International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2017; 3(1): 635-639

www.orthopaper.com
Received: 02-11-2016
Accepted: 03-12-2016

Dr. Sachin Joshi
Assistant Professor GMC Kota, Rajasthan, India

Dr. Shamendra Kumar Meena
Medical Officer MBS Hospital Kota, Rajasthan, India

Dr. Gaurav Dixit
Private Consultant, Kota, Rajasthan, India

Correspondence
Dr. Sachin Joshi
Assistant Professor GMC Kota, Rajasthan, India

Clinical & radiological analysis of results of primary hemiarthroplasty using cemented bipolar modular prosthesis in fracture neck of femur

Dr. Sachin Joshi, Dr. Shamendra Kumar Meena, Dr. Gaurav Dixit

DOI: http://dx.doi.org/10.22271/ortho.2017.v3.i1j.92

Abstract
Single assembly total hip prosthesis, which sought to provide a completely mobile head elements and an additional head surface to allow movement within the acetabulum. Thus he aimed to create a compound system providing for a greater distribution of bearing forces, which could minimize wear both on implant and on articular cartilage, it was proved to have greater stability and decreased chances of dislocation and increased range of motion compared to unipolar prosthesis. Finally it was expected that bipolar arthroplasty could be more easily revised than total hip arthroplasty in cases of acetabular deterioration.

Keywords: Arthroplasty, fracture, femur

Introduction
Fracture neck of femur in old age is one of the most frequent causes of admission in any hospital all over the world. It is endemic disease of elderly and its incidence is increasing with the rise in the population of elderly in our society.
The problem of intra capsular fracture neck of femur has been generating a lot of interest among orthopedic surgeons for a long time for its indefinite outcome.
Complications like nonunion and avascular necrosis still have a very high incidence and hence this fracture still well deserve the term unsolved fracture given to it by speed in 1983.
The treatment of displaced fracture neck of femur has long been controversial.
In young adults treatment of fracture neck of femur is unanimous i.e. cancellous screw fixation. In elderly fracture neck of femur treatment has many options and every option has its own merits and demerits.
Single assembly total hip prosthesis, which sought to provide a completely mobile head elements and an additional head surface to allow movement within the acetabulum. Thus he aimed to create a compound system providing for a greater distribution of bearing forces, which could minimize wear both on implant and on articular cartilage, it was proved to have greater stability and decreased chances of dislocation and increased range of motion compared to unipolar prosthesis. Finally it was expected that bipolar arthroplasty could be more easily revised than total hip arthroplasty in cases of acetabular deterioration [2, 3]

History of Replacement Arthroplasty
The first attempt at Arthroplasty of the hip was made long back in 1826 where Burton & Ollier used muscle tissue, and Jones used gold foil has supports between the femur and the pelvis . John Rhea Barton (1826) is credited with the first successful operation to achieve results. He performed an osteotomy on an ankylosed hip, and by maintaining motion obtained a pseudoarthrosis that gave satisfactory results for a time.
Since then other procedures and materials have been used such as neurectomy, osteotomy muscle release, Arthroplasty with fascia, chromicized pig's bladder, cellophane cartilage caps, and other substances butt none of them resulted in lasting success. Various salvage processes were also devised such as resection of head of femur with displacement of the greater trochanter distally, osteotomy and bone grafting.

Thompson made evaluation of hip motion in 30 patients in their separate categories:
1. Patients with early nonunion without shortening in whom the necrotic head was removed and the prosthesis was inserted without extensive capsular division had full range of motion of hip joint.
2. Patients in which extensive capsular division was done to gain length as to correct overriding and shortening patients of this category had some limitation of internal rotation and abduction. They were able to sit normally and handled their extremities without too much stiffness.
3. Patients of these categories were those in whom arthoplasties were done for a primary degenerative condition and in which pain and limitation of motion was present before operation, motion was greater after insertion of the prosthesis. Flexion was slightly more than 90 degrees with good internal rotation and limited external rotation and abduction.
In no case the muscle power returned to normal, although stability was present and there was no positive Trendelenburg sign or an abductor lurch. Chief deficiency in muscle power seems to be abductor and it took well over a year to hold the abducted extremity elevated above the table without tilting their pelvis.
Most of the patients were capable of walking across the room without a cane. Crutches were insisted upon for a period of nine months until the femur had regained strength and become well mineralized.

Austin Moore (1954) [9] reviewed series of 153 patients. The importance of partial weight for a period at least 6 months should be emphasized. New bone formation look place within fenestration of the chiseling away the new bone. Prosthesis literally becomes self-locking. It was very interesting to see roentgeno graphically, the increasing density of bone under the prosthesis in stress bearing location.
Fracture neck of femur is the fracture of old age usually occurring after 60 years of age. This fracture has been reported in children and abult also. But the incidence is less. The reasons behind this high incidence in elderly are many. Increasing osteoporosis of the bone, which loses its minerals and so the density. Due to these change the neck becomes more weak and susceptible to fracture in the elderly age group. Usually the patients sustained this fracture by trivial trauma like slipping down in the bathroom. In younger age this fracture requires more violent trauma.
Pauwels (1935) divided these facture into three groups according to the angle formed with line passing through the fracture site and the horizontal lines drawn between tow anterior superior iliac spines. His groups were as follows:

Group I:	Angle $<30^0$
Group II:	Angle 30^0 - 50^0
Group III:	Angle $> 50^0$

The classification by pauwels has been elaborated by adding a fourth group in which on the angled line of the fracture there is, in the lower part of the femoral neck, a tongue like “basal sporn” formation running distally (Laitz 1966). This type of fracture is the unstable of all.
The well-known complication of these fracture are:
Avascular tar necrosis of the femoral head.
Delayed Union or non-union
Secondary osteoarthritic changes of the hip. Etc.
The chances of getting these complication depends upon site of fracture (Sub capital or transcervical) type fo fracture (Complete or Incomplete), amount of displacement (Partial or Complete). Perfect ness of the reduction and the fixation and age of the patient.

History of Bipolar Arthroplasty Low Friction Arth Roplasty
It is the arthoplasty either partial or total, performed with prosthesis of special component and design to reduce the friction at the interface of the articulating surface.
Principal: The friction between the metal and the articular cartilage is high and when there is degeneration it is further increase. By using the synthetic materials like high-density polyethylene to articulate with the metal is reduce the friction and the movement are freer. The same principal is used in bipolar prosthesis alos.

Adantages of Low Friction Arthroplasty
- Due to low friction, shearing stresses upon the sterm are reduced and so the incidence of steam loosening is less.
- No incidence of long standing pain in hip during movements.
- Durability of the arthroplasty is increased.
- No incidence of acetabular erosion and protrusion.
- Early mobilization of the patients is possible.

Bipolar Prosthesis
Application of principle of low friction arthroplasty to the hip has been made accepted widely because of Charnley’s pioneering work in this area. High-density polyethylene first made by Ziegler in 1954 formulated a new step to the low friction arthrooplasty. Application of low friction principle in fractures of femoral neck without removing or distorting the acetabulam was made possible by the concept of bipolar.
Bateman [1, 2, 3] an orthopedist and Averill, a bio-engineer divised a three-piece bipolar prosthesis for the proximal femur in the year 1974. Contained within the outer metallic head was an inner cup bearing of ultra-high molecular polyethylene. Into this was inserted a smaller inner bearing. Thus reducing the wear and tear of acetabulum. Later it was improved with longer straight stem and slightly inset center of rotation of the inner bearing. Several authos have reported that erosions do not occur and have reported that bipolar design were associated with less post-operative pain. At the same time as Bateman in 1974. Gilberty also invented a similar bipolar assembly.

Bateman [1, 2, 3]	UDF Bipolar Prosthesis
Gilberty [12]	Bipolar prosthesis
Monk	Bipolar prosthesis
Variokopf	Bipolar prosthesis
Christiansen	Bipolar prosthesis
Hasting	Bipolar prosthesis
Muller	Bipolar prosthesis

Designe of Different Bipoloar Prosthesis
1. Monk’s Bipolar Prosthesis [38]
The prosthesis has a head and medullary stem. The stem can be either th solid Thompson or the fenestrated Moore type. The head of this inner head made of vitallium. It is not possible to separate outer cup from inner head [38].

2. Christiansen Bipolar Prosthesis
This prosthesis consists of a shaft piece of Francobol produced in two lengths [130 & 160 mm]. A cylindrical trunnion is integral with the upper end of shaft piece, fitting into a

corresponding recess in capitulum. Capitulum is made of delrin [plastic] fitted with a francobol cup. The axis of trunnion with the capitulum and the principle axi of shaft forms an angle of 115 degree. Capitulum comes in six sizes from 44 mm to 54mm in 2mm increments [23].

3. Variokopf Bipolar Prosthesis

It is similar to other prosthesis in design. It consists of a femoral stem with a ball head articulating with a head piece made of high density polyethylene covered by a polished metal shell. The nonfenestrated femoral component is available in several lengths of both stem and neck and with two diameters of ball [32 mm & 22 mm]. The ball and socket joint is "snap fit" and dislocation of two components is further prevented by a locking ring [41].

4. Charnley Bipolar Prosthesis

It consists of a femoral stem with a ball head articulating with femoralcup made of ultra high molecular weight polyethylene covered with a metal polished shell [UHMW- chirulen] femoral stem comes in five stem offsets i.e.101, 102, 201, 301, 401 with neck length fixed with each stem orderly 24, 28, 32, 36, 40 mm. [in 4 mm increments]. Femoral cup sizes range from 38mm to 56mm in 2mm increments. It is possible to separate head from acetabular cup [8].

5. Muller Bipolar Prosthsis

It consists of a femoral stem [316 L stain less steel] with a trunnion on the side of neck articulating with ball shaped head piece. This head ariculate with acetabular cup made of UMMW polyethylene [chirulen] and metal polished on surface. Stem has three sizes [7.5 mm, 10 mm, 125 mm] to accommodate the medullary canal of different sizes better. Head piece has three neck lengths [-3.5mm, 0mm, +3.5mm]. Acetabular cupsize range from 38mm to 56mm in 2mm increments. It is not possible to separate the head from acetabular cup. The head make assembly with trunnion of neck by locking rings.

Other authors however have experienced better result with bipolar oprosthesis in comparative studies. Early finding by Bateman (1974) [3] and greater ROM than previous unipolar prosthesis (496 cases of bipolar hemiarthoplasti).

Aims and Objectives

1. To analyze the result of bipolar modular prosthesis clinically using Harris hip score.
2. To analyze the movement of the bipolar prosthesis between head & cup and between cup & acetabulum using specialized X-ray view.
3. To assess the quality of low viscocity cement, a fixating material for stem of prosthesis.

Material and Method

This proposed prospective study will evaluate patients with fracture neck of femur in adults who will be treated in orthopedics department of PBM hospital Bikaner by hemiarthoplasty using bipolar modular prosthesis during to the period pf 2005-2008.

The clinical assessment will include a detailed history and clinical examination of the patients. It will also include other associated injuries, shortening, abrasion and bedsores if any, will be noted. A detail information will be prepared to note down all the pre & post-operative details.

All patients will be treated by following Indian made prosthesis-

1. Charnley prosthesis- with head diameter 22mm & neck length in 4mm increments but with increasing stem offset.
2. Muller prosthesis with 28mm head – with head diameter 28mm & 3.5mm true neck modularity and three stem diameter i.e. 7.5mm, 10mm, 12.5mm.
3. Muller prosthesis with 26mm head – with head diameter 26mm & same neck length and stem modularity as Muller prosthesis.

Method of Assessment

Assessment of patients will be done on clinical and radiological criteria.

Clinical assessment

The clinical assessment of patients will be done on the basis of Harris hip score with a slight modification. Pain and functional capacity will be two basic considerations. Based on these reasoning a points scale with a maximum of 100 points will be used with the following maximum possible scores [6, 16, 17, 22].

Harris Hip Score

1. Pain [30 points] that is further divided into 6 grades as follows:-

Grade description	Points
a. No pain	30
b. Normal walking, momentary pain present on either sitting getting up or climbing stairs.	25
c. Normal walking without sticks, regular pain on sitting	
d. Squatting and stair climbin.	20
e. Pain on normal walking decreased by analgesics and also by stick.	15
f. Pain is regular feature. Analgesics is required regularly does not decrease by sticks	10
g. Non weight bearing movement is painful.	05

2. Function: - (61 points) this is further classified into daily activity and gait.

Activity –	Points
a. Stairs	8
-Foot over foot without use of banister	6
-Foot over foot with use of banister	3
-Stairs in any manner	0
b. Sitting	
-Squat and sit cross-legged	12
-Squat but can't sit cross-legged	8
-Can sit on bed and high chair but cannot squat And sit cross-legged	4
-Unable to sit on chair	0
c. Ability	
-Can dress with ease	4
-Can dress with difficulty	
-Unable to dress	0
d. Occupation	
-Back to prior work	12
-Change over to lighter job or modified	6
-Unable to work	0
e. Transportation	
-Able to enter public transportation	4
-Unable to do so	0

Gait

a. Limp

-None	5
-Slight	3
-Moderate	2
-Severe	0

b. Support

-None	6
-Single cane for long walk	4
-One crutch	2
-Two crutch	1
-Not able to walk	0

c. Distance

-	10
-One mile	7
-Half mile	4
-Indoor	2
-Bed and chair	0

3. Absence of deformity

One point was given if there is no fixed deformity

4. Limb length discrepancy

One point was given to patient who does not have limb length discrepancy more than 2.5 cm.

5. ROM [Range of motion]

In Indian social habits the importance of squatting and sitting cross-legged is much more important than the west. In squatting and sitting cross-legged the prime movement is flexion, abduction and external rotation. Therefore these movements were considered for clinical assessment of patient.

Range of motion	Range	points
1. Flaxion (3 points)	0^0-45^0	1
	45^0-90^0	2
	90^0-120^0	3
2. Abduction (2 points)	0-20	1
	20-40	2
3. External rotation (2 points)	0-20	1
	20-40	2
TOTAL		100

Overall clinical assessment categories into four grades viz. excellent, good, fair and poor. This would be decided on basis of Harris hip score. This range of Harris hip score varied as follows for different categories.

Grade	Range of Harris hip score
Excellent	80 to 100 points
Good	60 to 80 points
Fair	40 to 60 points
Poor	20 to 40 points

Radiological Assessment

Radiological assessment will be done on the basis of fraction of total movement at hip joint that occur at inbuilt joint of prosthesis. Follow up will be done immediately post-operative, at one month, at three month.

Radiological examination, using image intensification, will be carried out immediately after operation and after 1 & 3 months. First the view will be taken in lateral position in neutral & full flexion. The total hip excursion will the noted. Movement at inbuilt joint & between cup and acetabulum will be noted. The fraction of total hip movement which occurs at inbuilt joint of prosthesis is noted.

Observation

This work was conducted in the department of orthopeaedics S.P. medical college & P. B.M. Hospital, Bikaner. The study Consists of 30 consecutive cases of displaced fracture neck femur treated by bipolar modular hemiarthroplasty in the department.

Discussion

The present study "clinical and radiological analysis of results of primary hemiarthroplasty using cemented bipolar modular prosthesis in facture neck of femur" was conducted in department of orthopaedics S.P. Medical College & P.B.M. Hospital, Bikaner during the period of 2005-07. This study was conducted in total 30 consecutive patients of intra-capsular fracture neck of femur who needed hemiarthorplasty as a primary treatment. It was a prospective study. In 30 consecutive cases of intra-capsular fracture neck of femur cemented bipolar modular prosthesis was used. Implant used in this study was bipolar modular prosthesis of muller prosthesis with 28mm head size, Muller prosthesis with 26mm head size, and Charnley prosthesis was done by bone cement [polymethylmethacryalte]. The selection of approach in lateral position. The clinical & radiological study was done and final clinical analysis was made on modified Harries hip score.3

Present study analyzed radiologically the intraprosthetic movements in bipolar prosthesis using plain sky grams in AP & Lateral views in extremes range of hip excursion.

All the data were recorded and a master chart was prepared to evaluate the final results.

Follow up

Follow-up was minimum 6 months to a maximum of 24 months. In this series 13 cases followed up to 7-12 months. 9 cases followed from 13-18 months, 5 cases from 19-24 months. Average follow up was 13.53 months.

Summary & Conclusion

1. The present series of 30 cemented bipolar modular hemiarthroplasties of hip constituted the prospective study, which were operated in PBM Hospital, Bikaner during the period of 2005-07.
2. Evaluation of clinical results was done on the basis of modified Harris hip score.
3. Evaluation of radiological results was done on the basis of intraprosthetic movements.
4. Maximum age of patients was 84 year & minimum 50 years with an average of mean 67.37 years.
5. Female outnumbered the males (19 females, 11 males).
6. In present series left side predominate over right with left to right ratio 2:1 [20 left, 10 right cases].
7. 80% patients had low velocity trauma where as 20% cases had high velocity trauma.
8. 90% cases had preoperative medical problems (commonest was hypertension).
9. Posterior Moore's approach was used I all cases.
10. These types of bipolar modular prosthesis were used. Those were Muller prosthesis with 28mm head [5 cases]. Muller prosthesis with 26 mm head [10 cases] and Charrnley prosthesis with 22 mm head [15 cases].
11. Most common cup size used in females was 42 mm and in males it was 50mm and 51mm.

12. Stem was fixed in all prosthesis with low viscosity cement [polymenthylmethacryate].
13. The average size of prosthesis used in the male patient was 49.8 mm and females in 43.1mm.
14. Superficial infection occurred in 1, deep infection in none, bed sore in 2 wound gap in 1 patient.
15. 2 cases had disassembly of prosthesis components [both Charnley prosthesis cases]. 2 cases had dislocation of prosthesis [both cases Muller prosthesis with 26mm head].
16. 86.66% patients were allowed weight bearing within 12 days of operation.
17. Average hospital stay was 16.83 days.
18. Average follow up was 13:53 months.
19. Average limb length discrepancy in present series was 0.98 cm with maximum recovery by average of 0.70 cm in Muller prosthesis with 28mm of head and minimum recovery in Charnley prosthesis [0.3cm].
20. Majority of cases [76.66%] had either no pain or occasional pain. While 23.33% patients had grade III & IV degree of pain because patients did not follow the proper physiotherapy regime and typical Indian habits of squatting and cross leg sitting.

References

1. Bateman JE. Single assembly total hip prosthesis. Preliminary report orthop. Digest, 1974, 2:15.
2. Bateman JE: Experience with a multi-bearing implant in reconstruction fir hip deformities. Ortho. Trans. 1977, 1:2.
3. Bateman JE. Long term results of bipolar arthroplasty in osteoarthritis of the hip. Clin. Orthop. And related research, no. 1990; 251:54-56.
4. Bergner M, Bobbitt RA *et al.* The sickness impact profile: conceptual formulation and methodology for the development of a health status measures. Int. J. Health Serv. &: 1981, 393-415,
5. Boyd HB, Salvatore JE. Acute fracture of the femoral neck: internal fixation or prosthesis. JBJS, 1964; 46:1066,
6. Casrroll BL. Rating Scale for Hip Disabilities. 1963.
7. Chambers IW, Macdonald LA, Tugwell P, Buchanan WW: The McMaster health index questionnaire as a measure of quality of life. Journal of Rheumatology, 1982; 9:782-784.
8. Chen SC, Badrinath K, Pell LH. The movements of the components of the hasting bipolar prosthesis. JBJS, 1989; 71:186-8.
9. Emery RJ, Broughton NS, Desai K. Bipolar hemiarthoplasty for fracture neck of femur:a prospective randomized trial of cemented Thompson and uncemented Moore prosthesis. JBJS. 1991, 73:322,
10. Gallinaro P, Tabasso O, Negretto R, Elena M. Experience with bipolar prosthesis in femoral neck fractures in the elderly and debilitated. Traumatologico Orthopaedico 1990, 29, 10126.
11. Garden RS. Malreduction and avascular necrosis in subcapital fracture neck femur. JBJS. 1971, 53:183.
12. Giberty RP: Hemiarthroplasty of the hip using a low friction bipolar endoprosthesis, clin Ortho, 1983, 175:86.
13. Garrahan WF, Eduardo VV, Dobarganes FG. The Bateman bipolar prosthesis in osteoarthritis and rheumatoid arthritis. Clinic Ortho, 2001, 251:82.
14. Gouch IR, Furnival CM, Schilder L. Love V. Assessment of the quality of life of patients with advanced Cancer: Aus. J. Cancer Clin Oncol. 1983; 19(8):1161,
15. Hammoad KR, Stewart TR, Brehmer B, Steinman D. Social judgement theory. In human judgement and decision-making. 1975; 271-312.