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Brief Report

A Case Series of Concomitant Falls and COVID-19 Infection Among Older Adults

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ABSTRACT

Introduction. Few studies have examined the hospital course and patient outcomes among elderly trauma patients with COVID-19 and traumatic fall-related injuries. This study aimed to describe patient characteristics and hospital outcomes for older adults who sustained fall-related injuries and were concurrently infected with COVID-19.

Methods. A retrospective chart review was conducted for patients aged 65 years and older who were admitted to a single Level 1 trauma center with fall-related injuries between March 3, 2020 and March 3, 2021.

Results. Of the 807 patients who presented with fall-related injuries during the study period, 16% (n = 128) were tested for COVID-19, and 17% (n = 22) of those tested positive. After excluding one patient, 21 patients were included in the analysis. Common comorbidities among these patients included hypertension (86%, n = 18), dyslipidemia (57%, n = 12), and diabetes (43%, n = 9). Upon admission, 62% (n = 13) of patients exhibited respiratory symptoms such as cough, shortness of breath, and hypoxemia, while approximately 24% (n = 5) were asymptomatic for COVID-19 at presentation. Complications included unplanned intensive care unit or operating room visits (29%, n = 6). COVID-19-related complications included acute hypoxic respiratory failure (67%, n = 14) and pneumonia (43%, n = 9). In-hospital mortality was 19% (n = 4).

Conclusions. During the height of the COVID-19 pandemic, 17% of elderly patients admitted to a single Level 1 trauma center for fall-related injuries were concurrently infected with COVID-19. These patients experienced a high frequency of complications and in-hospital mortality. Therefore, COVID-19 should be recognized as a severe and potentially lethal comorbidity among older adults who sustain fall-related injuries.

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INTRODUCTION

Among older adults, falls are a leading cause of injury and hospitalization.[1] In 2018, approximately 28% of older adults in the U.S. reported falling, which resulted in 950,000 hospitalizations and about 32,000 deaths.[1] With the worldwide spread of COVID-19, new challenges emerged in treating older adults, particularly since a study conducted in Wuhan, China, found that older age is an early predictor of poor prognosis and increases the odds of in-hospital mortality for COVID-19 patients.[2]

Additionally, older adults may present with different symptoms than younger populations due to immunosenescence, comorbidities, and nutritional status.[3] While younger individuals typically present with respiratory symptoms, some research suggests that falls and other atypical symptoms of COVID-19 are more prominent among older adults.[4-8] However, none of these studies have specifically examined the hospital course and outcomes of elderly trauma patients with COVID-19 and traumatic fall-related injuries.[9]

A study conducted at our institution compared the characteristics of elderly patients admitted with traumatic fall-related injuries before and during the COVID-19 pandemic.[9] The findings indicated that despite differences in comorbidities, injury patterns, complications, and discharge locations, the frequency of falls was similar across the COVID-19 and pre-pandemic periods.[9]

This study extends that analysis by focusing specifically on COVID-19 positive patients from the previous study.[9] It aimed to analyze patient characteristics and hospital outcomes among older adults who were COVID-19 positive and presented with fall-related injuries at a Level 1 trauma center during the height of the pandemic.

METHODS

After obtaining Institutional Review Board (IRB) approval, we used the trauma registry at an American College of Surgeons-verified Level 1 trauma center to identify patients 65 years and older who experienced fall-related injuries during the first phase of the COVID-19 pandemic (March 3, 2020 through March 3, 2021). The first patient with confirmed COVID-19 at our facility was reported on March 13, 2020.[10] Medical charts were reviewed to determine if these patients with fall-related injuries were concurrently positive for COVID-19.

A retrospective review of the trauma registry and patient medical records was conducted. Variables abstracted included patient demographics (e.g., age, gender, comorbidities), living environment before the fall, and pre-injury medication. The mechanism of injury was categorized into one of the following groups: same-level fall, fall from height, or fall from unspecified height. Injury details included the Injury Severity Score (ISS), Glasgow Coma Scale score (GCS), and type of injury. Additional data collected included intake vitals, initial labs, and COVID-19 symptoms, such as cough, shortness of breath, and hypoxemia. Information on ICU admission and duration, mechanical ventilation and duration, hospital length of stay, COVID-19-specific treatments, complications, discharge details, and mortality also was gathered.

Statistical Analysis. Statistical Analysis System® (SAS) software, Version 9.4 (SAS Institute Inc., Cary, NC) was used for data analysis. This study aimed to characterize trends, injury patterns, and outcomes of people 65 years and older who experienced a traumatic fall. Patients' socio-demographic characteristics were summarized using descriptive statistics. Means and standard deviations were presented for normally distributed, skewed, or ordinal scaled parameters. Qualitative variables were reported as absolute numbers and relative frequencies.

Likelihood ratio chi-square and Fisher's exact tests were used for 2x2 and RxC contingency tables to test the association and agreement between COVID-19 periods and all categorical and nominal variables.

The Kolmogorov-Smirnov normality test assessed whether continuous variables were normally distributed. For normally distributed outcome variables, paired t-tests and independent t-tests were utilized. For non-normally distributed outcome variables, the Wilcoxon or Hodges-Lehmann method was used for a robust nonparametric estimator of the population's location parameter. This approach estimates parameters based on the "pseudo-median," closely related to the population median. All statistical tests were considered significant at $p \leq 0.05$.

RESULTS

Of the 807 patients who presented with fall-related injuries during the study timeframe, 16% (n = 128) were tested for COVID-19. Among those tested, 17% (n = 22) were positive. One patient was excluded from the analysis due to being a member of a vulnerable population, resulting in a total of 21 patients included in the analysis. Most patients were White (91%, n = 19), male (52%, n = 11), and lived at home or independently prior to falling (67%, n = 14; Table 1). The average age at presentation was 83 ± 6.7 years. The most common comorbidities were hypertension (86%, n = 18), dyslipidemia (57%, n = 12), and diabetes mellitus (43%, n = 9).

Approximately 33% (n = 7) of patients sustained injuries in a rural location, and 24% (n = 5) were transferred from an outside hospital (Table 2). The average time to presentation was approximately seven hours. The mechanism of injury for most patients involved same-level falls (62%, n = 13), while a smaller proportion experienced falls from height (24%, n = 5) or unspecified falls (14%, n = 3). Patients were minimally injured, with an average Glasgow Coma Scale (GCS) score of 14.5 ± 0.9 and an average Injury Severity Score (ISS) of 8 ± 4.1. The most common injuries were lower extremity fractures (48%, n = 10), followed by soft tissue injuries (24%, n = 5) and rib fractures (24%, n = 5).

On admission, 62% (n = 13) of patients had respiratory symptoms such as cough, shortness of breath, and hypoxemia (Table 3). Less commonly encountered symptoms included altered mental status or confusion (29%, n = 6), fever or chills (14%, n = 3), weakness (14%, n = 3), and diarrhea (5%, n = 1). Approximately one-fourth of patients (24%, n = 5) were asymptomatic for COVID-19 at presentation. Notably, 33% (n = 7) of patients were previously diagnosed with or known to have COVID-19 at presentation.

Average vital signs were normal except for a slightly elevated average systolic blood pressure (Table 3). Only three patients were tested for alcohol levels, none of which were positive. Abnormal glucose readings (76%, n = 16), abnormal hemoglobin results (67%, n = 14), and abnormal creatinine values (52%, n = 11) were common.

Approximately 43% (n = 9) of patients required immobilization or traction for their fall-related injuries (Table 4). Repair or replacement procedures of the lower extremity were also relatively common (29%, n = 6). COVID-19-related medical treatments included therapeutic anticoagulants (71%, n = 15), corticosteroids (57%, n = 12), antiviral agents (52%, n = 11), and antibiotics (52%, n = 11; Table 4). Oxygen therapy was utilized for 71% (n = 15) of patients.

Table 1. Demographics and comorbidities among COVID-19 positive older adults admitted with fall-related injuries.

Measures	All Patients (N = 21)
Age	83 ± 6.7 years
Gender	
Male	52% (11)
Female	48% (10)
Race	
White	91% (19)
Black/African American	5% (1)
Asian American	5% (1)
Living environment	
Home or independent living	67% (14)
Nursing home	24% (5)
Skilled nursing facility	10% (2)
Comorbidities	
Hypertension	86% (18)
Dyslipidemia	57% (12)
Diabetes mellitus	43% (9)
Dementia	38% (8)
Coronary artery disease (CAD)	38% (8)
Mental or personality disorder	38% (8)
Chronic renal failure	33% (7)
Atrial fibrillation	24% (5)
Chronic obstructive pulmonary disease (COPD)	24% (5)
Cerebral vascular accident (CVA)	19% (4)
Congestive heart failure (CHF)	19% (4)
Peripheral arterial disease (PAD)	10% (2)
Alcohol use disorder	5% (1)
Pre-injury medications	
Aspirin	67% (14)
Lipid-lowering agents	62% (13)
Beta-blockers	43% (9)
Diuretics	43% (9)
Antihypertensives	38% (8)
Inhalers	24% (5)
Insulin	19% (4)

*Presented as % (number) or mean ± standard deviation

Table 2. Injury characteristics among COVID-19 positive older adults admitted with fall-related injuries.

Measures	All Patients (N = 21)
Transfer	24% (5)
Rural location	33% (7)
Time to hospital presentation, days	0.3 ± 0.6
Mechanism of injury	
Same-level falls	62% (13)
Falls from height	24% (5)
Unspecified falls	14% (3)
Injury Severity Score (ISS)	8 ± 4.1
Glasgow Coma Scale (GCS)	14.5 ± 0.9
Abbreviated Injury Scale (AIS)	
Head	3 ± 0.0
Chest	3 ± 0.9
Abdomen	3 ± 0.0
Extremity	3 ± 0.4
Head injury	
Subdural hemorrhage	5% (1)
Loss of consciousness	5% (1)
Thoracic injury	
Rib fractures	24% (5)
Pneumothorax/hemopneumothorax	5% (1)
Spinal injury	
Cervical fracture	5% (1)
Lumbar fracture	5% (1)
Extremity injury	
Lower extremity fracture	48% (10)
Femur fracture	38% (8)
Upper extremity fracture	5% (1)
Soft tissue injury	24% (5)

*Presented as % (number) or mean ± standard deviation

Table 3. Admitting symptoms, vitals, and laboratory results among COVID-19 positive older adults admitted with fall-related injuries.

Measures	All Patients (N = 21)
Previously diagnosed with COVID-19	33% (7)
Symptoms of COVID-19	
Respiratory symptoms	62% (13)
Altered mental status and/or confusion	29% (6)
Asymptomatic	24% (5)
Fever and/or chills	14% (3)
Weakness	14% (3)
Diarrhea	5% (1)
Admitting vitals	
Heart rate beats per minute	90 ± 24 .5
Systolic blood pressure	137 ± 24.8
Diastolic blood pressure	78 ± 16.6
Mean arterial blood pressure	98 ± 17.1
Temperature, degrees Celsius	37 ± 0.6
% oxygen saturation	95 ± 2.8
Respiratory rate, breaths per minute	19 ± 5.4
Tested for alcohol	14% (3)
Alcohol above legal limits	0% (0)
Initial laboratory results	
Abnormal hemoglobin (<12 or >16 g/dL)	67% (14)
Abnormal glucose (<70 or >99 mg/dL)	76% (16)
Abnormal creatinine (<0.57 or >1.11 mg/dL)	52% (11)
Abnormal platelets (<150 or >400 x 103/uL)	38% (8)
Abnormal INR (<0.9 or >1.2)	24% (5)
Abnormal lactic acid (<0.5 or >2.2)	14.3% (3)
Abnormal PTT (<25 or >36.5 seconds)	14.3% (3)

*Presented as % (number) or mean ± standard deviation
Abbreviations: INR, international normalized ratio; PTT, partial thromboplastin time

Table 4. Management and COVID-19 treatment methods among COVID-19 positive older adults admitted with fall-related injuries.

Measures	All Patients (N = 21)
Imagining studies (e.g., CT scan, US, MRI)	100% (21)
CT exam conducted	76% (16)
Positive FAST exam	0% (0)
Placement (e.g., packing and immobilization)	43% (9)
Immobilization/traction of neck	19% (4)
Immobilization/traction of back	5% (1)
Immobilization/traction of upper extremity	5% (1)
Immobilization/traction of lower extremity	14% (3)
Measure and monitor	86% (18)
Extracorporeal or systemic assistance and performance	10% (2)
Medical and/or surgical procedures (repair, replacement)	57% (12)
Lower bone	29% (6)
Skin	5% (1)
Upper bone	5% (1)

Table 4. Management and COVID-19 treatment methods among COVID-19 positive older adults admitted with fall-related injuries. *continued.*

Measures	All Patients (N = 21)
Subcutaneous and fascia	5% (1)
Lower joints	10% (2)
Vasculature	14% (3)
Urinary systems	19% (4)
COVID-19 drug-based treatment	
Therapeutic anticoagulant	71% (15)
Corticosteroids	57% (12)
Antibiotics	52% (11)
Antiviral	52% (11)
Convalescent plasma	38% (8)
Diuretic	19% (4)
Bicarbonate	5% (1)
Inotrope	5% (1)
None	14% (3)
COVID-19 non-drug-based treatment	
Oxygen requirement	71% (15)
Non-invasive positive pressure ventilation	14% (3)
Hemodialysis	10% (2)
Mechanical ventilation	10% (2)
Vapotherm® (heated and humidified high flow nasal cannula)	10% (2)
Proning (turning on abdomen)	5% (1)
None	29% (6)

*Presented as % (number)

Complications included unplanned visits to the intensive care unit (ICU) or operating room (29%, n = 6; Table 5). COVID-19-related complications included acute hypoxic respiratory failure (67%, n = 14) and pneumonia (43%, n = 9). Half of the patients (52%, n = 11) required ICU admission, and one patient (5%) required mechanical ventilation. Most patients were discharged to skilled nursing facilities (38%, n = 8) or home (23%, n = 5). In-hospital mortality was 19% (n = 4), with two patients dying from cardiac arrest and two from respiratory arrest. All deaths were attributed to COVID-19 infection.

Table 5. Complications and hospital course among COVID-19 positive older adults admitted with fall-related injuries.

Measures	All Patients (N = 21)
Overall complications	
Unplanned intensive care unit/operating room visit	29% (6)
Cardiac arrest with CPR	10% (2)
Myocardial infarction	10% (2)
Arrhythmia	5% (1)
Atrial fibrillation	5% (1)
Shock (hypovolemic, cardiogenic, or neurogenic)	5% (1)
None	29% (6)
COVID-related complications	
Acute hypoxic respiratory failure	67% (14)
Pneumonia	43% (9)
Cardiovascular (e.g., exacerbation of HFrEF, cardiac arrest, atrial fibrillation, MI)	19% (4)
Encephalopathy	10% (2)
Septic shock	5% (1)
None	29% (6)
Transfusion of packed red blood cells	33% (7)
PRBC units	3 ± 2.3
Intensive care unit admission	52% (11)
ICU length of stay, days	6 ± 4.1
Mechanical ventilation	5% (1)
Mechanical ventilation days	1 ± 0.0
Comfort care	19% (4)
Hospital length of stay, days	8 ± 7.2
Discharge location	
Skilled nursing facility	38% (8)
Home with services	14% (3)
Home	10% (2)
Inpatient rehab	10% (2)
Hospice	10% (2)
In-hospital mortality	19% (4)

*Presented as % (number) or mean ± standard deviation
Abbreviations: HFrE, heart failure with reduced ejection fraction; MI, myocardial infarction; PRBC, packed red blood cells; ICU, intensive care unit

DISCUSSION

The elderly population has been disproportionately affected by the COVID-19 pandemic due to pre-existing conditions and the natural effects of aging.[3] This demographic also experiences a high rate of falls, increasing the risk of serious injury.[1] During the height of the COVID-19 pandemic, we found that 17% of elderly patients admitted for fall-related injuries who were tested for COVID-19 were infected.

Most of these patients experienced lower extremity and femoral fractures. Common comorbidities included hypertension, dyslipidemia,

and diabetes mellitus, which are known risk factors for severe COVID-19 complications.[2-4,11] The interplay among falls, COVID-19, and patient comorbidities had not been examined prior to this study.

Respiratory symptoms such as cough and shortness of breath were the most reported COVID-19 symptoms, consistent with existing literature.[6-11] Non-respiratory symptoms included altered mental status or confusion, while weakness and diarrhea were less common. Another study found that one in five hospitalized older adults presented with fever, cough, and shortness of breath,[12] while 30% of patients aged 70 and older did not exhibit typical symptoms.[7] Additionally, 28% of those with fall-related injuries also presented with delirium.[7]

Notably, only 16% of patients with fall-related injuries were tested for COVID-19 in our study. Previous studies suggest that delayed diagnosis due to asymptomatic or atypical presentations can lead to rapid spread, particularly in long-term care facilities.[12,13] Testing only patients with cardinal COVID-19 symptoms risks misidentifying older adults who present with atypical symptoms such as falls.

In-hospital mortality for this study was 19%, higher than the 4% mortality rate from our previous study during the same period.[9] These patients were symptomatic on admission, presenting with fall-related findings and COVID-19 symptoms such as hypoxia, dyspnea, fever, and cough. Studies have shown that the odds of 30-day mortality are three times higher for patients presenting atypically compared to those with typical symptoms.[8,14] Additionally, patients with atypical symptoms were more likely to be frail and have a higher risk of delirium and falling, though no difference in 30-day mortality was observed between groups.[8]

Limitations. The generalizability of this research may be limited due to the use of data from a single institution, a small sample size, and a retrospective study design that relies on the accuracy of the trauma registry and medical charts. Additionally, patient history may be subject to recall bias, particularly if there was a delay in presentation following the injuries. Some patients may not have been appropriately identified as having COVID-19 due to the lack of testing for asymptomatic patients and the limited availability of testing kits early in the pandemic. Notably, information regarding COVID-19 vaccination status was not assessed in this study, as vaccines only became available starting December 11, 2020, partway through the study period.[15]

CONCLUSIONS

To our knowledge, this is the largest single-institution study in the U.S. to describe this concomitant presentation. Our findings suggest that elderly fall patients admitted with COVID-19 experienced a high frequency of complications and in-hospital mortality compared to rates at our institution during the same period. Therefore, it is important to recognize COVID-19 as a severe and potentially lethal comorbidity among older adults with fall-related injuries.

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