Original Research Article

# A clinical study to evaluate the functional outcome of fracture of femoral neck with bipolar prosthesis

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## Abstract

**Background and Objectives:** Hip fractures are located in the proximal femur and can involve the femoral neck, trochanteric and subtrochanteric regions. The two most common types are trochanteric (intertrochanteric) and femoral neck (cervical) fractures (FNF). Fractures that extendfrom the trochanteric area and distally within 5 cm below the lesser trochanter are named subtrochanteric fractures. These fractures are a common sight at orthopaedic departments around the world and are a common cause of misery and mortality in the aging population. **Methods:** 23 patients aged more than 50years, who sustained fracture neck of femur, were treated by hemiarthroplasty using Bipolar prosthesis, in Dr VRK Womens Medical College & SIMS Hyderabad between October 2020 to September 2021 The patients were followed up for a minimum of one year. Short term functional outcome was analyzed using the Harris hip scoring system. **Results:** In our study the patients were in the age group of 51 to 78 years with the mean age of 59 years. 53.21% of the patients were females with 60.79% of all cases sustaining the fracture following a trivial trauma. The functional outcome using the Harris hip score was excellent in 16%, Good in 60%, fair in 16 %and poor in 8% of cases. So, 72% of the patients achieved an excellent or good result. **Conclusion:** The outcome of the hemiarthroplasty depends on various pre-operative factors like age of the patient, type of prosthesis, associated co-morbid conditions. The bipolar prosthesis has allowed freedom from pain, early weight bearing, early rehabilitation. It also allowed squatting and greater range of movements.

**Key words:** Femoral Neck Fractures; Bipolar Prosthesis; Hemiarthrioplasty; Harris hip score



## Introduction

Hip fractures are located in the proximal femur and can involve the femoral neck, trochanteric and subtrochanteric regions. The two most common types are trochanteric (intertrochanteric) and femoral neck (cervical) fractures (FNF). Fractures that extendfrom the trochanteric area and distally within 5 cm below the lesser trochanter are named subtrochanteric fractures. These fractures are a common sight at orthopaedic departments around the world and are a common cause of misery and mortality in the aging population. The term "hip fracture" excludes fractures located at the acetabulum, femoral shaft or the femoral head due to their different clinical presentation, operative treatment and rehabilitation.

The FNF was first described by Sir Astley Cooper (1768-1841) in 1822. The definition of "femoral neck fracture" is most often used to describe an intracapsular fracture thereby excluding fractures through the lateral or basocervical region. The first to argue for operative treatment was a German surgeon Mr B. von Langenbeck (1810- 1887) while the pioneer who first implemented surgical treatment was Professor J. Nicolaysen (1831-1911), at Rikshospitalet in Oslo, Norway. Nicolaysen published his novel technique and the results of closed nailing of FNF for his series of 21 patients. Hip fractures are a major public health problem in many countries. The number of worldwide hip fractures per year is estimated to be 2.6 million by the year 2025, and. 4.5 million by the year 2050. Femur neck fractures frequently occur in elderly patients, more commonly in women than in men and are usually due to simple low-energy trauma. A considerable reduction in bone strength and tendency to fall are the two most common risk factors for femur neck fractures in the elderly.

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Non-displaced femur neck fractures are commonly treated by internal fixation (IF). Treatment of displaced femur neck fractures seems to vary mainly with the age of the patient. Most surgeons prefer to perform reduction and IF in displaced fractures of patients under the age of 60years. Hemiarthroplasty (HA), or less commonly, total hip arthroplasty (THA) is usually the choice of treatment in patients over the age of 60 years. There is no universally accepted agreement on the type of replacement arthroplasty, type of femoral stem fixation, type of the replaced femoral head and configuration of the femoral stem.

In this clinical case series, we aimed to report our initial experience with the use of cementless, rectangular, dual-taper, straight femoral stem (Zweymüller stem) with bipolar head prosthesis in intracapsular femur neck fractures among elderly patients. We assessed the effect of several preoperative and intraoperative factors such as age, gender, laterality, fracture type and surgical approach on the clinical results and mortality rates.

The purpose of the current study is to assess the functional and quality of life scores in patients treated with bipolar prosthesis for intracapsular fracture of the femoral neck.

## Aim & Objectives

- To study the functional outcome of fracture of femoral neck with bipolarprosthesis.
- To study the end results of bipolar prosthesis with respect to pain, mobilityand stability.
- To study the complications of bipolar hemiarthroplasty

## Meterials and methods

### Source of Data

Patients having fracture neck of femur, who satisfied the inclusion criteria and admitted in Dr VRK Womens Medical College & SIMS, Hyderabad were included in the present study.

**Method of collection of data**

**Study design**

This study proposed to include patients with fracture neck of femur requiring surgical interventions, after taking their consent, analysed clinically and radiologically. Required investigations were done to get the fitness for surgery.

**Sample size**

Cases satisfying the inclusion criteria admitted in Dr VRK Womens Medical College &SIMS, Hyderabad during the study period of October 2020 to September 2021 included. A total of 23 cases studied without any sampling procedure.

**Inclusion criteria**

Patients with

- Displaced fractures of the intracapsular part of the femoral neck
- Age of the patient >50 years
- Failed internal fixation
- Avascular necrosis of femoral head secondary to fracture neck of femur

**Exclusion criteria**

1. Skeletally Immature.
2. Patient medically unfit for surgery
3. Patient not willing for surgery
4. Age of the patient <50 years

**Period of follow-up**

All patients were followed up for a period of 1 year at regular intervals.

**Preoperative protocol**

Patients were admitted through outpatient and from casualty. Diagnosis confirmed by radiograph. 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 anaesthesia. An informed written consent for the procedure as per the guidelinesof the institution and consent for inclusion of the patient for the present study was taken. All patients were put on high tibial skeletal traction. The involved lower limb was prepared from nipple to ankle on the day before surgery. The per-operative antibiotic used was Ceftriaxon given 1 g intra-venous at the induction of anaesthesia and continued for 7 days postoperatively.

**Description of the implant**

It consists of head, neck and stem. The stem allows optimal fit in the femur. Collar of femoral stem sits over the calcar femorale, the strongest portion of bone and thus prevents subsidence. Stems are Corundum blasted stem for uncemented fixation (for increased osseous integration).

Material: Stainless Steel AIS 316 LStem size:

8mm x 150 mm (small) size bipolar, 37 mm to 41 mm 8.5mm x 165 mm (med.) size bipolar 43 mm to 47 mm9 mm x170 mm (large) size bipolar 49 mm to 53 mm Degree of device: 135 degrees

**Fig 1: Bipolar Prosthesis**

**Surgical procedure**

All cases were done under regional anesthesia which included spinal or epidural anaesthesia or combined. The choice of the anaesthesia was according to the discretion of the anaesthetist.

**Surgical Approach**

Moore's posterior approach to the hip[138]

**Follow up**

Regular follow up of all cases was done at 6 weeks, 3 months, 6 months, 9 months and one year. At each follow up, patients were evaluated clinically using the Harris Hip Score and radiologically with appropriate X-rays.

**Results**

During the period between October 2020 to September 2021 23 patients were treated with hemiarthroplasty with Bipolar prosthesis for fracture neck of femur at the Dr VRK Womens Medical College & SIMS, Hyderabad..

Data was collected based on detailed patient evaluation with respect to history, clinical examination and radiological examination. The postoperative evaluation was done both clinically and radiologically. Out of the 23 cases, all patients were available for follow up till one year which was taken as a basic pre-requisite for inclusion in thestudy

**Table 1: Age distribution**

| Age | Frequency | Percent % |
|---|---|---|
| **50-60** | 15 | 60% |
| **61-70** | 4 | 16% |
| **>70** | 6 | 24% |

Table-1 shows the age distribution pattern of the patients. The average age was noted to be 59 years. The youngest patient in the study was 51 years and the oldest was 78 years.

**Table 2: Sex Distribution**

| Sex | Frequency | Percent % |
|---|---|---|
| Male | 12 | 48% |
| Female | 13 | 52% |

Table-2 shows the sex distribution pattern of the study patients. Female patients werefound to be slightly higher than Male patients.

**Table 3: Laterality**

| Side | Frequency | Percent % |
|---|---|---|
| Right | 9 | 36% |
| Left | 16 | 64% |

Table–3 shows the laterality pattern of all the study patients with left side beingaffected in 64% of the patients.

**Table 4: Mode Of Injury**

| | Frequency | Percent% |
|---|---|---|
| Direct | 10 | 40% |
| Indirect | 15 | 60% |

Table-4 depicts the mode of injury causing the fracture of the neck of femur. 60% ofthe patients sustained the injury by Indirect mode and 40% due to Direct Injury.

**Table 5: Time Of Presentation**

| Hrs & Wk | Frequency | Percent % |
|---|---|---|
| <24hrs | 4 | 16% |
| 24hrs-72hrs | 3 | 12% |
| 72hrs-1wk | 3 | 12% |
| >1wk | 15 | 60% |

Table - 5 shows the time of presentation after injury, 16% presented within 24 hours, 12% presented between 24 hrs - 72 hrs, 12% presented between 72 hrs – 1 wk and 60% patients presented after a delay of 1 week.

**Table 6: Type Of Fracture**

| Type of Fractures | Frequency | Percent % |
|---|---|---|
| Transcervical (TC) | 20 | 80% |
| Subcapital (SC) | 5 | 20% |
| Basicervical (BC) | 0 | 0 |

Table – 6 shows that the majority of study patients (80%) had a trans-cervical type offracture with only four patients (20%) having sub-capital fractures.

**Table 7: Systemic Co-Morbidity**

| | Frequency | Percent % |
|---|---|---|
| Hypertension (HTN) | 4 | 16% |
| DM | 1 | 4% |
| HTN & DM | 1 | 4% |
| Jaundice | 2 | 8% |
| Heart Disease | 1 | 4% |
| Normal | 15 | 60% |

Table 7 depicts that 16% of study patients had Hypertension, 4% had DM, 4.% had both hypertension and DM , 8% had Jaundice and 4% had HeartDisease.

**Timing of surgery**

All the study patients were taken up for the surgical procedure between the 3rd and 30th day after the admission, the average delay to surgery being 10 days.

**Type of anaesthesia, position and approach**

All the surgeries were performed under spinal or epidural anaesthesia after a thorough preanaesthetic evaluation and preparation. The choice of the type of anaesthesia was as per the anaesthetist‘s discretion and all patients were administered spinal anaesthesia or combined epidural and spinal anaesthesia. All patients were operated after being put into lateral decubitus position with affected side up, by the posterior approach of Moore.

**Table 8: Size Of Prosthesis**

| Bipolar Head Size | Frequency | Percent % |
|---|---|---|
| 39mm | 1 | 4% |
| 41mm | 3 | 12% |
| 43mm | 5 | 20% |
| 45mm | 9 | 36% |
| 47mm | 4 | 16% |
| 49mm | 3 | 12% |

Table -8 depicts that the most commonly used prosthesis size was 45mm followed by 43mm. The mean prosthesis size was 45 mm.

**Table 9: Type Of Prosthesis**

| Type of Prosthesis | No |
|---|---|
| Uncemented | 23 |
| Cemented | 2 |

Table 9 shows that most common prosthesis used in the study was uncementedbipolar prosthesis, in 23 patients uncemented prosthesis was used and in 2 patients cemented prosthesis was used.

**Table 10: Blood Loss**

| Millitres | Frequency | Percent% |
|---|---|---|
| **<500ml** | 9 | 36% |
| **500ml-750ml** | 13 | 52% |
| **>750ml** | 4 | 16% |

Table-10 depicts the average blood loss during the procedure. Majority of the patientshad a blood loss of below 750 ml.

**Table 11: Per Operative Complications**

| | Frequency | Percent% |
|---|---|---|
| **Hypotension** | 3 | 12% |
| **Peri Prosthetic Fracture** | 1 | 4% |
| **Normal** | 21 | 84% |

Table 11 depicts that the most commonly encountered peri-operative problem was hypotension. This was managed by blood transfusion, administration of intravenous Dopamine in 1 case along with colloids and crystalloids. There was one case of peri- prosthetic fracture. This was Vancouver Type B1. The patient was managed conservatively with delayed weight bearing.

**Table 12: Early Complication**

| | Frequency | Percent% |
|---|---|---|
| **Superficial Infection** | 3 | 12% |
| **DVT** | 1 | 4% |
| **Normal** | 21 | 84% |

Superficial infection in the form of a wound dehiscence was seen in three patients, one of who was a diabetic. All patients were managed by debridement and secondary suturing with adequate control of the diabetic status and appropriate intravenous antibiotics based on culture-sensitivity results. The infection resolved without any sequelae in all cases and there was no late reactivation of the same. One patient had a DVT post-operatively, confirmed by colour Doppler. This was managed with low-molecular weight heparin (Enoxaparin 40 mg twice daily subcutaneously) for 5 days followed by oral anticoagulants (Warfarin 5 mg, titrated as per PT-INR values).

**Late postoperative complications**

There were no late postoperative complications like loosening, dislocation, erosion, calcar resorption, protrusio acetabuli or periprosthetic fracture.

**Duration of hospital stay**

The minimum duration of hospital stay amongst the study patients was 13 days and maximum duration was 42 days with the average being 23 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, 20 patients (80%) had slight, occasional, no compromise in activities while 5 patients (20%) had mild pains with no effect on average activities. No patient had pain of such severity as to limit his/her activities.

**Gait Analysis**

20 (80%) of the study patients had slight limp while 5 patients (20%) had a moderate limp. At the end of one year, 15 patients (60%) were found to be ambulating without the help of any support and the remaining 10 patients (40%) needed some support in the form of a cane or walker for long walks. 15 (60%) of the study patients could walk an unlimited distance at any given point of time while 8 patients (32%) could walk no more than 1000 meters at a time and 2 patients (5%) could only manage 500 meters at a time.

**Activity**

On evaluation of the patients ability to climb stairs it was found that 6 patients (24 %) were able to climb stairs without the use of any support or railing while the remaining 21 patients (84%) were able to do so with the support of the railing. With regards to the ability to sit for a long duration it was found that 20 (80%) of the study patients were able to sit comfortably on a chair for up to one hour while 3 patients (12%) were not able to sit on a chair for more than half an hour at a stretch. All 25 of the study patients were able to enter and use public transport for commuting.

**Evaluation of deformities**

None of the 25 study patients had fixed deformities. Two (8.69%) of the study patients had post-operative limb shortening by 1 cm.

**Range of Movements**

The average range of movement score of the study patients was 4.8 with 8 patients (32%) having a score of 5 indicating attainment of maximum range of movements.

**Progression Of The Harris Hip Score**

The average Harris Hip Score at 6 weeks after surgery was 53.74 with the highest score being 70 and the lowest being 40. The average Harris Hip Score at the second follow-up of 3 months was 63.35 with the maximum score being 80 and the minimum 50. At the third follow-up at 6 months the average Harris Hip Score was 71.49 with the highest being 88 and the lowest being 60. At nine months the average Harris Hip Score rose to 77.19 the maximum score being 92 and the minimum being

At the final one year follow-up the average Harris Hip Score was 83.4 with a maximum score of 96 and a minimum score of 67. 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.

**Table 13: Final Harris Hip Score And Clinical Result**

| Grade | Harris HipScore | Frequency | Percent % |
|---|---|---|---|
| **Excellent** | 90-100 | 4 | 16% |
| **Good** | 80-89 | 15 | 60% |
| **Fair** | 70-79 | 4 | 16% |
| **Poor** | <70 | 2 | 8% |

**Final harris hip score and clinical result**

In our study, the final Harris Hip Score as evaluated at one year follow-up averaged 83.3 with the maximum score being 96 and the minimum score being 67. Overall, 4 patients (16%) achieved Excellent result, 15 patients (60%) achieved Good result, 4 patients (16%) achieved fair result and 2 patients (8%) achieved poor result. 86% of the patients achieved an excellent or good result.

**Discussion**

The aim of replacement surgery in fracture neck femur is early return to daily activities and pre fall levels. This is particularly applicable to the elderly age group where complications related to prolonged immobilization need to be prevented.

The mean age of the patients in the present study was 59 years. The aim of assessing age is to estimate the patient's mean survival time and their ability to comply with rehabilitation protocol. Some authors have advocated hemiarthroplasty in patients over 70 years of age[124,139]. The average age of patients in our series is lower to those reported in Western literature viz. - 77.2 years[8], 81 years[9], 79years[10].

Indian population as compared with the Western population with hip fractures. These patients have an increased mortality rate during the first year after fracture but after one year the mortality rate is comparable to that of the general population.

In present study females (52%) were slightly higher than males (48%). In other standard studies[11,12], also had a higher number of females. This is due to the lower peak bone mass and postmenopausal bone loss in women[13]. Womenhave a skeleton that adapts less well to ageing by periosteal apposition. More women have bone size and volumetric BMD reduced to below a critical level at which the loads on the bone are near to, or greater than, the bone's structural ability to tolerate them[14].

The left side (64%) was more commonly affected than the right. There is less subject of discussion in very few studies. Boyd and Salvatore had 55% patients with left side fractures in their series. The left side was involved in 55.4% patients in Majority in our study patients (60%) sustained the injury due to a trivial trauma (i.e. Indirect Injury) like slipping. This is in accordance with the series by Evans (1973)[15], Ingalhikar (1987)[16]. Falls are a common event, particularly among the elderly. Modest changes in balance function have been described in fit older subjects as a result of normal aging. Subtle deficits in sensory systems, attention, and motor reaction time contribute to the risk, and environmental hazards abound. Epidemiologic studies have identified a number of risk factors for this like weakness, balance deficit, gait disorder, visual deficit, etc[13].

Most of the patients (60%) presented to ours 1 week after the injury. Other patients (24%) presented between 24hrs to 1 week. Only 4 patients (16%) presented within 24hrs. This is a common scenario in our country where patients present to a doctor much late given the seriousness of the condition or seek treatment from osteopaths and then come to an orthopaedician only after no relief is obtained. Difficulty in post-operative rehabilitation was particularly noticed in the subset who presented after 1 week.

All of our study patients had a displaced fracture of the neck of femur. Majority of the patients (80%) had Transcervical Fracture. Only 5 patients (20%) had Subcapital Type. The anatomical type of fracture and the displacement are not considered when choosing hemiarthroplasty for management of fracture neck femur. This decision is based on the age of the patient and time since injury[17].

Hypertension was found to be the most common co-morbidity seen in 16% of the study patients. Another 4 % patients had both HTN and DM. One patient had Type II Diabetes and was on oral hypoglycemic agents. Patient was shifted to insulin pre-operatively and blood sugar values optimized before taking up for surgery. Two patient had Jaundice, out of that one had Congenital hyperbilirubinemia whose pre operative and post operative period were uneventful and another patient had jaundice because of alcoholic liver disease, he was evaluated thoroughly and serial monitoring of liver function test was done before surgery. One patient had sick sinus syndrome for which patient was strictly monitored intra-operatively with pacemaker support. It was observed that the post-operative rehabilitation of patients was significantly affected by the presence of the above co-morbidities. This also had an effect on the final functional result of the procedure. Similar observations have been made by Koval et al and Bath[18].

In 9 cases, the blood loss was less than 500ml for the whole procedure and in 13 others it was between 500ml to 750 ml. Only 4 cases % had blood loss of >750 ml leading to hypotension requiring 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[9].

Superficial infection in the form of a wound dehiscence was seen in 3 patient (12%) one of them was diabetic. Patients were managed by debridement and secondary suturing and appropriate intravenous antibiotics based on culture-sensitivity results and adequate control of the blood glucose level for diabetic patient. The infection resolved without any sequelae. Infection rates reported in other series have ranged from 4.5% by D'Arcy[9].

There was no case of any cement related complication like hypotension, pulmonary embolism or cardiac arrest. The rationale for avoiding the use of cement comes from previous studies linking cementing to perioperative death and cardiopulmonary complications[19].

The minimum duration of hospital stay amongst the study patients was 13daysand maximum duration was 42days with the average being 23 days, because patient required optimization of the co morbid conditions. Average hospital stay of 18 days reported by Han et al[20].

In our study post-operative follow up none had loosening of implant, dislocation, erosion, subsidence, protrusion acetabuli. 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, and one year. Only the patients who completed a minimum 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 83.3 with the maximum score being 96 and the minimum score being 67. Overall, 4 patients (16%) achieved Excellent result, 15 patients (60%) achieved

Good result, 4 patients (16%) achieved fair result and 2 patients (8%) achieved poor result. 80% of the patients achieved an excellent or good result.

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. 9 patients (36%) were =very satisfied', 11 (44%) were =fairly satisfied'and 5 (20%)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.

There was one patient (4%) with peri prosthetic fracture. There were no errors in selecting prosthesis of the correct head size. These results are less compared to those of Weinrauch P. where the author had studied intra-operative errors during Austin Moore hemiarthroplasty (uncemented) in 147 patients. In that study, there was inadequate length of neck remnant in 27% cases, inadequate calcar seating in 22% cases and intra operative periprosthetic fracture in 14% cases[21].

**Conclusion**

The outcome of the hemiarthroplasty depends on various pre-operative factors like age of the patient, type of prosthesis, associated co-morbid conditions.

The bipolar prosthesis has allowed freedom from pain, early weight bearing, early rehabilitation. It also allowed squatting and greater range of movements.

As compared to other standard studies of AMP hemiarthroplasty, our study with Bipolar being better in functional aspect and showed lower

incidence of complication and can be used for comparatively younger age group considering longer life span of Bipolar prosthesis. There was no incidence of stem loosening or acetabular erosion in our study asstudy period was short hence long term follow up needed.

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