

The functional outcome of intracapsular fracture of femoral neck with modular bipolar prosthesis

¹Dr. Rakshith Kumar K, ²Dr. KM Pawan Kumar, ³Dr. Sunil Santhosh

^{1,3}Assistant Professor, Department of Orthopedics, BGS GIMS, Bangalore, Karnataka, India

²Associate Professor, Department of Orthopedics, BGS GIMS, Bangalore, Karnataka, India

Corresponding Author:

Dr. KM Pawan Kumar

Abstract

Fracture neck of femur is a leading cause of hospital admissions in elderly age group. The number of such admissions is on a rise because of increased longevity, osteoporosis and sedentary habits. Conservative methods of treatment is not acceptable because it results in nonunion with unstable hip and limitation of hip movement as well as complications of prolonged immobilization like bed sores, deep vein thrombosis and respiratory infections. The present study was a prospective study of 20 cases of fracture neck of femur admitted to hospital. Cases were selected according to inclusion and exclusion criteria i.e., patients with intra-capsular fracture neck of femur above the age of 50yrs. Medically unfit and patients not willing for surgery were excluded from the study. At the final one year follow up assessment with Harris Hip Score 6 patients (30%) achieved 'Excellent' result, 9 patients (45%) achieved 'Good' result, 2 patients (10%) achieved 'fair' result and 3 patients (15%) achieved 'poor' result. Overall, 75% of the patients achieved an excellent or good result. On enquiry regarding the overall satisfaction with the procedure and return to pre-fracture levels of activity, 8 patients (35%) were 'very satisfied', 12 (50%) were 'fairly satisfied' and 2 (15%) were 'not satisfied'.

Keywords: Fracture neck femur, elderly, hemiarthroplasty, modular bipolar prosthesis, harris hip score

Introduction

Femoral neck fractures, one of the most common injuries in the elderly, have always presented great challenges to orthopaedic surgeons. The prevalence of these fractures has increased with improvement in life expectancy, increased incidence of osteoporosis, poor vision, neuro-muscular incoordination and changes in lifestyle leading to sedentary habits. The incidence of these fractures are expected to double in the next twenty years and triple by the year 2050 ^[1]. The prevalence of the fracture also doubles for each decade of life after the fifth decade ^[2].

With our society becoming more and more a geriatric society, the burden of this fracture and its sequelae continues to be on the rise ^[3]. The goal of treatment of femoral neck fractures is restoration of pre-fracture function without associated morbidity ^[4]. However, treatment of displaced femoral neck fractures in elderly has been controversial. Open reduction and internal fixation of these fractures in elderly has poor outcome including high rate of non-

union and avascular necrosis.

The introduction of a single piece unipolar metal prosthesis by Thomson in 1954 and Austin Moore in 1957, to replace the femoral head ushered in the era of hemiarthroplasty of the hip as a treatment for these fractures. Experience of the last four decades has shown that hip arthroplasty is the best treatment for intracapsular fracture neck of femur in elderly in terms of both short-term and long-term results^[5]. Currently, surgeons can choose between unipolar hemiarthroplasty, bipolar hemiarthroplasty and total hip arthroplasty in the treatment of intracapsular fractures of the neck of femur in the elderly^[6].

The problems encountered with unipolar prostheses (Austin Moore's Prosthesis and Thomson's Prosthesis) were acetabular erosion and loosening of stem giving rise to pain. Bateman in 1974 introduced the Bipolar prosthesis (initially popular as the Bateman's prosthesis) which had mobile head element and had additional head surface to allow movement within the acetabulum. This led to reduced wear of acetabular surface and hence reduced incidence of pain and acetabular protrusion because motion is present between the metal head and the polyethylene socket (inner bearing) as well as between the metallic head and acetabulum (outer bearing). Initially the Bipolar prostheses were of non-modular design followed presently by the modular prostheses. The modular nature of the prosthesis allows for neck length adjustment with interchangeable stems. Future conversion to a total hip replacement is easier with a modular prosthesis because only the acetabular component needs to be added. The advantage of the system is in the modularity obtained from the different sized stems, shell which are available in increments of size allow exact matching of the head and the ease with which the system can be converted to Total hip Arthroplasty without replacing the stems.

Methodology

Patients who have sustained an intracapsular femoral neck fracture and are admitted to Hospital were taken for this study after obtaining their consent. No. of cases: 20 cases.

Inclusion criteria

- Displacement fractures of the intracapsular part of the femoral neck.
- Age of patient > 50 years.
- Failed internal fixation.
- Nonunion, Avascular necrosis of femoral head secondary to fracture of the femoral neck.

Exclusion criteria

- Patients below 50 years.
- Patients with arthritic changes involving acetabulum.
- Pathological fractures.
- Patients not willing for surgery.
- Patients medically unfit for surgery.

Method of collection of data

Patients with fracture neck of femur satisfying the inclusion criteria, who required surgical intervention, were worked up clinically and radiologically. All patients selected for the study were examined according to protocol, associated injuries, if any, were noted and investigations carried out in order to evaluate fitness for anesthesia.

Preoperative protocol

All study patients were put on high tibial skeletal traction or skin traction and 4-7 kilograms of weight applied to maintain the length of the lower limb and facilitate subsequent hemiarthroplasty procedure. Adequate medical management of associated co-morbid conditions like Diabetes Mellitus, Systemic Hypertension, Chronic Obstructive Pulmonary Disease and Heart Diseases were initialized to optimize patient's fitness for anesthesia. An informed written consent for the procedure as per the guidelines of the institution and a consent for inclusion of the patient for the present study was taken. The Involved lower limb from nipple to ankle was prepared on the day before surgery. The peri-operative antibiotic used was Cefuroxime given 750mg 8th hourly intra-venous starting 20 minutes before the procedure and continued for 5-7 days. None of the study patients received Deep Vein Thrombosis (DVT) prophylaxis. Cementation of the femoral stem was used in patients with osteoporosis, poor bone quality, without serious medical comorbid conditions.

Results

Table 1: Peri-Operative Complications

Peri-operative Complication	No. of patients	Percentage
Technical difficulty	5	25
Post-op hypotension	1	5
Intra-op hypotension after putting cement		0

Table 1 depicts that the most commonly encountered peri-operative problem was technical difficulty in insertion of the prosthesis. Postoperative hypotension in 1 patients for which blood transfusion and I.V fluids were given.

Table 2: Early Post-Operative Complications

Complications	No of patients	Percentage
Limb shortening	2	10
Superficial infection	2	10
Dislocation	1	5

Limb shortening (1-1.5cm) was observed in two patients (10%) of old neglected nonunion neck of femur cases who had gross (4-5 cm) preoperative shortening and was managed with shoe heel risers. Superficial infection in the form of a wound dehiscence was seen in one patient who was a diabetic. She was managed by debridement and secondary suturing.

With adequate control of the diabetic status and appropriate antibiotics based on culture-sensitivity results. The infection resolved without any sequelae and there was no late reactivation of the same. One patient had posterior dislocation of prosthesis within one month which was reduced by closed reduction.

Late postoperative complications

One patient had aseptic loosening of implant after one year of surgery.

Duration of hospital stay

The minimum duration of hospital stay amongst the study patients was 14 days and maximum

duration was 35 days with the average being 16 days.

Follow up

All patients were followed up regularly at 6wks, 3 months, 6 months, 9 months and one year. Only the patients who completed a one year follow-up were included in the final analysis. The Harris Hip Scores were recorded at each follow-up visit.

Analysis of the harris hip score

Pain: At the final one year follow-up, 17 patients (85%) had slight, occasional, no compromise in activities while 2 patients (10%) had mild pains with no effect on average activities 1 patient had moderate pain with minimal effect on activities. Our study compares favourably with other standard studies evaluating pain relief with Bipolar Hemiarthroplasty.

Table 3: Comparison of pain scores in present study with standard studies

Name of the study	Percentage
Current study	85
Labelle ^[7]	89.6
Mannarino ^[8]	93
Long and Knight ^[9]	97
Gilberty ^[10]	92

Gait analysis: 18 (90%) of the study patients had slight limp while 2 patients (10%) had a moderate limp. At the end of one year, 12 patients (60%) were found to be ambulating without the help of any support and the remaining 8 patients (40%) needed some support in the form of a cane or walker for long walks. 15(75%) of the study patients could walk an unlimited distance at any given point of time while 3 patients (15%) could walk no more than 1000 meters at a time and 2 patients (10%) could only manage 500 meters at a time.

Activity: On evaluation of the patients ability to climb stairs it was found that 4 patients (20%) were able to climb stairs without the use of any support or railing while the remaining 16 patients (80%) were able to do so with the support of the railing. Since majority of the study patients did not have the habit of using shoes and socks, their ability to trim their toe nails was used as a parameter for evaluation. It was found that 12 patients (60%) were able to trim their toe nails without any difficulty while 10 patients (40%) found it difficult to do so. With regards to the ability to sit for a long duration it was found that 18 (90%) of the study patients were able to sit comfortably on a chair for upto one hour while 2 patients (10%) were not able to sit on a chair for more than half an hour at a stretch. All 22 of the study patients were able to enter and use public transport for commuting.

Evaluation of deformities: None of the 20 study patients had fixed deformities. Two (10) of the study patients, who had gross preoperative shortening (4-5 cm), had persisting post-operative limb shortening by 1 cm.

Range of movements: The average range of movement score of the study patients was 4.83 with 8 patients (40%) having a score of 5 indicating attainment of maximum range of movements.

The progression of the harris hip score

The average Harris Hip Score at 6 weeks after surgery was 58.09 with the highest score being 66.65 and the lowest being 43.83. The average Harris Hip Score at the second follow-up of 3

months was 70.94 with the maximum score being 83.88 and the minimum 58.05. At the third follow-up at 6 months the average Harris Hip Score was 79.88 with the highest being 88.8 and the lowest being 57.45. At nine months the average Harris Hip Score rose to 84.65 the maximum score being 93 and the minimum being 65.8. At the final one year follow-up the average Harris Hip Score was 85.68 with a maximum score of 93 and a minimum score of 65.8. Though a steady increase in the Harris Hip Score was seen in most patients between each follow-up there was not much change between the fourth (nine month) and fifth (one year) follow-up.

Final harris hip score and clinical result

In our study, the final Harris Hip Score as evaluated at one year follow-up averaged 85.68 with the maximum score being 93 and the minimum score being 65.8. Overall, 6 patients (30%) achieved Excellent result, 9 patients (45%) achieved Good result, 2 patients (10%) achieved fair result and 3 patients (15%) achieved poor result. 80% of the patients achieved an excellent or good result.

Table 4: Final Harris Hip Score and Clinical Result

Grade	Harris Hip Score	No of Patients	Percentage
Excellent	90-100	6	30
Good	80-89	9	45
Fair	70-79	2	10
Poor	<70	3	15

Table 5: Comparison of Clinical Result with Standard Studies

Grade	Our Study	Moshein ^[11]	Lestrangle study ^[12]
Excellent	30	40	39.6
Good	45	25	31.2
Fair	10	23	15.3
Poor	15	12	13.9

Table 16 shows the comparison of the present study with standard studies. The results obtained with bipolar hemiarthroplasty in the current study are comparable with standard studies.

Discussion

All the surgeries were performed under spinal or epidural anaesthesia after a thorough preanaesthetic evaluation and preparation. The choice of the type of anesthesia was as per the anesthetist's discretion.

All patients were operated after being put into lateral decubitus position by the posterior approach of Moore. The posterior approach was preferred because of the familiarity of most of the surgeons at our institution with the approach. Though the dislocation rate is reported to be more with the posterior approach, none of our study patients had a post-operative dislocation of the prosthesis. This was because meticulous attention was given to suturing the posterior capsule and the short external rotators and keeping the limb in slight abduction after the procedure. Patients were also explained in the immediate post-operative period about the risk of dislocation with excessive flexion or adduction of the hip ^[13].

The size of the prostheses used, in general matched well with the pre-operatively measured size of the head as assessed by X-rays. In 40% of the cases 45 mm prostheses were used. This was followed in frequency by 43 mm (20%), 47 mm (20%) and 41 mm (10%) prostheses in

the order of frequency. The rasps used for broaching the canal were part of the instrumentation that came with the prosthesis. The advantage was that the rasp corresponded to the exact length and width of the prosthesis which prevented any additional rasping of the canal and subsequent loose seating of the prosthesis. All the prostheses were inserted by press fit technique. Additional augmentation of femoral stem with cement was used in patients with osteoporosis, wide medullary canal and without serious medical comorbidities ^[14].

Technical difficulties encountered with the procedure were most often related to the operating surgeons' learning curve. The main difficulty faced was calculating the angle of the neck osteotomy which in the case of the bipolar prosthesis was more vertical as compared to the traditional Austin Moore's Prosthesis. This resulted in poor seating of the prosthesis collar on the neck and calcar. The second difficulty encountered was difficulty in reduction with proper size prosthesis in old, neglected fracture neck of femur cases because of soft tissue contracture even though after putting on skeletal traction.

In upto 60% of the cases, the blood loss was < 500ml for the whole procedure and in most of the others it was between 500-750ml. Only 15% of cases had a blood loss of >750 ml requiring a blood transfusion. It has been reported in literature that the average blood loss with hip hemiarthroplasty is less in the anterior approach as compared to the posterior approach. Most of the surgeries were completed between 90-120 minutes of starting the procedure. Similar duration of the procedure has been reported by Haidukewych, *et al.* and Drinker, *et al.* Neither the intra-operative blood loss nor the duration of the procedure had any effect on final function ^[15].

Most of our study patients were mobilized in bed on day one of surgery and with weight bearing as tolerated within the 72 hours postoperative period. Delay if at all was due to medical reasons.

Persisting of Limb shortening (1-1.5 cm) was observed in two patients of old neglected fractures who had gross shortening (6-7cm) pre-operatively and effectively managed with heel risers.

Superficial infection in the form of a wound dehiscence was seen in one patient (5%) who was a diabetic. They were managed by debridement and secondary suturing with adequate control of the diabetic status and appropriate antibiotics based on culture-sensitivity results. The infection resolved without any sequelae and there was no late reactivation of the same. Infection rate of 3.9% after bipolar hemiarthroplasty is reported by Nottage, *et al.* None of our study patients had bed sores ^[8].

The minimum duration of hospital stay amongst the study patients was 10 days and maximum duration was 18 days with the average being 14 days. Average hospital stay of 21 days with bipolar hemiarthroplasty has been reported by Lestrage. Drinker and Murray have reported an average hospital stay of 23 days with the same procedure.

One case dislocation of prosthesis within one month and one case had late postoperative complication of aseptic loosening of implant. We are unable to comment upon long term acetabular erosion due to relative short follow up.

All patients were followed up regularly at 6wks, 3 months, 6 months, 9 months and one year. Only the patients who completed a one year follow-up were included in the final analysis. The Harris Hip Scores were recorded at each follow-up visit.

In our study, the final Harris Hip Score as evaluated at one year follow-up averaged 85.68 with the maximum score being 93 and the minimum score being 65.8. Overall, 7 patients (35%) achieved Excellent result, 9 patients (45%) achieved Good result, 2 patients (10%) achieved fair result and 2 patients (10%) achieved poor result. Overall, 80% of the patients achieved an excellent or good result. Our results are comparable with standard studies of bipolar hemiarthroplasty performed for fracture neck femur ^[6].

All study patients were also evaluated with their level of satisfaction with the procedure and

their ability to return to pre-fracture level of activity. 7 patients (35%) were 'very satisfied', 10 (50%) were 'fairly satisfied' and 3 (15%) were 'not satisfied'. The level of satisfaction being a subjective assessment did not correlate well with the Harris Hip Score which was an objective assessment.

Our study is not without its own shortcomings. Firstly, our duration of follow-up of one year is very less in assessing the longevity and functional endurance of the prosthesis used and hence come to definitive conclusions. Secondly, we have not evaluated the degree of intra-prosthetic motion at the inner bearing at each follow-up. Such studies are complicated and beyond the facilities available at our institution. Such studies are indicated because there are claims that the motion at the inner bearing reduces over time and most prostheses behave as unipolar prostheses over a period of time.

Conclusion

Modular Bipolar hemiarthroplasty for fractures of the femoral neck provides better range of movement, freedom from pain and more rapid return to unassisted activity with an acceptable complication rate.

The end functional results depend on the age of the patient, associated co-morbidity and optimum post-operative rehabilitation.

References

1. Schmidt AH, Swiontkowski MF. Femoral neck fractures. *Orthop Clin North Am.* 2002;33(1):97-111.
2. Leighton RK. Fractures of the Neck of the Femur. In: Rockwood and Green's fracture in Adults. Ed: Bucholz RW, Heckman JD, Court-Brown CM. 6th edn. Philadelphia, Lippincott Williams & Wilkins, 2006, 1753-1791.
3. Swiontkowski MF. Intracapsular fractures of the hip. *J Bone Joint Surg Am* 1994;76:129-138.
4. Ioro R, Healy WL, Lemos DW, Appleby D, Lucchesi C, Saleh KJ, *et al.* Displaced femoral fractures in the elderly: outcomes and cost effectiveness. *Clin Orthop.* 2001;383:229-242.
5. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta P, Obremskey W, Koval KJ, *et al.* Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. *J Bone Joint Surg Am.* 2003;85:1673-1681.
6. Ioro R, Schwartz B, Macaulay W, Teeney SM, Healey WL, York S. Surgical treatment of displaced femoral neck fractures in the elderly: a survey of the American Association of Hip and Knee Surgeons. *J Arthroplasty.* 2006;21(8):1124-1133.
7. LaBelle LW, Colwill JC, Swanson AB. Bateman bipolar hip arthroplasty for femoral neck fractures-A five to ten year follow up study. *Clin Orthop.* 1990;251:20-25.
8. Myrya SKS, Thukral R, Chandeeep Singh. Prosthetic replacement in femoral neck Fracture in elderly; Results and Review of the literature. 2008;42(1):61-67.
9. Leighton RK, Schmidt AH, Collier P, Trask K. Advances in the treatment of intracapsular hip fractures in the elderly. *Injury.* 2007;38:S24-34.
10. Griffin JB. The calcar femorale redefined. *Clin Orthop.* 1982;164:211-214.
11. Moshein J, Alter AH, Elconin KB, Adams WW. Transcervical fractures of the hip treated with the bateman bipolar prosthesis. *Clin Orthop.* 1990;251:48-53.
12. Lestranger NR. Bipolar arthroplasty for 496 hip fractures. *Clin Orthop.* 1990;251:7-18.
13. Klestil T, Biedermann R, Kruger A, Gfoller P, Schmoelz W, Rangger C, *et al.* Cementless hemiarthroplasty in femoral neck fractures: Evaluation of Clinical results and measurement of migration by EBRA-FCA. *Arch Orthop Trauma Surg.* 2006;126:380-386.

14. Bezwada HP, Shah AJ, Harding SH, Baker J, Johanson NA, Mont MA. Cementless bipolar hemiarthroplasty for displaced femoral Neck fractures in the elderly. *J Arthroplasty*. 2004;19:73-77.
15. Khan RJ, MacDowell A, Crossman P, Keene GS. Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip-a systematic review. *Injury*. 2002 Jan;33(1):13-17.