

Hip Fractures Before and During the COVID-19 Pandemic: Comparative Demographics and Outcomes

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Abstract

Introduction: During the height of the COVID-19 pandemic in New York, hip fractures requiring operative management continued to present to Stony Brook University Hospital. Given the novelty of SARS-CoV-2, there is recent interest in the pandemic and its relationship to orthopedic operative outcomes. This retrospective cohort study compared outcomes for operative hip fractures in patients prior to and during the COVID-19 pandemic at a level I academic center. **Materials and Methods:** Data was collected on patients age 18 years or older who underwent operative management for hip fractures performed from January 21, 2019 to July 1, 2019 (pre-pandemic) or from January 21, 2020 to July 1, 2020 (pandemic). COVID-19 status, demographics and outcomes were analyzed. **Results:** Overall, 159 patients with hip fractures were included in this study, 103 in the 2019 group and 56 in the 2020 group. Within the 2019 group, there was a significantly greater proportion of female patients compared to 2020 ($p = 0.0128$). The length of hospital stay was shorter for the 2020 group by 1.84 days ($p = 0.0138$). COVID-19 testing was positive in 4 (7.1%) patients in the 2020 group, negative for 22 patients (39.3%), and the remaining 30 patients in the 2020 group (53.7%) were not tested during their admission. There were no other significant differences in demographics or outcomes between the 2019 and 2020 groups. **Discussion:** The COVID-19 pandemic did not significantly alter most aspects of care for hip fracture patients at our institution. Interestingly, postoperative pulmonary outcomes were not affected by the pandemic. **Conclusions:** In this study, a significantly higher proportion of males presented with hip fractures in the pandemic group. In addition, the average length of hospital stay was shorter during the COVID-19 pandemic. Further research is needed to understand the nuances that may lead to improved care for patients with hip fractures during a pandemic.

Keywords

COVID-19, hip fracture, pandemic, pneumonia, outcomes

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Introduction

In December 2019, patients with pneumonia of an unknown origin in Wuhan, Hubei Province, China were found to have been infected with the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) coronavirus.¹ The disease which this virus causes was termed Coronavirus Disease 2019 (COVID-19). COVID-19 was subsequently declared a pandemic on March 11, 2020 with more than 118,000 cases in 114 countries and 4,291 deaths.^{2,3} In the United States, the first confirmed case of COVID-19 was identified in Washington

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State on January 31, 2020. Although it was not until March 1, 2020 when the first case was confirmed in New York (NY) state, the New York City and Long Island areas quickly became the first nidus in this country for the COVID-19 outbreak. As of October 21, 2020, there were over 8 million confirmed cases and 218,641 deaths due to this disease in the United States according to the World Health Organization (WHO).⁴

The highest mortality from COVID-19 is in the elderly and patients with multiple comorbidities, a population also significantly impacted by hip fractures.⁵⁻⁹ The incidence of hip fractures in the United States is forecasted to increase significantly in the coming decade, with projections of 289,000 hip fractures being sustained annually by the year 2030.¹⁰ Previous studies have shown that patients with both fracture and pneumonia have more severe clinical characteristics when compared to patients without pneumonia.^{8,11} Moreover, post-operative pulmonary complications are reported to occur in approximately 4.9% of patients after operative management of hip fracture.¹¹ The paucity of studies combined with the ever-present morbidity and mortality associated with this pandemic as well as hip fractures highlight the need for further investigation of the relationship between COVID-19 infection and hip fractures outcomes.

During the height of the COVID-19 pandemic in NY, hip fractures requiring operative management continued to present to Stony Brook University Hospital. Given the novelty of SARS-CoV-2, there has been a recent focus in the orthopaedic literature on the pandemic and its relationship to operative outcomes. This retrospective study compared outcomes for operative hip fractures in patients prior to and during the COVID-19 pandemic at a level 1 academic center. The data from this study and associated discussion will enrich the surgical literature as it relates to operative management of hip fractures during a pandemic.

Materials and Methods

Institutional Review Board (IRB) approval was obtained for this study under the author's institutional IRB. An electronic medical record search was used to perform this retrospective study at a Level 1 academic trauma center approximately 60 miles outside of New York City. The International Classification of Disease-10 (ICD-10) codes for fractures of the femoral head/neck, pertrochanteric hip fractures, and subtrochanteric hip fractures (S72.0, S72.1, and S72.2, respectively) sustained after both traumatic and atraumatic injury were investigated. Patients age 18 years or older who underwent operative management for femoral head/neck, pertrochanteric, and subtrochanteric hip fractures performed from January 21, 2019 to July 1, 2019 or from January 21, 2020 to July 1, 2020 were identified and recorded. Patient medical records, operative reports, and follow up data were reviewed. Subjects were organized into pre-pandemic (January 21, 2019 to July 1, 2019) and pandemic (January 21, 2020 to July 1, 2020) cohorts.

Patient data including age (in years), race, gender, body mass index (BMI), and functional status from the American

Table 1. Demographics of Patients in the Pre-Pandemic (2019) and Pandemic (2020) Eras.

Variable	2019 N = 103	2020 N = 56	P value
	Mean \pm SD Median (min, max)	Mean \pm SD Median (min, max)	
Age	79.10 \pm 12.92 82.00 (30.00,98.00)	76.45 \pm 17.26 82.00 (20.00,99.00)	0.6650
Length of Stay	7.29 \pm 5.52 5.00 (2.00,42.00)	5.45 \pm 3.53 5.00 (1.00,23.00)	0.0138
Follow-up days	34.17 \pm 29.60 24.00 (1.00,218.00)	27.92 \pm 18.28 22.50 (8.00,98.00)	0.2193
Operating Room Time	76.49 \pm 42.68 66.00 (31.00,272.00)	90.84 \pm 67.77 74.00 (21.00,411.00)	0.0521
History	N (%)	N (%)	
Gender (Female)	80 (77.67%)	33 (58.93%)	0.0128
Anesthesia	5 (4.85%)	3 (5.36%)	0.8898
Diabetes	25 (24.27%)	10 (17.86%)	0.3511
Smoke	8 (7.77%)	9 (16.07%)	0.1055
Dyspnea	1 (0.97%)	0 (0.00%)	0.4595
Functional Status	57 (55.34%)	24 (42.86%)	0.1326
Ventilator	2 (1.94%)	0 (0.00%)	0.2940
COPD	11 (10.68%)	7 (12.50%)	0.7293
CHF	20 (19.42%)	8 (14.29%)	0.4171
HTN	76 (73.79%)	35 (62.50%)	0.1387
CKD	17 (16.50%)	5 (8.93%)	0.1863
Dialysis	5 (4.85%)	2 (3.57%)	0.7064

College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) classification, and American Society of Anesthesiologists (ASA) classification were recorded. Additionally, patient postoperative complications including death, coma lasting more than 24 hours, on a ventilator more than 48 hours, unplanned intubation, stroke/cerebrovascular accident, thromboembolic event (deep venous thrombosis or pulmonary embolism), cardiac arrest, myocardial infarction, acute renal failure, sepsis, septic shock, return to the operating room, wound dehiscence, deep surgical site infection (SSI), organ/space infection, graft/prosthesis/flap failure, and peripheral nerve injury were recorded.

Patient comorbidities including COVID-19 status, smoker status, diabetic status, hypertension, chronic obstructive pulmonary disease (COPD), heart failure, and dialysis need were also recorded. Subjects met inclusion criteria if they were an adult (older than 18 years of age) patient and underwent operative management for hip fracture from January 21, 2019 to July 1, 2019 or from January 21, 2020 to July 1, 2020. Alpha was set to 0.05, and statistical analysis comprised of Student's t-test for continuous variables, Mann-Whitney U-tests for ordinal variables, or Chi-square tests for categorical variables.

Results

Overall, 159 patients with hip fractures were evaluated in this study, 103 in the 2019 group and 56 in the 2020 group (Table 1). Within the 2019 group, there was a significantly greater proportion of female patients compared to 2020 ($p =$

Table 2. Postoperative Complications in the Pre-Pandemic (2019) and Pandemic (2020) Eras.

Complication	2019 (N = 103)	2020 (N = 56)	P Value
Superficial Incisional SSI	0 (0.00%)	1 (1.79%)	0.1737
Deep Incisional SSI	. (%)	. (%)	.
Wound Dehiscence	. (%)	. (%)	.
Organ space infection	. (%)	. (%)	.
Graft prosthesis flap failure	. (%)	. (%)	.
Peripheral nerve injury	. (%)	. (%)	.
Stroke CVA	0 (0.00%)	1 (1.79%)	0.1737
Pneumonia	6 (5.83%)	0 (0.00%)	0.0656
Unplanned Intubation	0 (0.00%)	1 (1.79%)	0.1737
DVT	2 (1.94%)	3 (5.36%)	0.2385
Pulmonary Embolism	2 (1.94%)	2 (3.57%)	0.5308
Urinary tract infection	11 (10.68%)	5 (8.93%)	0.7259
Ventilator greater 48H	1 (0.97%)	1 (1.79%)	0.6597
Acute Renal Failure	5 (4.85%)	3 (5.36%)	0.8898
Coma greater 24h	0 (0.00%)	1 (1.79%)	0.1737
MI	1 (0.97%)	1 (1.82%)	0.6500
Transfusion Intraoperatively	37 (35.92%)	19 (33.93%)	0.8015
Sepsis	1 (0.97%)	2 (3.57%)	0.2496
Septic Shock	. (%)	. (%)	.
Return to OR	. (%)	. (%)	.
Adverse Events			
Minor	12 (11.65%)	8 (14.29%)	0.6322
Major	41 (39.81%)	23 (41.07%)	0.8765
Any	44 (42.72%)	24 (42.86%)	0.9865
Infectious Complication	1 (0.97%)	3 (5.36%)	0.0916

0.0128). There were no other significant differences between the demographics of the two groups. SARS-CoV-2 polymerase chain reaction (PCR) tests were positive for 4 (7.1%) patients in the 2020 group. PCR tests were negative for 22 patients (39.3%). The remaining 30 patients in the 2020 group (53.7%) were not tested during their admission.

The length of hospital stay was shorter for the 2020 group by 1.84 days ($p = 0.0138$). There was one unplanned intubation post operatively for the 2020 group compared to no unplanned post-operative intubations in the 2019 group; however, this was not significant ($p = 0.1713$). Overall, there were 12 (11.65%) minor adverse events in the 2019 group postoperatively compared to 8 (14.29) minor adverse events in the 2020 group. This was not statistically significant ($p = 0.6322$). There were similar quantities of major adverse events in both groups post operatively. The 2019 group had 41 major adverse events (39.81%) compared to 23 (41.07%) adverse events in the 2020 group ($p = 0.8765$). Infectious complications were slightly higher in the 2020 group with one (0.97%) complication in the 2019 group and three (5.36%) complications in the 2020 group, but this was not statistically significant ($p = 0.0916$). There were no other significant findings (Table 2).

Discussion

COVID-19 continues to affect the daily lives of billions of people. All the while, hip fractures continue to be one of the most

common orthopedic injuries requiring operative treatment. In fact, although other orthopedic traumas have decreased during the COVID-19 pandemic, the incidence of fragility fractures has remained the same.¹² In the present study, a comparison of hip fracture demographics and outcomes before and during the COVID-19 pandemic was performed. It was found that a significantly higher proportion of females presented with hip fractures in the pre-pandemic group. In addition, the average length of hospital stay was shorter during the COVID-19 pandemic. Furthermore, some patients were not tested for COVID-19 during their hospital admission, likely due to the lack of routine testing protocols during the beginning of the data collection period along with the sparsity in available tests.

In March 2020, the COVID-19 pandemic surfaced at the institution in this study. Beginning on March 13th, no hospital visitors were allowed to accompany adult patients. The COVID-19 positive inpatient census peaked at 437, with many thousands more being classified as Patient Under Investigation (PUI). PUI status was afforded to patients who were suspected of being COVID-19 positive due to symptoms and exposure status, prior to the COVID-19 test resulting. These patients, who took several days to learn the results of their testing, especially in the earlier days of the pandemic, were treated with the same precautions as COVID-19 positive patients. Eventually, all patients that were being admitted or going to surgery would be routinely tested for COVID-19 via PCR testing. However, this policy was not enacted until late Spring of 2020, when testing was widely available. These circumstances account for the fact that some patients in the pandemic group of this study were not tested for COVID-19.

At the institution in this study, the increased burden of care was met with cross-coverage by residents, with multiple orthopedic surgery residents being deployed to work COVID-19 medical floors and intensive care units. Furthermore, additional nursing staff and ventilators were sent in from other hospitals to assist during the peak months of the pandemic. As elective surgeries were cancelled, the ambulatory surgery center was converted into an additional COVID-19 intensive care unit in order to utilize the ventilators and additional staffing available. Moreover, over 1,000 telehealth visits were performed in the department of orthopedics. The concern over the hospital exceeding its capacity, combined with a potential impetus felt by patients to leave the hospital in order to minimize exposure to COVID-19, may have contributed to shorter overall average length of stay in the pandemic group.

The COVID-19 Directive Regarding the Resumption of Elective Outpatient Surgeries and Procedures in General Hospitals in Counties and Facilities Without a Significant Risk of COVID-19 Surge stipulated traumatic injuries as Tier 3 status, which were recommended to continue without postponement due to their high acuity nature. Hip fractures fell under this category, with further classification as Tier 3a or Tier 3b if they were healthy or unhealthy, respectively.¹³ Therefore, hip fracture surgery continued amid the chaos of the pandemic. Despite this, in the current study there were only about half as many patients in the pandemic group compared to the

pre-pandemic group. This may be due to the overall fear of the general public of presenting to the hospital during the pandemic.

In a study of 30-day mortality for hip fractures during COVID-19 compared to the preceding year, no significant difference in demographics or risk factors was identified.⁸ This study was conducted in the United Kingdom, another global hotspot for the disease. However, it should be noted that aside from pulmonary complications, the only other outcomes recorded included thromboembolic event, infection, and periprosthetic dislocation. The present study had similar outcomes, with the exception of a statistically significant decrease in females and overall length of stay in 2020. In elderly patients with hip fractures, length of stay has been shown to be most affected by ASA classification, male gender, requiring preoperative cardiac testing, and admission on Thursday or Friday.^{7,14,15}

In a retrospective study of 635 elderly patients with hip fractures, Ricci et al. found that male gender had a significantly longer length of stay compared to female patients.⁷ Interestingly, the findings in our study directly contradict this, with a larger proportion of males in 2020 along with a significantly decreased length of stay in this same cohort. The gender difference may be explained by the fact that males with hip fractures are often sicker, as defined by having more comorbidities and a higher average ASA classification.⁵ In addition, the shorter duration of stay during this pandemic may have been a combined institutional effort as well as a patient desire to leave the hospital setting in order to minimize exposure to COVID-19. It also should be noted that in the present study, all adult patients were included, and a small number of patients in each group were not over 65 years old. A minute number of these patients were also included in order to analyze the overall effect of COVID-19 on hip fracture outcomes without the caveat of requiring patients to fit the elderly low-energy mechanism.

Hip fractures are associated with significantly elevated morbidity and mortality rates. A study by Panula et al. of 428 hip fracture patients found overall one year postoperative mortality to be 27.3%, approximately three times higher than that of the general age-matched population.⁶ In addition, surgery within the first 48 hours of injury has been associated with decreased length of stay and overall mortality as well as improved functional recovery.^{10,16} In addition, upper respiratory illnesses have been associated with increased postoperative complications in hip fractures. A retrospective cohort of 9,237 hip fractures found that influenza-like illness (ILI) was associated with a 13% average increase in hip fracture hospitalization risk.¹⁷ In terms of seasonality, multiple studies show an increased hip fracture burden in the winter compared to spring, summer or fall.^{18,19} The present study had no significant difference in pneumonia rates between the two groups, likely accounted for by the low percentage of COVID-19 positive patients in the pandemic group. In addition, the data collection period was standardized over winter, spring and early summer for both groups to minimize the influence of seasonality on outcomes.

Bobin et al. recently completed a retrospective study examining characteristics and early prognosis of COVID-19 infection in fracture patients.²⁰ They analyzed data from 10 hospitalized patients with both fracture and COVID-19 infection and found that one patient died 11 days after surgery and three died after admission before they were able to undergo surgery. Interestingly, in the present study, the postoperative complication rates were not significantly different between the pandemic and pre-pandemic groups.

This study was conducted during an evolving and unprecedented era and is not without its limitations. First, this is a retrospective study. However, a prospective study on the topic of the COVID-19 pandemic would be very difficult to carry out during this time period. Second, some patients in the pandemic group of this study were not tested for COVID-19. As the data collection period was early in the pandemic, testing was not widely available, and it was not yet routine to test all patients prior to admission. In addition, the 2019 pre-pandemic group was larger than the 2020 pandemic group. However, the time period of the data collected was kept the same during each year to account for seasonal changes in hip fracture incidence.^{18,19} Finally, the study did not classify patients into separate groups for younger, high-energy fractures compared to older, lower-energy fractures. As COVID-19 disproportionately affects the elderly, it would be beneficial to further analyze a population over 65 years of age to determine outcomes. Despite this, the vast majority of patients in each study group were geriatric. Furthermore, although it may be a challenging study to design, it would be interesting to prospectively analyze patients with hip fractures and COVID-19 as well as determine the effects of the second pandemic peak on outcomes.

Conclusion

In this study, outcomes were largely similar in the pandemic group compared to the pre-pandemic group. A significantly higher proportion of females presented with hip fractures in the pre-pandemic group, and the average length of hospital stay was shorter during the COVID-19 pandemic. The pandemic continues to alter the lives of patients and physicians alike. This study, as well as further larger studies, may be of interest to the orthopedic surgery community as strategies are developed to manage hip fractures in patients with COVID-19.

Authors' Note

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Declaration of Conflicting Interests

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References

1. He F, Deng Y, Li W. Coronavirus disease 2019: what we know? *J Med Virol.* 2020;92(7):1-7. doi:10.1002/jmv.25766
2. Zarrintan S. Surgical operations during the COVID-19 outbreak: should elective surgeries be suspended? *Int J Surg.* 2020;78:5-6. doi:10.1016/j.ijssu.2020.04.005
3. Etkind SN, Ba B, Dtmh M, et al. The role and response of palliative care and hospice services in epidemics and pandemics: a rapid review to inform practice during the COVID-19 pandemic. *J Pain Symptom Manage.* 2020;60(1):e31-e40. doi:10.1016/j.jpainsymman.2020.03.029
4. World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard | WHO Coronavirus Disease (COVID-19) Dashboard. *WHO.* 2020. Updated October 21, 2020. Accessed October 21, 2020. <https://covid19.who.int/> <https://covid19.who.int/region/wpro/country/cn> https://covid19.who.int/?gclid=CjwKCAjwztL2BRATEiwAvnALcpJvfJoB2ZO9AW4csCjB0QAvD_BwE <https://covid19.who.int/region/amro/country/br>
5. Sterling RS. Gender and race/ethnicity differences in hip fracture incidence, morbidity, mortality, and function. *Clin Orthop Relat Res.* 2011;469(7):1913-1918. doi:10.1007/s11999-010-1736-3
6. Panula J, Pihlajamäki H, Mattila VM, et al. Mortality and cause of death in hip fracture patients aged 65 or older—a population-based study. *BMC Musculoskelet Disord.* 2011;12:105. doi:10.1186/1471-2474-12-105
7. Ricci WM, Brandt A, McAndrew C, Gardner MJ. Factors affecting delay to surgery and length of stay for patients with hip fracture. *J Orthop Trauma.* 2015;29(3):e109-e114. doi:10.1097/BOT.0000000000000221
8. Macey ARM, Butler J, Martin SC, Tan TY, Leach WJ, Jamal B. 30-day outcomes in hip fracture patients during the COVID-19 pandemic compared to the preceding year. *Bone Jt Open.* 2020;1(7):415-419. doi:10.1302/2046-3758.17.bjo-2020-0077.r1
9. Johansen A, Golding D, Brent L, et al. Using national hip fracture registries and audit databases to develop an international perspective. *Injury.* 2017;48(10):2174-2179. doi:10.1016/j.injury.2017.08.001
10. Bottle A, Aylin P. Mortality associated with delay in operation after hip fracture: observational study. *Br Med J.* 2006;332(7547):947-950. doi:10.1136/bmj.38790.468519.55
11. Lo IL, Siu CW, Tse HF, Lau TW, Leung F, Wong M. Pre-operative pulmonary assessment for patients with hip fracture. *Osteoporos Int.* 2010;21(SUPPL. 4):579. doi:10.1007/s00198-010-1427-7
12. Kumar Jain V, Lal H, Kumar Patralekh M, Vaishya R. Fracture management during COVID-19 pandemic: a systematic review. *J Clin Orthop Trauma.* 2020;11:S431-S441. doi:10.1016/j.jcot.2020.06.035
13. Ducournau F, Arianni M, Awwad S, et al. COVID-19: Initial experience of an international group of hand surgeons. *Hand Surg Rehabil.* 2020;39(3):1-8. doi:10.1016/j.hansur.2020.04.001
14. Garcia AE, Bonnaig JV, Yoneda ZT, et al. Patient variables which may predict length of stay and hospital costs in elderly patients with hip fracture. *J Orthop Trauma.* 2012;26(11):620-623. doi:10.1097/BOT.0b013e3182695416
15. Kay HF, Sathiyakumar V, Yoneda ZT, et al. The effects of American Society of Anesthesiologists physical status on length of stay and inpatient cost in the surgical treatment of isolated orthopaedic fractures. *J Orthop Trauma.* 2014;28(7):153-159. doi:10.1097/01.bot.0000437568.84322.cd
16. Orosz GM, Magaziner J, Hannan EL, et al. Association of timing of surgery for hip fracture and patient outcomes. *J Am Med Assoc.* 2004;291(14):1738-1743. doi:10.1001/jama.291.14.1738
17. Mcconeghy KW, Lee Y, Zullo AR, et al. Influenza illness and hip fracture hospitalizations in nursing home residents: are they related? *J Gerontol A Biol Sci Med Sci.* 2018;73(12):1638-1642. doi:10.1093/gerona/glx200
18. Mazzucchelli R, Crespí-Villarías N, Pérez-Fernández E, et al. Weather conditions and their effect on seasonality of incident osteoporotic hip fracture. *Arch Osteoporos.* 2018;13(1):28. doi:10.1007/s11657-018-0438-4
19. Lin HC, Xiraxagar S. Seasonality of hip fractures and estimates of season-attributable effects: a multivariate ARIMA analysis of population-based data. *Osteoporos Int.* 2006;17(6):795-806. doi:10.1007/s00198-005-0060-3
20. Bobin M, Chen L, Xiong Y, Xue H, Zhou W, Liu G. Characteristics and early prognosis of COVID-19 infection in fracture patients. *J Bone Jt Surg.* 2020;102(9):1-9. doi:10.2106/JBJS.20.00390