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Original Research Article

A comparative study of mortality rate in operated elderly patients of fracture neck of femur, within 90 days of surgery before and during COVID-19 pandemic in the Indian population

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ABSTRACT

Background: Fracture neck of the femur is a significant cause of morbidity and mortality in the elderly and surgical interventions are the preferred treatment. The COVID-19 pandemic caused a reduction in operative cases and emphasized non-operative management. We studied the impact of the COVID-19 pandemic on post-operative 90 days mortality of hip fracture in the elderly Indian population.

Materials and Methods: We, retro-prospectively compared data from our hospital over a two-year time frame on a large group. The first confirmed case in Maharashtra was reported on 9th March 2020 in Pune. The cases reported until one year from this date were termed 'Covid period' and cases one year before this date were termed 'Pre-covid period'. After applying exclusion criteria to 638 patients from 2 years of data, 379 patients(208 in Pre-covid and 171 in Covid period) were included and analyzed for mortality rate and secondary outcomes.

Results: The pandemic caused a statistically significant increase in postoperative 90 days mortality in the elderly by 75.7% compared to pre-covid mortality. The decrease in incidence of operated fracture neck femur was non-significant during Covid compared to incidence in pre-covid. Pneumonia caused six times more mortality during Covid period.

Conclusions: The COVID-19 pandemic caused a statistically significant increase in postoperative mortality. Pneumonia was the significant cause of death in Covid period and should be diagnosed and treated early. A specific subset of the consent process is a must in elderly neck femur fracture undergoing surgery and shared guidelines of this study will help in the decision-making process of future covid pandemic situations.

1. Introduction

COVID-19 was declared a pandemic by WHO on 11 March 2020.[1] The first confirmed case in India was detected on 27 January 2020.[2] The first confirmed case in Maharashtra, India was reported in Pune on 9th March 2020.[3] COVID-19 can cause clinical scenarios ranging from asymptomatic patients to flu-like symptoms to severe immunosuppression causing respiratory failure, interstitial pneumonia, and even death.[4,5] The COVID-19 pandemic transformed orthopedic services with the cessation of elective operations and a reduction in orthopedic trauma cases.[6,7] The specific impact on hip fracture patients by a pandemic is not clear, however as hip fracture patients are typically older, it appears that such patients continue to present at a similar rate to orthopedic trauma services due to falls and osteoporosis.[8,9]

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Hip fracture is a significant cause of morbidity and mortality in the above 65 years and older age group.[10] Surgical interventions like internal fixation or hip replacement are associated with better outcomes in patients with a femoral neck fracture.[11]

The rise in the average age of fracture presentation is associated with persistently high mortality and morbidity.[12] There are also certain complications if these fractures are left untreated like prolonged immobilization, bedsores, and chest infection. Importantly, COVID-19 mortality rates are also higher in people with comorbidities and old age.[13] So compared to the normal population, hip fracture patients are at higher risk of poor outcomes if left untreated. However, The British orthopedic association (BOA) had recommended that during the coronavirus pandemic, there should be an increased emphasis on managing patients with non-operative strategies.[14] Some authors also advocated the option of non-operative management for hip fracture patients during COVID-19.[15]

In early Covid times, theoretical risk to life due to perioperative Covid infection created a constant dilemma for orthopedic surgeons regarding the outcome of operative procedures on patients's lives. Also in the Indian subcontinent, very few studies were conducted that showed statistically significant parameters of impact of operative procedure during covid period. We, therefore, aimed to look at the impact of the COVID-19 pandemic on neck or femur fracture patients to assess whether postoperatively mortality increased in the elderly age group of the Indian population.

2. Materials and Methods

In this retro-prospective observational study, "we compared the mortality of operated elderly patients of fracture neck femur(both extra and intracapsular) in our hospital, Pune for one year in Pre-covid period and one year during the Covid period". Our study compared Covid and Pre-covid period irrespective of laboratory-tested Covid-positive or negative patients since guidelines to do Covid tests kept changing during Covid period, whether to test on a particular patient or patient presenting with particular symptoms, we did not do a Covid test for every patient undergoing surgery right from the start of the pandemic.

We enrolled elderly people more than 65 years in our study, as it's a significant cause of morbidity and mortality in the above 65 years and older age group.[10] We included both intracapsular and extracapsular neck femur fractures and excluded subtrochanteric fractures, as they have different sets of management and rehabilitation because of the unique anatomical and biomechanical features of the subtrochanteric region and reduction difficulties associated with the strong deforming forces acting on the proximal femur.[16] We also excluded those that were managed conservatively, pathological fractures due to bony metastasis, and polytrauma patients.

2.1. Sample size

An earlier investigation by Pietro Maniscalco et al (2020) reported 14% mortality during the Covid period versus 4% mortality Pre-covid period among NOF patients.[17] Thus assuming that mortality during the Covid period is higher than that Pre-covid period, with one-tailed α of 0.05 (confidence interval of 95%) & 90% power, the minimum sample size required in a ratio of 1:1 for the Pre-covid period during the Covid period, would be minimum 167 NOF cases in both Pre-covid period and Covid period 638 patients with neck femur fractures were admitted during 2 years. The first confirmed case in Maharashtra was reported on 9th March 2020. The cases reported up to one year from this date (i.e 9^{th} March 2020-8th March 2021)were included and termed as Covid period and cases reported one year before this date(i.e 9^{th} March 2019-8th March 2020) were included and termed as Pre-covid period.

We applied the above-mentioned exclusion criteria, and the remaining 384 patients (210 patients of pre-covid and 174 patients of Covid period) who were operated on for the fracture neck of the femur one year before and during the Covid period were analyzed. We could not communicate with 2 patients in pre-covid group and 3 patients in the Covid group. We termed them "lost to follow up" and these patients were excluded. A total of 208 patients of pre-covid and 171 patients of the Covid group were included in our study. We compared mortality at 90 days, trauma admission interval, admission to surgery interval, the total interval from trauma to surgery, postoperative stay, an implant used, any postoperative complication, surgery to mortality interval, and cause of mortality during covid and pre-covid period. We also studied the relation of mortality with each above-mentioned parameter to see whether they contributed to increased/ decreased mortality during Covid period.

The data was collected from hospital records for all patients who were already operated on in the past. Records were scrutinized for mortality within 90 days of surgery in the hospital either at the same admission or in subsequent admission. Also, from the records, we retrieved the date of trauma, date of admission, date of surgery, trauma admission interval, admission to surgery interval, the total interval from trauma to surgery, postoperative stay, any postoperative complication, surgery to mortality interval, and cause of mortality either at the same admission or in subsequent admission within 90 days from the date of surgery on follow-up were and entered on patients history sheets. For newly operated patients, we took the data during their admission. We followed up by telephonic correspondence and gathered the information of the past patients whose mortality could not be assessed from hospital data and for follow-up of newly operated patients.

3. Observation and Results

Descriptive statistics were used to describe the data. Mean and standard deviation was used to describe the numerical data. Frequency and percentage were used to describe categorical data. The Chi-square and Fisher's exact test were used to find an association. A simple bar and multiple bars were used for categorical variables. All analysis was done using SPSS version 25. A P-value less than 0.05 is considered significant.

There was a significant difference in Mortality within 90 days of surgery between Pre-covid period and Covid period who were operated for the fracture neck of the femur and was found higher in Covid period statistically.

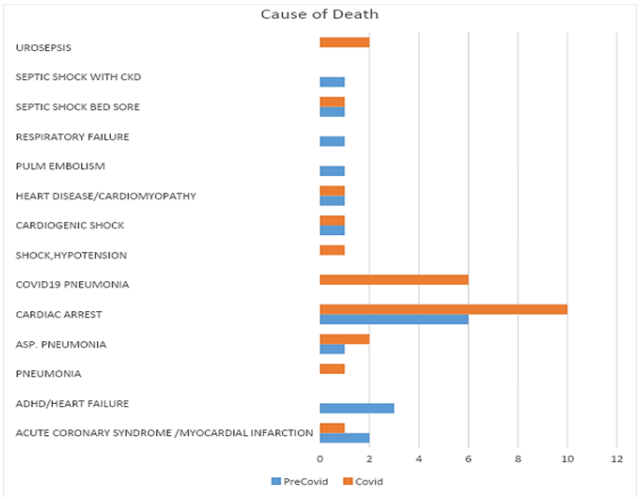

Figure 1: Cause of mortality distribution

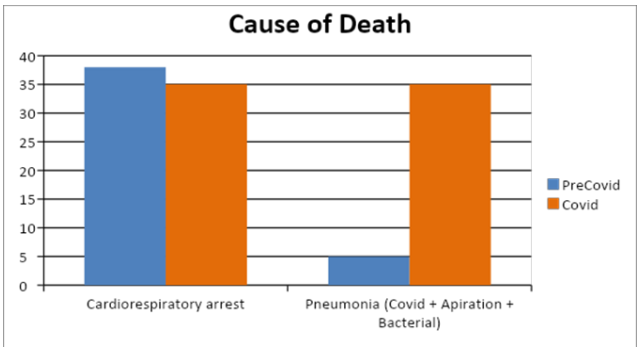

Figure 2: Main causes of mortality percentage

The most common cause of death in Covid period was cardio respiratory arrest (38%) followed by pneumonia (Covid pneumonia +aspiration pneumonia + bacterial pneumonia) which was 35% of total deaths in Covid period. In the Pre-covid group cardio respiratory arrest (35%) was the most common cause followed by acute decompensated heart failure (17%). Thus, pneumonia was predominantly seen as a cause of mortality only in Covid period.

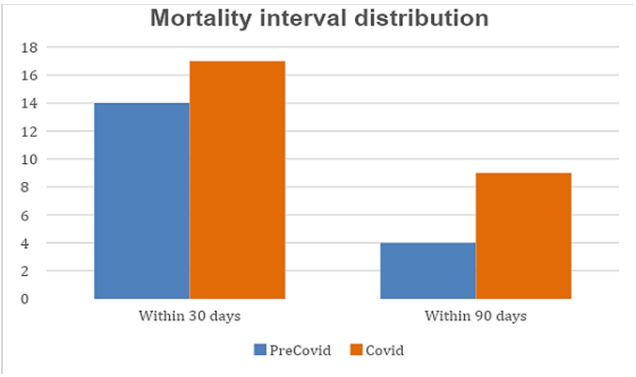

Figure 3: Mortality interval distribution

There was no significant difference in Mortality interval distribution between Pre-covid period and Covid period using Fisher's exact test. The maximum death occurred within 30 days of surgery in both groups (14 in Pre-covid and 17 in the Covid period).

4. Discussion

Our study found increased postoperative mortality at 90 days in covid period, which was 75.7% more compared to Pre-covid mortality. It was 18 out of the total 208 patients (8.65%) in the Pre-covid period and 26 out of the total 171 patients (15.2%) in the Covid period. The results were comparable to a study by Maniscalco P. et al, the only published study on comparative mortality in the Covid period irrespective of laboratory tested Covid positive or negative. The study observed 14% deaths during Covid and 3.5% during a similar Pre-covid period.[17] Most of the Literature showed consistently higher short-term mortality during Covid spread.[18–23] Our data from a larger patient population confirms this observation. According to, the British orthopedic association's guidelines, the risk to patients by attending hospitals and subsequently contracting COVID-19 was high, which led to the UK guidance advocating non-operative management[24] however, Catellani F. et al.[25] despite showing higher mortality concluded that though elderly patients with Covid with comorbidities and a proximal femoral fracture with the life-threatening condition are at high risk for orthopedic surgery, delayed surgical treatment may negatively affect the clinical course by prolonging pain and bed rest, increasing use of medication, and necessitating intensive care. We found a decreased incidence of operated fracture neck femur in Covid period which was 45.1% compared to 54.9% in pre-covid period. This decrease is 7.8% compared to the Pre-covid period. Similar results are shown in a study by Maniscalco P. et al., which had a 28.4% reduction in proximal femur fracture surgery during the Covid spread.[17] Though the decrease in incidence was statistically non-significant during the Covid period, mortality was

Table 1: Mortality distribution (at 90 days)

Outcome	Covid	Percentage	PreCovid	Percentage	Total	P value
Death	26	15.20	18	8.65	44	
Live	145	84.80	190	91.35	335	0.048
Total	171	100	208	100	379	

significantly higher.

The most common cause of death was cardiorespiratory arrest in both periods. A similar result was seen in the study by Maniscalco P. et al in operated neck femur fracture of Covid period.[17] Cardiac arrest is more likely to be an outcome rather than a cause in general for deaths. In our study, the most common cause of death in both Covid period was cardiorespiratory arrest (38%). Pneumonia was the second most common cause of mortality in the Covid period and caused six times more mortality compared to in the Pre-covid period. The pneumonia (Covid pneumonia +aspiration pneumonia + bacterial pneumonia) caused 35% of total deaths in Covid period compared to 5% in Pre-covid period. In a study by Ward AE et al., it was found that in COVID-19-positive patients, there was a significantly higher rate of bacterial pneumonia and/or respiratory distress in comparison to their COVID-19-negative counterparts[26] which may be related to the overall pathogenesis of the co-existent infection and the fracture. Injuries and associated surgical procedures associated with this pathology can cause inflammation and subsequent release of inflammatory cytokines which potentiate covid induced inflammation, possibly leading to cytokine storm.[27]

Archer et al.,[20] Wright E V et al.,[22] Dallari, D et al.,[23] and Kumar P et al.[28] in their study have reported higher 30 days mortality in Covid positive patients. Our data also shows maximum death within 30 days of surgery in Covid period but it was irrespective of covid status (17 out of 26 deaths within 30 days). However, when compared to the Pre-covid period, no significant difference was found. (14 deaths in pre-covid and 17 deaths in Covid). To date, there is no gold standard for surgical indications and timing of surgery for such patients. Further data are needed to evaluate surgical indications and optimal timing of surgery.[23]

We did not find any statistically significant difference among age, sex, laterality, trauma admission interval, admission surgery interval, trauma surgery interval, and post-op hospital stay during Pre-covid and Covid period. The association of increased mortality during covid period with each above-mentioned parameter was statistically nonsignificant.

The limitation in our study is, we have not analyzed the mortality between laboratory-confirmed Covid positive and negative cases so results of Covid period mortality may be different from mortality among laboratory confirmed covid positive patients. This is because while carrying out study, we did not do a Covid test for every patient undergoing surgery right from the start of the pandemic as,

1. The guidelines to test on a particular patient or patient presenting with particular symptoms were still emerging.
2. The guidelines which were established for doing Covid tests kept changing during Covid period.

We also did not study other factors which can contribute to increasing mortality in the pandemic situation like excessive load over hospital manpower and infrastructure, physical and mental stress on the hospital staff, delays in hospital workflow, etc.

5. Conclusion

We conclude that covid pandemic caused a statistically significant increase in postoperative 90 days mortality in the elderly age group by 75.7% compared to pre-covid mortality in the Indian population. A superimposed or undetected COVID-19 infection during the Covid period can worsen the outcome of surgery. So, a specific subset of the consent process is a must in elderly neck femur fracture undergoing surgery and shared guidelines of this study will help in the decision-making process of future covid pandemic situations. Pneumonia was the significant cause of mortality in Covid period and should be diagnosed and treated early. The association of increased mortality with age, sex, laterality, trauma admission interval, admission surgery interval, trauma surgery interval, and post-op hospital stay was statistically not significant. To see the association between increased mortality and effect of physical and mental load on hospital manpower and compromised infrastructure during the pandemic, further studies are required.

6. Source of Funding

None.

7. Conflict of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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