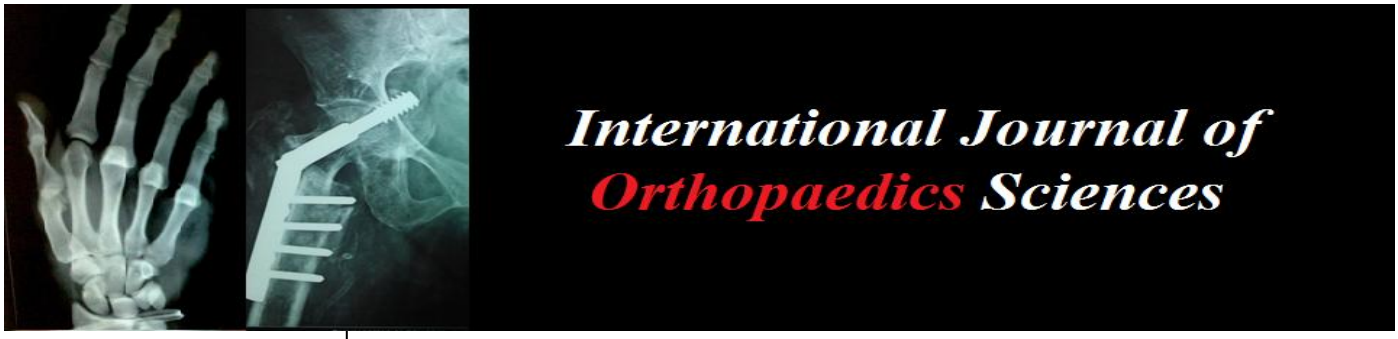

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A study of surgical outcome with cemented bipolar prosthesis in fracture neck of femur in elderly patients: original article

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Abstract
Introduction: A hip fracture is a break that occurs in the upper part of the femur and the symptoms may include pain around the hip particularly with movement and shortening of the leg. Usually the person cannot walk. They most often occur as a result of a fall. Risk factors include osteoporosis, taking many medications, alcohol use, and metastatic cancer. Intracapsular fractures of the proximal femur account for a major share in the community and have a tremendous effect on both the health care system and society in general. Despite the marked improvements in surgical interventions, treatment of fracture neck of femur since then remains a debate, especially in the elderly.
Materials and methods: Twenty cases of fracture neck of femur in elderly patients of age 60 years and above treated by hemi-arthroplasty using cemented bipolar prosthesis. Inclusion criteria employed was 1) Intra-capsular fracture neck of femur in patients of age 60 years and above, 2) Un-united fracture neck of femur, 3) Fracture neck of femur with avascular necrosis.
Results: At the end of 6 months after surgery, the functional results are analysed in 20 cases. All patients were in the age group of 60 to 82 years with mean average age of 75 years. 35% of the patients had a Garden type III fracture radiologically, while 60% had a Garden type IV and 1 patient was diagnosed with a non union fracture neck of femur. In 75% percent cases the mode of injury was trivial trauma. Associated medical conditions like hypertension, diabetes mellitus and heart disease or a combination of these were seen in 11 patients. Some of the complications observed were superficial infection of the wound or a limb length discrepancy, following the procedure. There were 50% excellent results and 30% good results.
Conclusion: The success of hemiarthroplasty no doubt depends on preoperative planning and proper attention to surgical details to achieve the optimum biomechanical stability. This study showed that the final functional outcomes were dependent on the presence of associated co-morbidities and the optimum post operative rehabilitation of the patient following surgery.

Keywords: Bipolar, hemiarthroplasty, femoral neck fracture, hip fracture, trauma

Introduction
Intracapsular fractures of the proximal femur account for a major share in the community and have a tremendous effect on both the health care system and society in general. Despite the marked improvements in surgical interventions, treatment of fracture neck of femur since then remains a debate, especially in the elderly. Some studies say that Osteosynthesis with open reduction and internal fixation have shown good results, but then, at the same time, has high rates of revision surgeries due to the problems of non union of the fracture, arthritis and avascular necrosis of the femoral head [1]. Prosthetic replacement of the femoral head with Austin Moore or Thompson prosthesis hemi-arthroplasty has undoubtedly played an important role in the treatment of these fractures, especially in those who require immediate mobilization with full weight bearing [2, 3]. However acetabular erosion is a significant long term complication of one piece hemiarthroplasty implants and is particularly common in active individuals [4]. To overcome these problems, cemented bipolar hemiarthroplasty has emerged as a good option for - Active elderly patients who need a stable fixation so as to return to the pre fracture level of activity and also an independent ambulation- Patients who had developed

non union of the fracture or avascular necrosis of the femoral head with Osteosynthesis [5]. 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. Bipolar prosthesis is slowly replacing the conventional unipolar prosthesis in the ever increasing segment of 'active elderly' because of its superior benefits and its attractive pricing [6, 7]. Its advantages over unipolar endoprosthesis are higher percentage of satisfactory results, less post-operative pain, greater range of movements, more rapid return to unassisted activity and reduced incidence of acetabular erosion [7, 8].

Aim of the study

Aims of this study are 1) to study the post operative time required for mobilization of the patient, 2) to study the complications related to this procedure, 3) to study the quality of life after hemi-arthroplasty using cemented bipolar endoprosthesis, 4) to study the functional outcome of fracture neck of femur treated with bipolar hemiarthroplasty.

Materials and Methods

This is a prospective study involving patients who have sustained an intra-capsular femoral neck fracture and are admitted for treatment. Total number of cases was 20.Inclusion criteria employed was 1) Intracapsular fracture neck of femur in patients of age 60 years and above, 2) Ununited fracture neck of femur, 3) Fracture neck of femur with avascular necrosis. Exclusion criteria employed in this study was-1) Patients below 60 years, 2) Avascular necrosis of femoral head with acetabular changes, 3) Pathological fractures of neck of femur, 4) Patients medically unfit for surgery. Once the patient was admitted to the hospital, both clinical and radiological investigations were carried out and all essential information of those who fulfilled the inclusion criteria was recorded in the proforma prepared for this study. Associated injuries, if any, were noted and the necessary investigations were carried out in order to evaluate fitness for anesthesia and the surgical procedure. All study patients were put on skin traction and 3-5kgs of weight applied to maintain the length of the lower limb and facilitate subsequent hemi-arthroplasty procedure. Adequate medical management of associated co-morbid conditions like Diabetes Mellitus, Systemic Hypertension 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 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 Cefperazone in combination with Sulbactam 8th hourly intra-venous starting 20 minutes before the procedure and continued for 5-7 days. All patients received Deep Vein Thrombosis (DVT) prophylaxis using low molecular weight heparins (Inj. Enoxaparin, 1mg/kg body weight), twice daily, from the day of admission and was stopped 12 hours prior to the surgery.

All cases were done under regional anesthesia which included spinal or epidural anesthesia. The choice of the anesthesia was according to the discretion of the anesthetist. Surgical Approach used was Moore's posterior approach to the hip.

All the patients who were operated were kept in supine position with the involved lower limb in 20-30^0 abduction using an abduction pillow. Regular half hour TPR and blood pressure chart was maintained for initial 6 hours followed by two hourly monitoring for 24 hours. The drain was removed between 24-48 hours depending on the amount of collection. Peri-operative prophylaxis of Inj. Cefperazone in combination with Sulbactam was administered 8th hourly intra-venously and was continued for the first 5-7 days, followed by administration of oral antibiotics. Deep vein thrombosis prophylaxis using Inj. Enoxparin 1mg/kg body weight was continued for 5 days, the first dose starting 24 hours following surgery. The wound was inspected at the time of drain removal and at the time of suture removal. If however, there was soakage of the dressing or if patient had high fever the wound was inspected accordingly.

All the patients were advised to sit with back rest from the 2nd postoperative day and advised deep breathing exercises. Mobilization with a walker was started between third and fifth post-operative day. Patients were initially advised toe-touch down weight bearing with the help of a walker and later advised progress to full weight bearing with the aid of a walker as tolerated. The sutures were removed between 10 - 14 days. The study patients were discharged from the hospital on an average of 21 days, the maximum hospital stay being 32 days and the minimum being 10 days. The patients were examined before discharge for the evidence of any infection at operated site. Active hip and quadriceps exercises for the knee were advised for a period of 6 weeks. Regular follow up of all cases was done at 6 weeks, 3 months and at the end of 6 months. At each follow up patients were evaluated clinically using the Harris Hip Score and radiologically with appropriate X-rays [9].

Results

During the study period, 20 patients were treated by hemiarthroplasty using cemented bipolar prosthesis, for fracture neck of femur 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 20 cases, all patients were available for follow up till one year which was taken as a basic pre-requisite for inclusion in the study. The average age was noted to be 75 years. The youngest patient in the study was 60 years and the oldest was 82 years. Most patients were in the age group 60-69 years (50%-10 cases). Male patients were 9 (45%) and females were 11(55%). Mode of injury causing the fracture of the neck of femur. 75% of the patients sustained the injury by tripping or slipping, 15% due to an RTA and the remaining 10% by a fall from a height. Time of presentation after injury was; 55% presented within 24 hours, 30% presented between 24 hrs - 72 hrs, 10% presented between 72 hrs – 1wk and 5% patients presented after a delay of 1 week, this case was diagnosed to be an old fracture neck of femur wherein the patient sustained trauma three months back. Type of radiological fracture is tabulated in Table 1.

Table 1: Radiological type of fracture

Radiological Type	Number of Patients	Percentage
Garden type I	0	0
Garden type II	0	0
Garden type III	7	35
Garden type IV	12	60
Non-union	1	5

In this study, systemic co-morbidities were evaluated which showed- 20% of study patients had heart disease, 10% had

diabetes, 5% had hypertension, 10% had heart disease as well as diabetes mellitus, 5% of the patients had heart disease and hypertension and 5% had both hypertension and diabetes mellitus (Table 2).

Table 2: Systemic Co-morbidities

Systemic co-morbidity	Number of Patients	Percentage
Heart Disease	4	20
Diabetes	2	10
Hypertension	1	5
Heart disease + Diabetes mellitus	2	10
Heart disease + Hypertension	1	5
Hypertension + Diabetes mellitus	1	5

All the study patients were taken up for the surgical procedure between the 2nd and 4th day after the presentation, the average delay to surgery being 4 days. All the surgeries were performed under spinal or epidural anesthesia after a thorough pre-anesthetic 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. Size of the prosthesis used was 41 mm to 47 mm. Average blood loss during surgery was approximately 500 ml in majority of the patients. The most commonly encountered Peri-operative problem was technical difficulty in insertion of the prosthesis and difficulty in cementation. In 5 patients, intra operative hypotension was encountered on insertion of cement which was corrected on table by the anesthetist. A limb lengthening of 1 cm was observed in 4 patients while one patient had a shortening of less than 1.5 cm post operatively probably due to an error in calcar preparation. Superficial infection in the form of a wound dehiscence was seen in two patients who were diabetic. Both the patients were managed by antibiotic treatment, debridement and secondary suturing with adequate control of the diabetic status. The infection resolved without any sequelae and there was no late reactivation of the same. There were no late postoperative complications like implant loosening, dislocation, painful prosthesis erosion, protrusion-acetabuli or peri-prosthetic fracture. The minimum duration of hospital stay amongst the study patients was 10 days and maximum duration was 32 days with the average being 21 days. All patients were followed up regularly at 6 weeks, 3 months, and 6 months. All patients who completed six months follow-up were included in the final analysis. Functional results of hemiarthroplasty were assessed by using the modified Harris hip scoring system (Table 3-6).

Table 3: Distribution of Pain Criteria Scores

Criteria	PAIN Score	Number of cases	Percentage
None	44	7	35
Slight	40	5	25
Mild	30	7	35
Moderate	20	1	5
Marked	10	0	0
Pain in bed	0	0	0
Total		20	100

Table 4: Distribution of Limp Criteria Scores

Criteria	LIMP Score	number of cases	Percentage
None	44	7	35
Slight	40	5	25
Mild	30	7	35
Moderate	20	1	5
Marked	10	0	0
Pain in bed	0	0	0
Total		20	100

Table 5: Distribution of Criteria of use of support scores

Criteria	Score	number of patients	Percentage
None	11	13	65
Cane for long walks	7	6	30
Cane most of the time	5	1	5
One crutch	3	0	0
Two canes	2	0	0
Two crutches	0	0	0
Unable to walk	0	0	0
Total		20	100

Table 6: Distribution of scores by the criteria of walking distance

Criteria	Scores	Frequency	Percentage
Unlimited	11	15	75
6 blocks	8	4	20
2-3 blocks	5	1	5
Indoors only	2	0	0
Bed and chair	0	0	0
Total		20	100

In this study, ability to put on the socks and shoes were assessed, and most of the patient's were able to do so with ease. Seventeen (17) patients were comfortably climbing stairs without using railing of the stairs and all 20 patients were able to sit comfortably for one hour in an ordinary chair. Range of movement was good in all the cases (Table 7).

Table 7: Range of Movements (ROM)

ROM	Score	Number of cases	Percentage
211°-300°	5	19	95
161°-210°	4	1	5
101°-160°	3	0	0
61°-100°	2	0	0
31°-60°	1	0	0
0°-30°	0	0	0
Total		20	100

The average Harris Hip Score at 6 weeks after surgery was 77.55 with the highest score being 91 and the lowest being 63. The average Harris Hip Score at the second follow-up of 3 months was 83 with the maximum score being 100 and the minimum 66. At the third and final follow-up at 6 months the average Harris Hip Score was 87.2 with the highest being 100 and the lowest being 55. In our study, the final Harris Hip Score as evaluated at six month follow-up averaged 87.2 with the maximum score being 100 and the minimum score being 55. Overall, 10 patients (50%) achieved Excellent result, 6 patients (30%) achieved Good result, 3 patients (15%) achieved fair result and 1 patient (5%) achieved poor result. 80% of the patients achieved an excellent or good result. At the end of 6 months follow up study, X-ray evaluation of all patients showed a contained prosthetic femoral head in the acetablum and valgus alignment of the femoral stems in the medullary cavity with no radiological changes or complications.

Fig 1: Pre-operative Radiograph showing fracture neck of the femur

Fig 2: Image showing Bi-polar Prosthesis Instrumentation

Fig 3: Intra-operative image showing Prosthesis insertion

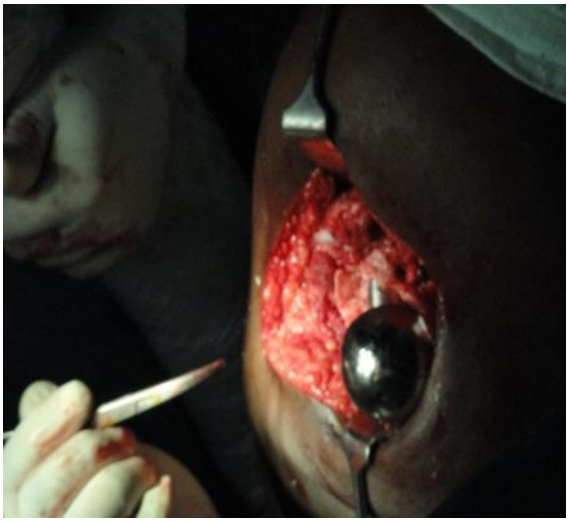

Fig 4: Intra-operative image showing Final Prosthesis seating on the Calcar

Fig 5: Post-operative Radiograph showing prosthesis

Fig 6: Clinical image of the patient walking with support

Discussion

The aim of replacement surgery in fracture neck femur is early return to daily activities. This is particularly applicable to the elderly age group where complications due to long periods of immobilization have to be prevented. The mean age of the patients in the present study was 75 years, the youngest being 60 years and the eldest being 82 years. Age distribution is an important factor in the management of hip fractures. The results of our study showed that age of the patient had minimal influence on the final functional outcome. As in most standard studies; the present study also had a higher number of females who sustained a fracture neck of femur as compared to the male population. Elderly females are more prone to fracture neck of femur due to osteoporosis according to Choudhari & Mohite [9].

Majority of our study patients (75%) sustained the injury due to a trivial trauma like tripping or slipping. This is a very common occurrence in elderly population where poor vision and lack of neuro-muscular coordination is a problem. Most of such injuries can be classified as "indirect" trauma. 10% patients sustained the injury due to a fall from a height and 15% due to a Road Traffic Accident. A little more than half of our study patients were brought to the hospital within three days of sustaining the injury. 55% of the patients were brought to the hospital within 24 hours of the injury while 30% presented for treatment within 24 hrs - 72 hrs. 10% were brought to the hospital between 72 hrs – 1 wk and the remaining 5% presented for treatment after one week. Difficulty in post-operative rehabilitation was particularly noticed in the patient who presented after 90 days following trauma, probably due to bony and soft tissue changes that

would occur in this duration which finally gave a poor outcome.

All of our study patients had a displaced fracture of the neck of femur. Majority of the patients (60%) had a Garden type IV fracture while seven patients (35%) had Garden type III fracture and one patient (5%) was diagnosed with a non union fracture neck of femur. Even in a comparision study by H. Krishnan, between the outcomes following Cemented and Uncemented bipolar prosthesis, 29 patients were of Garden type IV, while 5 patients sustained a Garden type III fracture type [10]. However the type of fracture and the displacement did not have any bearing on the final function.

Heart disease was found to be the most common co-morbidity seen in 20% of the study patients. Two patients had Type II Diabetes and were on oral hypoglycemic agents or Injection human actrapid. They were shifted to insulin pre-operatively and blood sugar values optimized before taking up for surgery. 5% of the patients were hypertensives, while 10% of the patients had both heart disease and diabetes mellitus, 5% had heart disease and hypertension and another 5% of the patients were diagnosed with both hypertension and diabetes mellitus. It was observed that the post-operative rehabilitation of patients was significantly affected by the presence of the above co-morbidities [11]. This also had an effect on the final functional result of the procedure. Similar observations have been made by Koval *et al*. and Bath [11, 12].

All the study patients were taken up for the surgical procedure between the 2nd and 4th day after the trauma, the average delay to surgery being 4 days. Delay in taking up for surgery was usually for optimizing the medical condition of the patient. DVT prophylaxis was given for all patients, using low molecular weight heparins, on admission and was stopped 12 hours before the surgery. All cases were performed on an elective basis and were scheduled as the first surgery in the morning. All the surgeries were performed under spinal or epidural anesthesia after a thorough pre-anesthetic 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 [13]. This was because, meticulous attention was given to suturing the posterior capsule and the short external rotators and keeping the limb in slight abduction using an abduction pillow, 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.

In 50% of the cases 45 mm prostheses were used which was followed by 43 mm (30%), 47 mm (15%) and 41 mm (5%) prostheses in the order of frequency. Following calcar preparation and over reaming of the medullary cavity using the rasps which were provided, manual packing of cement and insertion of the prosthesis was done.

Technical difficulties encountered with the procedure, firstly was calculating the angle of the neck osteotomy required and the amount of calcar to be retained for the correct placement of the prosthesis. Secondly a difficulty in cement insertion by the technique of manual packing was also encountered. Intra operative hypotension was encountered in 5 patients, during cement insertion but was corrected on table by the anesthetist.

In up to half of the cases, the blood loss was < 500ml for the whole procedure and in most of the others it was between 500-750ml. Only 13.63% 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 hemi-arthroplasty is less in the anterior approach as compared to the posterior approach [14, 15]. Most of the surgeries were completed between 90-120 minutes of starting the procedure. Similar duration of the procedure has not been reported by Haidukewych *et al*. and Drinker, *et al*. [15, 16]. Neither the intra-operative blood loss nor did the duration of the procedure have any effect on final function. 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.

Limb length discrepancies were observed in 5 patients (25%) post-operatively, of which 4 patients had a lengthening of 1 cm each, probably due to the less amount of calcar resection, while one patient had a shortening of 1.5 cm post operatively, probably due to excessive resection, during preparation of the calcar.

Superficial infection in the form of a wound dehiscence was seen in two patients (10%) who were diabetic. Both the patients were managed by antibiotic treatment, debridement and secondary suturing with adequate control of the diabetic status. 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*. [17].

No complications of Deep vein thrombosis was noticed in any patient due to the administration of low molecular weight heparins, pre operatively and for 5 days post operatively. The minimum duration of hospital stay amongst the study patients was 10 days and maximum duration was 32 days with the average being 21 days. Average hospital stay of 21 days with bipolar hemiarthroplasty has been reported by Lestrange [18]. Drinker and Murray have reported an average hospital stay of 23 days with the same procedure [16].

There were no late postoperative complications like loosening, dislocation, erosion, secondary osteoarthritis, Protrusio Acetabuli or periprosthetic fracture. We are unable to comment upon long term acetabular erosion due to relative short follow up. Post operatively and on discharge, patients were advised physical rehabilitation exercises of the hip and the knee in the form of quadriceps exercises. Moreover toe touchdown weight bearing with the help of a walker was initiated by the third to fifth day post operatively and was continued till the first follow up according to tolerance of pain. All patients were followed up regularly at 6 weeks, 3 months, 6 months and the functional outcomes were assessed using the Harris Hip Scoring system.

Pain following hemiarthroplasty is a major concern. Hinchey and Day in their series of 294 patients found pain following hemiarthroplasty in 22 patients in the early post operative period [19]. They could not find any definitive cause in them. Lanceford stated that the causes of pain could be due to infection, improper prosthetic seating, metallic corrosion and tissue reaction, improper sized femoral head, contractures and periarticular ossification [20]. In our study, 13 patients had complaints of pain on the final follow up. These patients were however advised exercises and were reassured about the condition, along with which medications were prescribed and advised to be consumed only when the pain was intolerable.

In our study, the final Harris Hip Score as evaluated at six month follow-up averaged 87.2 with the maximum score being 100 and the minimum score being 55. Off 20 patients,

10 patients (50%) achieved excellent result, 6 patients (30%) achieved Good result, 3 patients (15%) achieved fair result and 1 patient (5%) achieved poor result. Overall 80% of the patients achieved either an excellent or good result. Our results are comparable with standard studies of bipolar hemi-arthroplasty performed for fracture neck femur. The poor result in one patient may be attained to the late presentation following trauma, which had an effect on the surgical procedure and post operative rehabilitation, probably due to soft tissue and bony changes that must have occurred.

No radiological changes or complications were noticed in any patients, at the end of 6 months follow up.

Our study is not without its own shortcomings. Firstly, our duration of follow-up of six months 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

The success of hemiarthroplasty no doubt depends on preoperative planning and proper attention to surgical details to achieve the optimum biomechanical stability. This study showed that the final functional outcomes were dependent on the presence of associated co-morbidities and the optimum post operative rehabilitation of the patient following surgery. The poor result (5%) in 1 patient was probably due to the late presentation following trauma. We conclude that hemiarthroplasty using cemented bipolar prosthesis for fracture neck of femur is a good option in elderly patients rendering satisfactory results.

Limitations of the study: Sample size was relatively small; more studies can be done with longer follow-up which gives better assessment of the operative results.

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