**Original Article**

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# Incidental Finding of Deranged Renal Function in Elderly Patients Presenting with Fractures in a Tertiary Care Hospital

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**ABSTRACT**

**Objective:** To determine the incidental rate of renal impairment among elderly women with fractures who reported to the Orthopaedic OPD at a tertiary care Hospital.

**Methodology:** This prospective cohort study was done at Orthopaedic department and OPD Fauji Foundation Hospital, Rawalpindi from March 2022 to February 2023. A total of 147 females aged >60 years presented with Hip fractures, surgically managed and who had history of normal pre-fracture renal function were included. A 5ml blood sample was obtained and sent to the Hospital diagnostic laboratory to evaluate the renal profile, serum calcium and vitamin D levels. All the information was recorded via pre-structured study proforma.

**Results:** The study enrolled 147 elderly participants with an average age of 66.82 years. Among the participants, 24 patients (16.3%) experienced Acute Kidney Injury (AKI), with 9.5% having stage-I AKI, 4.8% with stage II AKI, and 2.0% with stage III AKI. Before sustaining the hip fracture, the mean serum creatinine level was 67.04 µmol/L, and following the fracture, it increased to 81.95 µmol/L (p-value < 0.0001). The severity of AKI did not exhibit a statistically significant correlation with the age of the patients. However, there was a statistically significant increase in serum creatinine levels among patients based on the duration of their fractures (p-value < 0.001).

**Conclusion:** The incidence of Acute Kidney Injury (AKI) in elderly patients following hip fractures was found to be 16.3%, with varying stages of severity.

**Keywords:** Hip fracture, AKI, elderly women, Creatinine level

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## Introduction

In the context of an aging population, fractures pose a substantial challenge, leading to heightened disability and mortality rates. Elderly individuals often experience reduced bone density, mineral depletion, and diminished muscular protection, rendering them more susceptible to fractures.[1] Furthermore, with advancements in chronic disease management, a growing proportion of the elderly population leads a more active lifestyle, thereby increasing their susceptibility to injuries.[1-3] Fractures near the hip joint, often caused by fragility, are frequent and severe injuries that are becoming more common due to the expanding and aging population.[4] Numerous healthy and physically active older adults, following a hip fracture, experience a decline in their ability to move independently.[5] Conversely, those who are more fragile may also lose their ability to live independently in their own homes. The most vulnerable individuals with pre-existing health issues experience even greater debilitation due to pain, reduced mobility, and an inability to care for themselves.[5,6] Prior research has pinpointed various risk factors for fractures, encompassing smoking, osteoporosis, obesity, aging, lifestyle, and occupation. Osteoporosis notably stands as the primary cause of fractures among

older women.[7] In regions like Pakistan, where injuries and trauma rank prominently among the top causes of impairment and contribute significantly to the disease burden, fractures exert a substantial toll on both mortality and morbidity.

A study by Ahmed et al reported that in women of age more than 50 years every 4 out of 15 women experience fracture.[8] The one-year mortality rate for hip fractures falls between 18% to 33%,[9,10] and individuals who sustain hip fractures face five to eight times higher mortality rates within the first three months following their injury compared to those without fractures.[9] As individuals age, there is a natural decline in renal function. Cross-sectional studies consistently demonstrate a gradual reduction in the estimated glomerular filtration rate (eGFR) among healthy aging adults, typically averaging about 0.75-1.0 ml/min/1.73 $m^2$ per year.[10] Consequently, chronic kidney disease (CKD) becomes more prevalent in the elderly, with approximately 20% of adults aged 65 or older showing signs of moderate to severe CKD based on eGFR measurements.[10] Additionally delayed mobilization, prolonged bed rests the sedation further increase the risk of renal impairment.

It has been recently observed that the Acute renal failure is a frequent post-surgical complication in elderly individuals who suffer a hip fracture, and it is linked to elevated in Hospital mortality rates,[11] for up to a year following the surgery.[12] Given the projected increase in the number of people suffering from hip fractures, it becomes increasingly vital to identify risk factors and implement effective perioperative strategies for managing acute kidney injury.[11] Few earlier investigations into acute renal failure among hip fracture patients indicated a risk ranging from 8% to 24% for the development of acute renal failure within 72 hours after the surgery or during their hospital stay.[13] Although there has been a lack of specific analysis regarding acute renal failure following hip fractures, with no adjustments made for confounding factors, especially at the local level. Hence, this study was conducted to assess the incidence of renal impairment among elderly women with fractures who presented at the Orthopaedic Department.

# Methodology

This was a prospective cohort study, conducted at Orthopaedic OPD of Fauji Foundation Hospital, Rawalpindi. Study was done during a period of one year from March 2022 to February 2023. A total of 147 females aged more than 60 years presented with Hip fractures, surgically managed and who had history of normal pre-fracture renal function were included. Patients with a history of acute renal failure before or preceding their hip fracture, possibly due to factors like dehydration, infection, or other underlying causes, as well as patients lacking a baseline creatinine measurement, were excluded from the study. Written informed consent was taken and patients were explored regarding study purpose and objective. For each participant, a 5ml blood sample was collected and promptly sent to the hospital's diagnostic laboratory to assess serum creatinine levels, blood urea levels, serum calcium levels, and vitamin D levels. All expenses for laboratory investigations were covered by the researcher herself. Renal impairment was defined and categorized by using Global Outcomes (KDIGO) classification for Acute Kidney Injury (AKI), into three stages based on specific criteria related to serum creatinine levels and urine output. Stage 1: increase in serum creatinine >0.3 mg/dL (≥26.4 µmol/L) or an increase to more than or equal to 150%-200% (1.5- to 2-fold) from baseline. Additionally, the urine output is less than 0.5 mL/kg per hour for more than 6 hours. Stage 2: serum creatinine increases to more than 200%-300% (>2- to 3-fold) from baseline. Similarly, the urine output remains low, less than 0.5 mL/kg per hour, but for a more extended duration, specifically more than 12 hours. Stage 3: a significant increase in serum creatinine, exceeding 300% (>3-fold) from baseline , or having a serum creatinine > 4.0 mg/dL (≥354 µmol/L) with an acute increase of at least 0.5 mg/dL (44 µmol/L), along with urine output is critically reduced, with less than 0.3 mL/kg per hour for 24 hours or anuria for 12 hours. All relevant information was recorded using a pre-structured proforma, and data analysis was performed using SPSS version 26.

# Results

The study included 147 elderly participants with an average age of 66.82 years, and the majority fell within the age group of 60-65 years. AKI was observed among 24 patients (16.3%), particularly as 9.5% had stage -I AKI, 4.8% had stage II AKI and 2.0% had stage III AKI. Figure 1

Before the fracture, the mean serum creatinine level was 67.04 µmol/L, with a standard deviation of 10.17 µmol/L. After the fracture, the mean serum creatinine level increased to 81.95 µmol/L, and it exhibited a wider standard deviation of 50.29 µmol/L, suggesting greater variability in post-fracture creatinine levels. The mean

difference between the pre-fracture and post-fracture creatinine levels was -14.91 µmol/L and a significant p-value of 0.0001, demonstrating the impact of the fracture on serum creatinine levels in the study population. Table I

Severity of AKI was statistically insignificant according to the age of the patients. Table II

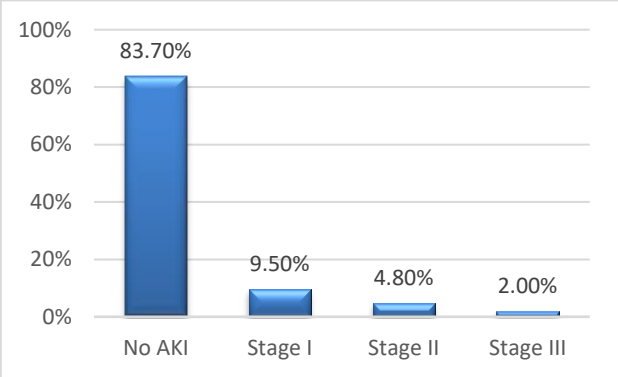


Figure 1: Incidence of acute renal impairment among elderly patients after fracture. (n=147)

Participants with fractures less than 1 month old had a mean serum creatinine level of 73.64 µmol/L, in the 1-3 months category, the mean creatinine level was 72.67 µmol/L. However, participants with fractures between 3-6 months or older than 6 months exhibited substantially higher mean creatinine levels of 122.35 µmol/L and 146.00 µmol/L, respectively. The analysis shows a statistically significant difference in serum creatinine levels among these groups, as indicated by the F-value of 10.17 (p<0.001). Table III

# Discussion

Hip fractures have serious implications for elderly individuals who are in a fragile state, resulting in decreased quality of life, heightened morbidity, and an increased risk of death. A frequent complication following surgery is acute kidney injury (AKI), which is characterized by a sudden decline in kidney function.[14,15] This study has been done to evaluate the incidental rate of renal impairment among elderly women with hip fractures with an average age of 66.82 years. Combatively Braüner Christensen J et al[14] conducted the study the occurrence of acute kidney injury (AKI) in geriatric patients undergoing hip fracture surgery and they found mean age of the patients 82.4 ± 8.8 years. Hagino T et al.[17] also observed a higher average age among elderly patients with hip fractures, 83.4 years. The variance in mean age between this study and others might be attributed to differences in the age range of participants; in this study, only female patients were included, which could explain the variations in age observed.

In this study, Acute Kidney Injury (AKI) was observed in 24 patients, constituting 16.3% of the study population. Specifically, 9.5% had stage-I AKI, 4.8% had stage II

**Table 1: Overall serum creatinine levels and change in levels before and after fracture (n=147)**

| Before and after | N | Mean | Std. Deviation | Mean difference | p-value |
|---|---|---|---|---|---|
| Before | 147 | 67.04 µmol/L | 10.17 µmol/L | -14.91 µmol/L | **0.0001** |
| After | 147 | 81.95 µmol/L | 50.29 µmol/L | -14.91 µmol/L | |

**Table II: Incidence of acute renal impairment according to age among elderly patients after fracture.**

| | AKI group | | | | | |
|---|---|---|---|---|---|---|
| **Age groups** | **No AKI** | **Stage 1** | **Stage 2** | **Stage 3** | **Total** | **p-value** |
| 60-65 | 58 | 7 | 5 | 0 | 70 | |
| | 39.5% | 4.8% | 3.4% | 0.0% | 47.6% | |
| 66-70 | 38 | 2 | 0 | 1 | 41 | |
| | 25.9% | 1.4% | 0.0% | 0.7% | 27.9% | |
| 71-75 | 15 | 4 | 2 | 2 | 23 | 0.096 |
| | 10.2% | 2.7% | 1.4% | 1.4% | 15.6% | |
| 76-80 | 12 | 1 | 0 | 0 | 13 | |
| | 8.2% | 0.7% | 0.0% | 0.0% | 8.8% | |
| Total | 123 | 14 | 7 | 3 | 147 | |
| | 83.7% | 9.5% | 4.8% | 2.0% | 100.0% | |

**Table III: Mean serum creatinine level according to duration of fracture. (n=147)**

| Duration of fracture | N | Mean | Std. Deviation | F-value | p-value |
|---|---|---|---|---|---|
| < 1 month | 85 | 73.64 | 24.33 | | |
| 1-3 months | 40 | 72.67 | 26.44 | | |
| 3-6 months | 14 | 122.35 | 111.29 | 10.17 | 0.001 |
| >6 months | 8 | 146.00 | 97.32 | | |
| Total | 147 | 81.95 | 50.29 | | |

AKI, and 2.0% had stage III AKI. Following the fracture, the mean serum creatinine level increased to 81.95 µmol/L, accompanied by a wider standard deviation of 50.29 µmol/L, indicating greater variability in post-fracture creatinine levels. The mean difference between pre-fracture and post-fracture creatinine levels was -14.91 µmol/L, and this difference was statistically significant with a p-value of 0.0001, underscoring the impact of the fracture on serum creatinine levels in the study population.

Comparatively Zhan S et al[18] study involved 308 elderly patients who had sustained a femoral neck fracture and, in their study, the overall occurrence of postoperative Acute Kidney Injury (AKI) 12%, which is slightly less than our study. Consistently McKeag P et al[19] conducted the study to establish the occurrence of acute kidney injury (AKI) after hip fracture surgery and they reported that the out of a total of 500 patients, 96 individuals experienced AKI, representing a rate of 19.2%. Agar A et al[20] reported that out of a total of 589 patients, 58 individuals had developed Acute Kidney Injury (AKI), which accounted for 9.8% of the patient population. Notably, the AKI group demonstrated a higher mortality rate.

According to the Rantalaiho I et al[21] AKI occurred in 8.4% of the patients with hip fracture and it's important to note that patients with AKI experienced a markedly higher mortality rate of 35.0% compared to those without AKI, where the mortality rate was 12.7% ($p < 0.001$). In the study by Wang H et al[22] also reported that the frequency of AKI was 12.1% following hip fracture. Our findings were also supported by the Li ZC et al[23] as they observed that the collective occurrence of AKI subsequent to hip fracture surgery was roughly 17%, and postoperative serum albumin levels might represent a noteworthy risk factor for AKI. The reduced occurrence of AKI (Acute Kidney Injury) followed by hip fractures in certain developed countries can be attributed to the advancements in their healthcare infrastructure and the enhanced postoperative care, particularly for elderly patients. This may include improved surgical techniques, more comprehensive monitoring, and better management of complications, ultimately leading to better patient outcomes in these countries. This study possesses several limitations, like it exclusively focused on female patients, which may restrict the generalizability of the findings to a broader population, the study did not account for the diversity in fracture types, which is essential to examine how different types of fractures may influence the occurrence of AKI following hip fractures. Furthermore, in current study, factors related to hospitalization, including the length of stay, and important intraoperative factors, such as blood loss and surgical complications, specifically post-operative infections, were not assessed and, the study also did not consider patients' dietary habits and post-discharge home care. These aspects can significantly affect recovery and the occurrence of AKI.

Future large-scale studies should take into account the various aspects of hospital status, such as the length of hospitalization, the quality of care received, and other related factors. Additionally, a detailed investigation into postoperative status, including any complications or infections that may arise after surgery, would provide a more comprehensive perspective on the development of AKI in hip fracture patients. These recommendations will contribute to a more holistic understanding of the risk factors and management strategies associated with AKI in this patient population.

# Conclusion

The study revealed an incidence of Acute Kidney Injury (AKI) in elderly patients following hip fractures at 16.3%, encompassing different stages of severity. Despite these significant findings, their implementation cannot be recommended at this stage due to several limitations. Nevertheless, there is a need for large-scale local studies to further investigate and validate these findings.

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