International Journal of Research in Orthopaedics
Kelkar R et al. Int J Res Orthop. 2024 Sep;10(5):1008-1013
http://www.ijoro.org

Original Research Article

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20242395

Comparative study of fully threaded and partially threaded cancellous cannulated screws versus partially threaded cancellous cannulated screws in femoral neck fractures in adults

Rajeev Kelkar[1], Deepak Rajput[2], Shirish Jadaun[1], Pranav Mahajan[1]*

[1]Department of Orthopaedics, Mahatma Gandhi Memorial Medical College and Maharaja Yeshwantrao Hospital, Indore, Madhya Pradesh, India
[2]Department of Physical Medicine and Rehabilitation, Mahatma Gandhi Memorial Medical College and Maharaja Yeshwantrao Hospital, Indore, Madhya Pradesh, India

Received: 19 June 2024
Revised: 11 July 2024
Accepted: 20 July 2024

***Correspondence:**
Dr. Pranav Mahajan,
E-mail: pranav.mahajan@gmail.com

ABSTRACT

Background: Femoral neck fractures constitute a significant portion of orthopaedic trauma, with intra-capsular fractures representing 50% of all hip fractures, their incidence is projected to rise dramatically due to the aging population. These fractures, particularly in the elderly, lead to high morbidity and mortality. Optimal surgical treatment for femoral neck fractures remains debated, especially in younger adults.
Methods: This hospital-based prospective comparative study was conducted over one year. Patients aged 18-60 years with femoral neck fractures were randomized into two groups: Group A were operated using combination of fully threaded and partially threaded cancellous cannulated screws and group B using partially threaded cancellous cannulated screws. Functional outcomes were assessed using the Harris hip score (HHS) and visual analog scale (VAS) for pain, and radiological union times were recorded. Complications such as non-union, screw back-out, and infection were also evaluated.
Results: The study included 30 patients, with 15 in each group. Group A showed significantly better HHS at 6 months (88.53±7.46) compared to group B (77.69±13.35) ($p<0.05$). VAS scores were lower in group A, indicating less pain, though the difference was not statistically significant. Radiological union time was shorter in group A (12.55±2.39 weeks) compared to group B (13.89±5.29 weeks) ($p<0.05$). Group A had fewer complications, with no cases of screw back-out compared to four in group B.
Conclusions: The combination of fully threaded and partially threaded cancellous cannulated screws when used appropriately offers better functional outcomes, faster radiological union, and fewer complications compared to partially threaded screws alone in femoral neck fractures in young adults.

INTRODUCTION

Femoral neck fractures, a common type of hip fracture, are a significant public health concern. With the aging population, the incidence of these fractures is projected to rise from 1.66 million in 1990 to 6.26 million by 2050.[1,2] These fractures, especially in elderly patients, result in high morbidity and mortality, often leading to loss of independence and reduced quality of life. In younger adults, femoral neck fractures usually result from high-velocity trauma and present complex treatment challenges.

Primary goal of surgical treatment for femoral neck fractures is to achieve stable fixation and promote bone healing to prevent complications such as non-union, avascular necrosis, and loss of reduction. Various surgical

techniques, including cannulated screws, sliding hip screws and proximal femoral locking plates, have been employed, each with advantages and drawbacks. Choice of surgical intervention often depends on factors as patient's age, fracture pattern, bone quality, surgeon's experience and preference. In elderly patients, hemiarthroplasty/ total hip arthroplasty is commonly preferred, while optimal procedure for osteosynthesis in younger adults remains debated and area of ongoing research.

Cannulated screw fixation is widely accepted due to its reduced operative time and lower blood loss, but it may not provide sufficient fixation strength in osteoporotic bone. Sliding hip screws and proximal femoral locking plates offer more robust fixation but are associated with higher complication rates, such as non-union and avascular necrosis.[3,4] Traditional internal fixation using partially threaded cannulated compression screws (PTCCS) is common but linked to significant complications, including femoral neck shortening, non-union, avascular necrosis, and malunion.[5] Recent studies suggest that fully threaded cannulated compression screws (FTCCS) may offer better stabilization.

This study aims to compare the efficacy of a combination of FTCCS and PTCCS versus PTCCS alone in managing femoral neck fractures in adults.

METHODS

The study was a hospital-based prospective comparative study conducted over one year from February 2023 to January 2024 at the Department of Orthopaedics, MGM Medical College and M. Y. Hospital, Indore which is one of the biggest tertiary care centres in central India. We took approval from the institutional ethical committee before commencing the study.

Patients aged 18-60 years with femoral neck fractures presenting within 7 days of injury were included in the study after taking proper informed consent. Patients who had presence of other ipsilateral fractures, pathological fractures, compound fractures, patients having and chronic diseases affecting fracture healing excluded from study.

All the patients who were considered to be a part of the study were randomized into two groups and sampling done by odd even method. In group A, patients were managed by closed reduction internal fixation using two partially threaded cancellous cannulated screws and one fully threaded cancellous cannulated screw. In group B, patients were operated upon by closed reduction internal fixation using 3 partially threaded cancellous cannulated screws.

Surgical technique

Group A (Combination of FTCCS and PTCCS): After achieving closed reduction under IITV control, guide wires were placed in inverted triangle pattern. One 4.5 mm cannulated drill bit was used to create the screw path. Two 6.5 mm partially threaded screws were placed infero-centrally and antero-superiorly and tightened. Washers were used in majority of cases. After achieving proper fixation using two screws, one fully threaded 6.5 mm screw was placed postero-superiorly and tightened.

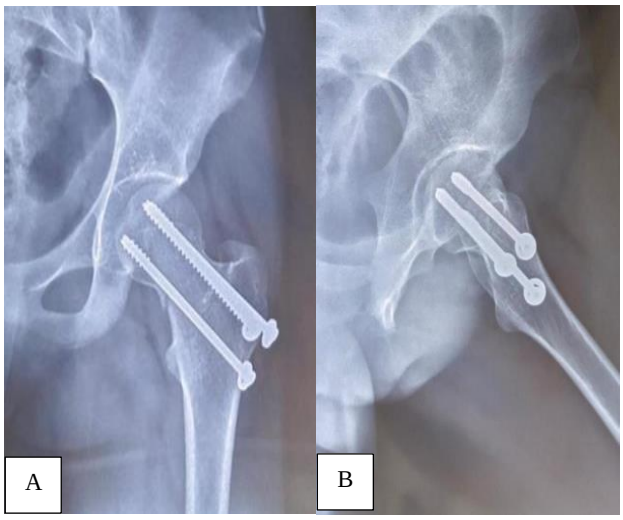

Figure 1 (A and B): Combination of two partially threaded and one fully threaded screw used for fracture fixation.

Group B (PTCCS): The procedure was similar, but all three 6.5 mm partially threaded screws were used.

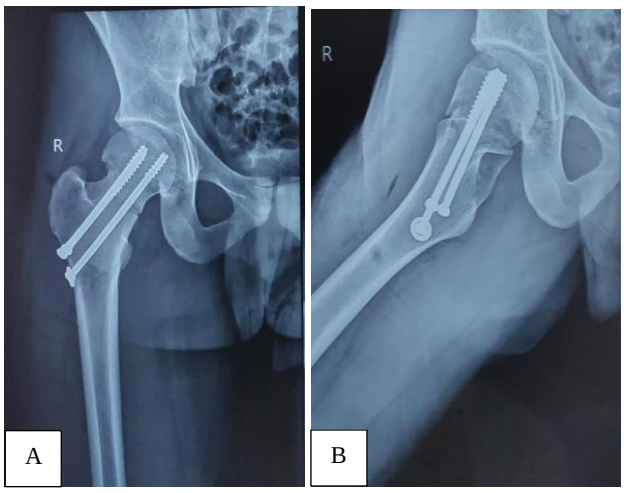

Figure 2 (A and B): All three partially threaded 6.5 mm cancellous cannulated screws used for fracture fixation.

Postoperative protocol

Early mobilization with knee bending was started on the 2nd day post-surgery, followed by toe touch weight bearing at 1 week using walker support and partial weight bearing at 2 weeks. Full weight bearing was allowed after radiological and clinical signs of union.

Follow-up

Patients were followed up at 2 weeks, 1 month, 3 months, and 6 months. Functional outcome of all the patients was assessed using the HHS and VAS for pain. Radiological union was evaluate using X-rays.

RESULTS

The data was collected and saved in Microsoft excel sheet (Windows 7 office version 2007). All the data was analysed using statistical package for social sciences (SPSS) software for Windows (version 22.0; SPSS Inc, Chicago). All the statistics including mean, standard deviation, Mann-Whitney U test, student t test was calculated with the help of statistician.

The majority of patients included in the study were in the age group 18 to 30 years (13). Nine patients were in the age group 31 to 40 years, 5 patients in 41 to 50 years age group, 3 patients in 51 to 60 years age group. Sixteen patients out of the total group were males and fourteen were females.

There was higher prevalence of right side fracture (18 out of 30 patients) as compared to left side (12 out of 30). Majority of patients sustained injury due to road traffic accident (17 out of 30), followed by slip and fall in 7 patients, 5 patients had fallen from height and one patient had sustained injury following assault.

Based on Garden's classification, 18 patients were grade II, 6 patients each in grade I and grade III (Table 1). The screw configuration in various types is as mentioned in Table 2.

Table 1: Types of fracture as per Garden's classification.

Age group (in years)	Grade I	Grade II	Grade III	Total
18-30	2	8	3	13
31-40	2	5	2	9
41-50	1	3	1	5
51-60	1	2	0	3
Total	6	18	6	30

Table 2: Screw configuration in various fracture grades.

Fracture grades	Combination of FTCCS and PTCCS	PTCCS	Total no. of cases
Grade I	3	3	6
Grade II	9	9	18
Grade III	3	3	6
Total	15	15	30

Out of the total patients, 18 patients out of 30 had excellent outcome at the end of 6 months, five patients had good outcome, three had fair and four patients had poor outcome based on HHS (Figure 3).

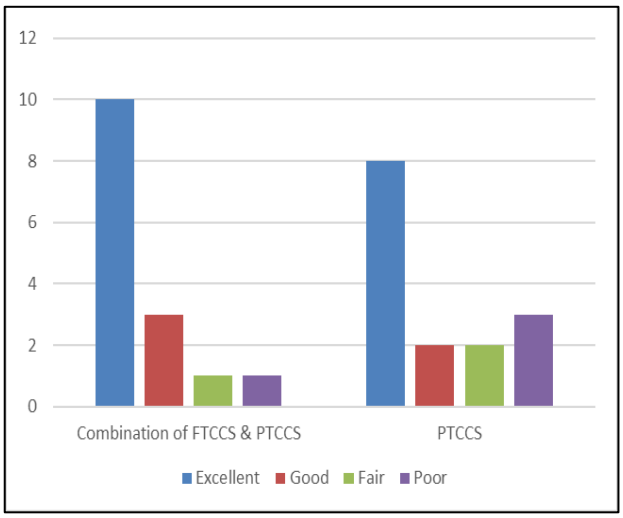

Figure 3: Functional outcome based on screw configuration.

Out of the total 15 patients in each group, 10 patients had excellent, 3 had good, one fair and one poor result in group A (Combination of fully threaded and partially threaded screw). In group B (All three partially threaded screws), eight patients had excellent outcome, two had good, two had fair and three had poor outcome (Table 3).

The mean HHS at the end of 6 months in group A was 88.53±7.46 and in group B was 77.69±13.35 with a p=0.012 which was significant.

Mean HHS for both the groups combined was 83.11. Range of HHS in group A was 68.3-96.7 and for group B was 58.1-96.7.

The mean VAS score at 6 months in group A was 1.07±1.34 while in group B was 2.07±2.17 with a p=0.22 which was significant.

Patients of group A showed less pain around hip at the end of 6 months follow up as compared to group B.

Table 3: Functional results in various age groups.

Age (in years)	Excellent	Good	Fair	Poor	Total
18-30	10	2	1	0	13
31-40	6	2	0	1	9
41-50	2	0	1	2	5
51-60	0	1	1	1	3
Total	18	5	3	4	30

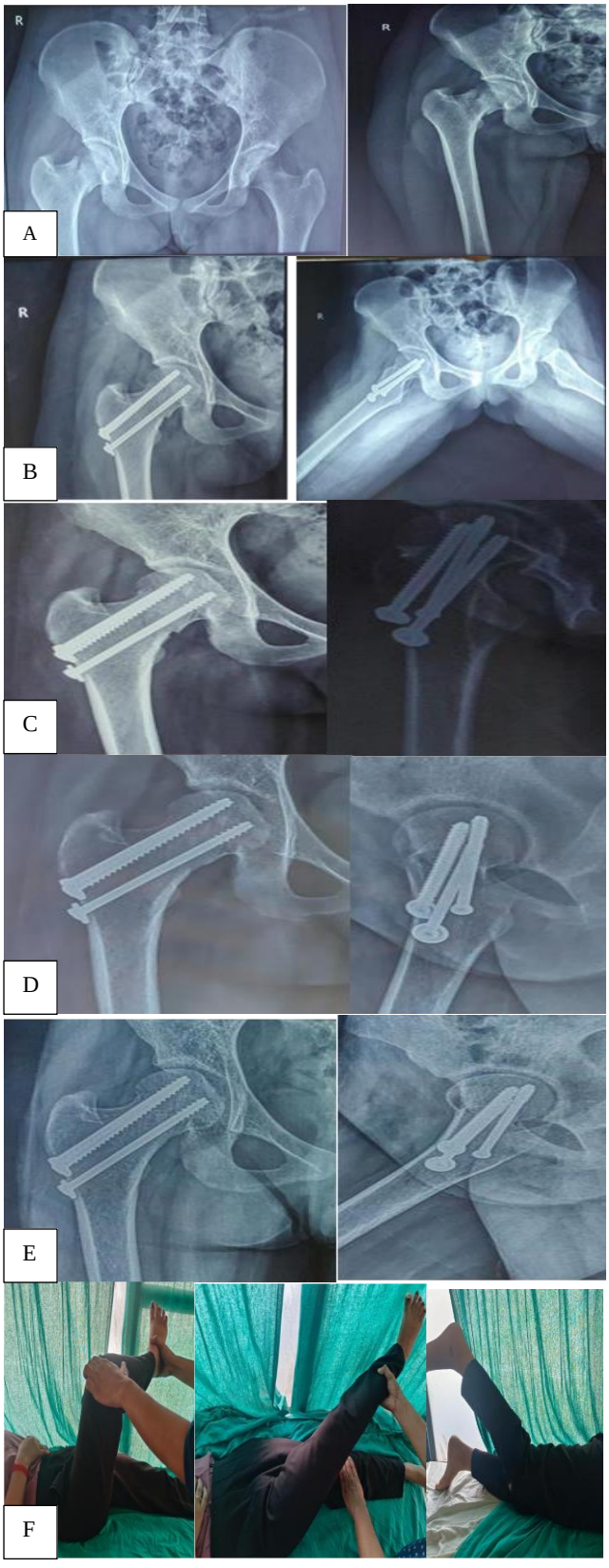

Figure 4 (A-F): Patient follow up-28/m with fracture neck femur operated using combination of fully and partially threaded cancellous cannulated screws, pre op X ray, post op X ray, 6 weeks post op, 3 months post op, 6 months post op and clinical images at 6 months follow up.

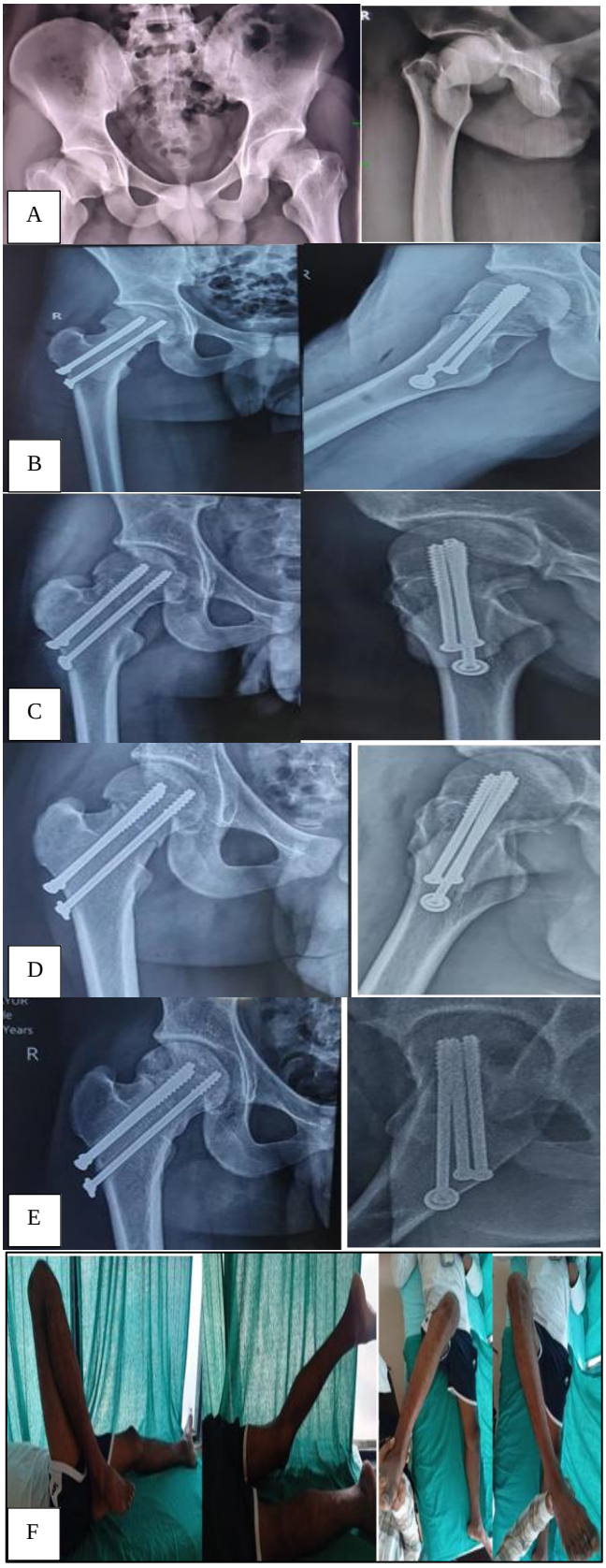

Figure 5 (A-F): Patient follow up-21/m with fracture neck femur operated using all partially threaded cancellous cannulated screws, pre op, post op, 6 weeks post op, 3 months post op, 6 months post op and clinical images at 6 months follow up.

Mean radiological union time in group A was 12.55 weeks while mean radiological union time in group B was 13.89 weeks.

There was one case of non-union presented in group A while 02 cases of non-union presented in group B. Both the group presented with 01 case each with infection. Screw back-out was noted in 04 cases of group B while none in group A.

DISCUSSION

Femoral neck fractures are typically observed in the elderly, often resulting from minor trauma. Recently, there has been an increase in the incidence of these fractures among young adults, primarily due to high-energy trauma.[7,8] Effective management of femoral neck fractures in young adults necessitates distinguishing between fractures in the young and the elderly. Notable differences include osseous and vascular anatomy, injury mechanisms, associated injuries, fracture patterns, and treatment goals.[9]

The primary aim of treating femoral neck fractures in young adults is to achieve union while preserving the femoral head and preventing osteonecrosis and non-union.[10,11] Arthroplasty is generally not recommended for younger patients due to their age and higher functional demands. These fractures in younger individuals are linked with a higher incidence of osteonecrosis and non-union, with reported osteonecrosis rates ranging from 12% to 86%. Achieving anatomic reduction and stable fixation is crucial in managing femoral neck fractures, although factors such as the timing of surgery and the method of fixation remain subjects of debate.

The most important objective in the treatment of a displaced intracapsular fracture of the hip is to obtain anatomical reduction and stable osseous support of the femoral head on femoral neck. The fixation is used to increase stability by compressing the fracture and then maintaining the reduction by neutralizing forces acting on the hip. The purpose of the fixation screws is to lock the fracture in a position in which the femoral neck gives bone on bone support to the femoral head-neck fragment, to prevent posterior and varus migration of the femoral head, and to be parallel so as to maintain bone-on-bone support as the fracture settles in healing period.

A total of 30 cases of intracapsular fracture neck of femur were treated by three cancellous cannulated screws in inverted triangle pattern by two modalities i.e. combination of fully threaded cancellous cannulated screws and partially threaded cancellous cannulated screws versus partially threaded cancellous cannulated screws.

The age of patients varied from 18 years to 54 years. 73.33% patients were younger than 45 years. Average age of patients in this series was 33.8 years. The mean age in group A was 35.27 years whereas in group B was 32.33 years. The mean age in Yuan et al study where he treated femoral neck fractures in 113 patients with fully threaded cancellous cannulated screws was 48.4 years.[6]

Males in the present study outnumbered the females slightly in the ratio of 1.14:1. This finding in the present study is contrary to various published reports Lee et al and Shina et al which indicate a pre-ponderance of female patients, this being attributed to several factors such as women having a wider pelvis with a tendency to coxa vara, they are less active and more prone to osteoporosis and their life expectancy is more than males.[12,13] In this study vehicular accident as a mode of injury was responsible for major group of patients (56.67%), followed by slip and fall (23.3%). Stromqvist et al found trivial trauma as the most common cause and suggested that in older patients weakening of osseous structures as a result of osteoporosis may expose them to higher risk of fractures.

On assessment of functional outcome during follow-up using HHS, we found superior functional outcome at 6 months in combination of FTCCS and PTCCS group compared to PTCCS group which was statistically significant. For combination of FTCCS and PTCCS group of mean HHS was 88.53 and for PTCCS group mean HHS was 77.69. Mean HHS of present overall study came out to be 83.11.

The average union time in present study in combination of FTCCS and PTCCS Group was 12.55 weeks which was better as compared to PTCCS group where it was 13.89 weeks and is statistically significant. Due to early union time in combination of FTCCS and PTCCS Group in our study, early full weight bearing could be started.

Failure rate as defined by non-union or fixation failure was found to be 20% in combination of FTCCS and PTCCS group with 1 case of non union,1 case of infection and 1 case of screw breakage. In our study failure rate in PTCCS group was 46.6% with 2 cases of non union, 1 case of infection and 4 cases of screw backout. 1 patient was reoperated with subtrochanteric valgus osteotomy with DHS fixation in PTCCS group due to varus collapse.

Both the method of fixation in our study had all the advantages of closed reduction i.e. preservation of fracture hematoma in situ, minimum soft tissue dissection, shorter operating time and less periosteal stripping which helps in early fracture healing and less post-operative infections.

Limitations

The study's sample size was small, and the follow-up period was limited to 6 months. Larger studies with longer follow-up are needed to confirm these findings.

CONCLUSION

The combination of fully threaded and partially threaded cancellous cannulated screws offers superior outcomes

compared to partially threaded screws alone in the treatment of femoral neck fractures. This technique provides better functional results, faster radiological union, and fewer complications, making it a preferable option for managing these fractures in adults.

ACKNOWLEDGEMENTS

Authors would like to thank to all our patients who supported us to be a part of the study. We would also like to appreciate the efforts done by our hospital staff, nurses, our colleagues from the department who helped us in completing this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporos Int. 2006;17(12):1726-33.
2. Gullberg B, Johnell O, Kanis JA. World-wide projections for hip fracture. Osteoporos Int. 1997;7(5):407-13.
3. Garden RS. Low-angle fixation in fractures of the femoral neck. J Bone Joint Surg Br. 1961;43(4):647-63.
4. Gupta RK, Singh N, Singh H. Comparative analysis of proximal femoral locking plate and dynamic hip screw for the treatment of unstable intertrochanteric fractures. J Clin Orthop Trauma. 2020;11(1):10.
5. Parker MJ, Raghavan R, Gurusamy K. Incidence of fracture-healing complications after femoral neck fractures. Clin Orthop Relat Res. 2007;458:175-9.
6. Yuan K, Yang F, Fu K, Zhu DY, Jiang CY, Jin DX, et al. Internal fixation using fully threaded cannulated compression screws for fresh femoral neck fractures in adults. J Orthop Surg Res. 2022;17(1):108.
7. Robinson CM, Court-Brown CM, McQueen MM, Christie J. Hip fractures in adults younger than 50 years of age: Epidemiology and Results. Clin Orthop Relat Res. 1995;312:238-46.
8. Protzman RR, Burkhalter WE. Femoral-neck fractures in young adults. J Bone Joint Surg Am. 1976;58:689-95.
9. Ly TV, Swiontkowski MF. Management of femoral neck fractures in young adults. Indian J Orthop, 2008;42(1):3-12
10. Dedrick DK, Mackenzie JR, Burney RE. Complications of femoral neck fracture in young adults. J Trauma Acute Care Surg. 1986;26(10):932-7.
11. Haidukewych GJ, Rothwell WS, Jacofsky DJ, Torchia ME, Berry DJ. Operative treatment of femoral neck fractures in patients between the ages of fifteen and fifty years. JBJS. 2004;86(8):1711-6.
12. Lee KBL, Howe TS, Chang HC. Cancellous Screw Fixation for Femoral Neck Fractures: One Hundred and Sixteen Patients. Ann Acad Med Singapore. 2004;33:248-51.
13. Shina KH, Honga SH, Han SB. Posterior fully threaded positioning screw prevents femoral neck collapse in Garden I or II femoral neck fractures. Injury. 2020;51:1031-7.

Cite this article as: Kelkar R, Rajput D, Jadaun S, Mahajan P. Comparative study of fully threaded and partially threaded cancellous cannulated screws versus partially threaded cancellous cannulated screws in femoral neck fractures in adults. Int J Res Orthop 2024;10:1008-13.