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Original Research Article

Evaluation of functional outcome following internal fixation of femoral neck fracture with cannulated cancellous screws: a prospective study from Bangladesh

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ABSTRACT

Background: Femoral neck fracture is a significant cause of morbidity in adults admitted to tertiary care centers in Bangladesh, and internal fixation with cannulated cancellous screws is the preferred head-preserving procedure in physiologically fit patients. This study aimed to assess the functional results, radiological healing, and complication rate of cannulated cancellous screw fixation of femoral neck fractures.
Methods: This concurrent prospective observational study was carried out at the Department of Orthopaedic Surgery, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh, from January 2024 to December 2024, on 45 patients with femoral neck fracture who were treated with closed or open reduction and internal fixation with 3 or 4 cannulated cancellous screws. Demographic, fracture, and operative data were collected, and functional outcome was evaluated at 3, 6, and 12 months after surgery using the Harris Hip Score (HHS). The data were analyzed using SPSS version 26.
Results: The age group 31-40 years was the largest (24.4%), and there was a significant male predominance (71.1%). The most common mechanism of injury was road traffic accidents (53.3%). The most common fracture type was type III (37.8%), and the majority of fractures (86.7%) were closed reduction with anatomical alignment. Radiological union was obtained in 91.1% of patients, avascular necrosis in 11.1%, and shortening of the femur in 15.6%. The percentage of patients with excellent-to-good HHS increased from 22.2% at 3 months to 68.9% at 12 months.
Conclusion: Although early diagnosis, early surgery, and anatomical reduction are key to reducing complications, the union rate and functional recovery are progressive and favorable for femoral neck fractures treated with cannulated cancellous screw fixation.

Keywords: Femoral neck fracture, Cannulated cancellous screws, Harris hip score, Avascular necrosis

INTRODUCTION

A femoral neck fracture is one of the most challenging fractures to treat in the field of orthopedic trauma surgery since it occurs in the intracapsular region of the proximal femur and affects the delicate retrograde blood supply to the femoral head.1 In patients who are physiologically young or middle-aged, such fractures are generally the

result of high-energy trauma (for example, motor vehicle accidents or falling from a height), and the choice of treatment is based on the aim of preserving the natural femoral head rather than proceeding with arthroplasty.[1,2] Even though implants and surgical techniques have improved, complications including nonunion, avascular necrosis, and femoral neck shortening are still observed in a large number of patients who have undergone surgery, leading to a considerable amount of long-term disability, particularly among those in economically active age groups.[2,3] When it comes to prognosis and planning treatment, anatomical classification is used. Even though agreement among observers is much better when the four Garden types are simplified to either displaced or undisplaced, the Garden classification is still the most commonly employed because it is easy to use and relies on the degree of displacement and the alignment of the trabeculae as seen on plain radiographs.[4] The Pauwels classification, on the other hand, divides fractures according to the biomechanical direction of the fracture line, with more vertically oriented fractures being subjected to greater shear stress and therefore having a higher risk of displacement and failure of fixation.[5,6] Both classification systems are used to help decide which implant to use, and cannulated cancellous screws are still widely employed nowadays because of their minimally invasive nature, the way they preserve soft tissues, and their favourable biomechanical characteristics in cases of low to moderate shear fracture patterns.[7] The two factors that can be most easily modified after screw fixation are carrying out surgery in a timely manner and restoring anatomical alignment, since both delaying treatment and leaving residual malalignment will damage the already fragile blood supply to the femoral head and increase the likelihood of screw fixation failing.[8,9] The Harris Hip Score is a combined score that takes into account pain, function, range of motion, and the absence of deformity and serves as a traditional means of measuring functional recovery, enabling studies to be compared with one another over time.[10] Epidemiological data from tertiary care hospitals in South Asia continue to indicate that road traffic accidents and falls from height are the most frequent causes of injury and that fractures of Garden type I and II account for a major portion of cases, underscoring the continued need for accurate classification to direct management in this area.[11] Although cannulated cancellous screws are widely used, there is relatively little prospective data available from Bangladesh regarding functional outcomes, rates of union, and complication rates. This is why the aim of the present study was to evaluate the functional outcome (assessed using the Harris Hip Score) and the radiological union rate as well as the profile of postoperative complications following cannulated cancellous screw fixation of femoral neck fractures in a tertiary care hospital in Bangladesh.

METHODS

This concurrent prospective observational study was carried out at the Department of Orthopaedic Surgery, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh, from January 2024 to December 2024. Forty-five patients with a radiologically confirmed femoral neck fracture who met the inclusion criteria and gave written informed consent were consecutively enrolled. The study included patients of either sex aged 18 years or more with an acute femoral neck fracture who were deemed to be suitable for surgical fixation using cannulated cancellous screws. Patients with pathological fractures, avascular necrosis or degenerative hip disease before the fracture, polytrauma that precluded early fixation, fractures of the same side of the body, prior surgery on the affected hip, or who were unable to complete the follow-up were excluded. Baseline demographic data (age, sex, BMI, smoking history, and comorbidity), fracture characteristics (mechanism of injury, side involved, Garden and Pauwels classification, degree of displacement, and time from injury to hospital arrival), and operative variables (time from injury to surgery, method and quality of reduction, number and configuration of screws, and operative duration) were recorded on a structured proforma. Closed or open reduction and internal fixation with three to four cannulated cancellous screws was performed in all patients under fluoroscopic control. Patients were followed up postoperatively at regular intervals to record time to full weight bearing, radiological union, time to fracture union, return to previous activity, limb length discrepancy, and complications (avascular necrosis, superficial wound infection, implant failure, coxa vara, femoral neck shortening, reoperation). Functional outcome was evaluated by the Harris Hip Score at 3, 6, and 12 months after surgery and graded as excellent, good, fair, or poor. Data were entered and analyzed in SPSS (Statistical Package for the Social Sciences) version 26; categorical variables were summarized as frequencies and percentages, continuous variables were summarized as mean with standard deviation, and results were presented in tabular form.

RESULTS

Among the 45 patients, the largest age group was 31-40 years (24.4%), followed by 51-60 years (22.2%), 18-30 years (20%), 41-50 years (17.8%), and above 60 years (15.6%). Males predominated (71.1%) over females (28.9%). The percentages of normal BMI, overweight, and obese were 57.8%, 31.1%, and 11.1%, respectively. 40% had a smoking history. Sixty percent had no comorbidity, 17.8% had diabetes mellitus, 13.3% had hypertension, and 8.9% had both (Table 1).

Table 1: Baseline demographic and clinical characteristics of the patients (n=45).

Variables	Category	N (%)
Age (years)	18-30	9 (20.0)
	31-40	11 (24.4)
	41-50	8 (17.8)
	51-60	10 (22.2)
	>60	7 (15.6)
Sex	Male	32 (71.1)
	Female	13 (28.9)
BMI (kg/m²)	Normal (18.5-24.9)	26 (57.8)
	Overweight (25-29.9)	14 (31.1)
	Obese (≥30)	5 (11.1)
Smoking history	Yes	18 (40.0)
	No	27 (60.0)
Comorbidity	None	27 (60.0)
	Diabetes mellitus	8 (17.8)
	Hypertension	6 (13.3)
	Diabetes+Hypertension	4 (8.9)

The most common injuries were due to road traffic accidents (53.3%), falls from height (26.7%), and falls on level ground (20%). In 55.6% of patients, the right side was involved. Garden type III fractures were most frequent (37.8%), followed by type II (28.9%), type IV (20.0%), and type I (13.3%). Pauwels type II predominated (51.1%), followed by type III (33.3%) and type I (15.6%). Displaced fractures were the most common type (57.8%), and patients were seen more than 24 hours after injury (57.8%) (Table 2).

Table 2: Fracture characteristics of the patients (n=45).

Variables	Category	N (%)
Mechanism of injury	Road traffic accident	24 (53.3)
	Fall from height	12 (26.7)
	Fall on level ground	9 (20.0)
Side involved	Right	25 (55.6)
	Left	20 (44.4)
Garden classification	I	6 (13.3)
	II	13 (28.9)
	III	17 (37.8)
	IV	9 (20.0)
Pauwels classification	Type I	7 (15.6)
	Type II	23 (51.1)
	Type III	15 (33.3)
Fracture displacement	Undisplaced	19 (42.2)
	Displaced	26 (57.8)
Time from injury to hospital	≤24 hours	19 (42.2)
	>24 hours	26 (57.8)

Surgery was performed within 25-72 hours of injury in 44.4% of patients, within 24 hours of injury in 17.8%, and beyond 72 hours of injury in 37.8%. Closed reduction was performed in 86.7%, and anatomical reduction was achieved in 73.3% of cases. 91.1% of patients had three screws, most frequently in an inverted triangle pattern (84.4%). The operative time was 60 minutes or less in 64.4% and more than 60 minutes in 35.6% (Table 3).

55.6% of patients achieved full weight bearing in 12 weeks. Radiological union was obtained in 91.1% of cases, with union in 58.5% within 16 weeks, 34.1% between 17 and 24 weeks, and 7.3% after 24 weeks. Return to previous activity was complete in 64.4%, partial in 24.4%, and patients were unable to return to previous activity in 11.1%. In 15.6% of patients, there was a difference in the length of the limbs (Table 4)

Table 3: Operative events (n=45).

Variables	Category	N (%)
Time from injury to surgery	≤24 hours	8 (17.8)
	25-72 hours	20 (44.4)
	>72 hours	17 (37.8)
Reduction method	Closed reduction	39 (86.7)
	Open reduction	6 (13.3)
Quality of reduction	Anatomical	33 (73.3)
	Non-anatomical	12 (26.7)
Number of screws	Three screws	41 (91.1)
	Four screws	4 (8.9)
Screw configuration	Inverted triangle	38 (84.4)
	Other	7 (15.6)
Operative duration	≤60 minutes	29 (64.4)
	>60 minutes	16 (35.6)

Table 4: Postoperative recovery and fracture union.

Variables	Category	N (%)
Time to full weight bearing	≤12 weeks	25 (55.6)
	>12 weeks	20 (44.4)
Radiological union	Achieved	41 (91.1)
	Not achieved	4 (8.9)
Time to fracture union	≤16 weeks	24 (58.5)
	17-24 weeks	14 (34.1)
	>24 weeks	3 (7.3)
Return to previous activity	Complete	29 (64.4)
	Partial	11 (24.4)
	Unable	5 (11.1)
Limb-length discrepancy	Present	7 (15.6)
	Absent	38 (84.4)

Table 5: Postoperative complications during follow-up.

Variables	Category	N (%)
Avascular necrosis	Present	5 (11.1)
	Absent	40 (88.9)
Superficial wound infection	Present	2 (4.4)
	Absent	43 (95.6)
Implant failure	Present	2 (4.4)
	Absent	43 (95.6)
Coxa vara	Present	3 (6.7)
	Absent	42 (93.3)
Femoral neck shortening	Present	7 (15.6)
	Absent	38 (84.4)
Reoperation	Required	4 (8.9)
	Not required	41 (91.1)

Avascular necrosis was seen in 11.1% and femoral neck shortening in 15.6% of patients. Superficial wound infection and implant failure were each seen in 4.4% of cases, and coxa vara in 6.7%. 8.9% of patients required reoperation and 91.1% did not require further surgery (Table 5).

Fair (40%) and poor (37.8%) scores were most common at 3 months, with only 22.2% rated good or excellent. At 6 months, good scores were most common (35.6%), followed by excellent (17.8%), fair (28.9%), and poor (17.8%). Good (37.8%) and excellent (31.1%) scores combined represented 68.9% of patients at 12 months, with fair and poor scores dropping to 20% and 11.1%, respectively (Table 6).

Table 6: Functional outcome according to Harris Hip Score during follow-up.

Follow-ups	Excellent	Good	Fair	Poor
3 months	2 (4.4)	8 (17.8)	18 (40.0)	17 (37.8)
6 months	8 (17.8)	16 (35.6)	13 (28.9)	8 (17.8)
12 months	14 (31.1)	17 (37.8)	9 (20.0)	5 (11.1)

DISCUSSION

In the study involving 45 patients with femoral neck fractures who were treated using cannulated cancellous screw fixation, the most common mechanism of injury was road traffic accidents (53.3%) and the age group most frequently affected was the third and fourth decades of life, just as has been described in other South Asian and regional groups, where high-energy trauma in economically active males is the most frequent cause of femoral neck fractures.[12] The high proportion of Garden type III fractures (37.8%) and Pauwels type II fractures (51.1%) found in this study is similar to that reported by Lim et al., who stated that the displaced, moderately unstable fracture pattern is a common presentation in surgically managed femoral neck fractures, and this reflects the biomechanical basis for the need to carefully configure the screw in cases with an intermediate-to-high shear angle.[13] Closed reduction was carried out in the majority of patients (86.7%) and anatomical reduction was achieved in 73.3% of them, a finding that is in line with Wen et al., who emphasised the importance of achieving anatomical reduction, not merely reduction, for successful union and functional recovery following screw fixation.[14] Even though most of the patients in this study underwent surgery more than 24 hours after the injury, a situation which is linked to poor vascular preservation of the femoral head, the union rate in our study of 91.1% is comparable to that reported by Caldaria et al., who used three or four cannulated screws in an inverted-triangle arrangement, showing that careful reduction can in part offset the adverse effects of a delayed surgery.[15] The complication rates in this study (11.1% for avascular necrosis, 15.6% for femoral neck shortening, 4.4% for implant failure, and 8.9% for reoperation) are similar to those reported by Jettoo et al., who found avascular necrosis rates of about 5-15% and reoperation rates of less than 10% in patient groups with a similar follow-up period.[16] The overall findings from comparative studies of dynamic hip screws versus multiple cannulated screws have generally been similar to those of the present study, with dynamic screws having a higher reoperation rate but a shorter mean operative time in most patients.[17,18] Larger comparative groups of patients with undisplaced fractures treated with cannulated screws and with longer follow-up periods have also reported functional and complication outcomes similar to those in this study, further supporting the durability of this fixation technique in low-resource settings.[19] The progressive improvement in Harris Hip Score from a majority of fair to poor scores at three months to a majority of good to excellent scores at twelve months is in agreement with the functional recovery observed in a study by Raj et al., who demonstrated that hip function continues to improve well beyond the early postoperative phase as fracture union takes place and rehabilitation advances.[20] This trend also supports the well-known principle that early postoperative scores should be treated with caution, since substantial improvements in pain and mobility scores usually occur during the first postoperative year.[21] The demographic, radiological, and functional results of this study together show that cannulated cancellous screw fixation is a reliable and effective method for treating femoral neck fractures in a resource-limited tertiary care centre, the quality of the reduction being the most important factor and adequate follow-up being essential for evaluating the full range of functional outcomes.

Limitations of the study

The present study was limited by its single-center design, relatively small sample size, and follow-up period of 12 months, which may not have been sufficient to detect late complications including delayed-onset avascular necrosis and fixation failure.

CONCLUSION

This study demonstrated that the radiological union rate of cannulated cancellous screw fixation was high, and the functional outcome was gradually improving. The most common mechanism of injury was road traffic accidents, and the most common fracture pattern in surgically treated patients was displaced and moderately unstable. Despite the high proportion of delayed presentation (over 50% of the study population), anatomical reduction was achieved in the majority of cases. The rates of complications such as avascular necrosis and femoral neck shortening were within previously reported ranges. There was significant improvement in Harris Hip Scores from the third to twelfth postoperative month. In general, this minimally invasive fixation method seems to be a reliable and repeatable method for the management of femoral neck fracture in similar clinical situations.

Recommendations

Further larger, multicenter, prospective studies with longer follow-up are recommended to confirm these results and to determine the factors predicting complications after

cannulated cancellous screw fixation of femoral neck fractures.

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