ORIGINAL RESEARCH

Prospective Study of Functional Outcome of Comminuted Unstable Inter-Trochanteric Fracture with Cemented Bipolar Prosthesis in Elderly Patients

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ABSTRACT

Introduction: An intertrochanteric femur fracture is one of the most important health problems amongst the elder population.

Aim: To evaluate the functional outcome and complications of cemented bipolar arthroplasty in unstable intertrochanteric femur fracture in Indian elderly patients.

Methods: This study was conducted in the Department of Orthopedics, SMS medical college, and associated groups of hospitals, Jaipur between July 2017 to Dec 2019. 30 cases of unstable [four-part] Trochanter fracture have been included in this study.

Results: The average age of the study patient was 75 years with the involvement of the left side in 55%. There was no case with the poor radiological result. There were two cases reported with limb lengthening less than 2 cm, and two patients with limb shortening one with < 2cm and one with > 2cm but these patients had good harris hip scores. At the final 1-year follow-up harris hip scoring system, 36-36% of patients had an excellent result, 46.66% had a good result, 10% of patients have fair results and 6.66% have a poor result. The patients who showed poor scores suffered from multiple medical problems and poor preoperative general physical health.

Conclusion: According to our result, we believe that cemented bipolar hemiarthroplasty is of choice in the freely mobile elderly patient above seventy years of age with an intertrochanteric femoral fracture.

Keywords: Bipolar Arthroplasty, Harris Hip Score, Intertrochanteric Femur Fracture

INTRODUCTION

An intertrochanteric femur fracture is one of the most important health problems amongst the elder population, it is most often due to trivial trauma. Incidence of intertrochanteric fractures is more due to osteoporosis[1,2]. Stable intertrochanteric fractures can be easily managed with osteosynthesis methods with satisfactory results but the same cannot be expected in comminated and unstable intertrochanteric fracture femur[2]. Osteoporosis and instability are one of the most important factors leading to unsatisfactory results[3].Also, these elderly

patients with unstable osteoporotic fractures required a period of restricted mobilisation[4], which may cause complications like atelectasis, bedsores, pneumonia, and deep vein thrombosis[5]. Thus fracture stability, bone strength, and early rehabilitation determined the final results in the case of intertrochanteric fracture[2].

AIM

This study aims to evaluate the functional outcome and complications of cemented bipolar arthroplasty in unstable intertrochanteric femur fracture in Indian elderly patients.

METHODS

This study was conducted in the Department of Orthopedics, SMSMedical College, and associated groups of hospitals, Jaipur between July 2017 to Dec 2019. 30 cases of unstable [four-part] Trochanter fracture have been included in this study. Inclusion criteria - Unstable intertrochanteric fracture in the elderly patient [three or four-part intertrochanter fracture with a loss of posteromedial cortical buttress and reversed obliquity fracture], Patient with age group >60 yr of either sex, Elderly patients with neglected intertrochanteric fracture for 3-4 weeks, Malunion of intertrochanteric fracture with arthritis of the hip joint, Non-union of intertrochantericfracture in the old patient.

EXCLUSION CRITERIA

Patient below 60 years of age, Open fracture, Pre-injury status non-ambulatory, Any evidence of the previous infection, Patient not willing for surgery, Patient medically unfit for surgery, Polytrauma patient, and patients, not given consent.

All of them were subjected to detailed history and clinical examination with emphasis on age, sex, mode of injury, fracture pattern, medical co-morbidities, another associated bony injury, duration of reporting after injury, and the time interval between injury and treatment. A thorough clinical examination of the affected limb was carried out according to the following points; attitude, pain, edema, ecchymosis, and deformity. Clinical examination also included general, systematic examination for other associated injuries.Radiographs of the hip were taken in appropriate views and the diagnosis was established by clinical and radiological means. The patient was put on preoperative buck's skin traction with appropriate weight. All patients were taken for elective surgery as soon as possible after necessary blood, urine, and radiographic preoperative work-up.

SURGICAL PROCEDURE

All surgeries were performed in the elective theatre using standard aseptic precautions. Surgery was performed under spinal or general anesthesia. Straight lateral position with the patient lying on the unaffected side.

SURGICAL APPROACH

Gibson's Posterior-lateral Approach to the Hip was used. The thigh and knee are flexed to 90° and the limb is rotated internally to expose the neck of the femur, osteotomy was done at the level of the neck, then the hip was dislocated posteriorly. The head of the femur was levered out of the acetabulum and the head size was measured using a template, the size was confirmed using a trial prosthesis. The acetabulum was prepared, the remnant ligament teres were completely excised and the remaining soft tissue from the region of pulvinar region was curetted. The femoral shaft was rasped using a broach (rasp) and prepared for the insertion of the prosthesis. The bipolar stem was cemented in place at 10-15° of anteversion using standard cementing techniques – lavage, cleaning, drying, and plugging of the canal. Before cementing in some cases calcar reconstruction was done using bone taken from the excised

head. The fractured lesser trochanter and the greater trochanter were put back in place, in case of communication they were fixed using a SS wire. Reduction of joint carried out. On the table movements of the joint were carried out for checking the stability of the prosthesis. The stability of the prosthesis and its tendency to dislocate is checked by flexing and adducting the hip. After suturing the capsule the external rotators were sutured, and the wound was closed in layers over a suction drain placed beneath the gluteus maximus, which is removed at the first change of dressing after 48 hours.

Post-operative management- Analgesics were given as per the patient's compliance, and IV antibiotics were continued for 5 days. Drain removal was done after 48 hours. Check radiograph was taken after 48 hours. Patients were made to sit up on the second day, stand up with support (walker) on the third day, and were allowed to fully weight bear and walk with the help of a walker on the fourth postoperative day, depending on her pain tolerance and were encouraged to walk thereafter. Sitting cross-legged and squatting was not allowed. Suture removal was done on the 12-15 postoperative days. The study patients were discharged after the 5th day or after stitch removal was done. The patients were assessed for any shortening or deformities. Any complications like infections and bed sores are treated before discharging the patients. Patients were followed up at an interval of 6 weeks, 3 months, 6 months, and 12 months. Clinical follow-up was based on Harris Hip Score. Radiological follow-up was is done with appropriate X-rays.Range of motion score = Total score × 0.05

Though the Harris Hip score is evaluated at every visit, the final Harris Hip Score calculated at one year is taken to determine the result of the procedure in the present study. Results are rated as Excellent: 90-100, Good: 80-89, Fair: 70-79 and Poor: <70. Patients were also radiologically evaluated for loosening of the prosthesis, heterotopic ossification, sinking/subsidence of the prosthesis, and protrusion acetabuli.

RESULTS

Data was collected based on detailed patient evaluation concerning history, clinical examination, and radiological examination. The postoperative evaluation was done both clinically and radiologically. Out of the 30 cases, all patients were available for follow-up for one year which was taken as a basic pre-requisite for inclusion in the study.

The average age of the study patients was 75 years. The youngest patient in the study was 63 years and the oldest was 88 years. The sex distribution pattern of the study patients was found to be women (60%). Laterality pattern of all the study patients with the left side being affected in 53.33% of the patients. mode of injury causing the trochanter fracture femur 63.33 % of the patients sustained the injury by tripping or slipping, 20% due to an RTA, and the remaining 16.66% by a fall from a height. time of presentation after injury 26.66% presented within 24 hours, 53.33% presented between 24 hrs -72 hrs, 13.33 % presented between 72 hrs-1, week and 6.66 % of patients presented after a delay of 1 week. The majority of study patients 16 (53.33 %) and an AO Type 31A2.1 of fracture with 8 patient having an AO Type31A2.2 and 6 patients having AO Type31A2.3 fractures. Systemic co-morbidities 20% of study patients had heart disease, 16.66% had diabetes, 16.66% had COPD, 33% had hypertension and 13.33% had ipsilateral knee osteoarthritis. The most commonly used prosthesis size was 45mm followed by 43mm, 47mm, and 41mm. average blood loss Majority of the patients had a blood loss of between 100- 200 ml (Table 1).

Table 1: Average blood loss

Average Blood Loss	Number of Patients	Percentage
< 100 ml	12	40
100-200 ml	14	46.66
>200 ml	4	13.13

All the study patients were taken up for the surgical procedure between the 4th and 17th day after the trauma, the average delay to surgery being 10 days. Complications (Table 2) of limb lengthening (<2 cm) were observed in two patients (6.66%) post-operatively due to technical errors in the form of the prosthesis sitting around the calcar.

Table 2: Complication during study

Complication	Number of patients	Percentage
Superficial infection	1	3.33
Deep infection	0	0
Wound gap	0	0
Subluxation / dislocation	0	0
Bed sores	2	6.66
Limb lengthening (<2 cm)	2	6.66
Limb shortening (<2 cm)	1	3.33
(>2cm)	1	3.33
Pulmonary embolism	0	0
Intra op fracture	0	0
Non-union of greater trochanter	3	10 %

Limb shortening was observed in 2 patients (one with < 2cm and one with >2cm). Superficial infection in the form of wound dehiscence was seen in one patient who was a diabetic. He 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. Three patient shows non-union of greater trochanter radiologically. There were no late postoperative complications like loosening, dislocation, erosion, secondary osteoarthritis, protrusio-acetabuli, or periprosthetic fracture. The minimum duration of hospital stay amongst the study patients was 5 days and the maximum duration was 12 days with the average being 8.5 days. 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, 25 patients (83.33%) had slight, occasional, no compromise in activities while 5 patients (16.66%) had mild pains with no effect on average activities. Our study compares favorably with other standard studies evaluating pain relief with Bipolar Hemiarthroplasty (Table 3)

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

Name of the study	Percentage
Current Study	83.33
Rodop[8]	89.6
Haentjens[9]	93
Kayali[10]	97
Broos[11]	92

GAIT ANALYSIS

27 (90%) of the study patients had a slight limp while 3 patients (10%) had a moderate limp. At the end of one year, 17 patients (56.56%) were found to be ambulating without the help of any support and the remaining 13 patients (43.33%) needed some support in the form of a cane or walker for long walks. 23 (76.66%) of the study patients could walk an unlimited

distance at any given point of time while 4 patients (13.33%) could walk no more than 1000 meters at a time and 3 patients (10%) could only manage 500 meters at a time.

ACTIVITY

On the evaluation of the patient's ability to climb stairs, it was found that 7 patients (23.33%) were able to climb stairs without the use of any support or railing while the remaining 23 patients (76.66%) were able to do so with the support of the railing. Since the majority of the study patients did not have the habit of using shoes and socks, their ability to trim their toenails was used as a parameter for evaluation. It was found that 17 patients (56.66%) were able to trim their toenails without any difficulty while 13 patients (43.33%) found it difficult to do so. With regards to the ability to sit for a long duration, it was found that 27 (90%) of the study patients were able to sit comfortably on a chair for up to one hour while 3 patients (10%) were not able to sit on a chair for more than half an hour at a stretch. All 30 of the study patients were able to enter and use public transport for commuting.

EVALUATION OF DEFORMITIES

None of the 30 study patients had fixed deformities. Two (6.66%) of the study patients had post-operative limb lengthening by <2 cm. Two of the study patient had got limb shortening (one with <2cm and one with > 2cm).

RANGE OF MOVEMENTS

The average range of movement score of the study patients was 4.83 with 11 patients (36.66%) having a score of 5 indicating attainment of the maximum range of movements.

THE PROGRESSION OF THE HARRIS HIP SCORE

The average Harris Hip Score at 6 weeks after surgery was 57.91 with the highest score being 66.65 and the lowest being 43.85. The average Harris Hip Score at the second follow-up of 3 months was 70.68 with the maximum score being 83.88 and the minimum 58.04. At the third follow-up at 6 months, the average Harris Hip Score was 80.22 with the highest being 88.8 and the lowest being 57.45. At nine months the average Harris Hip Score rose to 85 the maximum score being 93 and the minimum being 65.8. At the final one-year follow-up the average Harris Hip Score was 86.2 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 months) 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 86.2 with the maximum score being 93 and the minimum score being 65.8. Overall, 11 patients (36.66%) achieved Excellent results, 14 patients (46.66%) achieved Good results, 3 patients (10%) achieved fair results and 2 patients (6.66%) achieved poor results. 83.32% of the patients achieved an excellent or good result. (Table4)

Table 4: Final Harris hip score and clinical result

Grade	Harris Hip Score	No. of Patients	Percentage
Excellent	90-100	11	36.66
Good	80-89	14	46.66
Fair	70-79	3	10
Poor	60-69	2	6.66

Pre-operatively 7 patients needed (23.33%) had a blood transfusion and postoperatively 5 patients (16.66 %) had a blood transfusion, which was uneventful. Circlage wiring for the Greater trochanter was done in 14 cases (46.66 %) to hold the fragments together. Calcar reconstruction was done in 7 cases (23.33%). There was an incidence of postoperative superficial infection in 1 patient who had a serous discharge. They responded to conservative treatment alone without the use of antibiotics. 2 patients had superficial bedsores for which daily dressing was done and the wound healed before the patient was discharged from the hospital. Postoperatively, 1 patient had shortening of the operated limb of less than 2 cm, they walked with the help of a cane. 1 patient had shortened more than 2 cm, had a slight limp and used the support of a quadruple walker while walking. Two patients had a lengthening of less than 2cm. Full weight bearing was allowed on and after the third postoperative day. The mean day of full weight bearing was on the 3.9th day. The mean number of days spent by the patient in the hospital was 8.5 days.

All patients were advised not to squat and sit crossed-legged. The patients were followed up at 6 weeks, 3 months, 6 months, 9 months, and 1 year postoperatively. There was no incidence of acetabular erosion, loosening, or dislocation of the prosthesis in this series, on follow-up of 1year. At the end of 6 weeks, 12 patients walked without any support, 10 patients walked with the help of a cane, and 8 patients used a walker.

Fig 1: Case 1

Fig 2: Case 2


CASE 2
Pre-op
Post op
6 months
1 year
2018-12-20 14:10
CLINICAL PHOTOGRAPH

Fig 3: Case 3

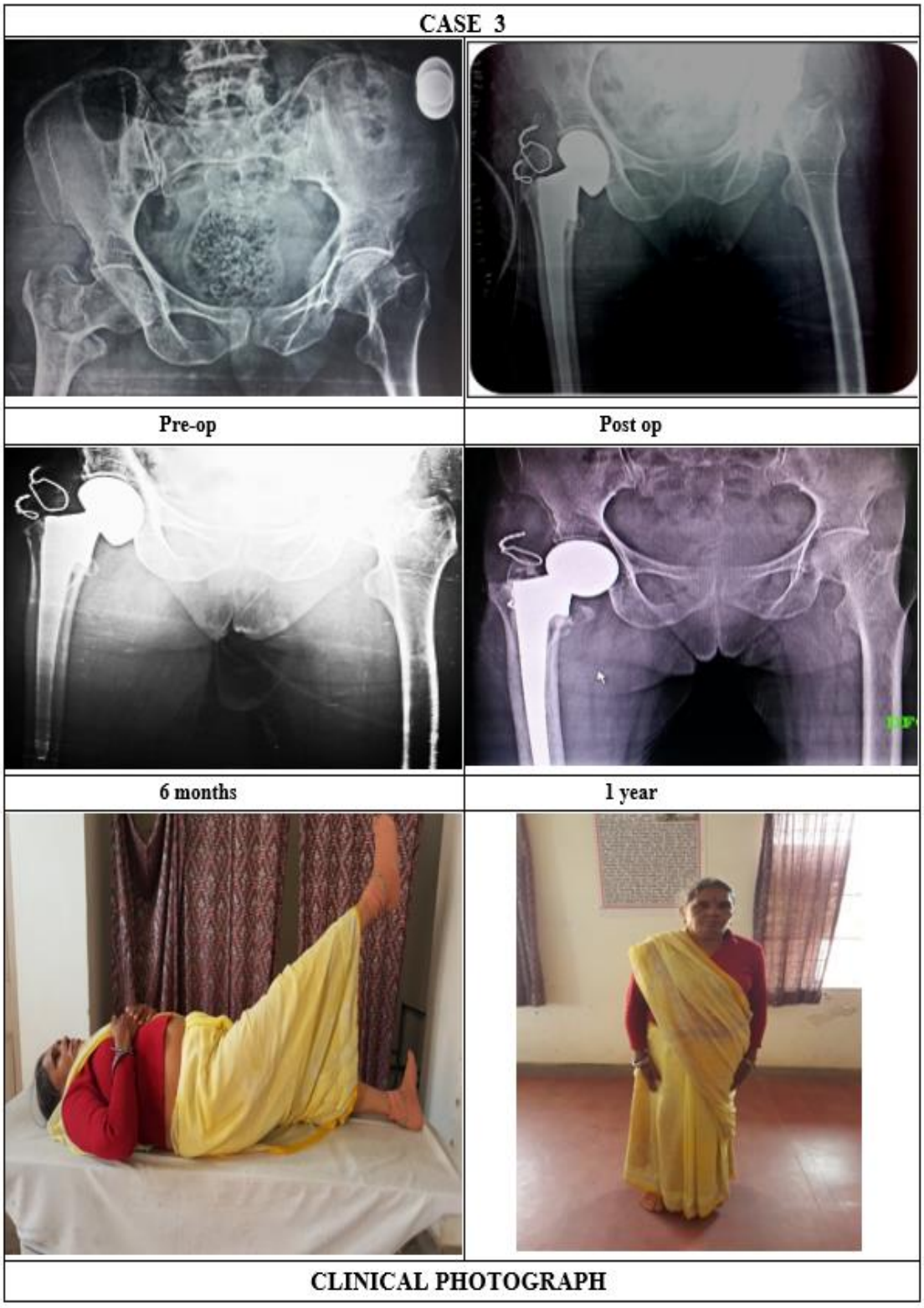

Fig 4: One year follow up. Complications -Superficial wound dehiscence which healed by local debridement and secondary suturing under adequate antibiotic cover

DISCUSSION

Displaced, unstable, and severely comminuted intertrochanteric fractures are associated with notable morbidity and mortality in elderly patients. Internal fixation has drastically reduced the mortality associated with intertrochanteric fracture[12]. however, early mobilization is still avoided in cases with communition, osteoporosis, or poor screw fixation[13]. Primary hemiarthroplasty offers a modality of treatment that provide adequate fixation and early mobilization in these patients thus preventing postoperative complication such as pressure sores, pneumonia, atelectasis, and pseudo arthrosis[6].

Primary Hemiarthroplasty offers a modality of treatment that provides adequate fixation and early mobilization in these patients thus preventing postoperative complications such as pressure sores, pneumonia, atelectasis, and pseudoarthrosis. Hemiarthroplasty has been used for unstable intertrochanteric fractures since 1971. however less frequently as compared to femoral neck fractures[14]. Its initial use was as a salvage procedure for failed pinning or other complications[15].

Rosenfeld, Schwartz, and Alter[16] reported good results with the use of the Leinbach prosthesis. Since there are multiple studies showing good results using this technique. Stern and Goldstein reported on 29 patients with unstable intertrochanteric fracture treated with the Leinbach prosthesis with excellent results in 88%.

Stern and angerman[14] reported on 105 cases of unstable intertrochanter fracture treated with Leinbach prosthesis they obtain a 94% success rate in returning the patient to the pre-fracture ambulatory status.

Green et al.[17], in a series of 20 cases, performed Bipolar Hemiarthroplasty for elderly patients with unstable trochanteric fractures with a mean time to ambulation of 5.5 days, and a mean follow-up of 13.2 months. Amongst the 20 cases, 7 patients had excellent results, 11 patients had good results, 7 patients had fair results, 5 patients had poor results and 3 patients died. They concluded that elderly patients were a suitable alternative to internal fixation because the prosthesis provided for early full weight bearing and rapid rehabilitation.

Haentjens et al.[9] in a series of 37 cases, with a mean age of 82 years who sustained unstable intertrochanteric fractures were treated with immediate Bipolar Hemiarthroplasty. Amongst the 37 cases, who were rated according to the criteria of Merle d'Aubigne, 7 patients had excellent results, 11 patients had good results, 7 patients had fair results, 5 patients had poor results, and reported death of 3 cases.

They concluded that immediate Bipolar Hemiarthroplasty for independently mobile patients older than 70 years having an unstable intertrochanteric fracture, allowed early walking with full weight bearing and helped the patients to return to the pre-fracture level of activity rapidly, preventing complications such as pressure sores, pneumonia, atelectasis, and pseudoarthrosis.

Casey C K et al.[18], in a series of 55 patients with intertrochanteric fractures, with a mean age of 84.2 years, were treated using Cemented Bipolar Hemiarthroplasty. They reported excellent results in 19 cases, good results in 8 cases, and the death of 12 cases in the series. They concluded that Cemented Bipolar hemiarthroplasties for intertrochanteric fractures have the advantage because the patients can bear full weight immediately after the surgery and there was no risk of excessive collapse, compromising walking function and so is a reasonable alternative to a sliding screw device for the treatment of unstable intertrochanteric fractures.

Stern MB et al[14], in a series of 105 cases with type III and type IV comminuted intertrochanteric fractures who were treated using Leinbach Bipolar prosthesis, concluded that functions were restored within a short period of time and allows unrestricted weight bearing almost immediately. The hospital stay was shortened and the incidence of secondary operations, thrombophlebitis, pulmonary embolism, decubitus ulcers, and pneumonia were relatively very low.

Broos P L et al[11], in a series of 565 patients, who sustained a fresh per trochanteric fracture, were treated with compression hip screw, angled blade plate, enders pins, and Bipolar Hemiarthroplasty. They concluded that fixation with angled blade plate and enders pins should be forsaken, patients treated with compression hip screw had good results but at this treatment had a risk for serious collapse and pain in 80% of the cases, he suggested that complex multi-fragmentary intertrochanteric fractures can be treated with endoprosthesis as it is no longer considered a severe intervention with less than 1% danger of mechanical complications

Rodop et al.[8], in a series of 54 elderly patients, with a mean age of 75.6 years, who had unstable intertrochanteric fractures were treated primarily with Bipolar hemiarthroplasties. The series showed excellent results in 17 cases, good results in 14 cases, fair results in 3 cases, poor results in 13 cases, and reported death in 7 cases. They concluded that Bipolar Hemiarthroplasty for unstable intertrochanteric fractures in the elderly was a good procedure that provides rapid weight bearing and rehabilitation of the patients.

George et al[19]., in a series of 60 patients with a mean age of 78 years amongst which 24 patients were treated by total hip arthroplasty, 27 patients were treated with Bipolar arthroplasty, and 9 patients were treated with unipolar arthroplasty, secondary to failed internal fixation of intertrochanteric fractures. The series showed excellent results in 26 cases, good results in 20 cases, fair results in 10 cases, and poor results in 4 cases. None of the patients had a revision arthroplasty for acetabular erosion. They did not observe any association between the quality of pain relief and treatment with Bipolar Hemiarthroplasty as opposed to total hip arthroplasty. They concluded that hip arthroplasty is an effective salvage procedure after the failed treatment of an intertrochanteric fracture in older patients. Most of the patients had good pain relief and functional improvement. (Table 5)

Table 5: Comparison of Clinical Result with Standard Studies

Grade	Our study	Green et al[17].	George et al[19].	Rodop et al[8].
Excellent	36.66	35.00	43.33	31.48
Good	46.66	36	33.33	25.92
Fair	10	25	16.66	15.03
Poor	6.66	9	6.66	24.07

In the short term, bipolar hemiarthroplasty seems to give better results than open reduction and internal fixation in the treatment of unstable intertrochanteric fracture in terms of mortality and morbidity rates, complications, early rehabilitation, and return to daily living activities. Long term problems such as loosening,protrusio, stem failure, late infection, and late dislocation have not been seen in these series.

CONCLUSION

According to our result, we believe that cemented bipolar hemiarthroplasty is of choice in the freely mobile elderly patient above seventy years of age with an intertrochanteric femoral fracture. The procedure offered faster mobilization, rapid return to pre-injury level, improved quality of life, and a long-term solution in elderly patients with intertrochanteric fractures of the femur.

Hemiarthroplasty in these cases is a surgically demanding technique. Bad surgical technique may lead to prolonged operative time, a high incidence of deep infection, dislocation, and poor radiological and functional outcomes. Careful restoration of neck length, offset and version maximizes the stability of the hip joint and increases the durability of the prosthesis.

Bipolar hemiarthroplasty reduced the complications of prolonged immobilization, prolonged rehabilitation, marked residual deformities, and the need for revision surgeries.

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