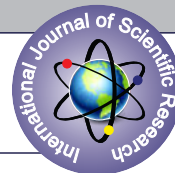


# NON CEMENTED BIPOLAR HEMI-ARTHROPLASTY, SURGICALLY INTERVENED FOR GERIATRIC FRACTURES OF NECK OF FEMUR, THAT ARE DISPLACED: A PROSPECTIVE CASE SERIES STUDY.



## Orthopaedics

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## ABSTRACT

Fracture neck of femur which are displaced, do not find a place in the elderly where the head can be preserved even if there is a surgical intervention. Fixation devices like the DHS have time and again failed to satisfactorily treat these fractures. It's here that the Bipolar Hemi Arthroplasty comes to us, as a very handy operative tool. The question is, whether or not the stem of the Bipolar, be cemented or not. The problems of cementation in the elderly carries the risk of BCIs – the bone cementing implantation Syndrome; which can at times be fatal. Cementation makes, future needed Total Hip Replacement, more difficult. In this prospective study of patients conducted at Chettinad Hospital and Research Institute, Kelambakkam, South India; we have chosen an age group between 61 to 75 years, with an inclusion criterion satisfying type III or IV Garden, but also at the same time, be classifiable, as a type A or type B DORR's classification. Our male to female ratio was 1:2 the mean age was 68.5 years and 93.3% (n=84) of patients undergoing un-cemented Hemi-Arthroplasty, when graded by HHS were either Excellent or Good. We had no Poor outcomes in our study. Our minimum follow up was for 12 months, with a mean follow up of 23.5 months. All our cases were done by the Southern Moore's approach, with an average duration of surgery at 82 minutes. The blood loss on an average was 285 ml and the average blood transfusion rate was at 1.8 units. The average post operative stay was for 12 days. From this short-term prospective study, we concluded that Un-Cemented Hemi-replacement Arthroplasty gives Good to Excellent clinico-functional outcomes. It also does not cause any hindrance, if future Total Hip Replacement, is required. Our complication rates were also manageable, with only about 6.7% (n=6) patients, needing revision surgery due to stem loosening.

## KEYWORDS

Un-cemented Bipolar Prosthesis, displaced fracture neck at femur Sothorn Moore's approach.

## INTRODUCTION:

World over the life expectancy is on the increase. The percentage of the elderly population has also seen a growth which is exponential. As a comorbidity of ageing, we have an element of osteoporosis, which results in fragility fractures in the elderly age group. Among the common fractures encountered in this age group are the fractures around the hip joint. About 53% of the sustained hip fractures are of the femoral neck variant. 2/3 among these fracture necks of femur are displaced fractures according to Somashekar M S et al (1); According to AllFram PA et al (2); In the particular age group fracture neck of femur and per-trochantric fractures have almost an equal incidence. This view is also shared by Gallagher J C et al (3); thus, these two fractures variant according to Orlin Filipov et al (4); constitute 90% of the fractures sustain in these areas. It's only the remaining 10% that are of the sub-trochanteric variant. To address the problem of displaced fracture neck of femur, various surgical protocols have been described in the literature. But till date it remains a debatable topic. The management of these fracture in the younger age group is divergent from the management protocol that can be adopted for the elderly age group. Raghvendra TS et al (5); highlights that in the last two decades treatment methodologies adopted for these fractures have undergone significant surgical implant refinement. The complications of treatment of fracture neck of femur when done surgically are those of non-union and avascular necrosis of neck of femur. According to Somashekar MS et al (1); further according to AllFram PA et al (2); and Shivanand Mayi C et al (6); osteoporosis is a major determinant in predicting the clinico-functional outcomes. AllFram PA et al (2); clearly lays down the goals in the treatment of displaced fracture neck

of femur. Over the last three decades, slowly fading away in popularity, are the prosthetic replacement of femoral head with an Austin Moore or a Thompson prosthesis. They are slowly becoming obsolete. Bipolar Hemi Arthroplasty is an effective stable fixation device for these complicated fractures. The former Hemi Replacement Arthroplasty had complications like acetabular erosion and a disabling hip pain. Bipolar Hemi Arthroplasty was popularized by Gilbert and Bateman in 1974. Here the erosion and protrusion of acetabulum are less because the motion is present, between the metallic head and polyethylene socket (inner bearing).

The motion between the metallic cup and acetabulum (outer bearing) is also smoother because the cup is not fixed to the bone. Because of the sound Biomechanical advantage, the Bipolar Hemi Arthroplasty component performs superior to their unipolar counter parts and yet are not such a morbid operation as the conventional THR (8). These are made available in sizes 22 to 32mm diameter head. There has been some recent modification in the design, so that the access of the metallic and polyethylene cups is fixed in an eccentric manner, so that the metallic cup tends to rotate laterally rather than medially and this avoids fixation of the implant in a varus position. Furthermore, it avoids the impingement of the edge of the cup on the head. The distinct advantages of Bipolar Hemi Arthroplasty are :-

1. Provides for a wide range of movement.
2. Stability is improved.
3. Complications are limited.
4. There's an increased lifespan of the prosthesis.
5. We can do a total hip later.

The absence of a fixed acetabular cup also eliminates, usage of Methyl Methacrylate. Some of its disadvantages are stem loosening, redislocating and the cost factor involved (10). To summarize we find that the bipolar has a lesser wear and tear, they are more modular in their design and if left un-cemented, can be later converted into Total Hip Arthroplasty.

## MATERIALS AND METHODS:

This prospective study was conducted at the Department of Orthopaedics, Chettinad Hospital and Research Institute, Kelambakkam, Chengalpattu district, Tamil Nadu between January 2016 to December 2019. The recruitment was for a period of 48 months, (i.e till December 2019) and the study concluded in December 2020, so that there was a minimum follow up period of 12 months (Range 12 to 59 months), mean of 23.5 months.

### 2.1 Inclusion criteria:

1. Garden 4 and 3 fractures neck of femur.
2. Age between 61-75 years of both the sex.
3. Singh's Index in range of 3 and above.
4. Satisfying Dorr classification A and B.

### 2.2 Exclusion criteria:

1. Non-displaced femoral neck fractures.
2. Extra-capsular neck of femur fracture.
3. Metabolic bone disease fractures, other than plain osteoporosis.

All the patients were evaluated for comorbid conditions like Diabetes Mellitus, Systemic Hypertension, Heart Disease etc; and anesthetic fitness obtained. All cases were done under regional anesthesia that included Spinal or Epidural anaesthesia, and were taken up for surgery within 3 days of admission. Using the Southern Moore's approach, uncemented Bipolar Hemi Arthroplasty was done. The average duration of surgery was 66 minutes with average blood loss of 235 ml, mean duration of hospital stay was 15 days (range 12 to 18 days). After the surgery, IV antibiotics were continued for two days and Thromboprophylaxis were prescribed for 5 POD days. PWB were initiated with the support of a walker on day 3 post surgery. SR was done on POD 12 in general. FWB was initiated only after 42 days. Follow-up of all surgically intervened cases were done at week 6, month 3, month 6 and at end of 12 months. Upon the 12<sup>th</sup> month follow-up, patients were critically analyzed clinically using Harris Hip Score and Roentgenography.

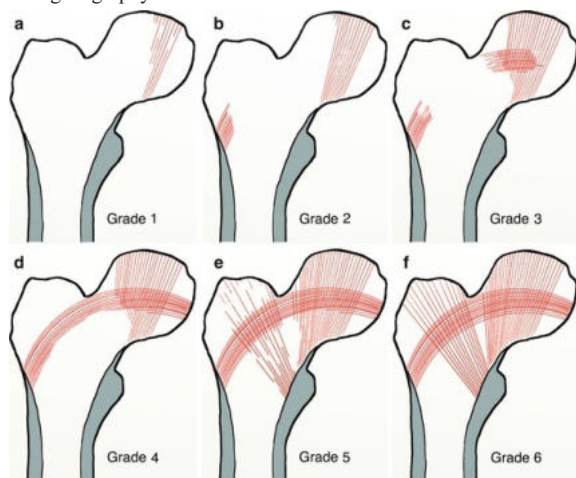


Fig.1: Singh's Radiological index of Osteoporosis.

Table 1: Dorr's ratio Classification:

| Dorr Classification | Canal to calcar diameter ratio | Suggested femoral component fixation |
|---------------------|--------------------------------|--------------------------------------|
| Type A              | <0.5                           | Uncemented                           |
| Type B              | 0.5-0.75                       | Uncemented                           |
| Type C              | >0.75                          | Cemented                             |

Table 2: Harris Hip score interpretation:

| Harris Hip Score | Interpretation |
|------------------|----------------|
| 90-100           | Excellent      |
| 80-89            | Good           |
| 70-79            | Fair           |
| <70              | Poor           |

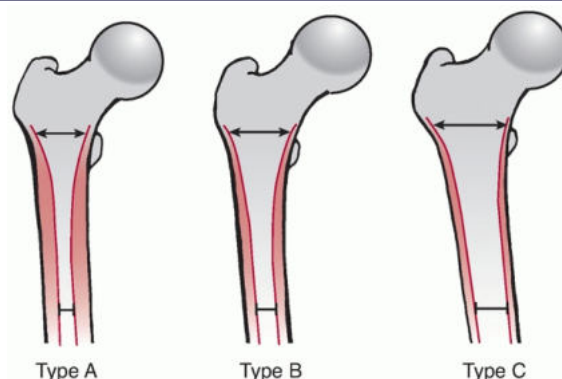


Fig.2: Dorr's Classification and typification.

## RESULT:

Table 3: Demographic Sex and Age distribution:

| Age (in years) | Male (n) | Female (n) | No. of patients (n) | Percentage |
|----------------|----------|------------|---------------------|------------|
| 61-65          | 9        | 27         | 36                  | 40         |
| 66-70          | 12       | 15         | 27                  | 30         |
| 71-75          | 9        | 18         | 27                  | 30         |
| Total          | 30       | 60         | 90                  | 100        |

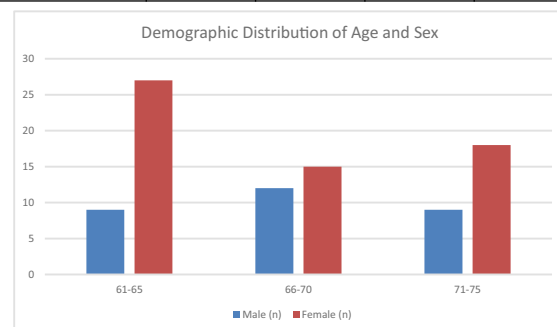


Fig.3: Graphical representation of Demographic Distribution of Age and Sex

Table 4: Affected Side

| Affected side | Number of patients (n) | Percentage |
|---------------|------------------------|------------|
| Right         | 54                     | 60         |
| Left          | 36                     | 40         |
| Total         | 90                     | 100        |

Table 5: Mechanism of Injury

| Mechanism of injury | Number of patients (n) | Percentage |
|---------------------|------------------------|------------|
| Trivial Fall        | 72                     | 80         |
| RTA                 | 18                     | 20         |
| Total               | 90                     | 100        |

Table 6: Fracture pattern distribution (Garden Classification)

| Fracture pattern (Garden Classification) | Male (n) | Female (n) | Total (n) | Total percentage |
|------------------------------------------|----------|------------|-----------|------------------|
| Type 3 Garden                            | 12       | 21         | 33        | 36.67            |
| Type 4 Garden                            | 18       | 39         | 57        | 63.33            |
| Total                                    | 30       | 60         | 90        | 100              |

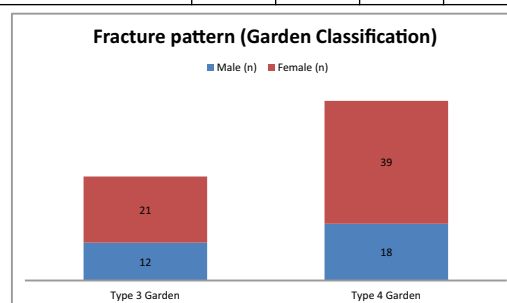
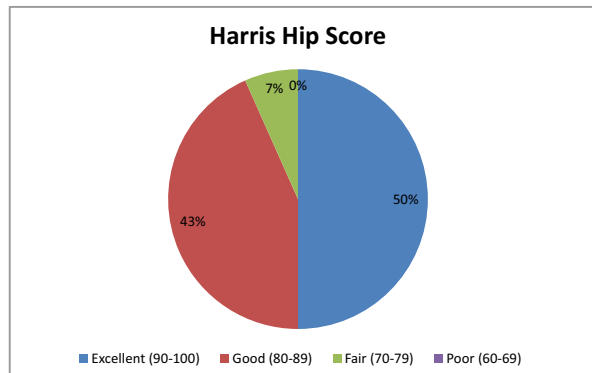


Fig. 4: Graphical representation of Fracture pattern (Garden Classification)

**Table 7: Harris Hip Score Grading**

| Harris Hip Score Grading | No. of patients (n) | Percentage |
|--------------------------|---------------------|------------|
| Excellent (90-100)       | 45                  | 50.0       |
| Good (80-89)             | 39                  | 43.3       |
| Fair (70-79)             | 06                  | 6.7        |
| Poor (60-69)             | 0                   | 0          |
| Total                    | 90                  | 100        |

**Fig.5: Pie chart showing Harris Hip Score Grading****Table 8: Complications:**

| Complications         | No. of patients (n) | Percentage |
|-----------------------|---------------------|------------|
| Superficial infection | 3                   | 3.3        |
| Painful Hip           | 9                   | 10         |
| DVT                   | 3                   | 3.3        |
| Stem loosening        | 6                   | 6.7        |
| Limb Lengthening      | 3                   | 3.3        |

Conforming to our inclusion criteria, we had recruited 90 patients of these 30 patients were males and 60 females so that, the male to female ratio was at 1:2. 80% (n=72) these patients had their mode of injury as a trivial fall from standing height, the remaining 20% (n=18) patients were a victim of RTA. 54 patients had a right sided injury and 36 patients had a left sided injury. With regard to fracture pattern distribution 63.33% (n=57) were of the Garden Classification type IV whereas, the remaining 36.67% (n=33) had sustained a type III Garden fracture. Our age group range was from 61 to 75 years with a mean age of 68.5 years. All surgeries were carried out by the Southern Moore's approach and the average duration of surgery was 82 minutes. The mean blood loss was in ml was 285 ml and the average blood transfusion rate was 1.8 units of blood. The average stay at hospital post operatively was for 12 days. At the end of 12 months the HARRIS Hip Score was at the range between 75 and 95 and the mean HSS score was at 85.5. Thus our minimum follow up was for 12 months and the mean follow up was for 23.5 months. With regard to complications, 3.3%(n=3) had superficial infection, 10%(n=9) patients had a painful hip, 3.3%(n=3) had developed DVT, 6.7%(n=6) had stem loosening and 3.3%(n=3) had features of limb lengthening. Of these 6.7%(n=6) who had developed stem loosening, required re-surgery at the end of 12 months, the HARRIS Hip Score grading was at 50% (n=45) Excellent, 43.3%(n=39) of Good and 6.7%(n=6) of Fair outcomes. We did not have any patient falling under the Poor Grade category.

## DISCUSSION:

**Table 9: Experimental evolution of alternatives, for the femoral head replacement**

| Year Of Conceiving The Concept | Surgeon                      | Replacement of femoral head                 |
|--------------------------------|------------------------------|---------------------------------------------|
| 1932                           | Hey Grooves                  | Ivory                                       |
| 1938                           | Smith Peterson               | Vitallium mould                             |
| 1944                           | Juliet Brothers              | Acrylic femoral head                        |
| 1947                           | Mc Bride                     | Threaded stem                               |
| 1948                           | Moore                        | Self-locking cobalt chrome alloy prosthesis |
| 1950                           | Thompson                     | New concept of hemi-replacement prosthesis  |
| 1952                           | James.E Bateman and Gilberty | Concept of Bipolar Prosthesis               |
| 1983                           | Charnley and Hastings        | Bipolar prosthesis                          |

The major goal of Replacement Bipolar surgery is, early ambulation

and a pain free hip, thereby improving the QOL. Fixations with DHS, have their highest rates of malunion and implant failure, thereby causing to re-surgical interventions (9). These displaced fracture necks of femur are more common in the elderly women with osteoporosis.

The Bi-polar prosthesis by design have an inner and an outer bearing system providing for movement and hence has a lesser incidence of acetabular protrusion and erosion.

This compound bearing system in the bipolar prosthetic design, gives an additional better range of movement, in comparison to their unipolar components (11). In the bipolar design too, now-a-days the stem access is metallic, whereas the cups are made of polyethylene. The cups also have been made of eccentric in design which enables the metallic cup to rotate in a lateral fashion rather than with the medial orientation, which provides for avoidance of the fixation in a varus mode and thereby also preventing the edge of the cup from impinging over the head at the edge of the acetabulum. The outer bearing always has movements in the opposite direction, so that the tendency to dislocate is counter-balanced. These Bipolar Prosthetic Constructs, have a durable lifespan in comparison to other universal endoprosthesis of the universal variant. Yamagata et al;(12) had stated that when an uncemented prosthesis is deployed, it is but essential to achieve a perfect fit within the femoral canal and to achieve a perfect seating on the neck of the prosthesis on the calcar valgus rather than it being varus in position. Lestrangle (13) in their review of 496 patients, who underwent Bipolar Hip Arthroplasty, for the displaced variant of femoral neck fractures found that in comparison to the fixed head prosthesis, had also demonstrated better stability, fewer instances of acetabular erosions and thereby giving an improved clinico-functional outcome.

Bochner et al;(14) also concurred with the fact that redislocation rates are far fewer, with the bipolar prosthesis. This is achieved in the principal constrict of the bipolar prosthetic combined arc of motion, which occurs at a dual level. Further during activities of daily living most of the movements occur in the constructs inner articulation.

Our present study, consisted of 90 patients in all, conforming to our inclusion criteria, the age group was from 61-75 years and our M:F ratio was 1:2. Our readings are in close comparison to that of Ankush Mohabey et al (15), Wender Figved et al;(16), R K Ponraj et al;(7), H. Krishnan et al;(19). Our HHS score averages were close to that of R K Ponraj et al (7), Ankush Mohabey et al; (15), Wender Figved et al; (16) and H.Krishnan et al; (18). Our follow up period was closest to Naiya Samares et al; (17) and that of H.Krishnan et al; (18).

Our approach (Souther- Moore) had been followed by other authors also, our operative duration of 82 minutes was close in comparison to that Ankush Mohabey et al; (15) and our average intra-surgical blood loss at 285ml was close to that of R.K Ponraj et al; (7) and Wender Figved et al; (16). Our average blood transfusion of 1.8 units compares well with that of Ankush Mohabey et al; (15) and Wender Figved et al; (16). Our average hospital stay of 12 days compares well with the study R.K. Ponraj et al; (7). Our sidedness and the mode of injury sustained was in close comparison to that of the study of Ankush Mahabey et al; (15). The superiority of the cemented version over the uncemented version of Bipolar Hemi Arthroplasty has not been satisfactorily accepted in the available literature (17). BCIS which is otherwise called as the Bone Cement Implantation Syndrome, which rarely could also be fatal, is totally avoidable in the uncemented version of Bipolar Hemi Arthroplasty, which we have adopted for all our patients.

## CONCLUSION:

Our follow up has been for a reasonable period of two years for all our 90 patients and we could modestly opine that Uncemented Hemi Arthroplasty for displaced femoral neck fractures, have given satisfactory clinico-functional outcomes. The choice of the patient however, is not just the age factor but also by the quality of bone as adjudged by the DORR's classification. In our humble opinion, Cementation for Bipolar Hemi Arthroplasty is better reserved for the type 'C' variant of DORR's classification. In the Type A and Type B of DORR's classification it would be prudent not to cement the prosthesis in the canal as, if there be a future need for Total Hip Replacement, the procedure becomes more difficult.

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