Increase in gunshot wounds at a level 1 trauma center following the COVID19 pandemic

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Abstract

Objectives: To compare the number of patients with gunshot wounds presenting to our level 1 trauma center before and during the COVID-19 pandemic with a focus on volume trends after the lifting of stay-at-home directives through August 2020.

Design: Retrospective.

Setting: Level 1 trauma center.

Patients/Participants: Seven hundred six gunshot wound patients between 2016 and 2020 (months March to September only).

Intervention: COVID-19 pandemic and resultant stay at home directives.

Main Outcome Measurements: Number of patients presenting with gunshot wounds per time period.

Results: The number of patients with gunshot wounds presenting to our institution increased by 11.7% in March–April 2020 and by 67% in May–August 2020 when compared to previous years. Length of stay significantly decreased in 2020 compared to 2018 and 2019. In 2020, significantly fewer patients had orthopaedic procedures than in 2018.

Conclusions: Patients presenting with gunshot wounds increased during the initial “stay-at-home” portion of the pandemic in March to April and increased significantly more after the restrictions were relaxed during May to August.

Level of Evidence: Therapeutic Level III

Keywords: COVID-19, gunshot wounds, penetrating injuries, social distancing, stay-at-home

1. Introduction

The SARS-CoV-2 (COVID-19) pandemic has led to worldwide implications. Social distancing and stay-at-home directives began in the United States in March 2020. These restrictions have had various documented effects on health care systems and emergency room visits. One study showed a decrease in all trauma admissions at a level 1 trauma center by 43% during the “stay-at-home” period between March and April.[1] Another study documented a decrease in orthopaedic consultations at a single level 1 trauma center despite an increase in gunshot wound injuries during the same time period.[2] Conversely, a level 2 trauma center published their experience during the early phase of the pandemic by reporting a 58.8% decrease in high-severity injuries with associated fractures and a 42.9% decrease in low-severity injuries.[3] While these preliminary studies give providers a glimpse into the pandemic’s impact on trauma volumes, there is limited data describing its effect on orthopaedic trauma, particularly in the months following the stay-at-home mandate.

During the COVID-19 pandemic, gun violence increased in multiple cities including New York City, Chicago, and Baltimore.[4] This increase in gun violence can be attributed to multiple factors including the significant rise in unemployment as well as the growing social unrest that seized the nation following multiple publicized shootings across the country.[5] Additionally, government restrictions have compelled families to remain at home for school and work. With dramatically reduced community outlets, at-risk families remained in homes where domestic disputes were prevalent leading to an increase in the incidence of domestic violence and abuse.[6,7]

In parallel with increasing socioeconomic stressors, there has been a dramatic increase in the number of firearm background checks as reported by the Federal Bureau of Investigation. From January to August 2020, the number of background checks increased 68% when compared with the same time period in 2019.[8] Notably, between March 8 and April 11, 2020, there was a 158% increase in gun preparation Google searches.[9] These
observations not only reflect signs of a strained society, but they portend the potential surge of trauma volumes for verified centers. The objective of this study is to compare the number of patients with gunshot wounds presenting to our level 1 trauma center before and during the COVID-19 pandemic with a focus on volume trends after the lifting of stay-at-home directives through August 2020. We hypothesize there was an increase in these injuries during the COVID-19 pandemic. We intend to further delineate this phenomenon with the hopes of increasing awareness and preparedness for injury management.

2. Materials and methods

After institutional review board approval, a retrospective investigation was conducted evaluating all trauma activations at an urban, academic level 1 trauma center from January 1, 2016 to August 31, 2020, months March to September only. Patients were identified via review of the trauma registry, which is a prospectively collected database consisting of all patients presenting as a trauma activation. All adult patients ages 18 years and older presenting with a gunshot wound during the defined time period were included in the study. Patients younger than 18 years of age were excluded. The primary outcome was number of patients presenting with gunshot wounds per time period. Secondary outcomes included orthopaedic injuries, operative orthopaedic procedures performed, and hospital length of stay. The dates were selected based on the state of Ohio social distancing and stay-at-home directives during the COVID-19 pandemic. Ohio public schools were closed on March 12, 2020. Since initial public-school closings, the availability of in-person education has remained variable throughout the state. On March 22, 2020, the stay-at-home order went into effect limiting access to essential services and retailers. Most businesses, including gyms, pools, indoor restaurants/bars, and childcare facilities, were able to reopen between May 15–31.[10]

Demographic data and pertinent medical history were collected via trauma registry review including age, sex, and ethnicity. The following injury characteristics and clinical data were collected: orthopaedic injuries, operative orthopaedic procedures, Injury Severity Score (ISS), and hospital length of stay.

Continuous data are reported as means and standard deviations; categorical data are reported using frequencies and percentages. Differences between groups are reported using independent t tests for continuous variables, and chi-square or Fisher exact tests for categorical variables. All tests are 2-tailed and P < .05 is considered statistically significant.

3. Results

During the March–August time periods each year from 2016 to 2020, a total of 706 gunshot wound (GSW) patients were identified. Of these patients, 147 (21%) occurred in 2016, 132 (19%) in 2017, 99 (14%) in 2018, 112 (16%) in 2019, and 216 (31%) in 2020 (Figs. 1 and 2).

3.1. March–April

During the months of March and April, the monthly average occurrence of GSWs was 20.5 in 2016, 21 in 2017, 11.5 in 2018, and 18.5 in 2019 for a 4-year previous historical average of 17.9 GSWs per month. The same time period in 2020 revealed an increase to a monthly average of 20 GSWs, an 11.7% increase overall. Demographic data for previous years were compared to 2020 (Table 1). The only statistically significant differences between 2020 and prior years were found between 2020 and 2018. In 2020, patients were significantly older than in 2018 (30.7 ± 10.3 vs. 28.1 ± 9.8, P = .035), and significantly younger than in 2018 (30.7 ± 10.3 vs. 33.8 ± 12.3, P = .042). In 2020, a significantly higher proportion of patients were African American than in 2018 (98% vs. 88%), P = .003. Hospital length of stay in 2020 was significantly shorter than in 2018 (4.3 ± 5.4 vs. 6.3 ± 10.6, P = .048), and 2019 (4.3 ± 5.4 vs. 6.6 ± 9.3, P = .015). There was a significantly higher rate of distal femur fractures that occurred in May to September 2016 (9.4%, P < .001, compared to 0% in later years). Thoracic vertebra fractures occurred at an increased rate in 2017 (15.1% vs. 1.9% in 2016, 3.8% in 2018, 4.5% in 2019, and 1.6% in 2020, P = .005). Scapula fractures occurred at an increased rate in 2019 (9.1% vs. 1.9% in 2016, 0% in 2017, 1.9% in 2018, and 0.8% in 2020, P = .27). There were no other significant differences in injuries sustained throughout the years.

4. Discussion

This study demonstrated an increase in the number of gunshot wounds presenting to our institution during the COVID-19 lockdown period between March and April by 11.7% with a subsequent rise in GSWs after the reopening of the state in May through August by 67.9%. Overall, 2020 yielded an unprecedented number of GSW patients compared to previous years. Between March and April 2020, there was a significant decrease in the percentage of patients undergoing operative orthopaedic procedures for gunshot wounds when compared to 2018 (15% vs. 43%; P = .028). It is difficult to draw conclusions as to the reason behind this finding although one may consider
the possibility that conservative management was favored over surgery to preserve personal protective equipment as well as to limit patient exposure to COVID-19 infection. Another reason for decreased surgical intervention may simply be that the fractures simply did not merit surgical fixation. There was also an increase in fatal shootings in the same period, as well as an older average age of patients presenting with gunshot wound injuries.

During the May to August 2020 period, despite no significant difference in injury severity score (ISS), there was a decrease in hospital length of stay when compared to both 2018 and 2019.

![Graph showing Gunshot Wounds By Month](image)

**Figure 2.** GSW monthly count.

| Variable                  | 2020          | 2016          | 2017          | 2018          | 2019          | 2020          |
|---------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Age                       | 35.2±14.4     | 29.3±13.8     | .061          | 31.0±13.2     | .171          | 28.3±7.8      |
| Sex                       | .712          | 1.00          | .699          | .507          |
| Male                      | 36 (90)       | 38 (93)       | 37 (88)       | 20 (87)       | 31 (84)       | 31.5±11.2     |
| Female                    | 4 (10)        | 3 (7)         | 5 (12)        | 3 (13)        | 6 (16)        |
| Race                      | .264          | .478          | 1.00          | 1.00          |
| Caucasian                 | 5 (13)        | 2 (5)         | 3 (7)         | 3 (13)        | 4 (11)        |
| African-American          | 35 (88)       | 39 (95)       | 39 (93)       | 20 (87)       | 33 (89)       |
| Orthopaedic injury        | .502          | .191          | 2.30          | 1.00          |
| Yes                       | 15 (38)       | 19 (46)       | 22 (52)       | 13 (57)       | 13 (35)       |
| No                        | 25 (63)       | 22 (54)       | 20 (48)       | 10 (43)       | 24 (65)       |
| Orthopaedic procedure     | .301          | .224          | .028          | .457          |
| Yes                       | 6 (15)        | 11 (27)       | 12 (29)       | 10 (43)       | 9 (24)        |
| No                        | 34 (85)       | 30 (73)       | 30 (71)       | 13 (57)       | 28 (76)       |
| ISS                       | 17.6±19.4     | 12.6±9.1      | .135          | 15.6±10.8     | .564          | 11.2±7.6      |
| Death                     | .194          | .924          | .041          | .727          | 1.00          |
| Yes                       | 7 (18)        | 3 (7)         | 6 (14)        | 0 (0)         | 6 (16)        |
| No                        | 33 (83)       | 38 (93)       | 36 (86)       | 23 (100)      | 31 (84)       |
| LOS                       | 4.8±6.1       | 6.4±9.4       | .371          | 6.0±9.7       | .480          | 6.6±13.2      |

*Indicates statistically significant difference at the $P<.05$ level.
April 30, 2020 at a Level 1 Trauma Center in Las Vegas. During review on all trauma consultations from March 17, 2020, to orthopaedic practices. Lubbe et al performed a retrospective domestic violence rates.

Other studies have looked at the impact of COVID-19 on orthopaedic practices. Lubbe et al performed a retrospective review on all trauma consultations from March 17, 2020, to April 30, 2020 at a Level 1 Trauma Center in Las Vegas. During this period, the number of patients presenting after motor vehicle and motorcycle collisions remained constant; however, there was an increase of automobile versus pedestrian accidents and patients presenting with GSWs during the COVID-19 period.

The COVID-19 pandemic has had many unexpected effects on the nation and health care system. Nationally and globally, many emergency departments documented a decrease in volume; however, this may not be the case for urban trauma centers in the United States. While some institutions have documented a decrease in all trauma admissions, our institution saw a large decrease in all trauma admissions, our institution saw a large increase in gunshot wounds. This is consistent with the rest of the nation and health care system. Nationally and globally, the COVID-19 pandemic.

There are limitations of this study. This is a retrospective review of data collected from a single institution’s trauma registry. There may be confounding factors that affected the described outcomes in the study that were not addressed: the incidence of crime, prevalence of mental illness, and the impact of societal stressors can lead to interpersonal violence and injury. There is a push to expedite discharge when patients were medically ready, which could possibly explain this decrease. This was similar to other studies that reported on length of stay in trauma patients during the pandemic. Other significant findings included a higher proportion of African American patients in 2020 compared to 2018 and older patients in 2020 when compared to 2016 and 2018. The reasons for these findings are unknown.

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(4.3 ± 5.4 vs. 6.3 ± 10.6 and 6.6 ± 9.3, respectively, P = .048 and .015). Due to the pandemic, there was a push to expedite discharge when patients were medically ready, which could possibly explain this decrease. This was similar to other studies that reported on length of stay in trauma patients during the pandemic. Other significant findings included a higher proportion of African American patients in 2020 compared to 2018 and older patients in 2020 when compared to 2016 and 2018. The reasons for these findings are unknown.

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| Table 2 | May–August demographic comparisons between 2020 and prior years |
|---------|----------------------------------------------------------------|
| Variable | 2020 | 2016 | 2017 | 2018 | 2019 | 2019 |
| Age     | 30.7 ± 10.3 | 28.1 ± 9.8 | .035 | 31.6 ± 11.5 | .514 | 33.8 ± 12.3 | .042 | 30.9 ± 11.4 | .905 |
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| Sex     | 838 | .585 | 1.00 | .003 | .003 | 1.00 |
| Male    | 155 (88) | 95 (93) | 82 (91) | 67 (88) | 61 (81) |
| Female  | 21 (12) | 11 (10) | 8 (9) | 9 (12) | 14 (19) |
| Race    | 4.79 | .449 | .003 | 1.00 |
| Caucasian | 4 (2) | 4 (4) | 4 (4) | 9 (12) | 1 (1) |
| African-American | 172 (98) | 102 (96) | 86 (96) | 67 (88) | 74 (99) |
| Orthopaedic Injury | .461 | .837 | .700 | .834 |
| Yes     | 84 (48) | 45 (42) | 41 (46) | 39 (51) | 34 (45) |
| No      | 92 (52) | 61 (58) | 49 (54) | 37 (49) | 41 (55) |
| Orthopaedic Procedure | .192 | .189 | .429 | .924 |
| Yes     | 52 (30) | 23 (22) | 19 (21) | 27 (36) | 21 (28) |
| No      | 124 (70) | 83 (78) | 71 (79) | 49 (64) | 54 (72) |
| ISS     | 14.8 ± 15.7 | 13.7 ± 13.6 | .542 | 14.8 ± 14.5 | .976 | 15.2 ± 16.6 | .857 | 17.1 ± 18.7 |
| Death   | .537 | .240 | .718 | .318 | 1.00 |
| Yes     | 40 (23) | 20 (19) | 14 (16) | 15 (20) | 17 (23) |
| No      | 136 (77) | 86 (81) | 75 (81) | 61 (80) | 58 (77) |
| LOS     | 4.3 ± 5.4 | 3.7 ± 4.6 | .353 | 5.1 ± 8.9 | .333 | 6.3 ± 10.6 | .048 | 6.6 ± 9.3 | .015 |

* Indicates statistically significant difference at the P < .05 level.
Further studies should follow the trend to see if these numbers decline to pre-COVID-19 levels after the pandemic ceases.

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