusion: Trauma patients presenting positive for COVID-19 are presumed to be asymptomatic before their traumatic event. Despite this, the physiologic toll of trauma combined with the COVID infection causes significantly worse clinical outcomes, including increasing hospital days in this patient population, which continues to tax the already burdened healthcare system.

Keywords

COVID-19, Trauma, Pandemic, Outcomes

Introduction

SARS-COV-2 has infected millions of people and has already caused over 5.51 million deaths and counting worldwide.¹ Those infected display clinical presentations ranging from asymptomatic to severe acute respiratory distress syndrome (ARDS) requiring mechanical ventilation.^{2–5} Other studies have shown increased post-operative complications in surgical patients.^{6–12} However, few have investigated the outcomes of COVID-19 on trauma patients. Notable exceptions are studies from Yeates et al and Kaufmann et al, who reviewed the outcomes of trauma patients in Southern California and Pennsylvania, respectively.^{13,14} Yeates et al. found the COVID-positive patients had a longer length-of-stay, ICU length-of-stay, higher rates of pneumonia, and increased mortality.¹³ Kaufmann found similar results in the

Pennsylvania cohort where COVID-positive patients had increased morbidity, length-of-stay, and mortality.¹⁴

This study investigated the outcomes of trauma patients admitted with COVID-19 at the only level 1 trauma center in a rural state. Our goal was to analyze the data from COVID-positive patients within our institutional trauma database and compare it to those who were COVID-negative. Based on observed outcomes in COVID patients at our institution, we expect our results to

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mirror previous studies. This study will also validate the existing studies. We aim to further contribute to understanding COVID-19 and its impact on trauma patients by comparing days necessary for discharge to post-acute facilities. Understanding the effects of COVID-19 on trauma outcomes will help physicians prepare for the anticipated outcomes and barriers to care seen in trauma patients who are COVID-positive.

Methods

The study was deemed non-human subjects research by the Institutional Review Board at the University of Arkansas for Medical Sciences. Our institutional trauma registry was queried for level 1 and 2 trauma activations from March 1, 2020, to July 31, 2021. All trauma activations requiring admission for 24 hours were included. Patients testing positive for COVID-19 on PCR assay were compared with those who tested negative. A multivariate regression analysis was used to assess outcomes while controlling for age and injury characteristics (ISS and GCS). These outcomes included: hospital length-of-stay (LOS), ICU LOS, ICU LOS in only patients admitted to the ICU, ventilator days, ventilator days in only patients requiring mechanical ventilation, and days required for discharge to a post-acute facility.

Descriptive statistics were also performed. Bivariate relationships were assessed with t-tests for continuous variables and chi-squared for dichotomous variables. Outcomes compared were total hospital days, ICU length-of-stay, ventilator days, in-hospital mortality, AKI, DVT, MI, ARDS, and decubitus ulcers. Further analysis compared ICU length-of-stay only among patients requiring ICU admission as well as ventilator days only among patients requiring intubation. All statistical analyses were performed using Stata Version 17 (College Station, Texas).

Results

2,562 trauma patients were admitted for longer than 24 hours during the study period. Eighty of those patients were COVID-positive (3.1%). The majority of the patients in the study were male at 65.6%. Caucasian was the most common race at 67.3%, while minorities made up the remaining 32.7%. The average age was 50.7 years old with a SD of 20.5.

Hospital LOS was 7.4 days in the COVID-positive cohort and 4.8 days in the COVID-negative cohort ($P = .0003$). ICU admission was required in 795 patients, of which 23 were COVID-positive (2.9%). There was no difference in the requirement of ICU care based on COVID status (28.8 vs 31.1%, $P = .65$). ICU length-of-stay was 8.4 days in the COVID-positive group and 5.3 in the COVID-negative group ($P = .014$). Mechanical

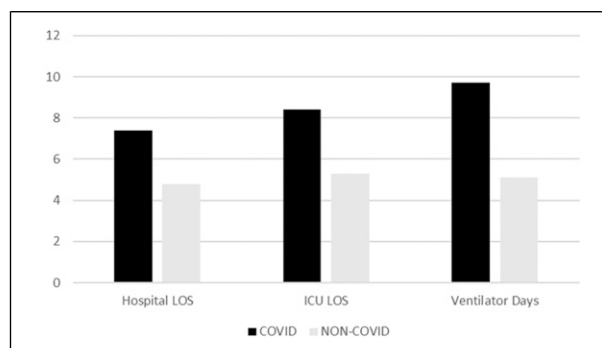


Figure 1. Hospital LOS, ICU LOS, and ventilator days compared between COVID-positive and -negative patients.

ventilation was required in 529 patients, of which 15 were COVID-positive. Mean ventilator days were 9.7 days in COVID-positive patients and 5.0 days in COVID-negative patients ($P = .003$). (Figure 1)

Based on the multivariate regression analysis, hospital LOS was 2.7 days longer for the COVID-positive group ($P < .0005$). ICU LOS was .9 days longer for the COVID-positive cohort ($P = .046$) and 2.9 days for COVID-positive patients, when only comparing patients requiring ICU care ($P = .017$). Ventilator days were .9 days longer for the COVID-positive cohort ($P = .015$), and 4.7 days longer when only comparing patients requiring mechanical ventilation ($P = .002$). (Figure 2)

Mortality was too rare for statistical analysis in this sample, with only 2 deaths in the COVID-positive group. Morbidity was also too rare for statistical analysis with only 2 patients with acute kidney injury, 1 with deep vein thrombosis, none with acute respiratory distress syndrome, 2 with pulmonary embolism, and 2 with decubitus ulcers in the COVID-positive cohort.

Discussion

At our center, trauma patients testing positive for COVID-19 had increased hospital LOS, ICU LOS, ventilator days, and longer days required for discharge to a post-acute facility. These increases proved true with the multivariate regression accounting for age and injury severity. Other trauma centers are beginning to publish data regarding the effects of COVID-19 on trauma patient outcomes, and our results share similarities with these. For instance, in California, COVID-positive trauma patients were found to have an increased LOS by 4.2 days, and Pennsylvania LOS was increased by 1.0 day.^{13,14} Our results were similar, with an increased LOS by 2.6 days. The study out of California also found an increased ICU LOS by .6 days; however, the Pennsylvania study found no increase in ICU LOS. Our results showed an increased ICU LOS by 2.9 days. These studies showed increased mortality and pulmonary

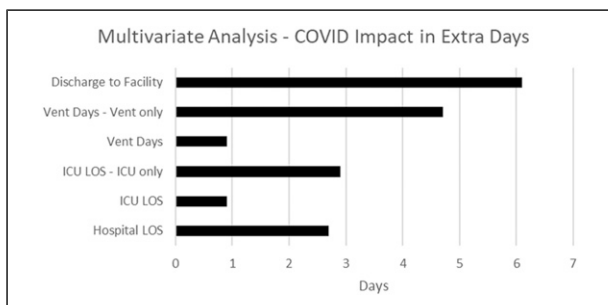


Figure 2. Extra days for COVID-positive patients in the hospital, ICU, on the ventilatory, and required for discharge to a post-acute facility.

complications, for which we were unable to demonstrate significance in our study. Trauma patients admitted to the ICU likely have longer stays due to the multiple organ systems affected by COVID-19. This necessitates ICU level care due complications with pulmonary, renal, and cardiac function.

Trauma patients positive for COVID-19 also required an additional 6 hospital days for discharge to a post-acute facility. This increased LOS in the COVID-19 positive group as it is well known that trauma patients frequently require discharge to such facilities.¹⁵ Other studies have shown barriers to discharge in COVID-19 patients, but evidence is lacking in trauma patients.¹⁶ Our literature review did not find another study investigating the discharge of COVID-positive trauma patients to post-acute facilities. There are several factors leading to the increased time to discharge to a post-acute facility. First, some facilities did not have the capacity to care for COVID-positive patients. Other facilities requested these patients be retested until COVID-19 or wait a predetermined length of quarantine at our hospital until discharge to the post-acute facility. Lastly, some facilities had quotas of the number of COVID-positive patients they were able to care for.

Limitations of this study are due to the retrospective nature and the utilization of our institutional trauma database. The retrospective nature allows only for association and not causation. In the COVID-positive group, morbidity (AKI, DVT, MI, etc.) was too small of a sample size to run a statistical comparison. This could result from the relatively small sample size. A multicenter study could accomplish this, as seen by Yeates and Kaufman. However, larger nationwide databases typically take a long time to modify their data dictionary. A more timely method could be employed to better capture data during pandemics. Further research should focus on treatment options for COVID-19 trauma patients. This could include prospective studies considering these patients high-risk and treating prophylactically for the COVID infection. Pathways for

discharge to a post-acute facility should also be explored and implemented early in the hospital course for these patients to ensure that this does not further prolong their LOS. A possible solution to this would be to convert some post-acute facilities into disease-only centers during future outbreaks in order to help with discharge from hospitals.

It is widely accepted that patients with comorbidities have worse outcomes with COVID-19 - traumatic injuries should be viewed in the same manner. Trauma patients with COVID-19 have increased hospital LOS, increased ICU LOS, increased ventilator days, and longer days required for discharge to a post-acute facility. The impact of COVID-19 on trauma patients should be recognized in trauma centers, and resources should be allocated to help diminish the consequences of trauma patients being infected with COVID-19.

Acknowledgments

We would like to thank the Department of Surgery at the University of Arkansas for Medical Sciences, our trauma coordinator, Monica Kimbrell, and Department Chair, Ron Robertson, MD.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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