Original Research Article

A prospective study to evaluate the functional outcome in fracture neck femur treated by cemented bipolar hemiarthroplasty in elderly patients

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Abstract

Introduction: Purpose of this research is to study the functional outcome in elderly patients of fracture neck femur treated by cemented bipolar hemiarthroplasty and to analyze the improvement in the ambulatory status of patient at variable periods of follow up. **Materials and methods:** This is a prospective observational study of 50 elderly patients (age ≥ 60 years) with femoral neck fractures treated by cemented bipolar hemiarthroplasty. Thorough preoperative, intraoperative and postoperative evaluation was done. Functional outcome was evaluated using Harris Hip Score at each follow up visit. **Results:**Out of 50 patients, 40 cases were available at the end of 12 months for final follow-up. At the final follow up, 42.50% had excellent results, 37.50% had good results, 12.50% had fair results and 7.50% had poor results. **Conclusion:** In elderly patients with femoral neck fracture, we recommend the use of cemented bipolar hemiarthroplasty. It provides good ambulatory ability, improves the quality of life in elderly age group and is cost-effective.

Keywords: cemented bipolar hemiarthroplasty , femoral neck fracture, functional outcome.

Introduction

Fracture neck of femur has a major share among all the hip fractures. It is common in the elderly age group with female predominance and may be associated with other injuries as well. It is usually the result of trivial trauma in the elderly patients. While, in the younger age group, it is usually the result of high energy trauma and associated injuries are common[1]. The incidence has increased with increasing life expectancy and with the increase in the incidence of osteoporosis, poor vision, neuromuscular incoordination and changes to sedentary lifestyle[2].

The management of unstable osteoporotic fractures in elderly is challenging because of difficult anatomical reduction, poor bone quality, and sometimes a need to protect the fracture from stresses of weight bearing. Internal fixation in these cases usually involves prolonged bed rest or limited ambulation, to prevent implant failure secondary to osteoporosis. This might result in higher chances of complications like pulmonary embolism, deep vein thrombosis, pneumonia, and decubitus ulcer.What should be the optimal treatment has been a matter of controversy in the treatment of these fractures. The available surgical options are – reduction with internal fixation, unipolar hemiarthroplasty, bipolar hemiarthroplasty and total hip arthroplasty. The goal of treatment is restoration of pre-fracture function and preventing the associated morbidity and mortality[3].

Bateman in the 1970s conceived the idea of single assembly bipolar prosthesis[4]. Internal fixation is found to be associated with high failure rate and poor functional outcome in the elderly age group[5]. Bipolar prosthesis provided greater range of hip motion, faster walking speed, reduced incidence of post-operative pain, acetabular erosion, loosening of stem, and rapid return to normal activity as compared to unipolar prosthesis[4]. Total hip arthroplasty is used as treatment of these fractures at various centers in our country but it is still not a popular treatment option considering the high cost, availability, and comparable postoperative results[3,6,7].

In this study, we evaluated the functional outcome in elderly patients with fracture neck of femur treated by cemented bipolar hemiarthroplasty using Harris Hip Score.

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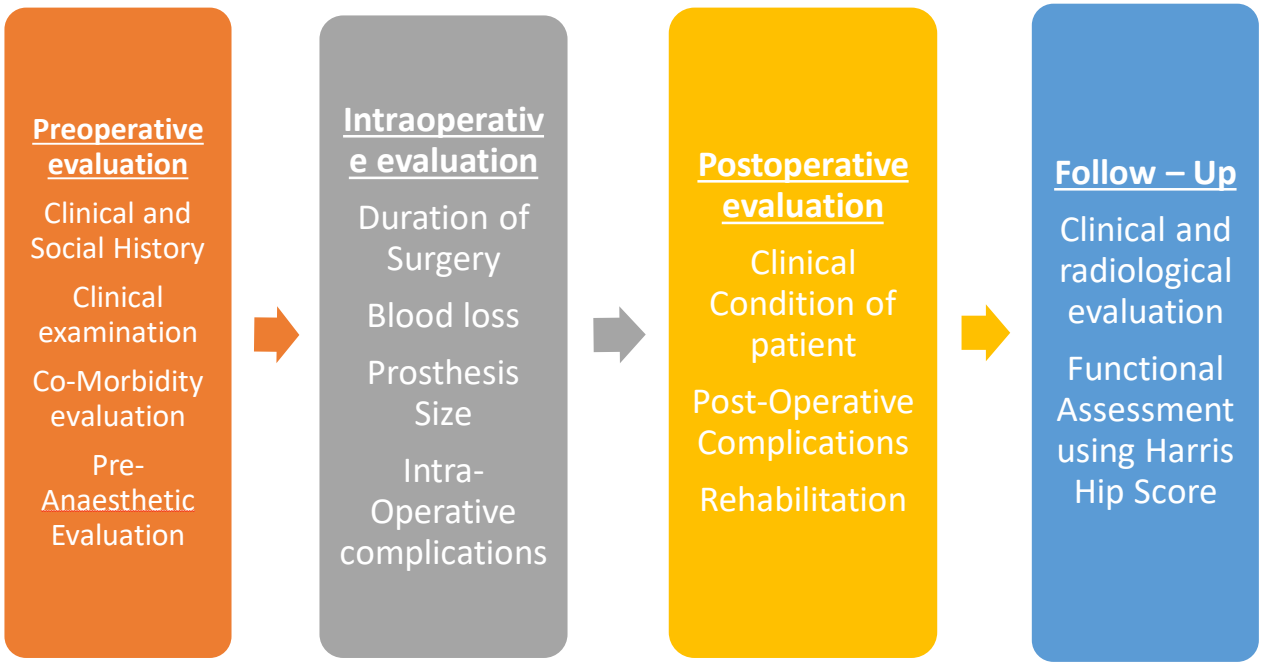
Materials and methods

This is a prospective observational study conducted between January 2019 to March 2021 at Department of Orthopaedics, L.N. Medical College and JK Hospital, Bhopal. 50 elderly patients who sustained femoral neck fracture were included in this study based on given inclusion and exclusion criteria (Table – 1), after taking informed consent. 10 patients were lost to follow up so final results were based on 40 patients who completed their follow up till 1-year duration.

Table 1: Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Patients with fracture neck of the femur	Patients below 60 years of age
Elderly patients of age 60 years and above	Patients with arthritic changes involving the acetabulum
Elderly patients with failed internal fixation	Non ambulatory patients prior to injury
Patients medically fit for surgery	Patients medically unfit for surgery
	Patients not willing for surgery



All study patients were put on above knee skin traction and 3-6 kilograms of weight applied to maintain the length of the lower limb and facilitate subsequent hemiarthroplasty procedure. 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.

Consent

Written consent was obtained from the relatives of patients after explaining them the nature and purpose of the study. They were assured that confidentiality would be strictly maintained. The option to withdraw from the study was always open.All the patients were operated under spinal or combined spinal epidural anaesthesia in lateral position. All the patients were operated through Moore's Posterior Approach (Fig. 1).

Fig. 1: Patient is lied in lateral position and operated through moore's posterior approach

The short external rotators weredetached close to femoral insertion and reflected backward to protect sciatic nerve and expose the posterior capsule. The capsule was incised by a T-shaped incision. Using a head extractor (Fig.2) and bone levers, head was delivered out of the acetabulum and the acetabulum was cleared of debris. The size of the extracted head was measured by using measuring gauze (Fig. 3).

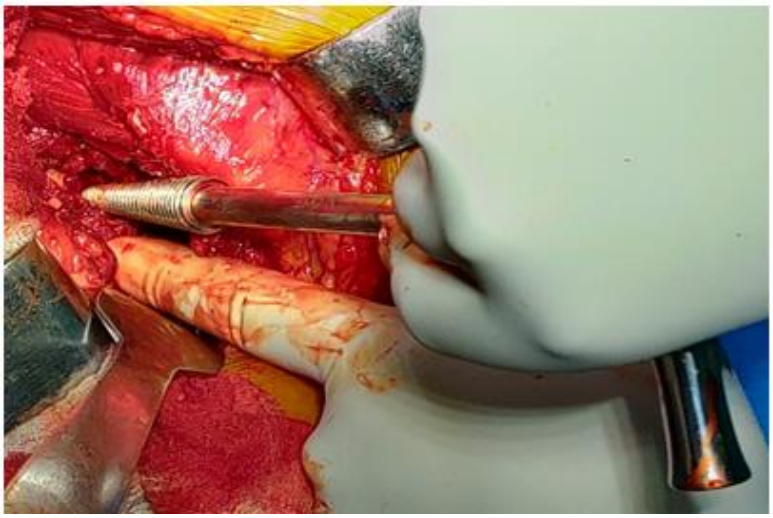


Fig. 2: Extraction of femoral head with the help of cork screw

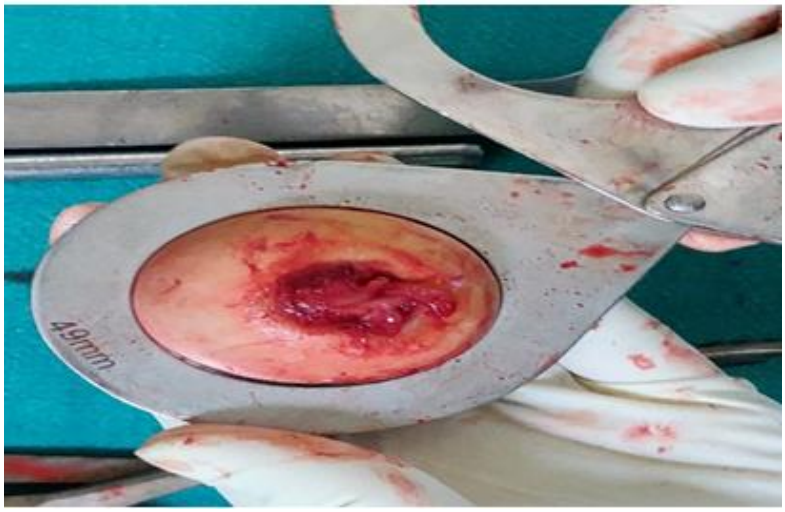


Fig. 3: Measurement of femoral head size

The neck was trimmed leaving 1 cm medial calcar, on which the shoulder of the prosthesis would eventually sit. The proximal femur was reamed with rasp. The direction of the insertion of the rasp was ascertained by using the lesser trochanter as a guide to achieve correct seating of the prosthesis in 10-15° anteversion.

Distal bone plug was prepared from extracted head of femur and inserted into the canal and canal preparation was done.Cement was mixed manually in the bowl with the help of spoon and inserted to canal by cement injecting gun (Fig. 4) in retrograde direction and pressure was maintained with the cement pressurizer.

Fig. 4: Insertion of cement with the help of cement gun

The appropriate size prosthesis was inserted into the cemented canal taking care to place it in 15^0 of anteversion. The final seating of the prosthesis was by gentle blows with the help of a pallet and the inserter (Fig. 5). Adequate seating of the prosthesis on the calcar was visualized directly. The hip joint was reduced and hip stability and limb length discrepancy was checked. Haemostasis was maintained throughout the procedure and layer wise closure done.

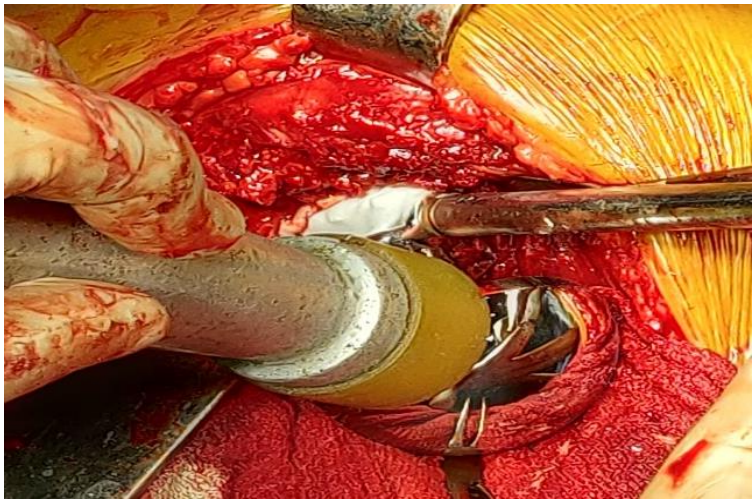


Fig. 5: Placement of hip bipolar prosthesis

The wound was inspected at the time of drain removal (day 3) and at the time of suture removal (on day 13 to 14).Postoperatively, patients were advised to keep both the lower limbs in abduction with the help of pillow and to avoid adduction, internal rotation, extreme flexion, squatting and cross leg sitting. Patient mobilization was commenced from day 1 to day 3 beginning with static quadriceps and gluteal exercises followed by partial weight bearing with the help of walker and further encouragement of progressive weight bearing under supervision of physiotherapist. Suture removal was done on 13 to 14th postoperative day. Follow up was done at 4 weeks, 3 months, 6 months, 9 months and 12 months. Functional evaluation was done using Harris Hip Score.

Patients were examined before discharge (mostly day 5 to 7) for the evidence of any infection at operated site. Abduction and quadriceps exercises were advised for a period of 6 weeks.The collected data were transformed into variables, coded and entered in Microsoft Excel. Data were analysed and statistically evaluated using SPSS-PC-20 version.

Observations and results

Out of 50 patients, 40 patients were available in the final follow up at 12 months. Patients were evaluated clinically and radiologically at each follow up visit.

Table 2 : Patient demographics

	Number	Percentage
Total no. of patients	50	
Age distribution (Figure – 6)		
• 60 – 69 years	45	90
• 70 – 79 years	3	6
• 80 years and above	2	4
Sex distribution (Figure – 7)		
• Male patients	10	20
• Female patients	40	80
Side Involved (Figure – 8)	18	36
• Left side fracture	32	64
• Right side fracture		
Type of Trauma	8	16
• High energy trauma	42	84
• Low energy trauma		

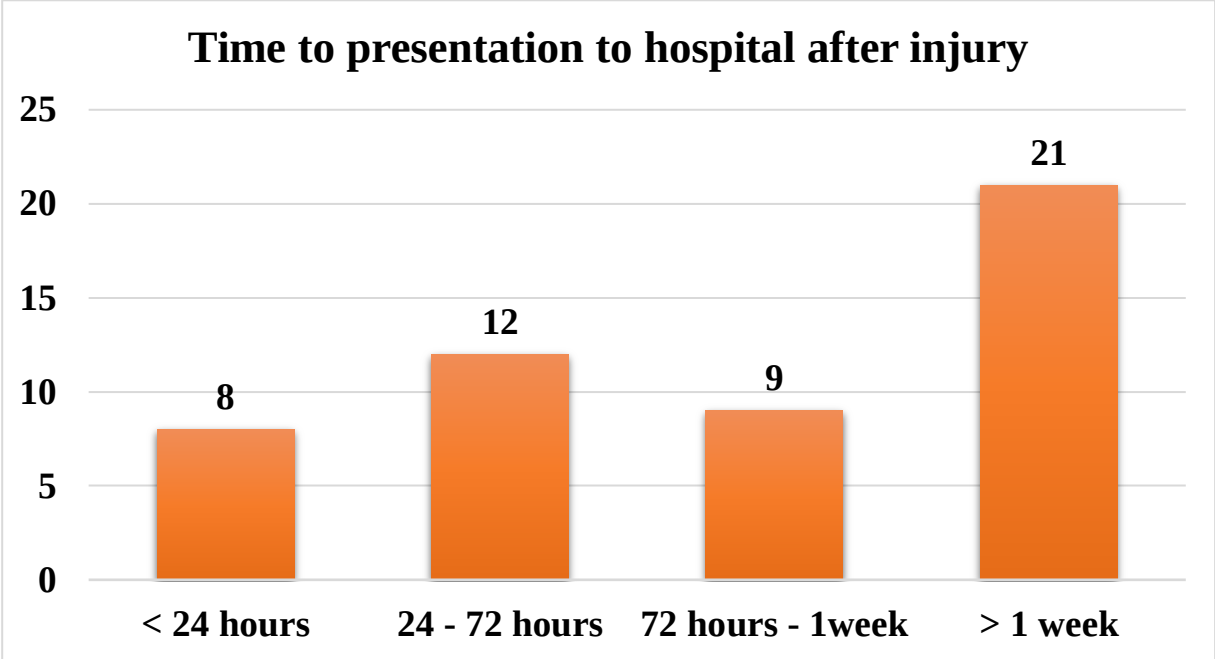


Fig. 6 :Time to presentation to hospital after injury

Mean duration between injury to presentation to hospital was 7.22 ± 5.14 days (Figure – 6).4 patients had Basicervical fracture, 16 patients had subcapital type and 30 patients had transcervical type of fracture (Figure – 10).

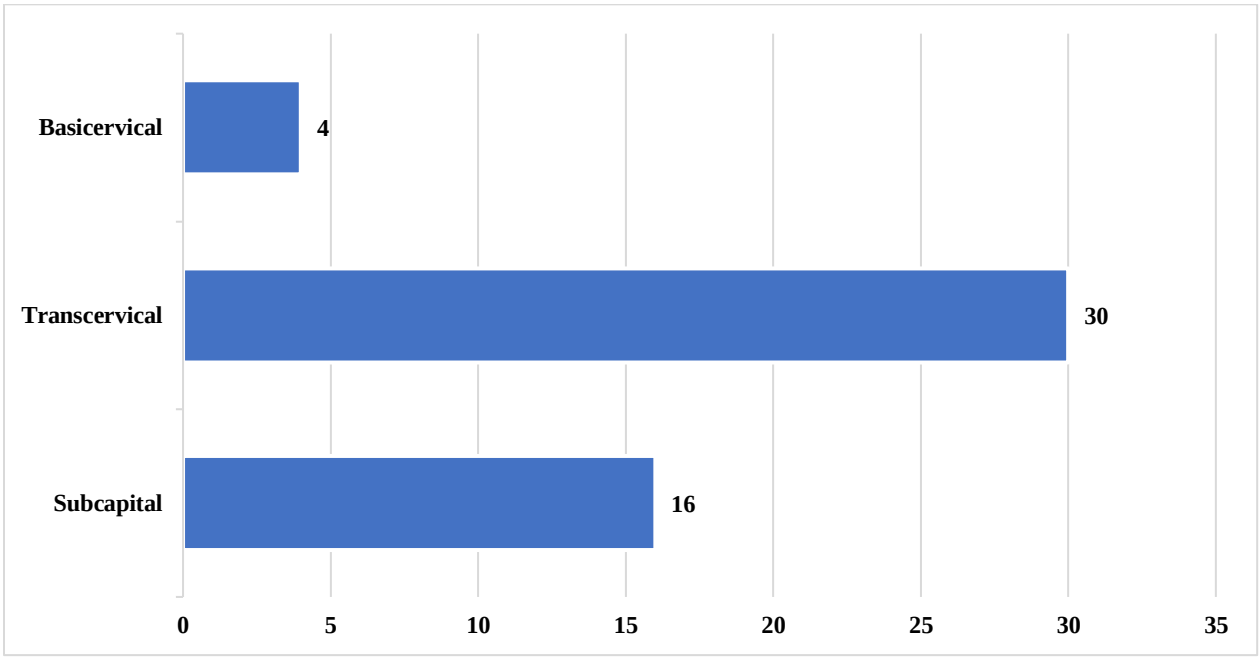


Fig. 7:Anatomical type of fracture

1 patient had garden type 2 fracture, 20 patients had type 3 and 29 patients had type 4 fracture. 2 patients had Pauwels' type 2 fracture while 48 patients had Pauwels' type 3 fracture. Singh's index grade 1 was present in 6 patients, grade 2 in 21 patients, grade 3 in 19 patients and grade 4 in 4 patients (Figure – 7).

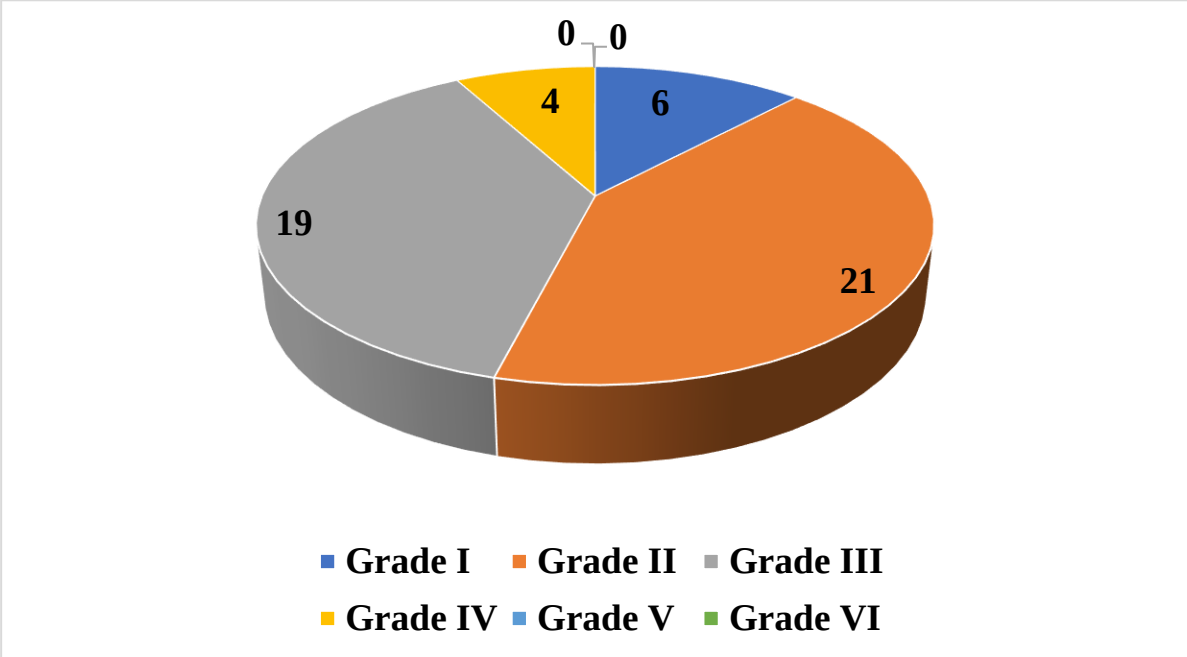


Fig. 8 :Singh's index grading

Mean interval between time of injury and time of surgery was 10.92 ± 6.63 days. The most common prosthesis size used was 45 mm (16 patients). Mean duration of surgery was 94.9 ±13.65 minutes.

Table 3: Complications observed during the study period

Complications	Type	No of Patients
Intraoperative complication	Hypotension	2
	Blood transfusion reaction	1
Early postoperative complication	Limb lengthening	2
	Surgical site infection	3
Late postoperative complication	Implant dislocation	1
	Periprosthetic fracture	1

3 patients (Table – 3) developed intraoperative complication in which 2 patients developed hypotension (managed in surgical ICU in the postoperative period) and 1 patient had blood transfusion reaction (transfusion was stopped and injection chlorpheniramine and hydrocortisone given). Limb lengthening, maximum up to 1 cm, was observed in 2 patients in the postoperative period. 3 patients developed wound infection noticed as continuous soakage and delayed wound healing (Table -3). They were managed with debridement and wound wash and antibiotic cover as per culture sensitivity. These complications resolved without any sequelae. Mean duration of hospital stay was 6.78 ± 3.08 days.1 patient presented with implant dislocation and 1 patient presented with periprosthetic fracture in the follow up period (Table – 3). No incidence of acetabular erosion, painful loosening of stem, protrusioacetabuli or secondary osteoarthritis was seen during the study period.

Table 4: Functional evaluation of patients at regular intervals

Follow up	No. of patients	Mean Harris Hip Score	Maximum	Minimum
4 weeks	50	57.51 ± 8.11	73.40	38.80
6 weeks	49	63.23 ± 8.31	79.14	48.14
3 months	47	73.21 ± 6.39	88.41	60.60
6 months	45	81.48 ± 7.82	92.34	62.34
9 months	41	84.84 ± 7.57	94.30	62.34
12 months	40	85.83 ± 7.54	94.30	66.38

In the last follow up at 12 months, 40 patients were available among which 17 achieved excellent results (42.50%), 15 achieved good result (37.50%), 5 achieved fair result (12.50%) and 3 had poor result (7.50%). Overall, 80% of patients achieved good to excellent results (Table – 4).

Fig. 9: Preoperative x-ray of a patient

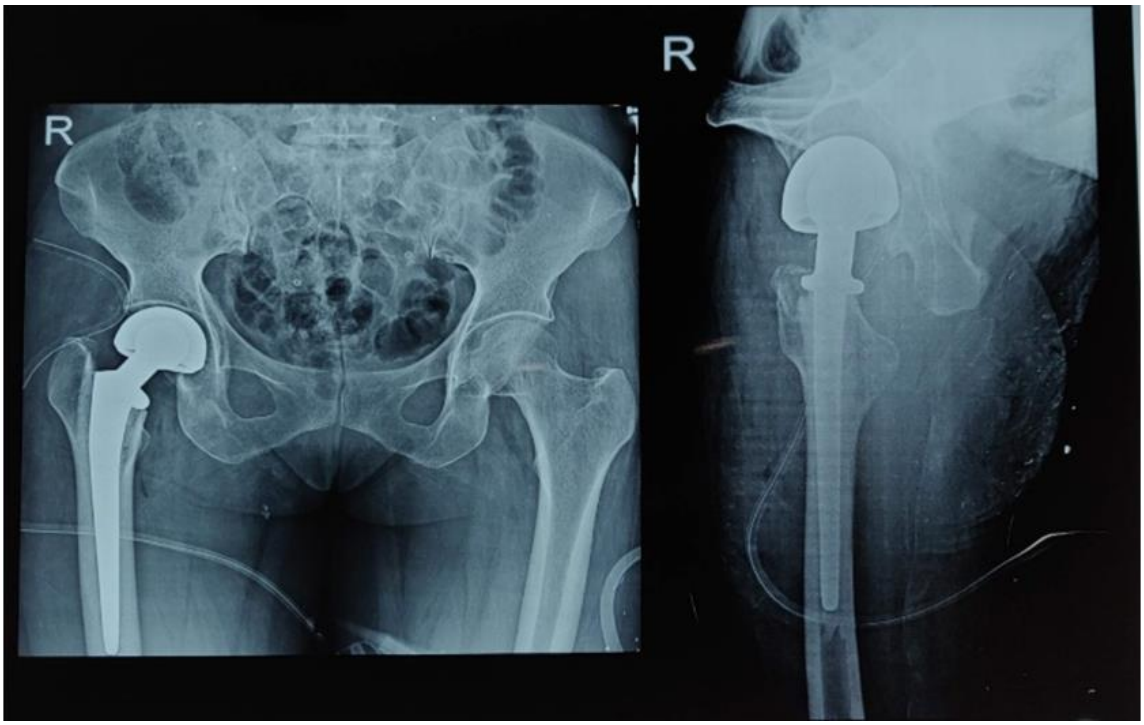


Fig. 10: Postoperative x-ray

Fig. 11: Clinical images of patient demonstrating movements of operated hip

Statistical analysis

Data was compiled using MS excel 2007 and analysis was done with the help of Epi-Info 7 software. Frequency and percentage were calculated & statistical test (Chi Square) was applied wherever applicable; $p<0.05$ was taken as statistically significant.

Discussion

The management of unstable neck femur fracture in elderly patients poses the challenges of difficult anatomical reduction as well as the need for prolonged immobilization and delayed weight bearing to prevent implant failure secondary to poor bone quality. Because of prolonged immobilization, complications such as deep vein

thrombosis, hypostatic pneumonia, pressure sores, dehydration, atelectasis, and metabolic disturbances may increase the morbidity and mortality. The goal of surgery in cases of fracture neck of femur is early rehabilitation and enabling patients to resume their daily life activities as early as possible. Also, in the elderly age group, care has to be taken to prevent the complications.

Mean age of patients in our study was 63.58 ± 7.28 years. Age assessment is necessary to estimate the mean survival time of the patient and their proper rehabilitation. Koval et al[9]. reported that therate of mortality is highest in the first year with majority between first 4 to 6 months. In our study, no effect of age was seen on the final outcome. Majority of patients in our study were female (80%). Similar distribution was reported by Hinton et al[10]. No effect of gender distribution was observed on final outcome in our study.In our study, right side fracture (64%) was more common than the left side. Although, it had no impact on the final outcome. Similar distribution was reported by S. Koaban et al[11]. In our study, majority of patients presented with low velocity trauma or trivial injury (84%). Majority of patients presented to hospital after 1 week of injury (42%) which is an alarming issue considering the complications of this fracture.

60% patients presented with Transcervical fracture, 32% hadSubcapital type and 8% had Basicervical type of fracture. 58% patients had Garden type 4 fracture, 40% had type 3 and 2% had type 2. 96% had Pauwels' type 3 fracture while 4% had Pauwels' type 2 fracture. 42% patients had grade 2Singh's index, 38% had grade 3, 12% had grade 1 and8% had grade 4 Singh's index. In our study, 54% surgeries were completed between 90 to 120 minutes. Drinker et al[12]. and Haidukewych et al[13]. reported similar duration of surgery in their studies.

Limb lengthening (< 1 cm) was observed in 2 patients in the postoperative period. Continuous soakage and delayed wound healing were observed in 3 patients who were managed successfully and no sequelae occurred. Nottage et al[14]. reported an infection rate of 3.9% in cases of bipolar hemiarthroplasty. In our study, 1 patient presented with periprosthetic fracture and 1 patient presented with implant dislocation as late complication, for which revision surgery was done. Langslet et al[15]. reported periprosthetic femoral fracture in 0.9% cases of cemented bipolar hemiarthroplasty. In the final follow up at 12 months the mean Harris hip score was 85.83 ± 7.54. 42.50% had excellent result, 37.50% had good result, 12.50% had fair result and 7.50% had poor result. Similar results were observed by Moshein et al[16]. and Lestrange et al[17]. For further evaluation of late complications, patients' status and functioning of bipolar prosthesis, longer period of study in a larger sample is required.

Jain D, Sidhu GS et al instituted a geriatric hip fracture program for comanagement of fracture hip injuries by orthopedic and internal medicine teams at their hospital in IndiaGeriatric hip fractures are a challenging clinical problem throughout the world. Hip fracture services have been shown to shorten time to surgery, decrease the cost of admissions, and improve the outcomes. The follow-up period ranged from 12 to 37 months with an average of 24 months. On follow-up, good to excellent Harris hip scores were seen in 88% of patients with 76% of patients returning to the preinjury ambulatory status. The mortality rate was 6% at 6 months follow-up and 10.9% at 2 years. Their study shows that a hip fracture program can be instituted in India. The program helped us in achieving the goal of early surgery, mobilization, and discharge from hospital with decreased mortality[18].

Cemented hip arthroplasty is an established treatment for femoral neck fracture in the mobile elderly. Cement pressurization raises intramedullary pressure and may lead to fat embolization, resulting in fatal bone cement implantation syndrome, particularly in patients with multiple comorbidities. The cementless stem technique may reduce this mortality risk but it is technically demanding and needs precise planning and execution. Marya SK, Thukral R et al report the perioperative mortality and morbidity of cementless bipolar hemiarthroplasty in a series of mobile elderly patients (age >70 years) with femoral neck fractures. All study patients were ambulatory and had painless hips; the mean Harris hip score was 85 (range: 69–96).Conclution of the study was that cementless bipolar hemiarthroplasty for femoral neck fractures in the very elderly permits early return to premorbid life and is not associated with any untoward cardiac event in the perioperative period. It can be considered a treatment option in this select group[19].

Femoral neck fractures in the elderly are associated with high morbidity and mortality. The optimal treatment remains controversial regarding the use of cement in hemiarthroplasty when treating a displaced femoral neck fracture in elderly patients. The primary hypothesis of this study was that the use of cement would afford better visual analouge pain and activity scores in elderly patients.Similar study like us was done by Rai SK et al in cemented vs uncemented modular bipolar hemiarthroplasty treatment for femoral neck fracture in elderly patients[20]. They found no statically significant between-groups differences in terms of length of hospital stay, Harris Hip Score and complications. However in Uncemented group 03 patients developed loosening of implant at the end of 2 year without any clinical of biochemical sign of infection. Walking ability and pain scores were better in the cemented group in the early follow-up period.

Based on above studies,we authors reached the conclusion that the use of cement during hip hemiarthroplasty in patients over 64 years of age who invariably has osteoporotic bone and wide femoral canal had no negative impact on mortality or morbidity. Hemodynamic changes during cement application are important, but it is noteworthy that patients fitted with cemented endoprostheses had increased levels of activity and lower pain levels.

Conclusion

Our study concluded that elderly patients with fracture neck of the femur treated with cemented bipolar hemiarthroplasty achieved good results in terms of range of motion, pain free movements, return to daily life activities and unassisted activity keeping in view of the complication rates. In developing countries like India, where cost of the surgery, availability of implants, requirement of range of motion are also considered; cemented bipolar hemiarthroplasty is a good option.

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