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Original Research Article

Study of the immediate short term clinical and radiological outcome of intertrochanteric neck of femur fractures treated with primary bipolar hemiarthroplasty in geriatric population in a tertiary care centre

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ABSTRACT

Background: Intertrochanteric fracture in elderly patient is a frequent problem and is becoming more common as the proportion of elderly people in the population increases. Unstable intertrochanteric fracture in the elderly patient is associated with a high rate of mortality as much as 20 percent during the first postoperative year. The treatment of such unstable intertrochanteric fracture is still controversial. So as to allow for earlier postoperative weight-bearing, primary hemiarthroplasty was proposed by some authors. The purpose of this study is to evaluate the functional and clinical outcomes of cemented bipolar arthroplasty as a primary treatment for unstable intertrochanteric fracture in the elderly patient.
Methods: It was an observational retrospective plus prospective study design over a period of 18 months in a tertiary care setting with a sample size of 41. Patients fulfilling the inclusion criteria were assessed clinically using Harris hip score and radiologically were operated for bipolar hemiarthroplasty. They were assessed intraoperatively, immediate postoperatively and after 4 weeks for functional outcome using Harris hip score and assessed radiologically. Patients were also be evaluated for intraoperative and postoperative complications if any. The outcome was analysed statistically to comment on functional outcome of bipolar hemiarthroplasty.
Results: In our study majority of the patients 70% (29) had excellent and good outcomes at the end of 1 month. Out of the rest 22% more had fair outcome at the end of month. Thus 93% patients had favorable outcomes at the end of 1 month while 7% (3 cases) had poor outcome when measured using Harris hip score.
Conclusions: Primary cemented bipolar hemiarthroplasty is a viable option that leads to good functional outcomes and allows early mobilization and weight bearing.

Keywords: Hemiarthroplasty, Bipolar hemiarthroplasty, Unstable intertrochanteric fracture, Elderly fractures, Cemented modular bipolar

INTRODUCTION

Intertrochanteric fracture in elderly patient is a frequent problem and is becoming more common as the proportion of elderly people in the population increases.[1,9] Various modalities of treatment are available including open reduction with rigid fixation.[1-4]

So as to allow for earlier postoperative weight-bearing, primary hemiarthroplasty was proposed by some authors.[5]

Unstable intertrochanteric fracture in the elderly patient is associated with a high rate of mortality as much as 20 percent during the first postoperative year.[10-13] The treatment of such unstable intertrochanteric fracture is still controversial, despite the publication of reports of randomized trials and comparative studies.[14-16]

Excessive collapse, loss of fixation, varus displacement cut-out of the lag screw resulting in poor function remain problems associated with internal fixation of unstable intertrochanteric fracture in the elderly patient with osteoporotic bone.[16]

For this reason and to allow earlier postoperative weight-bearing primary arthroplasty was proposed in cases of unstable intertrochanteric fractures.[8,17-20]

The purpose of this study is to evaluate the functional and clinical outcomes of cemented bipolar arthroplasty as a primary treatment for unstable intertrochanteric fracture in the elderly patient.

METHODS

It is an observational retrospective plus prospective study design. The study was conducted at the tertiary care centre at B. J. Government Medical College, Pune, Maharashtra, India. The study was conducted from September 2019 to December 2021.

Inclusion criteria

All patients above the age of 60, and patients classified under AO/OTA type 31A3.3 i.e., multifragmentary or Evans type II i.e., patients in whom fracture line extends downwards and outwards from the lesser trochanter reversed obliquity and all other unstable intertrochanteric fractures, were included in the study.

Exclusion criteria

Patients with intertrochanteric neck fractures below the age of 60, with other degenerative conditions of the hip, for example osteoarthritis of the hip, osteonecrosis of the hip; congenital disorders of the hip; conditions of the knee affecting mobility of the lower limb; unable to walk before the fracture; pathological fractures; previous contra lateral hip fracture**;** stable fractures and intact lesser trochanter were excluded.

Study procedure

Patients fulfilling the inclusion criteria were assessed clinically using Harris hip score and radiologically were operated for bipolar hemiarthroplasty. They were assessed intraoperatively, immediate postoperatively and after 4 weeks for functional outcome using Harris hip score and assessed radiologically. Patients were also evaluated for intraoperative and postoperative complications if any. The outcome was analysed statistically to comment on functional outcome of bipolar hemiarthroplasty.

Risk involved

No risk was involved as result of the study.

Ethical committee approval was taken from regional ethical committee at B. J. Government Medical College, Pune.

Statistical analysis

The sample size was 41. All measured values were expressed in the form of means and standard deviations. Statistical significance in all cases was be considered at the p value <0.05. Appropriate tests were used for statistical analysis including Chi square and regression analysis. Graphical representation has been done wherever possible.

Patient protocol

All patients fulfilling above criteria were considered for the study. Clinical diagnosis of intertrochanteric fracture was done with external rotation, shortening and history of trauma. Appropriate fluid and analgesic management were done upon admission along with screening for comorbidities including diabetes mellitus, hypertension, ischemic heart disease. Limb was placed in skin traction. Anteroposterior and lateral X-rays of pelvis with both hips and affected hip were taken. Hemogram, prothrombin time, liver function tests, and kidney function tests were sent as routine. Informed consent was obtained from the patient.

Operative protocol

Preoperative

Injection ceftriaxone 1 gm iv and injection amikacin 500 mg iv was given.

Anaesthesia

Spinal and epidural anesthesia was given. All cases were done using the modified southern moore posterior approach in the lateral position. Tension band wiring was used to fix the greater trochanter. Wires were placed after

femur preparation and tightened after cemented implant was inserted. Trial reduction was done and modular neck was inserted after ascertaining limb length and adequate reduction. We did not use drain for any of our cases.

Post operative

Injection ceftriaxone 1 gm iv and injection amikacin 500 mg iv was given twice daily for 4 days. LMW heparin was given 0.6 ml sc HS for 4 days. Wound check was done on day 4 after which patients were discharged on oral cefixime 200 mg twice daily for 10 days. Suture removal was done on day 14. Harris hip score was used to evaluate functional outcome. The score is reported as: 90-100 excellent results, 80-89 good, 70-79 fair, and below 70 poor. Radiological outcome was calculated as: excellent – no joint space narrowing, no medial migration, no superior migration, and no sclerosis; good – joint space narrowing, no medial migration, no superior migration, subluxation <1/4th of head, and slight sclerosis; fair – complete loss joint space, migration <1 cm, subluxation >1/4th diameter, no dislocation, and moderate pelvic reaction; and poor – complete loss of joint space, migration >1 cm, dislocation, and pelvic discontinuity or severe sclerosis.

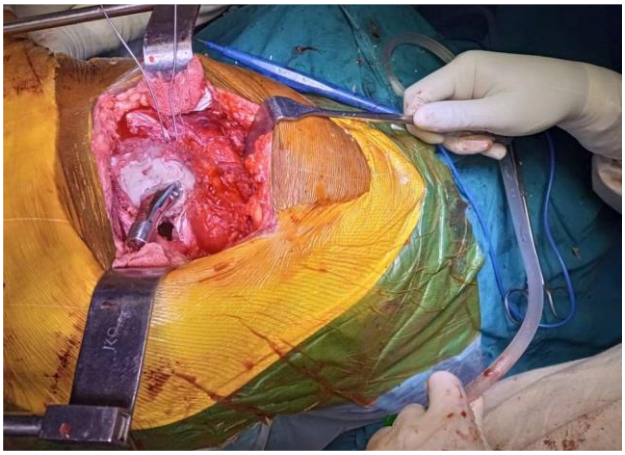

Figure 1: Passage of wires and stem implantation.

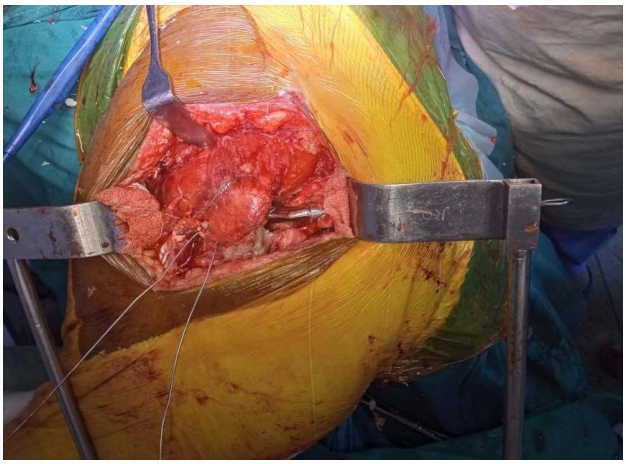

Figure 2: Passage of wires and stem implantation.

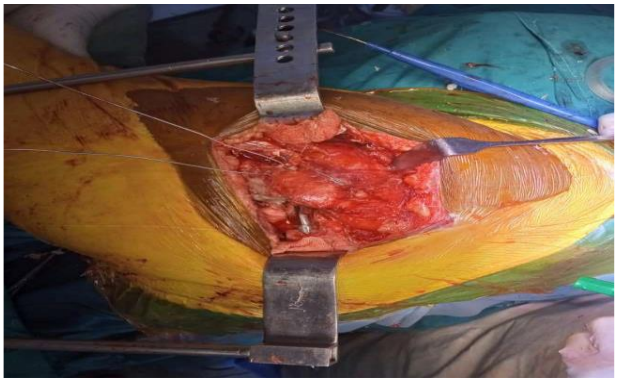

Figure 3: Tightening is done cementing and stem insertion.

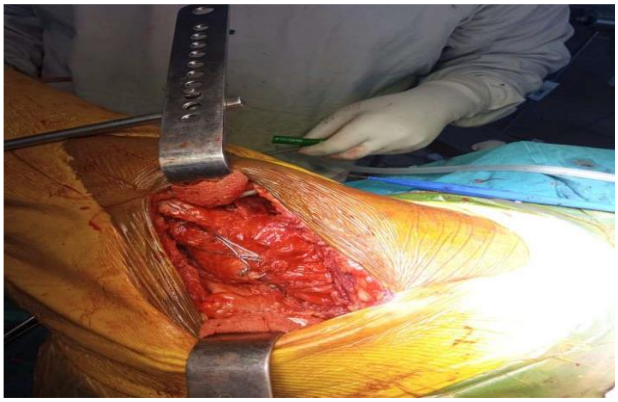

Figure 4: Tightening of the wire.

Figure 5: Preoperative case X ray.

Figure 6: Post operative case X ray.

RESULTS

A total of 41 cases were operated and studied. The observations were as follows.

Since, the study was conducted in geriatric age group, patients were divided in groups as mentioned above. Majority of the patients in our study were in the 60-70 and 71-75 years of age group (Table 1).

Table 1: Age distribution among patient.

Age group	Number of patients	Percentage (%)
60-70	28	68.3
71-75	7	17.1
76-80	2	4.9
>80	4	9.8
Total	41	100

Given the geriatric age group and prevalence of osteoporosis in the patients a majority 78% of the patients had fractures due to domestic fall, while 22% patients had fractures as a result of motor vehicle accidents (Figure 7).

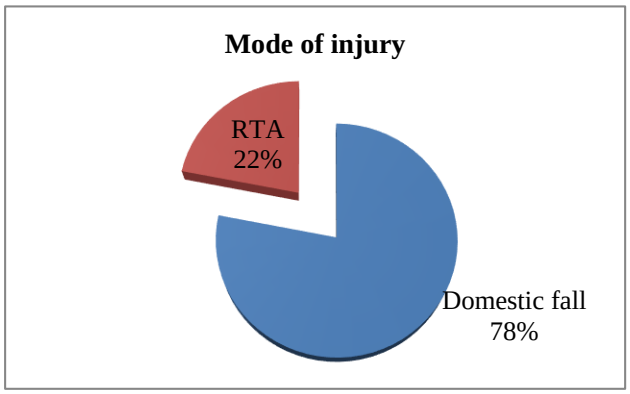

Figure 7: Mode of injury.

Comorbidities were present in 85% (35) patients. Most common was hypertension which was seen in 48.8% of the patients. The elderly age group accounted for the presence of comorbidities (Figure 8).

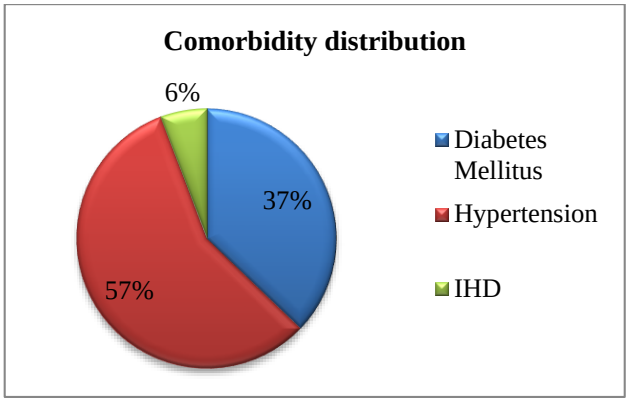

Figure 8: Comorbidity distribution among patients.

Patients were encouraged for weight bearing as soon as possible. Partial weight bearing was started on the day of surgery itself and full weight bearing was advised from the day 1 post operative day to all the patients possible. Dedicated physiotherapy regimen was started for all to ensure early mobilization.

78% (32) patients started full weightbearing within 5 days, 17% (7) between 5 to 10 days and 2 patients started weightbearing beyond 10 days.

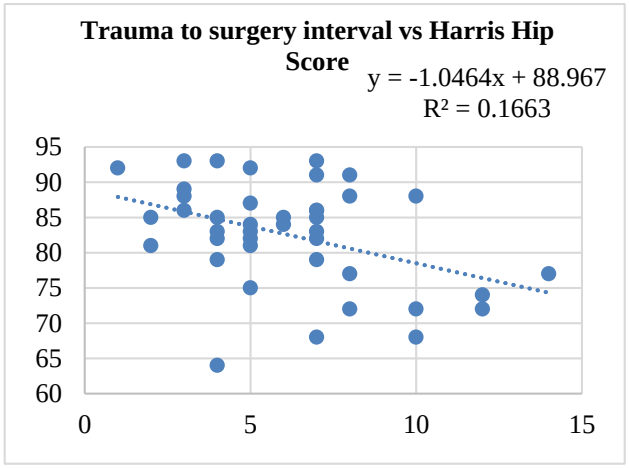

Figure 9: Correlation between trauma to surgery interval and Harris hip score.

Table 2: Blood loss, time taken for full weight bearing, trauma to surgery interval and surgical time.

Parameters	Blood loss during surgery	Time taken for full weight bearing after surgery	Trauma to surgery interval	Surgical time
Mean	141.83	3.65	6.12	79.26
Standard error	5.12	0.8	0.45	1.47
Median	140	2	6	80
Mode	150	1	7	75
Standard deviation	32.78	5.18	2.8	9.43
Range	130	27	13	31
Minimum	70	1	1	65
Maximum	200	28	14	96
Confidence level (95.0%)	10.34	1.63	0.90	2.97

Table 3: Regression statistics for no. of days between trauma and surgery.

Parameters	Values
Multiple R	0.40
R square	0.16
P value	0.008
Correlation coefficient	-1.04
Standard error	6.84

Trauma to surgery time was another factor considered. Given both the prevalence of comorbidities as well as workload at our institute average trauma to surgery time was 6 days (Table 6). Increased time was required for those with severe medical comorbidities. 61% (25) were operated between 6-10 days 31% (13) were operated within 5 days and 8% (3) patients were operated after 10 days. We found a significant correlation between trauma to surgery interval and Harris hip score. Regression analysis showed that Harris hip score decreased with increasing trauma to surgery interval.

Majority of the patients 70% (29) had excellent and good outcomes at the end of 1 month. Out of the rest 22% more had fair outcome at the end of month. Thus 93% patients had favourable outcomes at the end of 1 month while 7% (3 cases) had poor outcome when measured using Harris hip score.

Table 4: Harris hip score.

Parameters	Number of patients	Percentage (%)
Poor	3	7.3
Fair	9	22
Good	22	53.7
Excellent	7	17.1
Total	41	100

Table 5: Radiological outcome.

Radiological outcome	Number of patients	Percentage (%)
Fair	3	7.3
Good	8	19.5
Excellent	30	73.2
Total	41	100

Age distribution was compared with Harris hip score and upon analysis we found p value <0.05, correlation coefficient -0.50 with R^2 value 0.25. Thus, Harris hip score decreased with increasing age group (Table 6).

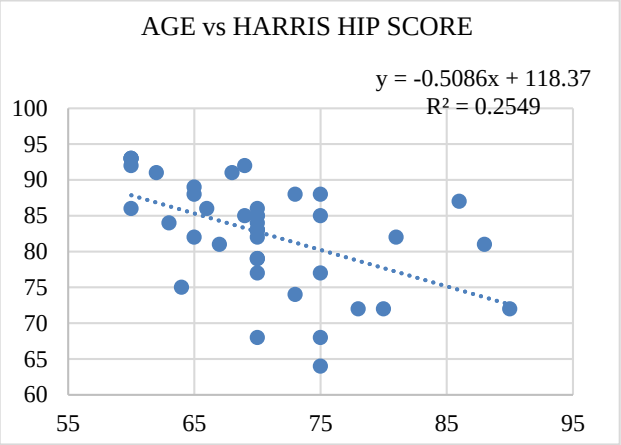

Figure 10: Harris hip score and age correlation.

Table 6: Harris hip score and age correlation regression statistics.

Parameters	Values
Multiple R	0.50
R square	0.25
P value	0.0007
Standard error	6.46

On comparing mode of injury with Harris hip score it was found to be significant. Those patients with road traffic accident as mode of injury had better outcomes vs those with domestic fall. This can be attributed to younger and more fitter patients in whom mode if injury was road traffic accident while generally older and osteoporotic patients in whom domestic falls caused the fracture.

Complications

A total of 5 patients suffered from complications. Most common was superficial infection ,2 cases, treated with daily dressing and iv antibiotics till web counters and CRP values were negative. Both the patients had a good recovery after iv antibiotics and no further intervention was necessary.

1 patient suffered from deep venous thrombosis; 1 patient suffered from pulmonary embolism while another patient suffered from a post operative limb shortening of 1 cm which was treated with a shoe raise.

Table 7: Harris hip score with mode of injury correlation.

Parameters	Radiological outcome			Total	P value
	Fair	Good	Excellent		
Poor	2	1	0	3	
Fair	1	3	5	9	<0.001
Good	0	4	18	22	

Continued.

Parameters	Radiological outcome			Total	P value
	Fair	Good	Excellent		
Excellent	0	0	7	7	
Total	3	8	30	41	
Harris hip score group					
Domestic fall	3	9	17	3	
RTA	0	0	5	4	0.036*
Total	3	9	22	7	

DISCUSSION

Hip fractures are associated with significant morbidity and mortality in elderly patients. The treatment of unstable, displaced intertrochanteric fractures is difficult and challenging. Given the osteoporotic bone, high comorbidities and need for early mobilization as well as variable and less predictable results of internal fixation of unstable intertrochanteric primary bipolar hemiarthroplasty is starting to emerge as a viable treatment option in these patients.

Age

Kayali et al compared 42 patients in which mean age was 73 years who underwent cone hemiarthroplasty using a cementless press fit through a standard posterior approach.[1] Rodop et al in their study had mean age of 75.6 years while Kesemenli et al and George et al had mean age 78 years.[8,25,27] This was similar to our study where mean age was 70.4 years. In our study, age was negatively correlated with Harris hip scores with outcomes showing a decreasing trend with increasing age. However, favourable outcomes were seen in majority (93%) of the patients.

Gender

73% (30) patients were male while 27 were female.

Comorbidities

Comorbidities were present in 85% (35) patients. Most common was hypertension which was seen in 48.8% of the patients.

The average blood loss was 141.8 ml.

Time taken for surgery from day of trauma

Trauma to surgery time was another factor considered. Given both the prevalence of comorbidities as well as workload at our institute average trauma to surgery time was 6 days. Increased time was required for those with severe medical comorbidities. 61% (25) were operated between 6-10 days 31% (13) were operated within 5 days and 8% (3) patients were operated after 10 days We found a significant correlation between trauma to surgery interval and Harris hip score. Regression analysis showed that Harris hip score decreased with increasing trauma to surgery interval. Thus, we recommend operating the patient as soon as patient is medically fit for optimal functional outcomes.

Mode of injury

78% (32) patients had domestic fall as mode of injury while 22% (9) had road traffic accident as mode of injury. This again points to the overall poor bone quality and poor health of the patients in this age group suffering from this fracture. Given the elderly population, the prevalence of comorbidities was high in this age group. On comparing mode of injury with Harris hip score it was found to be significant. Those patients with road traffic accident as mode of injury had better outcomes vs those with domestic fall. This can be attributed to younger and more fitter patients in whom mode if injury was road traffic accident while generally older and osteoporotic patients in whom domestic falls caused the fracture.

Surgical time

Green et al in their study found operative time to be 60 minutes.[3] Harwin et al reported average operative time 75 minutes while Haentjens reported average surgical time 82 minutes.[7,19] Chan et al reported average surgical time 69 minutes.[21] Grimsrud reported average surgical time of 110 minutes.[22] In our study time also, surgical time was within this range with mean 79.2 minutes.

Time for ambulation

The time for ambulation was reported by Green et al as 5.5 days.[3] Harwin et al reported 88% patients were ambulatory before 7 days.[19]

Rodop et al in their study had 98% patients ambulatory before discharge from hospital.[8] 78% in our study started weight bearing by 5 days. Patients were encouraged for weight bearing as soon as possible. Partial weight bearing was started on the day of surgery itself and full weight bearing was advised from the day 1 post operative day to all the patients possible.

Dedicated physiotherapy regimen was started for all to ensure early mobilization. 78% (32) patients started full weightbearing within 5 days, 17% (7) between 5 to 10 days and 2 patients started weightbearing beyond 10 days.

Complications

According the study conducted by Kayali 24% patients in the arthroplasty group died in the first half year, 1 amongst them acquired deep infection and did not respond to antibiotics.[1] There was 1 respiratory infection,1 intracranial bleed. Other patients died from causes not related to the trauma or surgery. Other complications included 4 bed sores and 1 superficial infection. In the study conducted by Grimsrud et al, 15% patients suffered complications.[22] There was 1 myocardial infarction,1 urinary tract infection, 1 deep infection, 2 decubitus ulcers, 1 posterior dislocation. Rodop et al in their study had 1 myocardial infarction, 2 pulmonary thromboembolisms, 1 deep infection, 1 death from unrelated malignancy, 5 cases of limb length discrepancy.[8]

In our study total of 12% (5) patients suffered from complications. Most common was superficial infection ,2 cases, treated with daily dressing and iv antibiotics till WBC count, erythrocyte sedimentation rate (ESR) and CRP values were negative. Both the patients had a good recovery after iv antibiotics and no further intervention was necessary. 1 patient suffered from deep venous thrombosis, 1 patient from pulmonary embolism and 1 from post operative limb shortening. Complications also significantly affected functional outcomes. Functional outcomes were poorer in those with complications than those without.

Radiological outcome

Radiological outcome was analysed and found to be 73%, good 20%, fair 7% and poor 0% at the end of 1 month. On comparing functional outcomes in Harris hip score and radiological outcomes there was significant relation between radiological and functional outcomes.

Functional outcome

In study conducted by Kayali et al functional results were excellent in 19%, good in 38%, fair in 14% patients, poor in 4% and mortality in 10% patients in hemiarthroplasty group.[1] They concluded that functional outcome was comparable in internal fixation and hemiarthroplasty but hemiarthroplasty allowed earlier mobilization. In their study Green et al reviewed 20 patients, operated for primary bipolar hemiarthroplasty in elderly age group with unstable intertrochanteric fractures.[3] They reported, 35% patients had excellent results, 55% patients had good results, 35% patients had fair results, 25% patients had poor results with 3 patients dying. They concluded that primary bipolar hemiarthroplasty in elderly patients allowed early mobilization and better physical rehabilitation.

In the study by Haentjens et al 37 patients were reviewed.[7] Elderly patients with unstable intertrochanteric fractures were treated with primary bipolar hemiarthroplasty. They reported, 18.9% (7) patients had excellent results, 29.7% (11) patients had good results, 18.9% (7) patients had fair results, 13.5% (5) patients had poor results and reported death of 8% (3) cases. They concluded that primary bipolar hemiarthroplasty for previously ambulatory patients older than 70 years enabled earlier full weight bearing along with reducing complications related to prolonged recumbency like pneumonia, decubitus ulcers and atelectasis. In the study by Rosenfeld et al 24, elderly patients with unstable intertrochanteric fractures were operated for primary hemiarthroplasty. Out of 72 patients they reported excellent results in 46% (33) patients, good results in 29% (21) patients, fair results in 15% (11) patients, poor results in 3% (2) patients and reported death of 7% (5) patients. They concluded that in elderly patients with unstable intertrochanteric fractures primary hemiarthroplasty helped in early ambulation and along with it also reduced the complications.

Chan et al studied 55 patients who had suffered from intertrochanteric fractures and were operated for primary cemented bipolar hemiarthroplasty.[21] They reported excellent results in 19 cases good results in 8 cases, and death of 12 cases in the series. Their conclusion was that, primary cemented bipolar hemiarthroplasties for intertrochanteric fractures allow immediate mobilization and full weight. They also concluded that there are no risk complications of sliding screw device like implant failure, excessive collapse. Thus, it is a preferable alternative to sliding screw system in unstable intertrochanteric fractures in the elderly. Stern et al studied 105 cases who were diagnosed with type III and type IV intertrochanteric fractures with comminution and got operated for Leinbach bipolar prosthesis.[4] They reported that there was reduced hospital stay. That it allowed immediate mobilization and thus decreased recumbency related complications.

Broos et al conducted a study with 565 cases.[18] They included intertrochanteric fractures treated with a variety of options including dynamic hip screw, fixed angled blade plate, enders pins and bipolar hemiarthroplasty. Their conclusion was that the surgical time, average blood loss, along with mortality rates were comparable between internal fixation and primary hemiarthroplasty. 73% in hemiarthroplasty group were considered pain free versus 63% in internal fixation group with similar functional outcomes. In the study conducted by Rodop et al they studied 54 patients diagnosed with unstable intertrochanteric fractures and treated primarily with Bipolar hemiarthroplasties.[8] They reported excellent results in 31% (17) cases, good results in 26% (14) cases, fair results in 5% (3) cases, poor results in 24% (13) cases and reported death of 13% (7) cases. Their conclusion was primary bipolar hemiarthroplasty for unstable intertrochanteric fractures in the elderly was a suitable procedure allowing early weight bearing along with earlier and better physical rehabilitation of the patients.

Kesemenli et al studied and reported 27 patients with unstable intertrochanteric fractures operated for Leinbach type bipolar endoprosthesis.[25] The series showed excellent

results in 22 cases, poor results in 3 cases and reported death 2 cases. They concluded that in elderly patients with unstable intertrochanteric fractures treatment with primary Bipolar hemiarthroplasty decreased immobilization related complications by allowing early weightbearing. Vahl et al in a study on communited unstable trochanteric fractures reported that for elderly patients with communited unstable intertrochanteric fractures, primary hemiarthroplasty provides a suitable alternative to internal fixation.[26]

Grimsrud et al conducted study of 39 cases who were diagnosed with unstable 3- or 4-part intertrochanteric fractures.[22] They described a novel cerclage technique along with primary cemented bipolar hip arthroplasty. After one year, they did not report loosening or subsidence of the femoral components. They concluded that, according this study their technique allowed early weightbearing and it had an acceptable rate of complications and thus was suitable procedure in such cases. In 2019, Zhou et al, studied and reviewed 108 patients. They reported comparable results in internal fixation and hemiarthroplasty with earlier mobilization in hemiarthroplasty group.[23] Kire et al concluded in a study of 75 patients that bipolar hemiarthroplasty resulted in earlier mobilization and better outcomes as well as prevention of osteoporosis related implant failure.[29]

In our study majority of the patients 70% (29) had excellent and good outcomes at the end of 1 month. Out of the rest 22% more had fair outcome at the end of month. Thus 93% patients had favourable outcomes at the end of 1 month while 7% (3 cases) had poor outcome when measured using Harris hip score.

Our study has shown similar results to above mentioned studies.

Limitations

The pandemic affected our follow up hence the long-term outcome will need further follow up. This study has been conducted at a single centre; large scale multicentric studies will help to add better data regarding this treatment modality in the management of this complex fracture.

CONCLUSION

Unstable intertrochanteric fractures are a common cause of morbidity and morbidity associated mortality in the elderly age group. The high prevalence of comorbidities and osteoporosis makes internal fixation challenging as well it leads to delayed mobilization, fixation failure, loss of reduction. Although higher Harris hip scores were seen in the younger age group amongst our patients, almost all the patients had favourable outcomes and early ambulation. Delayed mobilization leads to pressure sores, increased risk for deep vein thrombosis, lung infections and overall increased morbidity as well as poor functional outcomes. Thus, in this category of patients, primary cemented bipolar hemiarthroplasty is a viable option that leads to good functional outcomes and allows early mobilization and weight bearing. This prevents recumbency related complications like pressure sores, respiratory tract infections, thromboembolic phenomenon along with subjective satisfaction. Operating as early as the patients' medical condition permits also helps in achieving the most favourable outcomes. Thus, primary hemiarthroplasty should be considered as an option wherever results of internal fixation are predicted to be poor. However long-term studies are required for better analysis and to paint a more comprehensive picture regarding position of this surgery in management of this complex fracture.

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Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Kayali C, Agues H, Ozluk S, Sanli C. Treatment for unstable intertrochanteric fractures in elderly patients: internal fixation versus cone hemiarthroplasty. J Orthop Surg. 2006;14(3):240-4.
2. Broos PLO, Rommens PM, Greens VR, Stappaerts KH (1991) Pertrochanteric fractures in the elderly. Is the Belgian VDP prosthesis the best treatment for unstable fractures with severe comminution? Acta Chir Belg. 1991;91:242-9.
3. Green S, Moore T, Proano F (1987) Bipolar prosthetic replacement for the management of unstable intertrochanteric hip fractures in the elderly. Clin Orthop. 1987;224:169-77.
4. Stern MB, Angerman AL. Comminuted intertrochanteric fractures treated with a Leinbach prosthesis. Clin Orthop Relat Res. 1987;218:75-80.
5. Kesmezacar H, Ogut T, Bilgili MG, Gokay S, Tenekecioglu Y. Treatment of intertrochanteric femur fractures in elderly patients: internal fixation or hemiarthroplasty. Acta Orthop Traumatol Turc. 2005;39(4):287-94.
6. Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. North Am J Med Sci. 2010;2(12):561.
7. Haentjens P, Casteleyn PP, De HB, Handelberg F, Opdecam P. Treatment of unstable intertrochanteric and subtrochanteric fractures in elderly patients. Primary bipolar arthroplasty compared with internal fixation. J Bone Joint Surg. 1989;71(8):1214-25.
8. Rodop O, Kiral A, Kaplan H, Akmaz I. Primary bipolar hemiprosthesis for unstable intertrochanteric fractures. Int Orthop. 2002;26(4):233-7.
9. Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. North Am J Med Sci. 2010;2(12):561.

10. Jensen JS. Trochanteric Fractures. An Epidemiological, Clinical and Biomechanical Study. Acta Orthop Scand. 1981;188:11-9.
11. Sexson SB, Lehner JT. Fractures Affecting Hip Fracture Mortality. J Orthop Trauma. 1987;1:298-305.
12. White BL, Fisher WD, Laurin CA. Rate of Mortality for Elderly Patients after Fracture of the Hip in the 1980′s. J Bone Joint Surg. 1987;69-A:1335-40.
13. Eiskjaer S, Otsgard SE, Jakobsen BW, Jensen J, Lucht U. Years of potential life lost after hip fracture among postmenopausal women. Acta Orthop Scand. 1992;63(3):293-6.
14. Dahl E. Mortality and life expectancy after hip fractures. Acta Orthop Scand. 1980;51(1):163-70.
15. Claes H, Broos P, Stappaerts K. Pertrochanteric Fractures in Elderly Patients: Treatment with Ender's Nails, Blade-Plate, or Endoprosthesis? Injury. 1985;16:261-4.
16. Cobelli NJ, Sadler AH. Ender Rod versus Compression Screw Fixation of Hip Fractures. Clin Orthop. 1985;201:123-9.
17. Esser MP, Kassab JY, Jones DHA. Trochanteric Fractures of the Femur.A Randomised Prospective Trial Comparing the Jeweu Nail-Plate with the Dynamic Hip Screw. J Bone Joint Surg. 1986;68-B(4):557-60.
18. Broos PL, Rommens PM, Geens VR, Stappaerts KH. Pertrochanteric fractures in the elderly. Is the Belgian VDP prosthesis the best treatment for unstable fractures with severe comminution? Acta Chirurgica Belgica. 1991;91(5):242-9.
19. Harwin SF, Stern RE, Kulick RG. Primary Bateman Leinbach bipolar prosthetic replacement of the hip in the treatment of unstable intertrochanteric fractures in the elderly. Orthopedics. 1990;13(10):1131-6.
20. Green S, Moore T, Proano F. Bipolar prosthetic replacement for the management of unstable intertrochanteric hip fractures in the elderly. Clin Orthop Relat Res. 1987;224:169-77.
21. Chan KC, Gill GS. Cemented hemiarthroplasties for elderly patients with intertrochanteric fractures. Clin Orthop Relat Res. 2000;371:206-15.
22. Grimsrud C, Monzon RJ, Richman J, Ries MD. Cemented hip arthroplasty with a novel cerclagecable technique for unstable intertrochanteric hip fractures. J Arthroplast. 2005;20(3):337-43.
23. Zhou S, Liu J, Zhen P, Shen W, Chang Y, Zhang H, Zhu Q, Li X. Proximal femoral nail anti-rotation versus cementless bipolar hemiarthroplasty for unstable femoral intertrochanteric fracture in the elderly: a retrospective study. BMC Musculoskeletal Disord. 2019;20(1):1-7
24. Rosenfeld RT, Schwartz DR, Alter AH. Prosthetic replacements for trochanteric fractures of the femur. J Bone Joint Surg Am. 1973;55:420.
25. Kesemenli C, Subasi M, Arslan H, Kirkigoz T, Necmioglu S. Treatment of Inter trochanteric fractures in elderly patient with Leinbach type endoprosthesis. Ulus Trauma Derg. 2001;7(4):254-7.
26. Vahl AC, Dunki Jacobs PB, Patka P, Th M Haarman HJ. Hemiarthroplasty in elderly, debilitated patients with an unstable femoral fracture in the trochanteric region. Acta Orthopaedics Belgica. 1994;60(3):274-9.
27. George J, Haidukewych, Daniel Berry J. Hip Arthroplasty for salvage of failed treatment of Inter trochanteric hip fractures. J Bone Joint Surg. 2003;85(A):899-904.

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