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ORIGINAL ARTICLE

PRIMARY CEMENTED BIPOLAR HEMIARTHROPLASTY WITH TROCHANTERIC AND CALCAR RECONSTRUCTION IN UNSTABLE INTERTROCHANTERIC FRACTURES IN ELDERLY: A PROSPECTIVE STUDY

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ABSTRACT: INTRODUCTION: To avoid the complications and morbidity associated with attempted Osteosynthesis of the so called Unstable inter-trochanteric fractures in the elderly population, Primary Cemented Bipolar hemiarthroplasty been around for over three decades now. But, hardly any emphasis been given over the technical aspects to improve the functional outcome. Present study is one such, following reconstructive attempts (Of primary cemented bipolar hemiarthroplasty) with trochanter and calcar reconstruction in the elderly population to reduce the risk of unstable Hemiarthroplasty. **MATERIALS AND METHODS:** This prospective study included 20 cases of elderly patients with mean age of 73.5 years (Age range 66 to 82 yr) who sustained multifragmentary/communited inter-trochanteric femur fracture treated with Primary cemented bipolar hemiarthroplasty with trochanteric and calcar reconstruction to emphasize the importance of restoration soft tissue tension to reduce the risk of unstable Hemiarthroplasty. Essential Technical steps include Figure of eight/ multiple wire loop technique of reconstruction (with or without K 'wires) of greater trochanter/ abductor mechanism and calcar reconstruction either by wiring Lesser trochanteric fragment and or insertion of cortical piece of bone graft (medially under the collar of the prosthesis) harvested from head and neck fragment. The patients were followed up at six week, three month, six month and one year postoperatively and assessed using Harris Hip Score (HHS). **RESULTS:** The mean HHS score was 85 (range 69 to 91) at the end of one year. The main clinical measures were early post-operative full weight bearing, post-operative complication & functional outcome. The time to full weight bearing, the rate of post-operative complications & functional outcome was significantly better in cemented bipolar arthroplasty group. **CONCLUSION:** The authors strongly believe that primary cemented bipolar hemiarthroplasty with emphasis of restoration of abductor mechanism and calcar support is an ideal surgical strategy for unstable inter-trochanteric fractures of femur in elderly, so as to allow early ambulation, good functional outcome, stable hemiarthroplasty with minimal complications without the need for revision surgery.

KEYWORDS: Bipolar, Elderly, Hemiarthroplasty, unstable Intertrochanteric fractures, greater trochanter fixation, Calcar reconstruction, Harris hip score.

INTRODUCTION: Comminuted intertrochanteric fractures with severe displacement are common in elderly patients. These patients have poor bone quality and conventional osteosynthetic procedures frequently lead to non-union and metal failure. The primary goals of

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treatment are stable fixation and early rehabilitation. Stable intertrochanteric fractures can be easily managed with osteosynthetic methods with satisfactory results but the same cannot be expected in comminuted and unstable intertrochanteric fractures. Excessive collapse, loss of fixation and cut through of the screw are commonly encountered when conventional osteosynthesis is attempted.

To allow early post-operative weight bearing and rapid rehabilitation, some surgeons have proposed prosthetic replacement. The purpose of our study is to evaluate the functional outcomes after Primary cemented bipolar hemiarthroplasty for comminuted and unstable intertrochanteric fractures in the elderly population with special emphasis on the reconstruction of the Greater trochanter and Calcar The literature regarding this is sparse especially those with emphasis on the trochateric and calcar reconstruction.

MATERIALS AND METHODS: Prospective study conducted in Government general Hospital, Kakinada from June 2012 to October 2013. The classification used in the study was AO-OTA classification.

Inclusion Criteria	Exclusion Criteria
1) Unstable IT fracture (AO 312.2 & 2.3) 2) Age more than 65 yrs 3) Patients who are mobile previous to injury 4) No other fracture sustained, only isolated Inter-trochanteric fracture	1) Stable IT fractures 2) Age <65yrs 3) Patients unfit for Surgery 4) Patients who were non mobile previous to injury.

Pre-operative Data: Name, age, sex, side, fracture type and mode of injury.

Post-operative Data: Time to full weight bearing, average hospital stay, complications and evaluation done with Harris hip score.

The most commonly recommended/ accepted surgical strategy for unstable Inter trochanteric fractures is as follows (as proposed by Salunke et.al,)[1]

I	Calcar and lesser trochanter intact, no communition.	Bipolar prosthesis AMP type.
II	Calcar is fractured or less	Bipolar-thompson's type
III	Instability of postero-medial wall with lesser trochanter and calcar fractured	Modular type of bipolar prosthesis with reconstruction of greater trochanter and calcar reconstruction.

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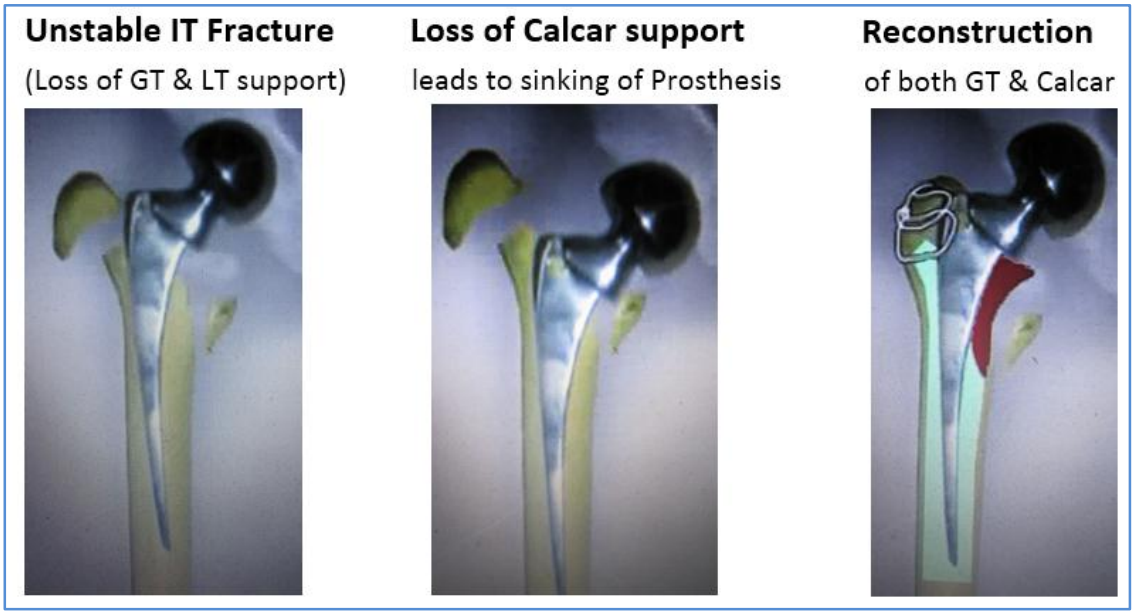
Surgical Technique: Patient is placed in lateral decubitus position and the hip joint is approached through transtrochanteric approach. Fractured head and neck were taken out transtrochaterically without incising the posterior short external rotator muscles. In cases where a posteromedial deficiency involving the calcar was found, reconstruction of this region was accomplished via fashioned autologous bone graft harvested from the excised femoral head. For this, a chunk of bone was cut from the femoral head. Its cartilage attachment was stripped off. The chunk was modelled into a peg with oscillating saw and bone nibbler. This peg was securely placed in the posteromedial area of the proximal femur to compensate for the absence of the original calcar. All other fragments of the greater and lesser trochanter were stabilized with cerclage wiring.

Partial weight bearing was allowed from 3rd post-operative day onwards and the patient was mobilized with a walker. The follow up period ranged from thirteen months to twenty two months with an average follow up of eighteen months.

Post-operative hip function was evaluated using the Harris hip scoring system.



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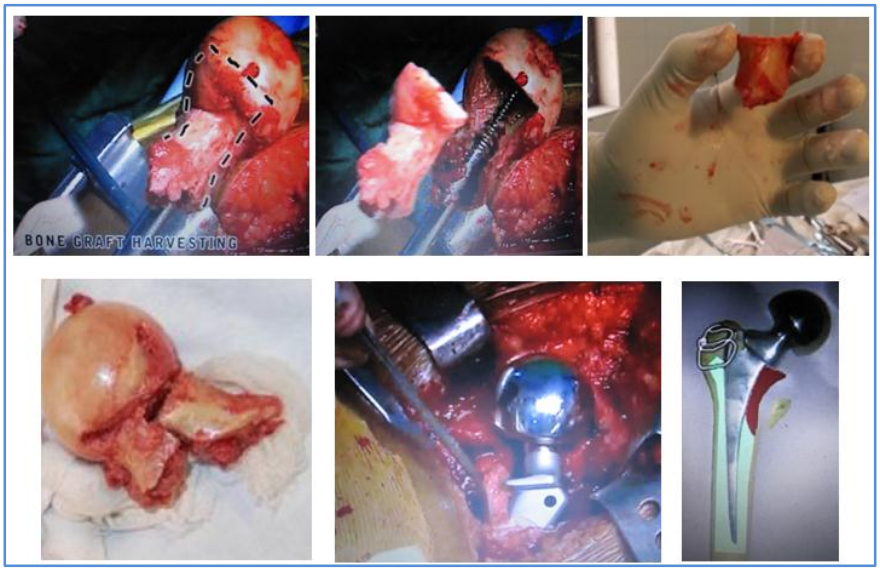
Bone graft Harvesting from Head neck portion & reconstruction of Calcar with Bone Graft:



RESULTS: In the present study, twenty cases of unstable intertrochanteric fractures treated with cemented bipolar hemiarthroplasty from June 2012 to October 2013. The follow up period ranged from thirteen months to twenty two months with an average follow up of eighteen months. The observations made in the study were

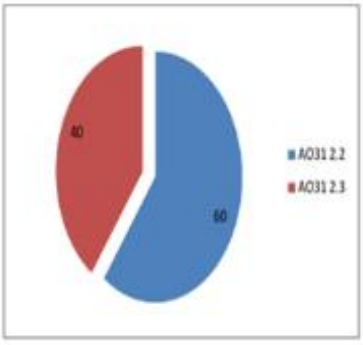
AGE INCIDENCE

AGE IN YEARS	NO. OF CASES	PERCENTAGE
65-79	18	90%
80 and above	2	10%
TOTAL	20	100%

Type of Fracture

AO TYPE	NO. OF CASES	PERCENTAGE
AO 31 2.2	12	60%
AO 31 2.3	08	40%
TOTAL	20	100%

AGE INCIDENCE



Type of Fracture

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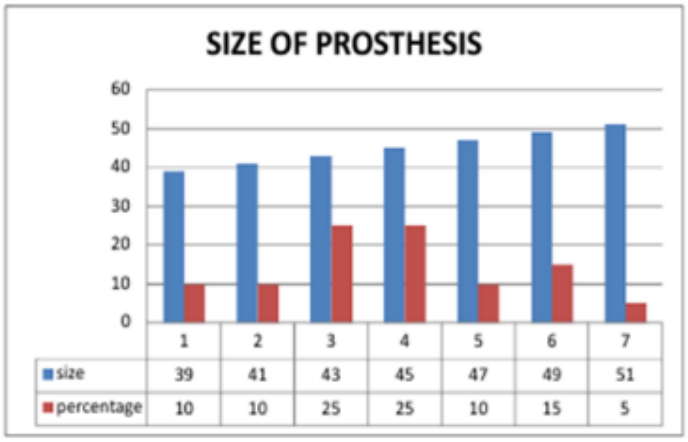
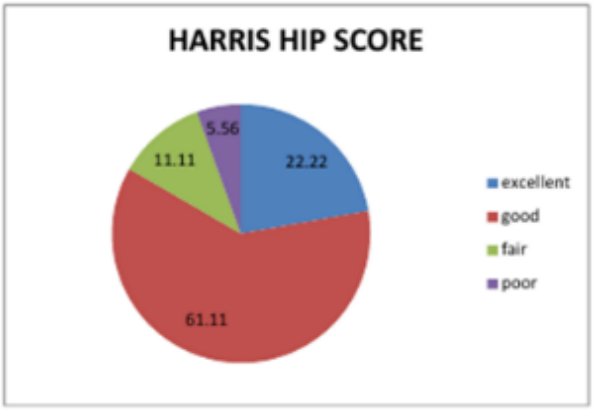
SIZE OF THE PROSTHESIS

SIZE	NO. OF CASES	PERCENTAGE
39	2	10%
41	2	10%
43	5	25%
45	5	25%
47	2	10%
49	3	15%
51	1	5%
TOTAL	20	100%



FUNCTIONAL EVALUATION WITH HARRIS HIP SCORE: Out of twenty patients two patients died between six weeks to six months follow up. So the result calculated for eighteen patients. For eighteen patients 83.33% patients had excellent to good results, while 11.11% patients had fair result and 5.56% had poor result.

HHS	NO. OF CASES	PERCENTAGE
EXCELLENT (90-100)	4	22.22%
GOOD (80-89)	11	61.11%
FAIR (70-79)	2	11.11%
POOR (<70)	1	5.56%
TOTAL	18	100%



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S.No.	Complications	No. of Cases
1.	Fracture of femur intraoperative	0
2.	Sciatic Nerve Injury	0
3.	Leg Length discrepancy (>1cm)	3
4.	Superficial Infection	1
5.	Deep Infection	0
6.	Trendlenberg gait	2
	Radiological complications	
7.	Dislocation	0
8.	Heterotrophic ossification	0
9.	Protrusioacetabuli	0
10.	Loosening of stem	0
11.	Implant breakage	0

COMPLICATIONS:

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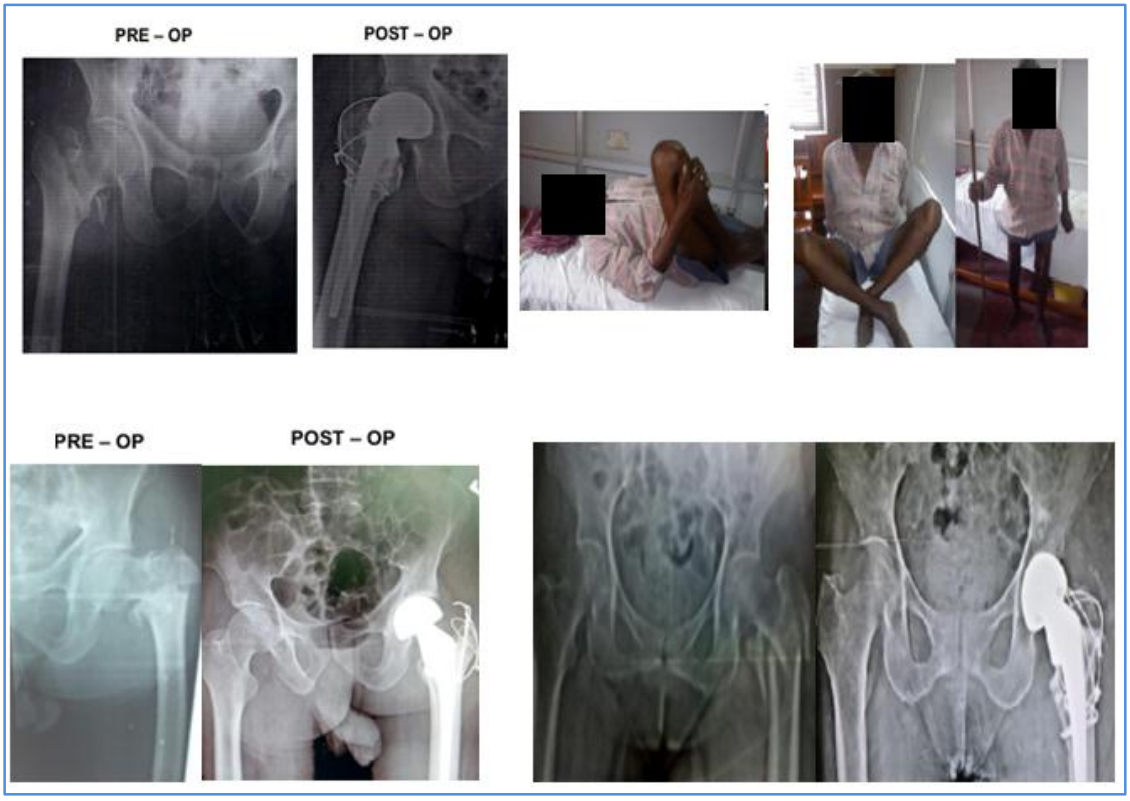

DISCUSSION: Intertrochanteric fractures are commonly been treated with DHS or intramedullary fixation (Gamma nail/ PFN).[2,3] Union rates as high as 100% have been reported in association with well-reduced, stable fractures that were treated with ideal implant placements, failure rates of as high as 56% have been noted in association with unstable fractures, comminutions, suboptimal fracture fixations, or poor bone qualities in elderly patients.[4,5]

The outcome of fixation depends mainly on quality of bone, age of patient, general health, trauma surgery interval, adequacy of treatment, comorbidities, and stability of fixation.[2,6] Holi Dimon and Hughston, Sarmentio and William's have done outstanding work in attempt to change an unstable intertrochanteric fracture into a stable one and fix it with an appropriate implants

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until it heals. The reported complication rate in literature for treating unstable intertrochanteric fracture range from 18-50%.[7] Intertrochanteric fractures in elderly leads to confusion regarding treatment options osteosynthesis Vs hemiarthroplasty. In this age group the fracture configuration is generally comminuted with presence of extensive osteoporosis. So maintenance of fracture reduction which should be anatomical or near anatomical, proper positioning of the implant and monitored weight bearing are the pre-requisites to achieve good functional outcomes.

Osteosynthesis of such fractures may reduce the morbidity of pain; it does not permit an early mobilization with a fear of failure of fixation. In old osteoporotic patients surgeon is often confronted with a challenge and dilemma between achieving bony union in a weakened bone stock with poor implants hold, against need for early mobilization. The special problems associated with unstable fractures in the geriatric age group are possibly due to one or more of the following factors: Osteoporosis. Comminution. Age related medical illnesses, and need for rapid mobilization.

All these problems are addressed by bipolar hemiarthroplasty. Early mobilization is possible as the technique bypasses of fracture healing and provides immediate stability and mobility thereby avoiding the problems of recumbency.

Hemiarthroplasty has been used for unstable intertrochanteric fractures since 1971,[8] however less frequently as compared to femoral neck fracture.[9] Its initial use was as a salvage procedure for failed pinning or other complications.[10] Tronzo claimed to be the first to use long, straight-stemmed prosthesis for the primary treatment of intertrochanteric fractures.[11]

Rosenfeld, Schwartz, and Alter reported good results with the use of the Leinbach prosthesis.[12] Stern and Goldstein used the Leinbach prosthesis for the primary treatment of 22 intertrochantric fractures and found early ambulation and early return to the prefracture status as a definite advantage.[10] Angerman et al in 1987 reported 105 cases, but Leinbach prosthesis with a solid head may accelerate wear of the acetabular cartilage.[13] For this reason some authors preferred to use a bipolar femoral prosthesis that could be converted to a total hip replacement.

Harwin et al in 1990 reported use of the Primary Bateman-Leinbach bipolar prosthetic replacement in the treatment of unstable intertrochanteric fractures in the elderly in a series of 58 patients Morbidity and mortality was no greater in this group than in groups treated by ORIF.

The earliest comparison of prosthetic replacement with internal fixation was undertaken by Haentjens et al.[14] and involved 79 patients. Encompassing an age range of 75 – 96 years, 37 consecutive patients underwent cemented bipolar hemiarthroplasty. The results in this population were compared in a retrospective manner with 42 patients undergoing internal fixation with a blade plate. Patients treated with a cemented hemiarthroplasty were permitted immediate weight bearing. Those patients treated with internal fixation were not allowed to bear weight fully until osseous union had occurred radiographically. The results were comparable among groups with a significant reduction in the incidence of pneumonia and pressure sores in those undergoing prosthetic replacement. This was thought to be due mainly to rapid mobilization of the prosthetic group as compared with those fixed internally. Further, the operative time, blood loss, and mortality rates were comparable between the two groups, with a slightly higher percentage (73% versus 63%) of those receiving a prosthesis considered to be pain free. Functional outcome was

comparable between the two groups one year after injury. Complications included three cases of painful fracture collapse in the dynamic hip screw group (2%) and one loosening in the prosthesis group (0.7%).

Grimsrud et al.[15] studied 39 consecutive patients of unstable intertrochanteric fractures treated with a cemented bipolar hip arthroplasty. They concluded that these fractures can be treated with a standard femoral stem and cerclage cabling of the trochanters. The technique allows safe and early weight bearing.

KH Sancheti et al.[16] retrospectively analyzed 37 cases of primary hemiarthroplasty done for elderly, osteoporotic, unstable IT fractures and 91% had excellent to fair functional results.

Khaldoun Sinno et al.[17] in 2010 analyzed the effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients and observed that HHS at 12 months postoperatively was significantly higher in patients who underwent bipolar arthroplasty (80.35± 4.98) (range 72 – 89) compared to the internal fixation group (68.17± 5.22) (range 59 - 78) ($p<0.0001$).

Atul Patil et al[18] conducted study on Role of Cemented Bipolar Hemiarthroplasty for Comminuted Inter-trochanteric Femur Fracture in elderly osteoporotic patients through a modified Transtrochanteric approach- "SION Hospital Modification" and observed that Mean Harris hip score at the mean follow up of 2.92 years was 80.76 and concluded that Bipolar Hemiarthoplasty has its set of long term complications questioning its long term survivorship, but it is an excellent and viable option for early ambulation and good early-midterm survivorship.

Nikunj Maru et al. in 2013 retrospectively analyzed Unstable Intertrochanteric Fractures In High Risk Elderly Patients treated With Primary Bipolar Hemiarthroplasty and concluded that Primary Bipolar Hemiarthroplasty may be a better alternative treatment for unstable Intertrochanteric fractures in elderly moribund patients.

Conflicting reports about postoperative mortality in cases with primary hemiarthroplasty are cited in the literature. Kesmezacare et al.[19] reported postoperative mortality in 34.2% after a mean of 13 months and in 48.8% after a mean of 6 months in patients treated with internal fixation and endoprosthesis, respectively. Other studies have shown no differences in postoperative mortality in two groups.[14,20,21] In present series only 2 patients out of the 20 died (10%) within 6 months of surgery due to unrelated causes.

In present study on 20 elderly patients with unstable inter trochanteric fracture treated with cemented bipolar hemiarthroplasty, the average age of patients was 72.25 years (range, 66–82 years) which was in the same age range conducted in other studies. This study also targeted the same age group as in other studies.

The study of cemented bipolar hemiarthroplasty was conducted in the old age group that is more than 65 years in all other studies so in present study also we have taken the age range 66 to 82 with mean age range 72.25 years.

All patients were operated within 15 days with delay due to time taken for patients to be fit for anaesthesia. Furthermore, because of inhomogeneous population in terms of existing co morbidity we could not comment on effect of time interval on final functional outcome.

The patients started ambulation with walker at an average 4.3 days after surgery (rg, 2–8 days).

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STUDY	YEAR	MEAN POA IN DAYS
Green S, Moore T et al.	1987	5.5 days
FatihEksioglu et al.	1998	4 days
Kiran Kumar Gn et al.	2013	5.4 days
MilindIngle et al.	2014	3 days
Present sudy	2014	4.3 days

Post-operative ambulation is the main important one that differs with the studies on internal fixation of intertrochanteric fractures, thus it has become clear that walking with full weight-bearing before the fracture has healed is often impossible in factures that are fixed but early ambulation following surgeries are important, for preventing complications that can be caused by long term bed rests in elderly patients with poor general conditions. So in present study we allowed the patients to ambulate post operatively between 2 to 8 days with mean value of 4.3 days depending on patient general condition post operatively.

Out of the 20, two patients expired due to unrelated causes.

In other studies conducted by Kesmezacare et al. [19] reported postoperative mortality in 34.2% after a mean of 13 months and in 48.8% after a mean of 6 months in patients treated with internal fixation and endoprosthesis, respectively. Other studies have shown no differences in postoperative mortality in two groups.[14,20,21]

In our study the remaining 18 patients having a minimum one year follow up were evaluated and data was further analyzed for only these 18 patients.

At 1 year follow-up the mean HHS was 85 (range, 69–91). A total of 4 patients (22.22%) were graded as excellent, 11 patients (61.11) as good, 2 (11.11%) as fair, 1 (5.56) as poor with excellent to good results in 83.33% patients and excellent to fair in 44% patients which was comparable to other studies.

STUDY	YEAR	HHS AT 1 YEAR
Osman Rodop et al.	2002	83.78% (E to G)
Liang et al.	2005	88% (E to G)
KH Sancheti et al.	2010	91% (E to F)
Kiran Kumar Gn et al.	2013	90% (E to F)
MilindIngle et al.	2014	96.15% (E to F)
Present study	2014	83.33% (E to G) 94.44% (E to F)

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At last follow up, 6 patients were walking without any aid, 11 patients used a stick for walking. Three patients had shortening of more than 1cm of the operated limb which was well compensated by giving a shoe raise.

A total of 2 patients had abductor muscle weakness with a positive Trendelenberg test and Trendelenberg gait at final follow-up.

Osman Rodop et al.[22] reported deep infection in one patient during the13th month post-operatively, one case of acetabular erosion, four patients with non-union of the greater trochanter, five with leg-length discrepancy due to high seating of the prosthesis and in two patients cerclage wire for the greater trochanter had broken and there was no dislocation or aseptic loosening.

In present study one patient had a superficial wound infection which settled down with a course of intravenous antibiotics for 2 weeks. There were no dislocation, loosening, late infections, heterotrophic ossification, protrusion acetabuli and no implant breakage.

STRENGTHS AND WEAKNESSES: Strength of the present study is it is a prospective study of elderly patients that is more than 65yrs old and only unstable intertrochanteric fractures (AO 31 2.2 & 2.3) so there is uniformity in age range and fracture type which cannot alter the results of the present study.

Strengths of the present study are by providing stable, painless hip the patients were mobilized early in post-operative period. So that there were no complications of prolonged recumbence and they are able to do their regular activities.

The elderly patients usually associated with medical co-morbidities and it is difficult to make them fit for anaesthesia. In such a situation we should provide them stable, painless hip in single operation. If the patient had undergone internal fixation of unstable inter trochanteric fracture there is high chance of failure so it is very difficult to make them fit for anaesthesia for second time. So in present study there is very high chance of avoiding second operation.

With some newer designs like modular bipolar prosthesis there is a possibility of adjusting neck length to achieve optimum limb length and joint tension and may allow conversion to total hip replacement without changing the femoral Component.

The weaknesses of the study are in the short term cemented bipolar hemiarthroplasty seem to give better results than open reduction and internal fixation in the treatment of unstable intertrochanteric hip fractures in terms of mortality and morbidity rates, complications, early rehabilitation and returning to daily living activities. Long-term problems such as loosening, protrusion acetabuli, stem failure, late infections and late dislocations have not been seen in the present study. While these theoretically are potential problems they are seen usually years after the surgery.

The average patient age in the present study was between 66 and 82 years and follow up period is between thirteen months to twenty two months with an average follow up of eighteen months. So short term complications seem to be more important than long-term ones. Because life expectancy increases in all countries, long-term disadvantages of the hemiarthroplasty may outweigh its short-term advantages, this is the main drawback of the study.

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Hemiarthroplasty for unstable intertrochanteric fracture is not done as frequently as osteosynthesis and hemiarthroplasty for fracture neck of femur. It needs high learning curve in reconstruction of GT, LT and calcar part. So it needs standardization in terms of indications, contraindications and operative procedure. If standardization of operative procedure done it leads to decreased operative time, decreased intra- operative blood loss, decreased postoperative morbidity of patient and early ambulation of the patient.

Results of primary bipolar prosthetic arthroplasty for unstable intertrochanteric fractures cannot be compared with the outcomes reported for internal fixation of similar injuries without a prospective randomized study. So there is a need of further studies in large numbers with randomization of the studies.

Although the current literature and present study contains many small case series and a few comparative studies, so there is need of the larger collaborative, randomized controlled trials to compare the efficacy of the newer techniques with standard treatments. Undoubtedly, the question as to whether prosthetic replacement or internal fixation should be performed in this population of elderly osteoporotic patients will probably remain controversial, until the publication of large prospective, correctly randomized or randomly allocated studies which have compared the two methods in different countries.

CONCLUSION: The proximal femoral fractures should be classified as stable and unstable, the fracture should be graded according to the degree of osteoporosis.

The proximal femoral fractures should be grouped according to fracture geometry so that correct choice of prosthesis can be used.

The treatment of proximal femoral fractures in elderly patients with osteoporosis differs from the treatment of other proximal femoral fractures. These fractures are better treated with Primary cemented hemi-arthroplasty with emphasis on the trochanteric and calcar reconstruction, so that a stable and mobile hip could be achieved with advantages of early ambulation and less hospital stay and no need for revision surgery.

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