

A HOSPITAL BASED PROSPECTIVE STUDY TO COMPARE THE OUTCOME OF OSTEOSYNTHESIS V/S HEMIARTHROPLASTY FOR THE TREATMENT OF DISPLACED FEMORAL NECK FRACTURE AT TERTIARY CARE CENTER

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Abstract

Background: Hip fractures are a life-changing event for many patients because they not only enhance the risk of disability but also increase the mortality ratio. In younger people, osteosynthesis is considered an ideal treatment, wherein the elder population arthroplasty is advised to manage fractures. The present study was designed to compare the osteosynthesis and hemiarthroplasty treatment to evaluate the postoperative functional performance of displaced femoral neck fracture at tertiary care center. **Materials & Methods:** A hospital based prospective study done on 50 patient's age between 30-70 years with displaced femoral neck fractures (Garden's III and IV) at department of orthopaedic at Jawahar Lal Nehru Medical College, Ajmer, Rajasthan, India during one year period. Patients divided in two groups; 25 patients in osteosynthesis group and another twenty-five patients in hemiarthroplasty group. Harris's hip score was used to evaluate the clinical status of patients with pain, whereas Palmer and Parker's mobility was used to access mobility. We set 0.05 as a statistically significant level of this research. **Results:** Our study showed that the mean age of patients in the hemiarthroplasty group was reported as 46.57 years, whereas 48.23 years was declared as the mean age of osteosynthesis group patients. We observed a high proportion of left side injury (13/25 and 14/25 respectively) than the right side (12/25 and 11/25 respectively). The average duration of injury until surgery was reported as 3.2 days in the osteosynthesis group, whereas 7.84 days were reported as the mean duration of injury to surgery in the hemiarthroplasty group. In both groups, we observed a steady increase in Harris hip score during follow-up. In the first three postoperative months, the mean score of the hemiarthroplasty group was reported as 74.56 ± 8.523 , which was comparatively high than the osteosynthesis group (65.48 ± 8.426). After six months, this score reached 81.16 ± 7.125 in the hemiarthroplasty group and reached its maximum of 93.15 ± 7.005 . After the first three months, the increment ratio was relatively slow with six ratios, but in the last visit, we observed a sudden increase in score in both groups. **Conclusion:** We concluded that minimizes the risk of reoperation with better outcomes, and patients reflect early mobilization after treating with hemiarthroplasty. It also helps to reduce the mortality ratio.

INTRODUCTION

The incidence of femoral neck fracture among the elderly in the United States is expected to increase dramatically because of the anticipated explosion in the population aged 65 years and older, increased

life expectancy, and the rising incidence of osteoporosis.^[1] Every year estimated 1.6 million people reported hip fractures. These hip fractures cause disability in 5 million people in all parts of the world. Hip fractures are a life-changing event for many patients because they not only enhance the

risk of disability but also increases the mortality ratio.^[2] Recent statistics revealed that in 2050, a total of 50% Asian elder age population will be at risk of femoral neck fractures. This alarming situation demands a quick medical response in terms of surgical management. In younger people, osteosynthesis is considered an ideal treatment, wherein the elder population arthroplasty is advised to manage fractures.^[3] In young patients, even with severe displaced femoral neck fractures, internal fixation is recommended, whereas, in elderly populations, osteosynthesis reported a 20% risk of fixation failure, nonunion, osteonecrosis, and delayed postoperative mobilization.^[4]

The majority of the hip fractures are intracapsular femoral neck fractures which usually handle with surgical intervention. However, in recent five decades, these surgical methods are controversial due to severe complications in the form of reoperation that occurs after internal fixation still there is no best treatment found yet.^[5]

Alternatives include prosthetic replacement (arthroplasty) and internal fixation. Arthroplasty options include hemiarthroplasty, bipolar arthroplasty, and total hip arthroplasty. Proponents of prosthetic replacement argue that replacement of the femoral head eliminates the necessity for revision surgery due to avascular necrosis and nonunion, both of which are serious problems following internal fixation.^[6] Surgeons who favor internal fixation report decreased operative time, blood loss, and risk of mortality because the procedure is quicker and often simpler than arthroplasty.^[7]

The decision to perform internal fixation, unipolar hemiarthroplasty, bipolar hemiarthroplasty, or THA must be based on patient mental status, living arrangement, level of independence and activity, and bone and joint quality. Three meta-analyses observed treatment of displaced femoral neck fractures and also examined the reoperation risk by using different methods of treatment. They found an overall 7-11% risk of reoperation after arthroplasty, whereas internal fixation has a high risk of reoperation (33-45%).^[8-10] The present study was designed to compare the osteosynthesis and hemiarthroplasty treatment to evaluate the postoperative functional performance of displaced femoral neck fracture at tertiary care center.

MATERIALS AND METHODS

A hospital based prospective study done on 50 patient's age between 30-70 years with displaced femoral neck fractures (Garden's III and IV) at department of orthopaedic at Jawahar Lal Nehru Medical College, Ajmer, Rajasthan, India during one-year period.

Inclusion Criteria

1. Patients age between 30-70 years of age.

2. The intervention was internal fixation (with a screw and a side-plate or with multiple screws) compared with arthroplasty (hemiarthroplasty).

Exclusion Criteria

1. Patients with a history of neoplasia, coronary vascular disease.
2. Patients with rheumatoid arthritis, osteomyelitis.
3. All those patients who consume steroids because it may enhance the avascular necrosis incidents.
4. All patients with ipsilateral and contralateral limb fractures and pelvic or spinal fractures.

Methods

A randomized allocation of patients in two groups in the emergency area with the help of chit box method. Patients divided in two groups; 25 patients in osteosynthesis group and another twenty-five patients in hemiarthroplasty group.

During surgery, we used Garden Alignment Index to calculate the reduction. This calculation was done in both postoperative plain radiographs. We considered 160° to 180° reduction in AP image and 170° to 190° in the lateral radiograph as acceptable. In achieving both of these grades, we marked them as an excellent achievement; if the score falls in one range, it was considered good, and if none of them fall within a degree, it was marked as bad.

We used two parameters, including tip apex distance and three-point fixation, to assess the fixation quality. Infratemporal cortical bone of the femoral neck was used to evaluate the three-point fixations. If we acquired an average 10 mm or shorter distance with good three-point fixation to the subchondral boundary of the femoral head, it was graded as excellent, whereas distance longer than 10 mm with good three-point fixation was marked as good. In case of unsatisfactory fixation with a length longer than 10mm, we evaluated it as inferior. Grading of avascular necrosis was done by using Ficat and Arlet staging. Patients with avascular necrosis were diagnosed through MRI and digital radiographs. Cases of displacement, screw loosening or cutout, absence of a bony union, and persistent hip pain were diagnosed as fixation failure. With the help of spinal anesthesia, internal fixation was performed. Patients were placed in a supine position on a fracture table, and reduction was checked through C-Arm/Garden's Alignment Index. We used three 6.5-mm cannulated cancellous screws (CCS) in an inverted triangle fashion to perform internal fixation. In contrast, cemented Hemiarthroplasty was performed in lateral decubitus position (using a posterior approach to the hip) with the help of an uncemented BHU bipolar modular hip device. We used Dorr's criteria to evaluate the need for the uncemented or cemented stem. Patients were allowed to do hamstring strengthening exercises on a postoperative day 14 after suture removal. Patients were followed at 3, 6, and 12 months after surgery.¹¹ Harris's hip score was used to evaluate the clinical status of patients with pain, whereas Palmer and

Parker's mobility was used to access mobility. Implant breakage, screw cut, and nonunion were considered as parameters of osteosynthesis failure. Furthermore, avascular necrosis was also categorized under the operational definition of osteosynthesis failure. At the same time, hemiarthroplasty failure was defined as two or more recurrent dislocation, aseptic loosening, periprosthetic fracture, and infection.

Statistical Analysis

In this research, baseline characteristics and outcome measurements were analyzed through proportion, whereas categorical variables were accessed through mean and standard deviations. Friedman test was applied to the data, and comparison was conducted through the Chi-square formula. We set 0.05 as a statistically significant level of this research.

RESULTS

Our study showed that the mean age of patients in the hemiarthroplasty group was reported as 46.57 years, whereas 48.23 years was declared as the mean age of osteosynthesis group patients. Out of 25 patients in the osteosynthesis group, 14 belonged to the female sex, whereas the male prevalence was reported as 11. Comparatively, in the hemiarthroplasty group, 15 female patients were

recruited with a high ratio of trivial fall incidents. We observed a high proportion of left side injury (13/25 and 14/25 respectively) than the right side (12/25 and 11/25 respectively). In the osteosynthesis group, we watched a 2.65 mean value of the American Society of Anesthesiologists score, whereas the researcher observed a 3.78 mean score of ASA score in the hemiarthroplasty group. The average duration of injury until surgery was reported as 3.2 days in the osteosynthesis group, whereas 7.84 days were reported as the mean duration of injury to surgery in the hemiarthroplasty group. [Table 1]

In both groups, we observed a steady increase in Harris hip score during follow-up. In the first three postoperative months, the mean score of the hemiarthroplasty group was reported as 74.56 ± 8.523 , which was comparatively high than the osteosynthesis group (65.48 ± 8.426). After six months, this score reached 81.16 ± 7.125 in the hemiarthroplasty group and reached its maximum of 93.15 ± 7.005 . After the first three months, the increment ratio was relatively slow with six ratios, but in the last visit, we observed a sudden increase in score in both groups. Regarding Palmer and Parker's mobility score, the hemiarthroplasty group reflected better outcomes than the osteosynthesis group. [Table 2]

Table 1: Patient Demographic information of osteosynthesis group and hemiarthroplasty group

Variables		Osteosynthesis group (N=25)	Hemiarthroplasty group (N=25)	P-value
Age (Mean±SD)		48.23±9.27	46.57±10.38	>0.05
Sex	Male	11	15	>0.05
	Female	14	10	
Mode of injury	Road traffic accident	5	6	>0.05
	Fall from height	16	18	
	Others	4	1	
Site	Right	12	11	>0.05
	Left	13	14	
Average ASA score		2.65	3.78	>0.05
The average duration of injury until surgery		3.2	7.84	<0.05*

Table 2: Comparison of the Harris Hip score and Palmer and Parker mobility score during follow up in the osteosynthesis versus hemiarthroplasty group

Follow up duration	Osteosynthesis group (Mean±SD)	Hemiarthroplasty group (Mean±SD)	P-value
Harris Hip score			
3 months	65.48±8.426	74.56±8.523	<0.05*
6 months	74.19±7.715	81.16±7.125	<0.05*
12 months	77.86±7.254	93.15±7.005	<0.05*
Palmer and Parker mobility score			
3 months	5.42±1.324	6.33±1.275	<0.05*
6 months	6.92±1.187	7.45±1.228	<0.05*
12 months	7.37±0.428	7.75±0.856	<0.05*

DISCUSSION

Proponents of prosthetic replacement argue that replacement of the femoral head eliminates the necessity for revision surgery due to avascular necrosis and nonunion, both of which are serious problems following internal fixation.^[6] Surgeons

who favor internal fixation report decreased operative time, blood loss, and risk of mortality because the procedure is quicker and often simpler than arthroplasty.^[7]

Previous literature and meta-analysis failed to observe any mortality differences among osteosynthesis and arthroplasty groups at mid and long-term follow-up.^[12] Comparatively, arthroplasty

has less chance of displaced fracture than the osteosynthesis group, as described in the previous meta-analysis.^[13]

We observed that Hemi replacement could be a better treatment for the patients under the 40-60 age group with less reoperation. Our study observed high complications ratio and high reoperation probability among the osteosynthesis group. Association of age with a high complication ratio was observed in many previous studies. Age factor can cause the risk of non-union in the neck of femur fracture.^[14] Contrary, the association of osteoporosis with osteosynthesis of neck femur fracture is still debatable.^[15] Comparatively, undisplaced fractures have better bony contact and vascularity than displaced fractures. Still, incidents of nonunion and fixation failure are high among the patients with undisplaced fractures with severe osteoporosis.^[16]

In our study showed that the overall functional performance of the arthroplasty group during follow-up was relatively more excellent than the osteosynthesis group. We observed a higher mean value of Harris hip score and Palmer and Parker mobility score in hemiarthroplasty.

Patients who underwent arthroplasty had greater blood loss than those who were treated with internal fixation (weighted mean difference, 176.4 mL; 95% confidence interval, 132.4 to 220.4, $p < 0.05$). Similarly, the surgical time for the arthroplasties was greater than that for the internal fixation procedures (weighted mean difference, 29.0 minutes; 95% confidence interval, 23.2 to 34.8, $p < 0.05$),^[17] which was similar to our results.

A previous meta-analysis of randomized trials comparing various methods of internal fixation of femoral neck fractures showed nonsignificant differences between implants; however, a specific comparison between compression screw and side-plate fixation and fixation with three or more screws (four trials including a total of 414 patients) with regard to fracture healing complications suggested a trend in favor of compression screw and side-plate fixation (odds ratio, 0.76; 95% confidence interval, 0.47 to 1.25).^[18] Araujo et al,^[19] reported insufficient factors as a predictor of complications, whereas they did not find any association of injury and surgery duration with complications. Many researchers observed a high incidence of nonunion in insufficient reduction, so they prioritize arthroplasty over other treatments to reduce the risk of displaced neck femur fracture.^[20] In our study, we observed low incidents of fixation failure, whereas some patients in the internal fixation (CCS) group reported an anatomical reduction.

Muhammad Rafique Joyo et al,^[21] did a retrospective study designed to compare the osteosynthesis and hemiarthroplasty treatment among the elderly population and evaluate the postoperative functional performance of these two recommended treatments of a displaced femoral neck fracture. They found that in the first three postoperative months, the mean score of the

hemiarthroplasty group was reported as 74.44 ± 8.480 , which was comparatively high than the osteosynthesis group (66.44 ± 8.520). After six months, this score reached 80.12 ± 7.005 in the hemiarthroplasty group and reached its maximum of 92.14 ± 7.125 . After the first three months, the increment ratio was relatively slow with six ratios, but in the last visit, we observed a sudden increase in score in both groups. Regarding Palmer and Parker's mobility score, the hemiarthroplasty group reflected better outcomes than the osteosynthesis group, these results similar with our study.

CONCLUSION

We concluded that minimizes the risk of reoperation with better outcomes, and patients reflect early mobilization after treating with hemiarthroplasty. It also helps to reduce the mortality ratio.

REFERENCES

1. William Macaulay, Michael R Pagnotto, Richard Iorio, Michael A Mont, Khaled J Saleh. Displaced femoral neck fractures in the elderly: hemiarthroplasty versus total hip arthroplasty. *The Journal of the American Academy of Orthopaedic Surgeons*. 2006 May;14(5):287-93.
2. Karagas MR, Lu-Yao GL, Barrett JA, Beach ML, Baron JA. Heterogeneity of hip fracture: Age, race, sex, and geographic patterns of femoral neck and trochanteric fractures among the US elderly. *Am J Epidemiol*. 1996; 143:677- 82.
3. Nicolaides V, Galanakis S, Mavrogenis AF, Sakellariou VI, Papakostas I, Nikolopoulos CE, et al. Arthroplasty versus internal fixation for femoral neck fractures in the elderly. *Strategies Trauma Limb Reconstr* 2011; 6:7-12.
4. Lykke N, Lerud PJ, Strømsøe K, Thorngren KG. Fixation of fractures of the femoral neck. A prospective, randomised trial of three Ullevaal hip screws versus two Hansson hook pins. *J Bone Joint Surg Br*. 2003; 85:426- 30.
5. Wang Y, Tao Y, Hyman ME, Li J, Chen Y. Osteoporosis in China. *Osteoporos Int*. 2009; 20:1651-62.
6. Chua D, Jaglal SB, Schatzker J. An orthopedic surgeon survey on the treatment of displaced femoral neck fracture: opposing views. *Can J Surg* 1997;40: 271-7.
7. Parker MJ, Pryor GA. Internal fixation or arthroplasty for displaced cervical hip fractures in the elderly: a randomised controlled trial of 208 patients. *Acta Orthop Scand* 2000;71: 440-6.
8. Rogmark C, Johnell O. Primary arthroplasty is better than internal fixation of displaced femoral neck fractures: A meta-analysis of 14 randomized studies with 2,289 patients. *Acta Orthop*. 2006; 77:359-67.
9. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta P 3rd, Obremskey W, Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. A meta-analysis. *J Bone Joint Surg Am*. 2003;85-A (9):1673- 81.
10. Masson M, Parker MJ, Fleischer S. Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults. *Cochrane Database Syst Rev*. 2003; 2:CD001708.
11. Singh CK, Khare GN, Deshpande J, Kumar M, Prajapati S. Outcome analysis of osteosynthesis versus hemiarthroplasty for the treatment of displaced femoral neck fracture in young elderly patients of Northern India. *J Orthop Traumatol Rehabil*. 2019; 11:89-94.
12. Jiang J, Yang CH, Lin Q, Yun XD, Xia YY. Does arthroplasty provide better outcomes than internal fixation at mid and long term followup? A Meta-analysis. *Clin Orthop Relat Res*. 2015; 473:2672-9.

13. Parker MJ, White A, Boyle A. Fixation versus hemiarthroplasty for undisplaced intracapsular hip fractures. *Injury*. 2008;39: 791-5.
14. Parker MJ. Prediction of fracture union after internal fixation of intracapsular femoral neck fractures. *Injury*. 1994;25 (Suppl 2): B3-6.
15. Heetveld MJ, Raaymakers EL, van EckSmit BL, van Walsum AD, Luitse JS. Internal fixation for displaced fractures of the femoral neck. Does bone density affect clinical outcome? *J Bone Joint Surg Br*. 2005; 87:367-73.
16. Han SK, Song HS, Kim R, Kang SH. Clinical results of treatment of garden type 1 and 2 femoral neck fractures in patients over 70-year old. *Eur J Trauma Emerg Surg*. 2016;42: 191-6.
17. Y Mohit Bhandari, P.J. Devereaux, Marc F. Swiontkowski, Paul Tornetta Iii, William Obrebskey and Kenneth J. Koval. Internal Fixation Compared with Arthroplasty for Displaced Fractures of the Femoral Neck; A Meta-analysis. *The Journal of Bone & Joint Surgery*. September 2003;85-A (9):1673-81
18. Parker MJ, Blundell C. Choice of implant for internal fixation of femoral neck fractures. Meta-analysis of 25 randomized trials including 4,925 patients. *Acta Orthop Scand*. 1998; 69:138-43.
19. Araujo TP, Guimaraes TM, Andrade-Silva FB, Kojima KE, Silva Jdos S. Influence of time to surgery on the incidence of complications in femoral neck fracture treated with cannulated screws. *Injury* 2014;45 (Suppl 5): S36-9.
20. Yang JJ, Lin LC, Chao KH, Chuang SY, Wu CC, Yeh TT, et al. Risk factors for nonunion in patients with intracapsular femoral neck fractures treated with three cannulated screws placed in either a triangle or an inverted triangle configuration. *J Bone Joint Surg Am*. 2013; 95:61 9.
21. Muhammad Rafique Joyo, Nizam Ahmed, Ghazanfar Ali Shah, Aftab Alam Khanzada, Tanveer Afzal, Niaz Hussain Keerio and Syed Shahid Noo. Outcome Analysis of Osteosynthesis Versus Hemiarthroplasty for the Treatment of Displaced Femoral Neck Fracture in Young Elderly Patient. *JPRI*. 2021;33(33A): 53-59.