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Clinical and radiological outcomes of hemiarthroplasty in elderly patients with unstable intertrochanteric femur fracture

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Abstract

Introduction: One of the most common ailments of hip joint is fracture neck of femur. In recent years incidence of comminuted intertrochanteric femur fractures are rising with rising number of geriatrics population in the country as well as worldwide, and responsible for one of the commonest mode of morbidity and mortality in this age group. Comminuted intertrochanteric femur fractures are challenging fracture to fix for orthopaedic surgeons. Appropriate surgical fixation of trochanteric fracture fragments can restore normal anatomical structure and ambulation and can aid in the recovery of biomechanical function of the hip. This study was designed to evaluate primarily outcome of hemiarthroplasty as well as constructing strength of abductors around hip joint for better functioning hip rather than just replacement by assessing quality of life and range of function in operated limb.
Aim: The aim of this study was to evaluate clinical outcomes such as abductor power, ambulatory ability and radiologic outcomes including the union of the trochanteric fragment in hemiarthroplasty in elderly patients who had unstable intertrochanteric femur fracture.
Materials and Methods: This prospective study included data of 25 patients from BJ Medical college, Civil Hospital, Ahmedabad between the date of 1 May 2019 to November 2021. Patients were included as per the inclusion and exclusion criteria. Hemiarthroplasty using cemented as well as un-cemented prosthesis were used. The functional outcome of surgery was assessed with Harris Hip Score postoperatively, visual analogue scales post operatively. Followup was conducted for 2 years. The power of the abductor was evaluated using Medical Research Council scale.
Results: At the end of 1year 20/25 (80%) patients showed excellent scores as well as combined 24/25 (96%) patients had good and excellent results, per Harris hip score, most patients with 23 out of 25 patients had no pain at all. The fixation of GT and abductor mechanism repair led to improvement in abductor muscles function with 76% patients developing full power (5) as well as combined Grade 4 and 5 patients' total number 23 (92%) had got almost better function of abductors.
Conclusion: From this prospective study, we have found that there is early weight bearing function results in less reliability and dependency on others, as well as better functioning of hip joint and abductor power results in more stability of hip joint. This study also found that patients having early mobilization rates which results in less chances of immobility related complications like DVT. This study shows that with the repair of abductor mechanism using fixation of fracture fragments of Greater trochanter (GT), there is better functioning of hip joint and strength of hip joint over longer period.

Keywords: Hip joint, comminuted intertrochanteric femur fractures, hemiarthroplasty, harris hip score, abductor muscles function improvement, visual analogue scales, medical research council scale

Introduction

The evolution from quadrupeds to anthropoid and anthropoid to human mode of progression, has evolved a big strain on hip, for it must carry double the weight and has to provide for balancing the erect body, thus making hip joint the most important joint in the body, and regarding its ailments is certainly the most difficult for treatment. One of the most common ailments of hip joint is fracture neck of femur. In recent years incidence of comminuted intertrochanteric femur fractures are rising with rising number of geriatric population in the country as well as worldwide, and responsible for one of the most commonest mode of morbidity and mortality in this age group [1, 2].
Most intertrochanteric fractures in elderly patients of age more than 65 years have reported mortality rates ranging from 15 to 30% [3].

With rising standards of healthcare and long-life expectancy with associated osteoporosis in this age group fracture around hip joint is most commonly encountered with more cases coming in emergency room. Internal fixation of stable fractures is easy to perform and gives good results. Anatomical reduction of unstable fractures (Evans type 3 or 4) and its maintenance by internal fixation is difficult due to comminuted fracture geometry and poor bone quality [4, 5]
Comminuted intertrochanteric femur fractures are challenging fracture to fix for orthopedic surgeons. Appropriate surgical fixation of trochanteric fracture fragments can restore normal anatomical structure and ambulation, and can aid in the recovery of biomechanical function of the hip.

For patients with limited activity demand Austin more prosthesis and Thompson prosthesis were developed as unipolar replacement method.

While for wider range of activity and in physically capable as well as young people bi-polar prosthesis are used.

Newer approach is Modular bipolar prosthesis implant with or without cementing used to give more stability and functional hip joint and for future total hip replacement doesn't require stem replacement for this modality.

This study was designed to evaluate primarily outcome of hemiarthroplasty as well as constructing strength of abductors around hip joint for better functioning hip rather than just replacement by assessing quality of life and range of function in operated limb.

Aim

The aim of this study was to evaluate clinical outcomes such as abductor power, ambulatory ability and radiologic outcomes including the union of the trochanteric fragment in hemiarthroplasty in elderly patients who had unstable intertrochanteric femur fracture.

Materials and Methods

In this prospective study we included data of 25 patients from BJ Medical college, Civil Hospital, Ahmedabad between the date of 1 May 2019 to November 2021.

Both male and female patients with age more than 60 years and associated with the comminuted intertrochanteric fractures (Evan's type 3, 4) were included in the study. Patients with open fractures, stable IT fractures, reverse oblique fractures (Russel Taylor type-2), fractures extending to proximal femur (sub-trochanteric) level, age less than 60 yrs, unfit for surgery, severe morbidity, psychiatric illness, musculoskeletal deformity and disorder, high risk patients, severe systemic illness and BMI>30, were excluded from study.

Methods

Patients history including mode of trauma, name sex, age, BMI, co-morbidity and other relevant details were collected. Patients were clinically assessed for knowing the region of pain, tenderness, bruise, hematoma. Distal pulse and movement were assessed in case of dislocation and neurovascular complications were likely to occur in high velocity trauma. After clinical examination, X-rays were performed to locate the fracture and type of fracture as well as to rule out other associated injury rather than going for single bone injury or any dislocation of hip to go for immediate intervention. CT scan was reserved for diagnosis of hairline fracture or any undisplaced fracture which were not identified on x-rays.

Surgical Technique- Patients were given spinal anesthesia under all aseptic precautions. After induction patients were placed in lateral decubitus position and operating site scrubbed with betadine scrub, painting and draping done. The hip joint approached through lateral approach. Skin and subcutaneous tissue were cut. Tensor fascia latae cut, rotators ligated, fractured fragments and head removed, acetabular surface cleared. Prosthesis with or without cementing according to criteria and surgeon preference. All other fragments of bone, the greater trochanter and the lesser trochanter were stabilized with SS wire after cementing of the femur stem of implant into femur canal. Extra cement was used to further stabilize the bone fragments held together by SS wire and final tightening of SS wire was done. Some patients with more comminution of GT fragments were fixed with non-absorbable suture materials, some patients with GT fragments were fixed only with encirclage wire method. Where 18gauge tension band wire were passed medially and fixed laterally through a knot. Hip joint reduction done and the range of motion and stability of joint were checked after that. Drain placed leaving an appropriate tube length. Closure done in layers of joint capsule, iliotibial band, deep subcutaneous, superficial subcutaneous and skin.

Post-operative Care

Postoperatively, all patients were given same antibiotics cover as prophylaxis for 3 days post operatively, as well as pain killers given intravenously for 3days. Intravenous third-generation cephalosporin antibiotics were started on the day of surgery and the first dose was given one hour prior to surgery. Intravenous antibiotics were given till the third postoperative day. Post-operative abduction pillows are given to prevent overaction of adductor muscles action. Blood transfusions were given wherever required. Drains were removed after 48 hours of surgery and postoperative check X-rays were done. Patients were encouraged to sit and stand out of their bed twice daily from the first postoperative day and range of motion exercises started from the next day of surgery. Partial weight bearing was allowed from 2nd post-operative day onwards and the patient was mobilized with a walker. Stitches were removed on the 14th day of the surgery. The time required for each patient to start full weight bearing and also to reach their preoperative condition were recorded in terms of number of days. The functional outcome of surgery was assessed with Harris Hip Score postoperatively, visual analogue scales post operatively.

Patients were instructed how to stand and walk by our rehabilitation protocols. They were allowed to walk on crutches or a walker with tolerable weight bearing on the second postoperative day. Patients who need further physical therapy were transferred to rehabilitation department or other institutions. As the ambulatory ability improved, the assistive device (walker, crutches, or cane) was changed as determined by a physical therapist. To prevent thrombo-embolism, patients wore anti embolic stockings and intermittent pneumatic pump was applied in the bed. Follow-up evaluations were done at six weeks, at 3, 6, 9 and 12 months, and every 6 months thereafter. Post-operative bony fragments fixation as well osteosynthesis around prosthesis using serial x-rays were done post operatively on serial follow-up over 1 month, 3month, 6 months,1 year and every 6 months post operatively. During each follow-up, antero-posterior and lateral radiograph were taken. At the 2-year follow-up, the abductor power was checked. The power of the abductor was evaluated using Medical Research Council scale.

Treatment method

Hemiarthroplasty using cemented as well as un-cemented prosthesis were used. All patients with abductor mechanism repairs done using primarily tension bend wiring used, some are fixed with non-absorbable sutures, some were fixed with cage with graft along with tension wire fixation.

Observations and results: Present study was to aimed for assessment for assessing the results of hemiarthroplasty performed for comminuted intertrochanteric femur fracture by preserving abductor mechanism in old age.

Table 1: Sex Distribution of Study

Gender	Count	Percentage (%)
Male	13	52%
Female	12	48%

As per the data obtained the study has shown that 52% of male patients, reflecting slightly more number of male patients more pronounced compared to that of female patients, which were at 48% in this study.

Table 2: Singh Osteoporosis Index

Grade	Count	Percentage (%)
Grade 1	2	8
Grade 2	6	24
Grade 3	17	68

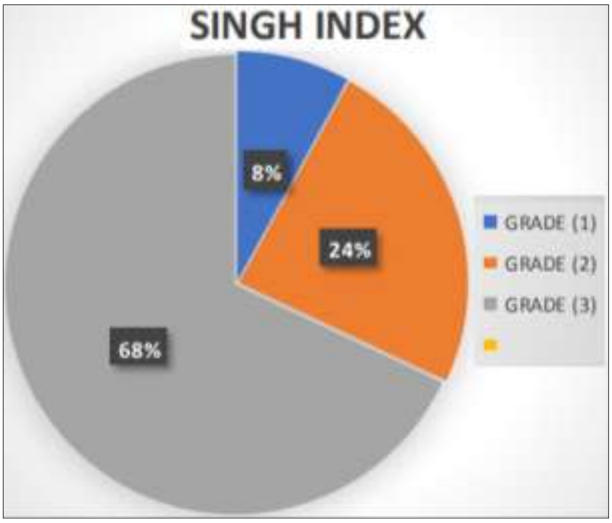

Fig 1: Singh Osteoporosis Index

This clinical study had age group of >60 years of age; which showed that all patients were going to have some or more osteoporotic bony changes occurred in the study. In our study, 68% of patients had developed stages of osteoporosis. While other remaining 36% patients had moderate to severe osteoporosis levels.

Table 3: Vas Score (Visual Analogue Scale) Analysis

Scale	Post op immediate	Follow-up at 1 month	Follow-up at 3 months	Follow-up at 6 months	Follow-up at 1 year
No	3	6	17	21	23
Mild	8	15	6	3	2
Moderate	7	4	2	1	0
Severe	5	0	0	0	0
Very severe	1	0	0	0	0
Worst	1	0	0	0	0

In our clinical study, we saw that post operatively patients showed improvement drastically in the early and mid-phase of analysis where they showed reduced pain severity among patients. Very few patients had moderate to severe pain post operatively, and it was mostly because of surgical procedure related pain, which was reduced with injectables. In the intervals of 3-6 months periods most patients had no pain or mild pain, which was relieved with oral medications when needed. At the end of 1 year most patients with 23 out of 25 patients had no pain at all.

Table 4: Harris hip score (HHS) analysis

Follow-up	Poor	Fair	Good	Excellent	Total
Post op immidiate	6	14	4	1	25
At 1 month	2	9	10	4	25
At 3 months	1	2	13	9	25
At 6 months	0	1	6	18	25
At 1 year	0	1	4	20	25

Harris hip scoring in this study showed at the post operatively immediate period having more that 50% patients had fair results which indicated that patients developed significant amount of hip joint function within immediate post-operative patients. These results improved with serial intervals, as around 3 months post operatively 21 out of 25 (80%) of patients had good and excellent results, per Harris hip scoring system. At the end of 1year 20/25 (80%) patients showed excellent scores as well as combined 24/25 (96%) patients had good and excellent results, per Harris hip score.

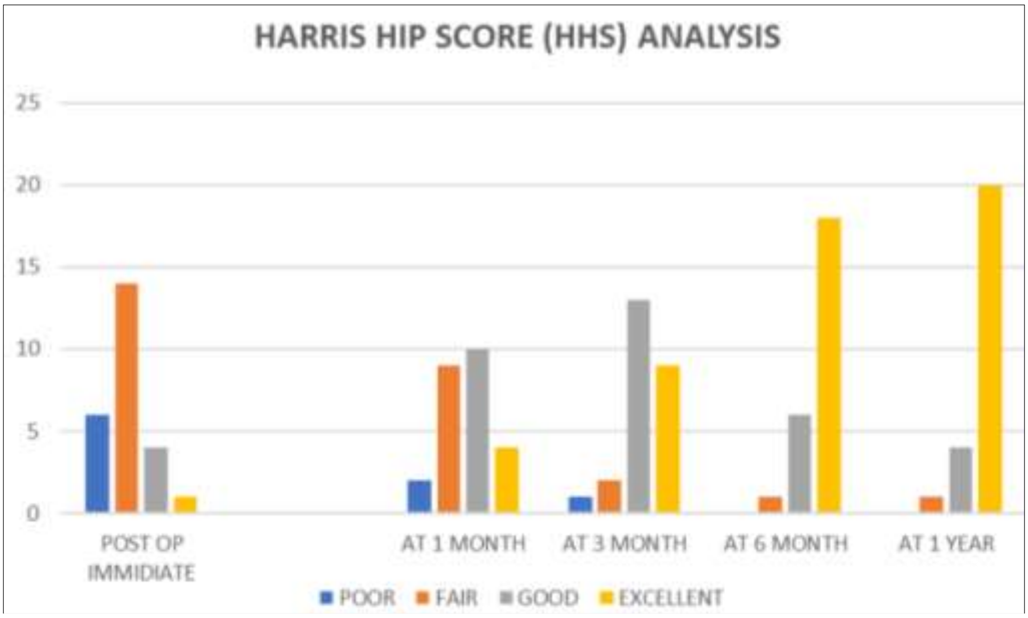

Fig 2: Results as per Harris hip score

Above graph indicates Harris hip scoring graph showing comparative results of improvement in range of motion of hip joint at serial intervals over a span of period of 1 year. It shows that there was drastic improvement post-operative period which continuously rises at significant level, with 80% having excellent results at the end of an 1 year span.

Table 5: Medical Research Council Scale

Scale of Abductor muscle power	Number of patients	Percentage
0	0	0
1	0	0
2	0	0
3	2	8
4	4	16
5	19	76
__	25	100

Above table shows results that with the fixation of GT and abductor mechanism repair led to improvement in abductor muscles function with 76% patients developing full power (5) as well as combined Grade 4 and 5 patients' total number 23 (92%) had got almost better function of abductors.

Table 6: Radiological Changes

Changes	1 month	3 months	6 months	1 year
Osteointegration	0	0	19	19 (76%)
Stress shielding	0	0	4	4 (16%)
Calcar resorption	0	0	0	0
Osteolysis	0	0	0	0
Heterotrophic bone formation	0	0	0	0
Fibrous ingrowth	0	0	0	0
Cortical Hypertrophy	0	0	2	2(8%)
Total			25	25 (100%)

Changes in these radiographic parameters with time were noted. All bony changes were estimated by eye-balling and were evaluated by using of Gruen zones.

Radiological changes at 1 year

In our study at final follow up mild stress shielding was founded in 4(16%) patients. Bone condensation (Osteointegration) found at the proximal as well as distal portion of femur around the contact region of implant in 19(76%) patients. Two patients (8%) demonstrated cortical hypertrophy at 6 month and 1 year of follow up. All of the following radiological changes have been seen at 6 months of follow up.

There was no evidence of osteolysis, fibrous ingrowth, heterotrophic bone formation seen in any patient up to 1 year of follow up. Radiographically, the at final follow up 18 stems were graded as well fixed with no evidence of radiolucent lines or implant loosening.

Table 7: Various Parameters Related To Surgery and Post-Operative Period

Parameters	Measures
Surgical time	88 min Mean
Peri-operative blood loss	525 ml Mean
Post-operative mobilization	3 Days Mean
DVT	4%
Infection rate	8%
Dislocation	8%

From the above table the study suggests that average duration of period for operative time was 92 min, while peri-operative blood loss was 525 ml which included post-operative drain output also.

Most patients were mobilized on post-operative day one, but average number of patients were mobilized on 3 days post operatively. As 2 patients were having complication of dislocations which were closely reduced and given immobilization for up to 21 days. Other 2 patients had superficial infection which were cleared by serial dressing and antibiotic change according to culture reports. Patient with post-operative complication with DVT was developed in a morbid patient with associated complication is dislocation, so immolised for 45 days with anticoagulant therapy and conservatively management done.

Discussion

Patients with fractures like comminuted IT fractures have various modes of fixation in these modern days. We are here to discuss treatment of this fractures by means of Hemiarthroplasty with abductor mechanism repair. Fracture by means of comminution have very crucial role for identification of patients, because for prosthesis to stay in femoral canal and fitting of prosthesis in femoral neck are difficult to achieve in comminution around intertrochanteric region as well as old osteoporotic bones with wider canal, also prosthesis rests on lesser trochanter support which is also get fractured commonly in comminution.

Hemi-Arthroplasty presents its own unique set of challenges. One of the issues that need to be addressed includes the method of femoral stem fixation (Cemented or cementless). Amongst the cementless group, further decision needs to be taken as to the extent of coating (Proximal, distal or extensive) and stability (Primary press-fit and/or secondary bony ingrowth). The possible complications (Fractures, stress shielding, osteolysis, loosening, subsidence and migration) and prognosis also needs to be looked into.

The method of choice of fixation of femoral components is controversial. Despite improvements in cementing techniques, the re-revision rates of cemented femoral components still increase with time and the radiological loosening rates are still high [7]. Other disadvantages cited are extensive bone loss (to accommodate cement) and inadequate primary (Inability to achieve proximal stability with deficient femoral) or secondary stability (Windshield wiper loosening of the cemented stem). Some authors [8] have, however, reported good results when cementation of the femur was used in conjunction with impacted cancellous allografts. This method is however technically demanding and fraught with complications (Fracture and early subsidence).

Proximally porous-coated femoral components have not known to consistently produce favorable outcomes [9]. Increased interest in proximally porous coated stems was sparked in the 1980s by first generation cemented stem failures in young patients and concerns arising due to extensively porous coated cementless stems regarding thigh pain and stress shielding. Despite design modifications, the modern proximally coated stem has not eliminated thigh pain or stress shielding [10]. Highly modular designs that afford assembly of a combination of adequately filling metaphyseal and diaphyseal portions may work to achieve the goals of appropriate primary as well as secondary fixation and stability [11]. The intraoperative flexibility provided by choices of diameter, stem length, fixation type and proximal stem size and orientation is purported to enable establishment of a stable hip center [12]. Proximal coating does not protect against loss of bone mineral content proximally or distally in the femur. Decreasing the extent of porous coating alone does not necessarily reduce proximal femoral bone loss [6-12].

Proper anatomic reduction of trochanteric fragments needs to be done for proper functioning of hip joint, which otherwise have lost abductors power, and overacting of adductors.

In our study it is found that Hemiarthroplasty patients with abductor repairs have post-operative immediate mobilization which reduces the chance of DVT like complications of bed ridden patients post operatively.

In our study it is found that most patients post operatively has improved function of hip joint as measured by Harris hip scoring system as patients have reduced pain, more improvement in range of motion, strength of abductors increases over time, no limping present over operated site with serial interval of follow-ups there is reduced use of walking aids like walker support.

Compared to the other studies of osteosynthesis methods like fixation using PFN this our study shows better result of patients has immediate post-operative mobilization and better functioning of hip joint as well as reduced rate of revision surgeries.

Prasoon kumar *et al*. 2019 shows Various systemic trials and meta-analysis between 2005 to 2017 assessment shows results of PFN versus hemiarthroplasty has given PFN a better option as it has a less blood loss, less infection rate and lesser mortality [13].

Currently there is no consensus on the superiority of one of these two techniques over the other and the present review was done to determine this.

Conclusion

In this prospective study of Results of Hemiarthroplasty for comminuted IT fracture Rx construction with abductor mechanism in Old age, we have found that there is early weight bearing function results in less reliability and dependency on others, As well as better functioning of hip joint and abductor power results in more stability of hip joint. This study also found that patients having early mobilization rates which results in less chances of immobility related complications like DVT. This study shows that with the repair of abductor mechanism using fixation of fracture fragments of Greater trochanter (GT), there is better functioning of hip joint and strength of hip joint over longer period.

Conflict of Interest

Not available

Financial Support

Not available

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