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Comparative Study Between Monopolar and Bipolar Hemi-Replacement Arthroplasty for Fracture Neck Femur in Old Age

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Abstract
Hemi-Replacement of the Hip Joint is a surgical procedure used to treat certain types of displaced femoral neck fractures, especially in elderly patients.
Hemiarthroplasty involves replacing only one half of the hip joint, typically the femoral head, while preserving the acetabulum (hip socket).
There are mainly two types of hemi-replacement based on using of implants 1) Mono-polar 2) bipolar
This study aims to conduct a meta-analysis comparing unipolar and bipolar implants used in hemiarthroplasty, with a focus on clinical outcomes, perioperative data, complication rates, and mortality.

Keywords: Hemiarthroplasty, Femoral Neck Fracture, Unipolar Implant, Bipolar Implant, Hip Replacement, Clinical Outcomes, Complication Rate, Mortality, Perioperative Data, Elderly Patients

INTRODUCTION

Femoral neck fractures, particularly in the elderly, remain a major orthopaedic challenge despite advances in treatment.
Often caused by low-energy trauma, these fractures are associated with high morbidity and mortality and have been termed the "unsolved fracture" due to frequent complications such as non-union and avascular necrosis.
Hemiarthroplasty, which replaces the femoral head while preserving the acetabulum, is a widely used treatment.
Two common implant types are unipolar and bipolar prostheses. Bipolar implants are designed to reduce acetabular erosion by allowing motion at both inner and outer articulations. However, some studies suggest that the inner bearing may become inactive over time, reducing its theoretical benefits.
This study aims to compare unipolar and bipolar hemiarthroplasty in the treatment of displaced femoral neck fractures, focusing on functional outcomes, complication rates, perioperative factors, and mortality.

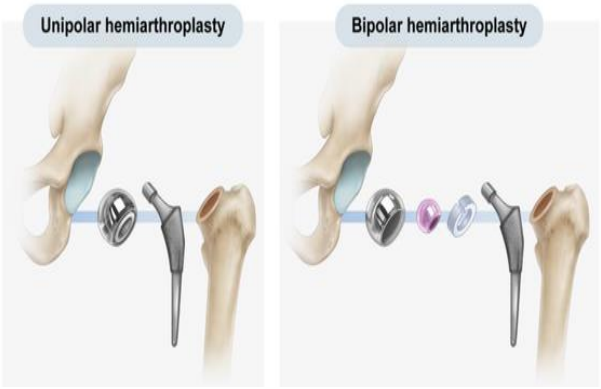


Figure 1: Various Types of Hip joint Replacement

Sources: https://www.researchgate.net/figure/Explosion-views-of-various-types-of-hip-arthroplasty-Upper-left-The-native-hip-joint_fig1_374248881

CLASSIFICATION OF NECK FEMUR FRACTURE

1. **Garden's classification (Most widely used)**
2. **Anatomical classification**
3. **Pauwel's classification**
4. **AO/OTA classification**

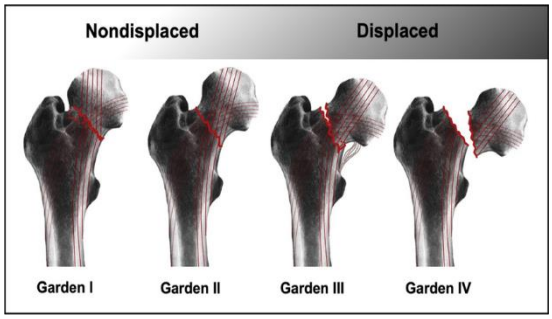


Figure 2: Garden's Classification

Source: Researchgate.net/figures

MATERIALS AND METHODS

This prospective cohort study was conducted in the Department of Orthopaedics at Shri M. P. Shah Government Medical College and Guru Gobind Singh Government Hospital, Jamnagar. The study aimed to evaluate and compare the functional and clinical outcomes of patients who underwent hemi-replacement arthroplasty for displaced fractures of the femoral neck, with a specific focus on unipolar versus bipolar prosthesis use.

Study Population

A total of 100 consecutive patients diagnosed with fracture neck of femur and managed operatively with hemiarthroplasty were included. Patients were enrolled after obtaining written informed consent and ensuring their willingness to comply with scheduled postoperative follow-up.

The cohort was divided based on the type of implant used:

- Unipolar hemiarthroplasty group (Austin-Moore Prosthesis)
- Bipolar hemiarthroplasty group

The decision regarding the type of prosthesis was based on the surgeon's preference, patient's age, activity level, and intraoperative considerations.

Inclusion Criteria

Patients were eligible for inclusion in the study if they met the following criteria:

1. Age ≥ 60 years
2. Diagnosed with a displaced intracapsular fracture of the femoral neck
3. Treated with primary hemi-replacement arthroplasty
4. Provided informed written consent
5. Willing and able to attend follow-up visits as per the study protocol

Exclusion Criteria

The following patients were excluded from the study:

1. Age < 60 years
2. Medically unfit for surgery due to uncontrolled systemic illness (e.g., cardiac, pulmonary, or renal disease)
3. Fractures associated with underlying malignancy (pathological fractures)
4. Patients with polytrauma or associated ipsilateral lower limb injuries affecting rehabilitation
5. Patients lost to follow-up before first clinical assessment

RESULTS

Table 1: Age Distribution Between Monopolar and Bipolar Groups

Age (Years)	AMP (n = 30)	%	Bipolar (n = 70)	%
31–40	1	3.3%	2	2.9%
41–50	2	6.7%	8	11.4%
51–60	3	10%	21	30%
61–70	9	30%	18	25.7%
71–80	15	50%	21	30%
Total	**30**	**100%**	**70**	**100%**

Chi-square (χ^2): 6.468

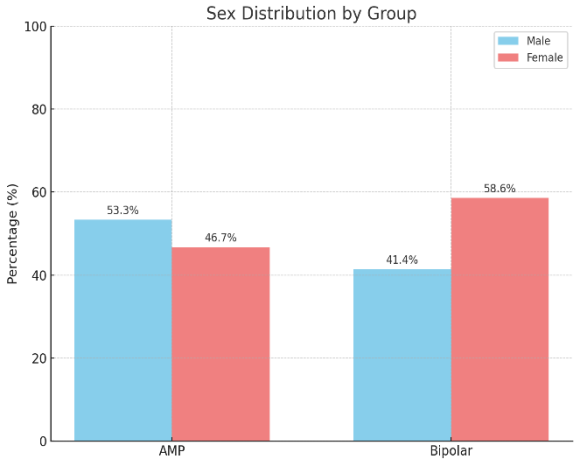
df: 4

p-value: 0.167 (Not Significant)

Mean Age ± SD: AMP: 70.9 ± 14 years | Bipolar: 64.4 ± 11.7 years

The table shows the age distribution of patients in the AMP and Bipolar groups. Most patients were between 71–80 years old, with 50% in the AMP group and 30% in the Bipolar group. The 61–70 age group included 30% of AMP and 25.7% of Bipolar patients. In the 51–60 age group, 10% were in the AMP group and 30% in the Bipolar group. Fewer patients were in the 31–50 age range in both groups. A chi-square test showed no significant difference between the two groups ($\chi^2 = 6.468$, $p = 0.167$), meaning the age distribution was similar. The average age was 70.9 ± 14 years in the AMP group and 64.4 ± 11.7 years in the Bipolar group.

Bar Graph 1: Sex Distribution Between Monopolar and Bipolar Groups

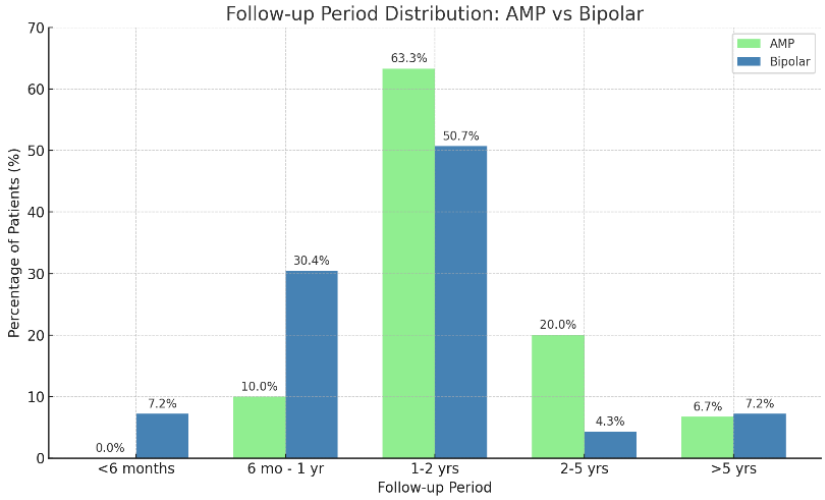


The bar graph shows the gender distribution in both the AMP and Bipolar groups:

- In the AMP group, 53.3% of patients were male and 46.7% were female.
- In the Bipolar group, 41.4% were male and 58.6% were female.

This means there were slightly more men in the AMP group and more women in the Bipolar group. However, the difference is not statistically significant ($p = 0.273$), so the number of men and women was fairly similar in both groups.

Bar Graph 2: Follow up period distribution between Monopolar and Bipolar Groups



This chart shows how long patients were followed after their hip surgery:

- In the AMP group, most patients (about 63%) came for follow-up for 1 to 2 years.
- In the Bipolar group, most also came for 1 to 2 years (about 51%), but a larger number (about 30%) only came for 6 months to 1 year.
- Very few patients in either group were followed for more than 5 years.
- The difference in follow-up times between the two groups was statistically significant, meaning it was not due to chance.
- On average, patients in the AMP group were followed longer (about 31 months) compared to the Bipolar group (about 22 months).

Table 4: Outcome Monopolar vs Bipolar

Outcome	Monopolar (%)	Bipolar (%)
Excellent	86.7%	87.0%
Good	10.0%	12.0%
Fair	3.1%	3.3%

In both groups, most patients had excellent outcomes:

- 86.7% in the Monopolar group
- 87.0% in the Bipolar group

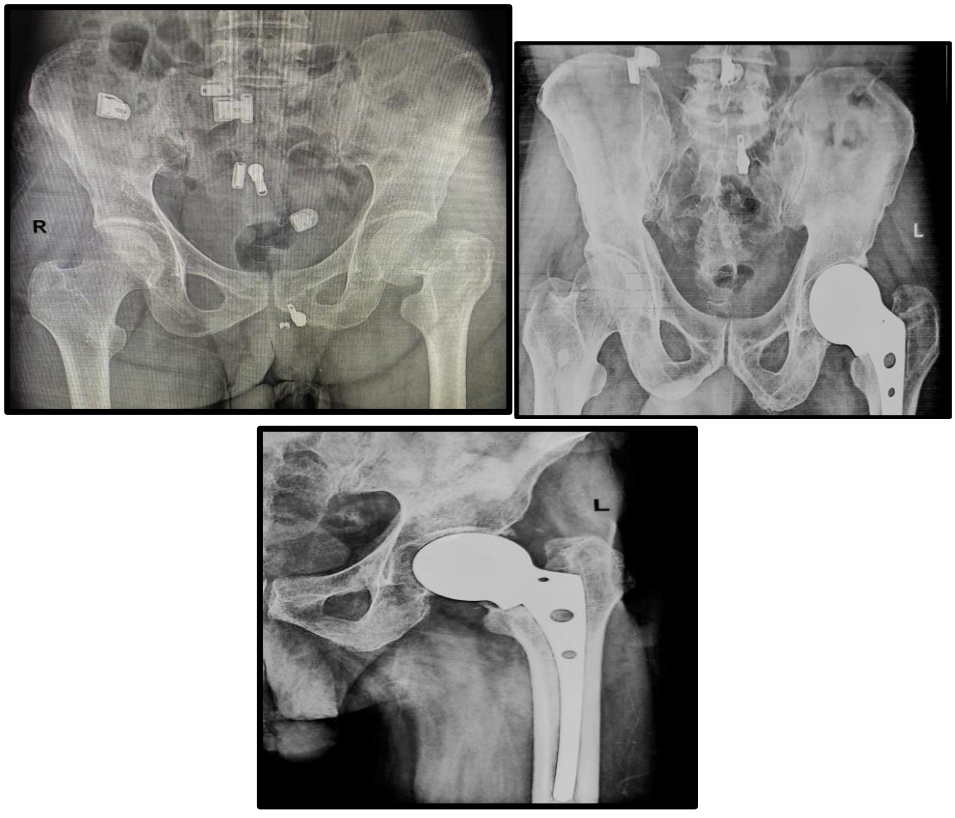
A small number of patients had good results:

- 10% in Monopolar
- 12% in Bipolar

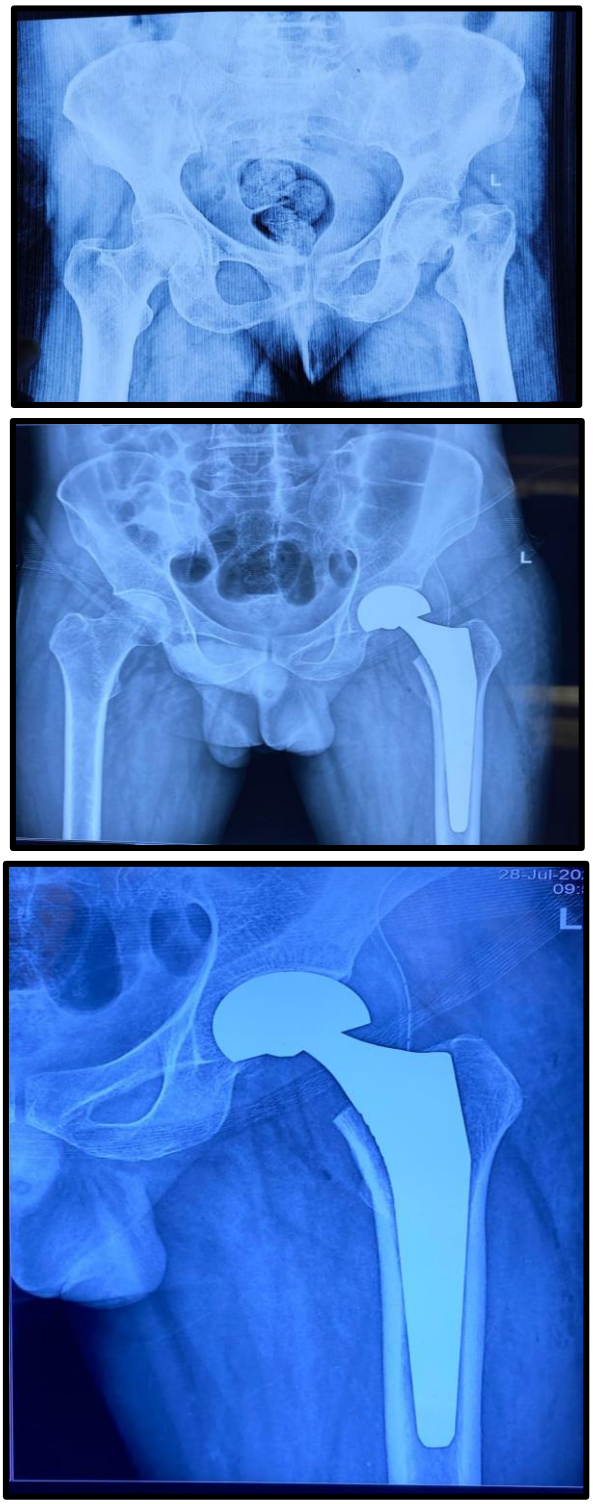
Very few had fair results:

- 3.1% in Monopolar
- 3.3% in Bipolar

Monopolar Case



Bipolar Case



DISCUSSION

This prospective comparative study analysed clinical and functional outcomes of hemi-replacement arthroplasty using Austin Moore Prosthesis (AMP) versus Bipolar prosthesis in elderly patients with femoral neck fractures. The study included multiple parameters such as demographic data, injury characteristics, surgical timing, and post-operative follow-up.

Key findings include:

- No statistically significant differences were found between the two groups in terms of age, gender, mechanism of injury, Garden fracture classification, injury-to-surgery interval, or post-surgical functional outcomes as measured by the Modified Harris Hip Score.
- Both AMP and Bipolar groups showed high rates of excellent outcomes (>85%) with comparable levels of good and fair results, indicating similar effectiveness in restoring hip function.
- A significant difference was observed in side of injury and follow-up durations, although these did not appear to influence clinical outcomes meaningfully.

Overall, the study concludes that both AMP and Bipolar prostheses are effective options for hemiarthroplasty in elderly patients, with no major clinical superiority of one over the other. Therefore, the choice of implant may be guided more by cost, availability, surgeon preference, or patient-specific factors rather than by anticipated functional outcomes.

CONCLUSIONS

- This study found that both Austin Moore (Monopolar) and Bipolar prostheses give excellent outcomes in elderly patients with hip fractures, especially in terms of mobility, pain relief, and overall function. There was no major difference between the two in parameters like pain, limp, daily activities, or Harris Hip Score.
- Although some differences were noted in side of injury and follow-up period, they did not impact overall results. In the Indian context, monopolar prosthesis is a cost-effective and reliable option for elderly, low-demand patients, while bipolar prosthesis may be preferred for younger or more active individuals.

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