Original Research Article

Displaced intra-capsular neck femur fractures in elderly: Austin Moore's prosthesis or Cemented Modular Bipolar Prosthesis

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Abstract

Introduction: With various options available like unipolar, bipolar hemiarthroplasty or total hip arthroplasty, it would be wise to choose hemiarthroplasty as it is a procedure with a short operating time with lesser morbidity for elderly patients with displaced intra-capsular neck femur fractures .This study is aimed primarily at comparing the functional results obtained after a hemiarthroplasty using Austin Moore's prosthesis and cemented modular bipolar prosthesis and studying the associated complications in these cases.

Materials and methods: A total of 68 elderly patients who had fulfilled the inclusion criteria were enrolled for this prospective, randomized, comparative study between 2 groups labeled as group A (Austin Moore's prosthesis) and group B (bipolar prosthesis). Out of total 68 patients, 4 patients from group A were lost to follow up and 2 patients from group A died. Similar surgical approach, perioperative and follow up protocol were followed for both groups. Functional outcome measured using Harris hip score. Statistical comparison of functional outcome and clinic-radiological assessment were done for each patient at 3 months, 6 months and 1 year.

Results: The average age of the patient was 73.0 years in Group A and 76.0 years in Group B. After the end of 12 months, mean score was 86.50 in Group A which was comparable to 89.56 in Group B subjects. After duration of 12 months 94.1% of the subjects in Group B had excellent to good

treatment which was more compared to 78.6% of the cases in Group A, but the difference was not significant. Incidence of superficial infection and dislocation of prosthesis was equal in both groups. Complications rate were also comparable between the two groups.

Conclusion: Primary Hemiarthroplasty is an efficient way for treatment of displaced intra-capsular neck femur fractures in the elderly patients more than or equal to 60 years. Percentage of patients achieving excellent to good outcome at the end of 1 year are more in group B. Long term studies are needed to compare complications with hemiarthroplasty using 2 different prostheses.

Key words

Austin Moore's prosthesis, Cemented Modular Bipolar Prosthesis, Elderly, Intra-capsular neck fracture femur.

Introduction

Fractures of the neck of the femur are one of the common fractures encountered by an orthopedic surgeon. The incidence of these fractures and the problems subsequent to them seems to be increasing; the cause of this is mainly the increase in elderly population in whom osteoporosis is prevalent. There are high chances that the fracture neck femur will progress to non-union or avascular necrosis due to precarious blood supply, lack of cambium layer of periosteum, effect of synovial fluid and tamponade effect of the intra-capsular hematoma.

Reduction and internal fixation of the fractures is the treatment of choice in younger patients whereas primary arthroplasty is better in case of elderly even with un-displaced fractures to avoid problems of prolonged recumbence and faster rehabilitation. In displaced fractures there are high chances of avascular necrosis and non-union leading to a high failure rate [1-3], re-operation rate [2], poor functional outcome [3] and mortality [4]. Hence, primary arthroplasty is recommended for displaced fractures of the neck of femur [3] in elderly patients.

With various options available like unipolar, bipolar or total hip arthroplasty, it would be wise to choose hemiarthroplasty as it is a procedure with a short operating time with lesser morbidity and is suitable in patients with lesser life expectancy [5].

Hemiarthroplasty of the hip was ushered into widespread use in 1943 by Moore and Bohlman, who reported fashioning a custom metallic femoral head and neck prosthesis for a patient suffering from a proximal femoral shaft tumor [6]. Forerunner of these prostheses was the unipolar replacement of the femoral head, which was used in the 1940's by Judet and Judet. Subsequently, commercially available fixed head endo-prostheses have acquired widespread popularity, especially the Moore and Thompson hip endoprostheses. Their placement has subsequently become acceptable treatment for acute displaced femoral neck fracture in elderly patients or for acute femoral neck fracture in neurologically handicapped or poor surgical risk patients [6]. Austin Moore and Thomson's hemiarthroplasty have given good results, but in these prostheses, it is the head size which decides the size of the stem which will fit in the femur. This lack of modularity and problems like joint pain, acetabular erosion, protrusio acetabuli, has led to a decrease in their use.

In 1974, James Bateman introduced the Bipolar prosthesis. The complication of acetabular erosion and pain are reduced by use of Cemented Bipolar prosthesis, but the cost still precludes its use especially for patients from lower economic strata in India. Modularity tends to be cost effective, as it offers the surgeon a very wide range of prosthetic sizes without significantly increasing hospital inventory. Wathne and co-workers[7] could identify no differences in the perioperative care, revision rates or the 1-year

outcomes in a prospective study comparing 140 elderly patients treated with either a cemented modular bipolar or unipolar prosthesis. They reported no advantages identified in using the bipolar device, despite a greater cost. More over there is increasing literature which state about loss of movement between the two bearing surfaces of a bipolar, which ultimately functions as a unipolar.

Thus, this study was aimed primarily at comparing the functional results obtained after a hemiarthroplasty in elderly patients with fracture neck of femur using Austin Moore's prosthesis and cemented modular bipolar prosthesis and studying the associated complications in these cases.

Materials and methods

A Prospective randomized comparative study was conducted at a tertiary care center during February 2014 to June 2015. A total of 68 elderly patients who were admitted and operated during study period and fulfilled the eligibility criteria, were enrolled for this study.

Inclusion criteria

- Age of patients 60 years and older.
- Garden's type III and IV intra-capsular fractures of the neck of femur.
- Patient ambulatory prior to fracture, though they may have used an aid like a cane or a walker.
- Patient giving informed consent for inclusion in the study.

Exclusion criteria

- Any other ipsilateral or contralateral fractures in the lower extremity.
- Any associated upper limb fracture.
- ASA Grade more than 4
- Patients with associated neurological disorders.

A total of 68 patients were allocated into 2 groups of 34 each according to randomized tables. Patients operated with Austin Moore's prosthesis were allocated to Group A; and those operated with bipolar Prosthesis were allocated to Group B. Written informed and valid consents were taken from the patients after providing adequate information and answering their question and queries in detail depth. Out of total 68 patients, 4 patients from group A were lost to follow up and 2 patients from group A died. So, final analysis was done on 62 patients.

Methodology

Patients were initially screened in the casualty or out-patient department. Anteroposterior X-rays of pelvis with both hips with opposite hip in 15° internal rotation and lateral view of the injured joint were taken. All patients with displaced intra-capsular neck of femur fractures were initially immobilized with Thomas splint and skin traction. Routine hematological investigations were done. Assessment of fitness was done by the anesthetist and physician. The patients were graded as per the American Society of Anesthesiologists (ASA) Scores. All patients were treated surgically with hemiarthroplasty using either the Austin Moore's or Cemented Modular Bipolar prostheses with the same approach. Post-operative and mobilization protocol was same for all patients. Post-operative visits were scheduled at 6 weeks, 3 months, 6 months and 1 year. Clinico-radiological and functional assessments were carried out at each follow up visit. All patients were functionally assessed using the Harris Hip Score and complications, if any, were documented.

All the data was entered in Microsoft Excel sheet 2013 and analyzed using appropriate statistical tests using SPSS software ver. 21.

Results

The average age of the patient was 73.0 years in Group A and 76.0 years in Group B. Of 64 patients, there were 31 females and 33 males. Gender, Age and ASA grade distribution was comparable between both groups ($p > 0.05$) (**Table - 1**). At 3 months follow up, mean functional score was 77.77 +/- 6.1 in Group A which in compared to 81.06 +/- 4.6 among

Group B subjects was significantly less. After 6 months mean functional score increased among both the groups and was 82.10 +/- 5.5 in Group A subjects and 85.62 +/- 4.3 in Group B subjects (p> 0.05). After the end of 12 months, mean score was 86.50 +/- 5.86 in Group A which was comparable to 89.56 +/- 3.82 in Group B subjects (p> 0.05) (**Graph - 1**). As per analysis 3 months of the duration 36.6% of the subjects in Group A had Excellent to good functional outcome which was less compared to 55.9% of the case among Group B but the difference was insignificant. After 6 month of the treatment 88.2% of the cases among the Group B had excellent to good functional outcome which was significantly more compared to 62.1% of the cases among Group A. After duration of 12 months 94.1% of the subjects in Group B had excellent to good functional outcome which was more compared to 78.6% of the cases in Group A, but the difference was not significant (**Table - 2**). Sciatic nerve palsy (6.7%), stem subsidence (6.7) and peri-prosthetic fracture (3.3%) occurred in group A while pneumonia occurred in 2 patients (5.8) patients of group B. Other complications include superficial infection (6.7% vs 5.8%) and dislocation (3.3% vs 2.9%) (**Table - 3**).

Table – 1: Comparison of baseline variables among study group.

Variables	Austin Moore (n-30)		Bipolar (n-34)	
	N	%	N	%
Females	16	53.3%	15	44.1%
Males	14	46.7%	19	55.9%
Age (mean +/- SD)	73.0 +/- 6.54		76.0 +/- 5.47	
ASA I/II	13	43.3%	16	47.1%
ASA III/ IV	17	56.7%	18	52.9%

Table – 2: Global Assessment of the study group at each follow up (as per Harris Hip Score).

Global Assessment	Group – A			Group – B		
	3 months (n-30)	6 months (n-29)	12 months (n-28)	3 months (n-34)	6 months (n-34)	12 months (n-34)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Excellent	1	1	13	0	4*	20
	3.3%	3.4%	46.4%	0.0%	11.8%	58.8%
Good	10	17	9	19	26	12
	33.3%	58.6%	32.1%	55.9%	76.5%	35.3%
Fair	14	11	6	14	4	2
	46.7%	37.9%	21.4%	41.2%	11.8%	5.9%
Poor	5	0	0	1	0	0
	16.7%	0.0%	0.0%	2.9%	0.0%	0.0%

Discussion

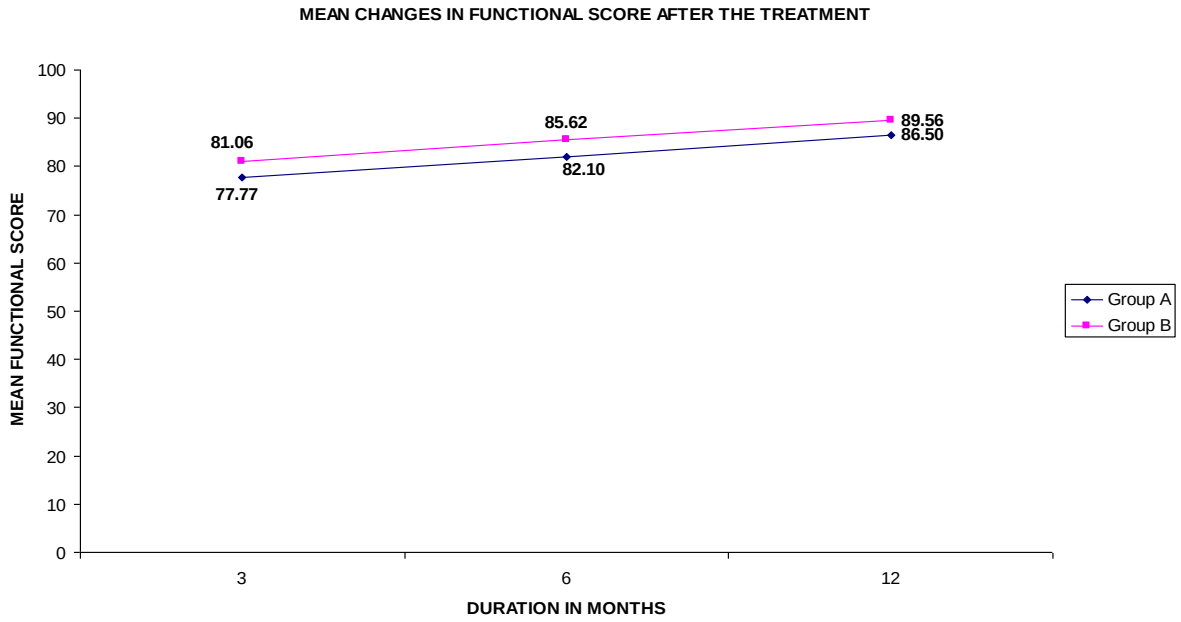
The elderly patients have problems like osteoporosis which when treated with internal fixation pose problems to the hold of the implant, and hence requiring prolonged immobilization for achieving bony union. On the other hand, there is a need for rapid mobilization with weight bearing for these patients, as these patients are generally medically compromised due to age and associated diseases. With internal fixation, there is a significantly high rate of re-operation, more pain and decreased early function than with

arthroplasty [8-10]. With the advent of modular bipolar implants for hemiarthroplasty of hip which help reproducing the exact biomechanics like the native hip joint, make help delay a primary acetabular replacement, especially when there are no preexisting acetabular degenerative changes. This study is a prospective, open comparative study of Austin Moore's and bipolar prosthesis as the surgical treatment modality for displaced intra-capsular neck femur fractures in elderly patients.

Table – 3: Comparison of complications between the two groups.

Complication	Austin Moore (n-28)	Bipolar (n-34)
Superficial Infection	2 (6.7%)	2 (5.8%)
Pneumonia	0	2 (5.8%)
Sciatic nerve paresis	2 (6.7%)	-
Dislocation	1 (3.3%)	1(2.9%)
Periprosthetic fracture	1 (3.3%)	-
Stem subsidence	2 (6.7%)	-

Graph – 1: Mean changes in functional score after the treatment.



In present study, at 3, 6 and 12 months, excellent to good results were observed in 36.6% vs 55.9% ($p > 0.05$); 62.1% vs 88.2% ($p < 0.05$) and 78.6% vs 94.1% ($p > 0.05$) patients in group A and B respectively. Cornell, et al. [11] performed a prospective six month follow up of 33 bipolar and 15 unipolar hemiarthroplasties and found no significant differences between the 2 groups in terms of functional recovery and rates of postoperative complications. Kenzora, et al. [12] in a prospective outcome study at 24 months of follow-up of 195 bipolar and 75 unipolar hemiarthroplasties showed that patients who underwent bipolar hemiarthroplasty had better pain relief and function. Lestrange, et al. [13] found that the bipolar prosthesis offered advantages over one piece designs in terms of fit, decreased acetabular erosion and improved function. La belle, et al. [14] in a long term follow up of bipolar vs unipolar prostheses concluded that there was less pain and decreased acetabular protrusion in the bipolar group. Merlo,

et al. [15] attested to the superiority of bipolar components when compared with conventional hemiarthroplasties. They reported better clinical results with bipolar components, although acetabular deterioration were frequent, 42% cartilage wearing and 25% protrusions. These were especially common in patients with errors in implant insertion.

Calder, et al. [16] in his prospective study reported 30% mortality rate at 1 year in both groups and no significant difference in the rate of complications. Hudson, et al. [4] in an 8 year retrospective review of 90 unipolar and 48 bipolar hemiarthroplasties showed no statistically significant differences in the rates of mortality, surgical complications or other events including medical complications. Long and Knight [17] as well as Drinker and Murray [18] showed that there was little difference between the unipolar and bipolar endoprostheses in terms of rapid postoperative mobility of the patient, operative morbidity and mortality. In our study, 2 patients operated with Austin Moore's replacement died till 1 year follow up due to medical cause (Myocardial Infarction). Lower rate of mortality comparable to other series is probably due to proper selection of cases, proper management of the associated medical problems preoperatively, routine use of antibiotics and most important was early mobilization.

In the present study, the rate of superficial infection was 6.7% in group A and 5.9% in Group B which is comparable with other similar studies [19]. The rate of superficial infection is not statistically significant between two groups. The rate of infection has been kept low by use of various measures like use of prophylactic antibiotics and keeping the operation room environment clean by laminar ventilation system. The infection rate has been reported high when posterior approach is used for arthroplasty due to proximity of the incision to the perineum [20]. Patient who developed infections had to stay longer in the hospital. Management of superficial infections was done with appropriate frequent dressings and antibiotics according to culture and sensitivity reports. In our study we did not encountered any deep infection.

Sciatic nerve injuries can occur due to various causes like direct trauma, traction, pressure of retractors, positioning of extremity, limb lengthening and thermal of pressure injury by cement Incidence of such injuries is 0.7% to 3.5% [21] which is comparable to the rate in the current study (3.1%).

Reports suggesting lower risk of dislocation with bipolar prosthesis [22] is unsubstantiated. Yao and Keller, et al. [2] in their metaanalysis found rate of dislocation 2 %, 3% and 11 % with unipolar, bipolar and total hip prostheses respectively. Some randomized trials show identical rate of dislocation for both unipolar and bipolar prostheses [17, 23] which is similar to our study. In our study rate of dislocation with bipolar prosthesis is 2.9 % and with Austin Moore prosthesis is 3.3% but the difference is not statistically significant. Weinrauch, et al. [24] noted that Austin Moore prosthesis dislocates due to inappropriate residual neck length and poor selection of prosthetic head size. Kodo, et al. [25] found that dislocations occurring within 5 days of Austin Moore's hemiarthroplasty are reduced closed but those occurring after 5 days required open reduction. Drinker and Murray, et al. [18] found that dislocation of unipolar prosthesis was reduced successfully with closed methods and dislocations of bipolar reduced by open methods. Interprosthetic dislocation of a bipolar prosthesis in which the head separates from the stem invariably leads to open reduction. Failure of closed reduction is related to disassembly of bipolar prosthesis. In our study we did open reduction for 1 patient in group B even in the absence of interprosthetic dislocation as movement of the head prevented closed reduction. Ko, et al. [25] in his study of 1832 hemiarthroplasties found that posterior approach cannot be substantiated as the most common cause of dislocation. He suggested that assessing the causes of the event is of utmost importance rather than comparison of rates of dislocation. More often the etiology of postoperative

dislocation is multifactorial involving number of surgical and patient related factors. A sound repair of posterior sleeve was necessary. In the current study, in both groups we used posterior Moore's approach, but we did repair the external rotators and the posterior capsule properly. The dislocation in patient from group B was mainly due to trivial trauma, reduced with open method and in group A was due to patient non-compliance, reduced with closed method. Postoperatively we kept both patients in traction with 30 degrees abduction for 3 weeks [26].

Weinrauch, et al. [24] noted cause of intra-operative fracture during Austin Mooore hemiarthroplasty is loose stem with inadequate rotational stability withstands difficulty during reduction. Most intra-operative periprosthetic fractures were sustained during the impaction of the prosthesis after broaching or during its reduction. Under broaching and relative over sizing of the stem with intent to provide interference fit, the prosthesis in osteoporotic bone may result in fractures during prosthesis insertion. Elderly women with compromised bone quality, extra care are needed to achieve better fitting so as to avoid iatrogenic metaphyseal fractures. Under sizing or cementing of the prosthesis is recommended when encountering difficulties. These intra-operative femoral fractures do affect postoperative mobility [27].

In the current study we did not have any intra-operative fractures in either group. We had one female patient in Group A with periprosthetic fracture which occurred at 1 month postoperative period with trivial trauma. She was revised to a custom made long stem Austin Moore's prosthetic replacement. For her Harris hip score was fair at the end of 1 year. Yamagata Chao, et al. [28] observed rate of reoperation was 12.5 % with fixed head endoprosthesis and 7 % with bipolar prosthesis. Cause of reoperation within first 2 years was dislocation and after two years were acetabular erosion and loosening of the femoral stem. In patients operated with primary hemiarthroplasty deep infection, dislocation, haematoma and periprosthetic fractures are the complications which require reoperation. We had 1 case of revision in Group A due to periprosthetic fracture and 1 reoperation due to dislocation in Group B. Various studies [29-32] have found that pain is more common with uncemented prostheses than cemented ones but Stavrakis, et al. [33] did not find any significant difference with respect to postoperative pain between cemented and uncemented prostheses. Yau, et al. [34] suggested subsidence and pivoting of the prosthesis as the cause of hip pain after Austin Moore hemiarthroplasty. Significant increase in subsidence was noted if the stem of prosthesis was not fitting well within shaft of femur.

Jadhav, et al. [35] said that pain affects function. In the current study we had two cases of subsidence of prosthesis detected on serial anteroposterior X-rays at periodic follow up, both from Group A, although none of them had any complains of pain in hip or thigh. Both of these patients in our study were less than 70 years of age who had poor to fair function initially but achieved good function at the end of 1 year. Some studies suggest fill of Austin Moore prosthesis within shaft of femur should be more than 70 % to avoid early loosening and relatively younger patients with acute fracture neck of femur should be treated by methods other than cementless Austin Moore prosthesis [24].

Superiority of bipolar over unipolar prosthesis has been reported with respect to decreased or absent acetabular erosion [36]. Some studies suggest the findings with reference to acetabular erosion in unipolar and bipolar prostheses appeared to be quite similar [37, 38]. The factors that have best correlated with the severity of acetabular erosion are patient activity level and duration of follow up [25]. Recently, Dalldorf, et al. [37] reviewed the histologic specimens in patients who were having a revision of hemiarthroplasty and compared them with age matched controls. They found that the progression of degeneration correlated directly with the duration of articulation of the implant

with the acetabulum but not the type of implant. The fate of the cartilage that had articulated with the unipolar prosthesis was similar to that of the cartilage articulated with bipolar prosthesis. In our study we did not find acetabular erosion with either prosthesis at the end of 1 year. To detect the acetabular erosion it may be necessary to follow patients for a period longer than three years [19].

Conclusion

Primary hemiarthroplasty is an efficient way for treatment of displaced intra-capsular neck of femur fractures in the elderly patients. The bipolar prosthesis offers modularity that is interchangeability between various sizes of head and stem thus helps to reproduce the biomechanics as close to pre-trauma as possible. In case, if at all, a revision arthroplasty is required, total hip acetabular component can be added retaining the stem. At the end of one year, functional outcome with cemented modular bipolar prosthesis were better than Austin Moore's prosthesis. While the incidence of superficial infection and dislocation of prosthesis was comparable in both groups. The serious disadvantage we found with the bipolar implant is that, in case of prosthesis dislocation in the post-op period, closed reduction is not likely to succeed and open reduction will be required. Whether the polarity or the modularity of the hemiarthroplasty system is more important in achieving better functional outcome can be determined by further randomized control studies.

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