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Review Article

COVID-19 and Hip Fracture Surgical Outcomes: 2020-2022

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Abstract

The novel corona virus known as COVID-19 has strongly impacted the delivery of health services, plus the effects of these. Those older adults who are living in the community with one or more chronic health conditions and who sustain a hip fracture, a very debilitating injury in its own right, appear especially vulnerable in this regard in the event they are COVID positive. Reviewed here in narrative form are some recent peer reviewed COVID-19 studies and their most recent findings that appear relevant to examine in light of the ongoing COVID-19 pandemic that continues to target the frail and vulnerable older adult, among others.

Keywords: Corona Virus Disease; COVID-19; Hip Fractures; Mortality; Older Adults, Orthopaedic Outcomes

Abbreviations

COVID-19: Refers to the novel SARS-CoV-2 corona virus that emerged in Wuhan, China in Dec. 2019 and rapidly spread to become especially lethal to vulnerable older adults in all parts of the world.

Introduction

Since the onset of the corona virus (COVID-19) pandemic in December 2019, many adults, especially those adults classified as being 65 years or older have acquired this viral infection and have died prematurely as a result of its virulence. Others who have become infected have recovered, while others appear to have acquired long-COVID-19 illness manifestations. Many vulnerable older adults especially those living in the community over this time, have appeared to suffer multiple ongoing or reactive adverse health outcomes. In addition, those who become infected commonly experience flu-like symptoms, including lethargy, myalgia, and fatigue [1], thus may be at risk for frailty and falls injuries, and worsened signs of prevailing chronic health conditions, along with fears of physical activity and mobility. However, most of these overlapping health issues are not well articulated or explored in the current literature, and a special lack of attention is evident with regard to possible orthopaedic conditions. That is, to date, very few published articles discuss possible multiple orthopaedic complications of COVID-19, and their determinants, some of which are commonly prevalent in older adults, especially among those with chronic comorbid conditions, such as osteoporosis, diabetes and cardiovascular diseases, while others may emerge due to stay at home orders as well as actual infections.

In this regard, many older adults, a group commonly at risk for injurious falls, can be expected to be at an increasing risk for this well-established bone fracture determinant, especially if they are unexpectedly isolated with limited resources including physical, visual, mental, and social resources [2]. They may also experience excess weakness, as well as dizziness, anxiety, and cognitive challenges known to be falls as well as frailty risk factors, along with primary or secondary hip fractures, a very serious injury affecting many older adults in general, and one specifically prevalent among frail older adults [3] if they remain isolated with limited contacts and supports.

But what are some of the specific observations that have emerged since 2019 as regards the parallel epidemics of COVID-19 and hip fracture occurrences in the older population? Are they of any undue concern and if so, do they point the way to any future need for resetting or supplementation of pre COVID preventative as well as therapeutic orthopaedic care strategies as applied to the elderly? In this report we elected to focus on hip fractures as a very common disabling injury incurred by aging adults and the extent to which outcomes observed imply more attention to hip fracture prevention than ever is warranted. As well, we wanted to examine if delays to hip fracture surgery as a result of the pandemic need to be addressed in the future-as these may tend to predict worse outcomes, and are probably contributing to observed increases in hip fracture cases who acquire COVID-19 infections [3].

Rationale

The frail elderly who are at high risk for hip fractures, as well as COVID-19 do not appear to have been targeted intentionally or systematically in the context of community based settings during the present COVID-19 pandemic. This is unfortunate because mounting evidence suggests, social isolation, limited home care services, muscle weakness, fatigue, poor nutrition, and cognitive fear factors and others put forth to prevent the risk of COVID-19 exposure, are also those actions that can readily heighten frailty, fragility, falls risk, and bone fractures, including the hip femoral neck or intertrochanteric or subtrochanteric zones.

Materials and Methods

To garner an overview of this topic, published articles posted on PUBMED, PubMed Central and GOOGLE SCHOLAR between 2020-2022 were duly reviewed, with specific attention being given to articles published January 2021-February 2022. Only relevant publications were reviewed, and all types of research were deemed acceptable. Only surgically oriented studies were examined, regardless of surgery mode, surgery site, resource of surgical site, fracture type, and geographic distribution. The focus was on community dwelling rather than nursing home residents. Moreover, only English language based reports were considered, and a qualitative descriptive approach, rather than a meta analysis was pursued. The term COVID-19 was used to include known variants of the virus, which were not distinguished in the literature reviewed.

Excluded were articles for the most part prior to 2020, abstracts, pre prints and conference reports. Only surgically oriented outcomes post hip fracture are reviewed, and the impact of COVID-19 on hospital practices was not included.

Results and Discussion

Among the available publications listed using key words 'Hip fractures and COVID-19', PUBMED, housing most of the relevant articles on the current topic, was found to list 185 current publications, and among these those below appear to be significant and compelling recent observations, since many did not match the current themes of inquiry, even though they were generally on the topic at large. As such, these more recent articles, which number approximately 124 as of February 1, 2021, currently concur strongly with findings observed between a prior analysis of data from 2020-March 2021 that reported on key observations of hip fracture surgical mortality rates recorded at the outset of the COVID-19 pandemic using largely retrospective reports stemming from China, Italy, France, Poland, Portugal, Scotland, the United States, the United Kingdom, Spain, and Turkey, and where 30-day mortality rates were the most common outcome indicator of the COVID-19 impact on hip fractures.

As such, over time, it appears that consistent with the multiple respiratory and other health impacts experienced by vulnerable older adults who continue to succumb to COVID-19 disease and its novel variants, along with frailty [3], and especially those older adults who sustain both hip fractures and COVID-19 disease are at heightened risk for early mortality, in general, even if this does not apply in all cases.

Indeed even though Paccou., *et al*. [4] found a decline in hip fracture admissions in the first few weeks of the COVID-19 pandemic, and it was reported that fractures as a whole appeared to decline post COVID-19 onset [5-8], along with hip fracture mortality rates [9], more articles than not published between January 2020-February 2022 provide quite strong evidence of a significantly heightened impact of COVID-19 on hip fracture outcomes, regardless of source of report, or hospital venue or region of the globe. That is, despite undergoing similar hip fracture surgical procedures that were performed in New York at the height of the pandemic, a prospective cohort study of seven orthopaedic centers comparing 138 current cases with 115 historical cases between February-April 2020 and 2019 respectively, showed the COVID confirmed cohort to have had an increased mortality rate. They also demonstrated

increased hospital stay lengths, greater rates of complications, and a higher need for ventilators post surgery [10].

These findings were not unique, but rather were clearly consistent with most other similar studies that have shown high increased mortality rates in those COVID-19 positive hip fracture cases requiring and receiving orthopaedic surgery during the height of the pandemic [6,11-15], especially among those in the higher age ranges [15] and those with multiple morbidities [13]. Also increased in the face of COVID-19 appears to be length of hospital stays, higher complication rates, along with a more than 10-fold increased mortality rate compared with COVID-19-negative patients [14].

Indeed, Arafa., *et al*. [7] specifically noted that even though trauma based orthopaedic problems tended to decline over the early pandemic period, this was not the case for hip fracture injuries due to falls, and where highly significant 30-day mortality rates for hip fracture cases diagnosed as having COVID-19 disease were observed, regardless of numbers of hospital admissions [6], and especially among men, those with diabetes, dementia and extracapsular fractures. Advanced age, a high frailty index, and multiple morbidities were found to be further adverse prognostic factors according to these authors. Chances of developing pneumonia and respiratory failure in the peri operative period were also found to be high, and possibly contributing to the observed four to seven fold higher rate of death than that of the usual inpatient hip fracture mortality rate among those observed elderly COVID-19 positive hip fracture surgical cases when compared to cases unaffected by COVID-19 [16-20]. At the same time, increases in the duration between the time the injury occurred to presentation in the hospital, a known surgery prognostic indicator, almost doubled over the pandemic period [21], alongside possible increases in manifestations of fatigue and weakness, as well as bone fragility [22,23], plus frailty along with a possible resultant weaker immune system [24].

Unsurprisingly, and in accord with a current meta analysis conducted by Fessler., *et al*. [25] up until October 2020, Al-Fahri and Humaid [26] as well as Dallan., *et al*. [27] too found similar 30-day mortality rate increases among their COVID-19 positive hip fracture surgery cases, as did Oputa., *et al*. [28] at both 30 days, as well as at 120 days after the hip fracture injury in an already high-risk cohort of surgical patients where nearly half the patients were diagnosed with COVID-19 at 14 days or beyond following admission. These findings were not attributed to differences in treatment approaches and clearly highlighted the importance of taking appropriate measures to decrease the incidence of severe COVID-19 infections in hip fracture patients once they enter the hospital environment. However, an array of declining signs of physical functioning ability, along with frailty, excess fears, sleep challenges, malnutrition, an increasingly sedentary lifestyle, psychological distress as a reaction to a prolonged exposure to stress and social isolation, plus a persistent falls history among other factors, which were not considered to any degree in any report could have played a strong deterministic role in heightening mortality risk as observed by Lozupone., *et al*. [24].

Another factor mentioned by LeBrun., *et al*. [29] that was not stressed as being a salient hip fracture patient outcome variable over the past two years was whether those who succumbed to COVID-19 tended to have higher than average comorbid health conditions along with possible decreases in functional status in year prior to the fracture incident.

This aforementioned decline in physical functioning, may also have increased at a more rapid than anticipated rate between the first and second COVID-19 waves, in light of as well as despite many restrictive public health measures, such as the possible increase in stress placed on older individuals due to reductions in required sources of support [24], thus continuing to impact numerous elderly hip fracture cases highly negatively and significantly, especially if they have been isolated for long periods in the community [30], but have limited skills and self-efficacy [24], and suffer from bone fragility [22]. In addition, both age associated, as well as chronic health declines along with reactive mobility and cognitive challenges may have been incompletely addressed in those acute care settings where organizational frameworks had not adapted to COVID-19 challenges [24], and the need to send patients home, rather than rehabilitation may have limited this process even further. As such, and although this has not been studied to any degree, hip fracture surgical survivors may be subjected to the same risk factors that may have exacerbated their hip fracture risk, as well as a high risk of further COVID-19 infections or long-COVID illness, especially in cases of multiple confinement issues [31].

Moreover, without adequate post surgical rehabilitation, intense therapy, and education, vulnerable older adults returning to their

homes post hip fracture would be expected to possibly be more prone than ever to falls injuries, muscle mass losses, pain, weakness, depression, and fatigue, as well as COVID-19 infections [31], especially if they live alone [30]. It has also been noted that there is a possible relationship between COVID-19 infection and fragility hip fracture in elderly patients that could be induced by fatigue and weakness due to COVID-19 disease [22], but this is not well studied at all, and could require specific targeted and personalized continuous interventions, rather than their curtailment.

In sum, even though not all mortality oriented data are in agreement, and may only reflect the unique circumstances and trends at hospitals with sufficient surgical personnel and resources, as well as hip fracture cases who were admitted and processed in a timely manner, versus those who may have failed to reach the care centers, or surgery triage centers in a timely way, and even if declines in hip fracture admissions have occurred or have remained the same [32] during the COVID pandemic and ensuing lock downs [33], and no mortality impact over time has been observed in selected cases [34], the data remain compelling as a whole. That is, it is challenging to dispute findings that show approximately one in three cases admitted for hip fracture surgery at the outset of the COVID-19 pandemic consistently died within 35 days of being admitted if they were COVID positive, even though they were comparable in most respects to uninfected cases where rates of mortality were one in ten cases overall, regardless of testing strategy [3,35]. This heightened mortality risk in hip fracture, as described by Kumar., *et al*. [36], Fessler., *et al*. [25] and Iyengar., *et al*. [37], although not observed by all [38], affirms a strong possible association between 30-day mortality and the designated theatre (Clean/COVID) where the patients are operated on, with higher mortality rates for intracapsular neck of femur fractures plus significant mortality associated with cemented hemiarthroplasty surgical approaches particularly among symptomatic or COVID-19 positive patients.

While the actual mortality causes or allied factors other than COVID-19 are not well documented, those cases with concomitant COVID-19 who demonstrate an associated increased risk of adverse post operative events such as pneumonia, sepsis, cardiac events and venous thrombosis [39], could also be strongly influenced by inflammation induced by the fracture or surgery for fracture fixation, further exacerbating any prevailing inflammation, and leading to a cytokine storm [17] and warrants study. As well, the role of frailty, poor general health, a vitamin D deficit [5] among other factors such as injurious falls due to poor balance and cognitive disease associated factors that might influence geriatric hip fracture susceptibility warrant attention. Additionally, and as per findings of Hoffman., *et al*. [40] the COVID-19 pandemic was associated with worsened physical functioning and fall outcomes, with the greatest effect on individuals with reduced physical activity and social isolation.

To this end, rather than focusing solely on isolation, and vaccines that are less effective in older adults, public health actions to address possible reductions in physical activity due to social isolation may markedly assist many older home-bound vulnerable adults to resist infectious agents, as well as falls that can lead to hip fractures. Knowing that there is a high COVID associated incidence of dizziness, unstable gait, attention impairments, and walking challenges [41] all falls risk factors that can occur readily, more preventive efforts to reduce the propensity of older adults towards falling and fracturing a hip in the face of the ongoing pandemic are strongly indicated as well. As per Columbini., *et al*. [42] who recently examined 30 lower limb fracture cases undergoing surgery, and found 13 cases who were COVID positive to have lower than desirable calcium levels, and slightly higher values of inflammatory markers pre-operatively among their COVID-19 positive patients, more focus on these attributes is needed to avert their possible long-term negative consequences, when compared to the COVID-19 negative post fracture patient.

On the other hand, until more is done to protect older vulnerable adults living in the community from excess health challenges, and in light of the fact that COVID-19 and its variants are likely to persist and continue to affect this risk, as well as the prognosis of those elderly adults who sustain a hip fracture in multi-factorial ways, the high mortality and morbidity rates attributable to hip fractures will probably continue for some time to come [6]. First, older adults are often challenged by having weaker immune systems, as well as lower vaccine responses, and if subjected to the COVID-19 virus or its variants may directly sustain lung tissue damage, as well as damage to the muscle tissue. Second, this lung function impairment may worsen the susceptible hip fracture survivor's overall health status, performance ability, as well as cognitive ability, while rendering successful rehabilitation efforts more challenging. As well, respiratory problems related to other pathogens may ensue readily.

In the meantime, more research to uncover factors influencing these higher than normal mortality rates in the early hip fracture post operative phases in the face of COVID-19, plus what places some hip fracture cases at very high risk for adverse outcomes versus others, and that are very important to identify need to be studied [43]. That is, what specifically should be put in place to avert any future repercussions of these highly costly events where approximately around 13% of current hip fracture patients may develop a COVID infection [44] plus a seven-fold increase in mortality risk [45]. Moreover, additional confounding factors associated with mortality risk post hip fracture, such as frailty, gender influences, and age range plus co-morbidity status need clarification especially in those cases with a dual COVID-19 as well as a hip fracture diagnoses. Where and when a hip fracture patient may have developed COVID-19 should also be carefully disaggregated in future studies, for example, whether the hip fracture patient had had COVID-19 this for some time, or whether they acquired this in the hospital may be revealing, along with the role of surgical stresses in the face of COVID-19 [46]. Other factors that could clarify what might be needed in the future and why- include - the role of COVID-19 severity, vaccination and mobility status, and their possible effects on 30- and 60-day mortality rates following admission for hip fracture [47].

At present, this mini review does appear to show that despite a substantive number of ably researched reports demonstrating clearly negative impacts of COVID-19 on hip fracture surgical mortality rates since 2020, even in COVID-19 negative cases [54,55]. That is, in spite of intense vaccination efforts, plus strictly enforced public safety rulings for most hospitals, these procedures alone do not prevent or avert excess death rates among many elderly hip fracture surgical patients in the face of COVID-19, but may markedly heighten these for various reasons. As such, and in light of the persistent COVID-19 pandemic and its variants that have and will possibly emerge in the future, needed in this regard are not only continued efforts to offset infection COVID-19 infections in the hospital and home setting, especially among those deemed frail who may be suffering from multiple co-morbid health conditions, and possible home isolation and travel restrictions, but more intense comprehensive post surgical rehabilitation efforts are strongly indicated as well [47], especially where the patient is discharged to their home over a rehabilitation facility [57]. In addition, older adults living in the community and who wish to remain in their own homes may benefit from dedicated efforts to better protect this oftentimes vulnerable older adult group from incurring one or more injurious falls or slips, symptoms linked to possible COVID-19 [58], and their possible impact on hip fractures sustained at home during the pandemic.

To this end health services access, as indicated, plus more precautionary rather than reactive efforts and applying what has been learned about COVID-19 impacts among the elderly, as well as among hip fracture risk from past research, alongside what we know about frailty, and its effect on injurious falls and fractures, as well as infections, is strongly indicated. As well, more emphasis on nutrition as this applies to bone and muscle health and that can favor immune function as well as musculoskeletal well being and recovery from surgery needs to be highlighted. Moreover, evidence based pre fracture prevention, as well as post fracture prevention approaches need to be more strongly embedded in far reaching insightful policies designed to protect the elderly in the future, and as a consequence, mitigate the associated costs of not doing this with the devastating results presently observed and other not reported that must surely fall on families as well as the public at large, plus vulnerable health economies, as well as limited resources.

Additional implications

Given the clear multiple adverse implications of incurring a hip fracture, as well as COVID-19 disease, it appears those hip fracture cases who are initially COVID-19 negative on hospital admission should still be actively protected from acquiring COVID-19 within the confines of the hospital or health unit to avoid possible adverse consequences such as heightened delirium [53,55].

Their rehabilitation process may also need to be carefully planned to avert any unwanted post-surgical complications and adverse outcomes, as well as possible COVID-19 infections or re-infections [12], especially if hospital length of stay is shortened or waiting time for rehabilitation is increased as observed by Shai., *et al*. [53].

To this end, best practices [51], including careful screening, routine COVID-19 testing [52,55], timely comprehensive surgery and insightful carefully construed rehabilitation and preventive as well as treatment plans appear imperative [55,58].

As well, efforts to optimize availability of qualified uninfected staff, regardless of prevailing shortages is strongly indicated [6,55] and might need to focus on the well thought out plans to secure

sufficient safe operating venues, individualized medical and anesthetic care needs, medical optimization before surgery with minimal delays [55], plus careful preoperative counseling [31,49,58] and ambulation associated graded protocols [55].

At the same time, what appears essential, but is rarely discussed, is not only a continuing need to prevent COVID-19 infections via multiple approaches on a continuous basis, but frailty, as well as falls and functional debility [5,6], plus social isolation impacts and its possible many adverse orthopaedic impacts and others [30] such as osteoporosis and sarcopenia [56].

As per Coudere., *et al*. [50] those vulnerable adults who fit the profile of being a male, older than 85 years of age, with diabetes, chest conditions, circulatory, and cognitive problems should be specifically sought and targeted early on to avert possible preventable COVID-19–related hospitalizations and death. As well, innovative provider approaches, as well as more active citizen participation, plus policy makers and administrators appear strongly indicated as well.

Conclusion

Much can be done to avert or mitigate the dual problem of hip fracture and COVID-19 concurrent diagnoses and probable worse than desired outcomes post hip fracture surgery.

While research is warranted to support any of the above findings and implications, current clinical efforts implemented in a timely insightful way are strongly indicated as are future modifications of community based preventive programs against hip fractures.

At the same time, rehabilitation programs must be personalized carefully, flexible and designed to anticipate the ongoing risk of the older community dwelling hip fracture surgery survivor to the additional risk and implications of COVID-19.

Conflicts of Interest

None.

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