Original Article

Adverse Outcomes of Internal Fixation Using Cannulated Screws or Dynamic Hip Screw in Stable Intracapsular Femoral Neck Fractures

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ABSTRACT

OBJECTIVE: To determine the frequency of adverse outcomes of internally fixed stable intracapsular femoral neck fractures either using Cannulated Screws or Dynamic Hip Screws.

METHODOLOGY: This cross-sectional study was conducted from 2013 to 2017 in the Department of Orthopaedics Khyber Teaching Hospital Peshawar. A total of 193 patients of both genders with age ≥60 years who had stable intracapsular femoral neck fractures and were performed internal fixation either using Cannulated Screws or Dynamic Hip Screws between 2013 and 2017 were selected for this retrospective study using hospital admissions and database. All X-rays were reviewed to establish the fracture classification and determine the cause of complication and reoperation. All data, including mortality, index hospitalization, revision surgery and causes of failure, were analyzed in frequency and percentages.

RESULTS: The Mean±SD of age was 81.647±7.58 years. Of these patients' the female gender was dominant with 64.25%, while males were 35.75%. Overall, 5year mortality rate was 26.42%. The percentage of patients requiring index hospitalization was 41.45%. Revision surgery was done in 20.2% of the patients. The main reasons for failure were noted to be avascular necrosis/pain/secondary arthritis (19.69%), early collapse (17.1%), infection (9.84%), failed fix (3.11%), decoupling (3.63%) and screw breakage (1.55%).

CONCLUSION: Working on the reasons which result in index hospitalization, reoperations, and mortality will be helpful to minimize these adverse outcomes, which lead to a high burden on the healthcare sector due to indexation and high rate of mortality in elderly patients after internal fixation of their non-displaced femoral neck fractures.

KEYWORDS: Femoral neck fracture, Intracapsular, Internal fixation, Non-displaced.

INTRODUCTION

As extracted from the data between 1990 and 2019, with the increase in world population growth and average age, there is an increased incidence and prevalence of hip fractures[1]. The annual rate of hip fractures is estimated to be 1.3-1.7 Million. Still, with increased life expectancy, the global incidence is expected to rise to 6.3 Million by 2050[2]. The incidence of hip fractures also varies globally among patients of 50 years or above age groups. It was reported to be as high as 500 cases/100,000 in Denmark and as low as 100 cases/100,000 in South Africa. These trends are also related to levels of urbanization in different parts of the world[3].

If we analyze the combined age groups, the rate of fractures is reported to be higher in males than in females[1]. This low incidence of fractures is found in females aged 54 years; however, this shows a rise after this age. Among older people of 64 years or above, there is a higher incidence of these fractures in females than males[4]. This higher incidence between 15 and 44 years of age is observed in males and is explained by the high risk they face during their occupational obligations compared to females[5]. The involvement of males in other outdoor activities like travelling, incidences of violence and hazardous sports also contribute to this higher incidence.[6]

Classifications have been suggested for categorizing femoral neck fractures (FNF). One of these was suggested by Pauwels in 1935, which was done depending upon the shearing angle of hip fracture. The classification suggested by Garden in 1961 is the most accepted and employed, defining the category per the degree of fracture displacement. This classification divides intracapsular hip fractures into four categories, where each category progresses over the previous one. Garden I and II are valgus-impacted fractures in the undisplaced fractures category. Gardens III and IV are those that are partially or displaced fractures[7]. Gardens III and IV represent two-thirds of all FNFs.

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doi: 10.22442/jlumhs.2023.00000

The intracapsular neck of femur fractures, if stable (Garden I and Garden II), are commonly preferred to be fixed with cannulated screws or a DHS with a side plate in the interest of salvaging the native hip. The unstable (Garden III and Garden IV) fractures are typically treated by a hemi arthroplasty or a total hip arthroplasty, depending on the physical and cognitive status of the patients. Unfortunately, despite the apparent simplicity of the Gardens classification, the treatment of intracapsular fractures remains under discussion.

Non-displaced FNF, approximately 20% of the total, was historically considered stable. The standard treatment suggested is internal fixation, conducted within 24-48 hours of hospitalization, intended to preserve the functions of the native hip, limit pain, and restore mobility. Salvaging the native head of the femur in young patients gives favorable outcomes in the shape of lower blood loss and transfusion, less surgical time, shorter anesthesia time and better functional outcomes; therefore, fixing is preferred compared to replacement. This process of the fixation of the intracapsular neck of femur fracture is, however, more attractive for the younger age groups where a long expected age of mobilization is ahead. Still, there are some disadvantages to this process for older adults. These limitations include the presence of comorbidities, low healing potential and low levels of functional reserves that cause higher than calculated complication[8].

Despite the growing body of literature on displaced FNF outcomes to examine the role of arthroplasty, less attention has been paid to the outcomes of internal fixation in elderly patients with non-displaced FNF. The available evidence reflects that the complication profile in older adults is high for non-displaced FNF with internal fixation. These injuries are involved with high mortality rates, which are as high as 24% within the first year and are also reported to be associated with equal rates of dysfunctions[9]. The significant adverse outcomes reported previously are the length of index hospitalization, transfusion and the risk of infection. The commonly reported causes of reoperation after internal fixation in cases of FNF are the removal of symptomatic implants and the nonunion. This poor outcome results in a heavy burden on the health sector, demanding more budgets and resources[10].

Another important matter of concern is that these hip fractures lead to other osteoporotic fractures in these individuals. In a study conducted in the US, in women of postmenopausal age having hip fractures, the incidence of another fracture was noted to be 8% within one year, 15% within the next two years, and 25% within the next five years[11].

We conducted a single-centre five-year retrospective study on internally fixed stable (Garden 1 and Garden 2) intracapsular neck of femur fractures. The rationale behind the study was to analyze the complication, revision rates and mortality after internal fixation in stable intracapsular neck of femur fractures. The study hypothesized that internal fixation of the neck of the femur is associated with high index hospitalization, reoperation rates and mortality in the stable neck of femur fractures. Furthermore, the reasons for revisions were also analyzed.

METHODOLOGY

This cross-sectional design study was conducted from 2013 to 2017 at the Department of Orthopedics Khyber Teaching Hospital Peshawar. A total of 193 patients from both genders of the age ≥60 years who had stable intracapsular femoral neck fracture and were performed internal fixation either using Cannulated Screws (CS) or Dynamic Hip Screws (DHS) between 2013 and 2017 were selected for this retrospective study using hospital admissions and hip fracture databases.

The exclusion criteria were unstable (Garden 3 and Garden 4) fractures in the internal fixation group, pathological fractures, basicervical fractures, ipsilateral shaft fractures, sub trochanteric extensions, patients who died after admission before surgery or were decided for non-operative management because of moribund status and incomplete records.

Two consultants saw all the X-rays to establish the fracture classification and determine the cause of complication and reoperation. Statistical analysis was carried out using the statistical analysis program SPSS 26. Mean ± standard deviations were calculated for quantitative parameters. All the data, including mortality, index hospitalization, revision surgery and the causes of failure, were analyzed in frequency and percentages.

RESULTS

The age range in this study was 61 to 94 years, with a mean age of 81.647±7.58 years. Of these 193 patients, the female gender was dominant, as 124 (64.25%) were females while 69 (35.75%) were males.

In these patients going through intracapsular internal fixation procedures, most were performed through a dynamic hip screw (DHS), i.e. 119 (61.66%), while in 74 (38.34%), cannulated screws (CS) were used.

Overall, the five-year mortality rate in this study was 26.42%. Among these, 36 (30.25%) had DHS Surgery done while 15 (20.27%) had cannulated screw 15 (20.27%) CS fixation done.

The total number of patients requiring indexed hospitalization was 80, out of which 44 (55%) were from patients who had DHS done. In comparison, 36 (45 %) from the CS Group of patients, among which 39 patients had revision surgery, details are given in **Table I**.

The primary reasons for the index hospitalization revision surgery are shown in **Table II**.

Table I:
Details of patients requiring revision surgery

IC Internal Fixation	Number of patients	Patients requiring revision surgery	
		Frequency	Percentage
DHS	119	17	14.28 %
CS	74	22	29.72%
Total	**193**	**39**	**20.2%**

Table II: Reasons for index hospitalization and revision surgery

Reasons for Indexation or Revision	DHS (n=119)		CS (n=74)		Total (n=193)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
AVN/Pain/Sec Arthritis	24	20.17%	14	18.92%	38	19.69%
Early Collapse	11	9.24%	12	16.21%	33	17.1%
Infection	19	15.97%	-	-	19	9.84%
Failed Fix	-	-	6	8.11%	6	3.11
Decoupling	3	2.52%	4	5.41%	7	3.63%
Screw Breakage	3	2.52%	-	-	3	1.55%
Total	**60**	**50.42%**	**36**	**48.65%**	**96**	**49.75%**

DISCUSSION

Several studies have been conducted discussing different perspectives on hip fractures. However, age is consistently an essential factor regarding different outcomes and mortality[12].

The Mean±SD of age in our study was 81.647±7.58.

Bartels S reported a high female gender of up to 60% in their group of patients undergoing internal fixation in FNF surgery[13]. Lin and Liang WM reported a predominantly female gender of 67.6% in their study with nonagenarian patients with hip fractures[14]. Barbosa TA et al[15] also shared this higher incidence (76.9%) in females. The female gender was also predominant in our study, with 64.25% of the total population.

Internal fixation is expected to have a lower mortality rate and be less invasive. Yet, studies have not shown any significant difference in mortality rate between internal fixation and arthroplasty in the follow-ups done after mid- and long-term[16]. Abrahamsen B 2009[17] reported that the mortality rate was from 3.3 to 17.2% after one month. After three months, it was 6.4 to 20.4%; after six months, it was 7.1 to 23%, while the one-year mortality rate was 5.9 to 59%. They also discussed that the mortality rate was highest after six months and remained higher for several years. Overmann AL 2019[10], after the meta-analysis of 15 studies in elderly patients of age 60 years or older going through non-displaced FNF surgery with internal fixation, reported the one-year mortality risk as 14.6%. Lin and Liang reported a 2-year mortality rate after surgery of hip fractures around 45%.[14] The results of our study also showed a high overall five-year mortality rate of 26.42%. The reported risk factors for postoperative mortality after internal fixation of FNF in different studies are older age, medical comorbidities, ambulatory status and the male gender[18]. Bai J et al.[19] mentioned dementia as a leading one-year risk factor for mortality, increasing it to 1.77-fold compared to other similar patients undergoing hip fracture surgery.

For non-displaced fractures, Parker MJ 2008[20] reported a 15.3% healing complication rate for internal fixation; hence, he showed a preference for internal fixation over other treatments for non-displaced fractures. In the study done by Lin and Liang, the reported readmission rate was 18.9% after one month, while it was 24.1% in three months[14]. Kang JS 2016[21], in his retrospective study with patients aged 65 years or older with non-displaced FNF, shared a complication rate of 12.3% for non-displaced hip fractures in 81 patients with internal fixation. However, the rate of reoperation was the same in the internal fixation and bipolar hemiarthroplasty group[21]. Lu Q et al.[22] shared the results of their trial with 41 elderly patients who performed internal fixation for Non-displaced FNFs. He reported that 21.4% of patients had to go through reoperation. In our study, the incidence of indexed hospitalization was 41.45%. This high incidence of indexed hospitalization may be explained by the high mean age of the patients in our study compared to the studies mentioned above in this segment[14].

Internal fixation, although less invasive than prosthetic surgery, carries a higher reoperation risk. The systematic review conducted by Overmann in elderly patients who have treated their non-displaced hip fractures through internal fixation reported a one-year reoperation risk of 14.1% [10]. Lin and Liang shared a cumulative incidence reoperation rate of 7.3% after one year and 9.2% after two years, while the five-year risk was 11.6% [14]. Bartels S 2018[13], in his study of patients between 55 and 70 years old, reported the significant reoperations after internal fixation to be as high as 33%; however, if we exclude minor reoperations, it remains 27%. The total number of patients requiring revision surgery in our study was in line with the previous studies and was reported to be 39 (20.2%).

The significant risk factors that cause reoperations reported in previous studies include avascular

necrosis, mechanical failure or nonunion, removal of implants and hematoma causing soft tissue debridement[13]. Overmann shared the review of 26 studies of FNF patients and found mechanical failure, symptomatic hardware and screw cutout among the causes of reoperations after internal fixation[10]. Barbosa TA et al.[15] mentioned septic shock as the primary cause of complications, readmissions and mortality (47.2%) in patients with femoral fractures.

In line with the reasons mentioned in the above studies, avascular necrosis, pain, secondary arthritis, early collapse**,** decoupling, screw breakage**,** failed fix and infections were the causes found in our research for the indexation and reoperation in these elderly patients with FNF and have internal fixation.

In short, there is a high rate of adverse events, including indexation, reoperations and mortality after internal fixation of FNF. The results of this study will be helpful to minimize these unlikely outcomes. The major limitation of our study was the small sample size. Moreover, our study was retrospective, and some data that could be helpful were not available in the record. Hence, more studies on this topic will be of great help.

CONCLUSION

In a population group which is highly susceptible to complications after surgery, it will be reasonable to work on the major causes of adverse events in elderly patients after internal fixation of their non-displaced femoral neck fractures as found in this study and work needed to minimize these events which leads to high burden on healthcare sector due to indexation and losses due to high rate of mortality.

ACKNOWLEDGEMENT

The services of departmental staff for maintaining and providing the patient's record are acknowledged.

Ethical permission: Khyber Medical College Peshawar ERC letter No. 282/DME/KMC.

Conflict of interest: There is no conflict of interest

Funding: No funding disclosure.

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publically.

AUTHOR CONTRIBUTION

Zeb J:	Manuscript writing
Hayat S:	Principle author, idea
Zeb M:	Data collection
Jamil F:	Data collection
Khatoon S:	Results and tabulation

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