

Early functional outcome between Moore and Modified Hardinge approach in hemi-replacement hip arthroplasty – A Prospective Interventional Study.

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ABSTRACT

Introduction: Hemiarthroplasty is a common treatment for patient with a fragility displaced femoral neck fracture. The surgical approach used for hemiarthroplasty is expected to affect the treatment outcomes, in terms of dislocations, performance in daily activities, quality of life after the procedure and the learning curve for surgeons. However, little is known about how the approaches influences the functional outcome following hemi arthroplasty. We hypothesized that both approaches would give comparable results.

Aim : To assess the overall functional outcome in patients undergoing hemi replacement hip arthroplasty using Moore's approach and modified Hardinge approach.

Material and methods: In a prospective interventional study between January 2020 to June 2021 which included 43 hips with a displaced Fracture Neck of Femur at RajaRajeswari medical college and hospital, Bangalore. Sample size was calculated using formula $n=Z^2*(SD)^2/L^2$. Subjects were assigned to treatment groups using simple random sampling technique. Intra-operative and immediate post-operative parameters was entered in MS EXCEL spread sheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 22.0. The student's t-test was used for normally distributed data and the Mann-Whitney U test for ordinal data. The chi-squared test or Fisher's exact test were used for nominal data. Patients were followed up for a duration of 6months post-operatively. Functional outcome was assessed by Harris Hip Score (HHS).

Results: The mean age was 70.46 years and 31 (72.09%) patients had left sided hip involvement. Mean operating time was significantly more in the Modified Hardinge's group (112 minutes) compared to the Moore's group (91.30minutes). Length of incision and amount of blood loss was significantly high in Moore's approach ($p < 0.001$). Two patients (8.6%) had posterior dislocation of hip postoperative and one patient (4.3 %) had superficial surgical site infection in Moore's group. Mean Harris Hip score at 6weeks (65.42 ± 5.70 , 70.68 ± 4.81 , p value < 0.03) and 3 months (71.21 ± 5.57 , 76.35 ± 5.25 , p value < 0.004) follow-up was significantly higher in

Modified Hardinge's Group and 6 months (84.31 ± 6.19 , 85.9 ± 2.55 , p value >0.05) did not show any significant difference between the two groups.

Conclusion: Adopting the Modified Hardinge's approach instead of the posterior approach in hip hemiarthroplasty for femoral neck fracture patients could lower the rate of complications.

Key words: Harris Hip Score, Hemiarthroplasty, Fracture Neck of femur, Osteoporosis, posterior dislocation

1) INTRODUCTION

Hip fracture is an international public health problem, and there are approximately 1.5 million hip fractures worldwide per year. In 2050, there will be an estimated 3.9 million fractures worldwide [1]. Intracapsular femoral neck fractures account for over 50% of all hip fractures. The lifetime risk of sustaining a hip fracture is high and lies within the range of 40% to 50% in women and 13% to 22% in men [3].

The morbidity and mortality after this kind of fracture is thereby high due to development of chest infections, deep vein thrombosis, muscle wasting and pressure sores [2]. Thus, hip fractures remain a public health concern, especially with the aging population and with the high incidence of osteoporosis [1].

The primary goal of treatment is to restore the pre-fracture functional status of the patient. Various treatment options include reduction and fixation, unipolar or bipolar hemiarthroplasty, and total hip arthroplasty [3].

Hemiarthroplasty (HA) is a common method for the treatment of displaced femoral neck fractures. Since octogenarians are predominantly affected, the outcome of this operative procedure is interesting especially in orthogeriatric. However, some questions concerning benefits of different approaches, complication rates, fixation, implant design and others are not completely resolved [4].

The anterior approach (Smith-Peterson) utilizes the tissue plane between the sartorius and tensor fasciae latae. The anterolateral approach (Watson-Jones) utilizes the intermuscular plane between the tensor fasciae latae and gluteus medius. The lateral approach includes separating the gluteus medius and vastus lateralis insertions from the greater trochanteric insertions, which are attached after prosthesis implantation into their original position. Modification of the lateral approach (Modified Hardinge) involve the division and later repair of the gluteus medius. The posterior approach includes separating the gluteus maximus muscle following the release of external rotators from the femoral insertion [5].

Hemiarthroplasty enables immediate full weight-bearing without the risk of typical complications related to internal fixation, including avascular necrosis and non-union. Moreover, in patients older than 60 years, HA results in fewer reoperations compared with internal fixation (6, 7).

The best approach for hip joint arthroplasty, however, remains controversial recently some less invasive modifications have been described and compared to the standard approaches such as posterior, lateral, anterolateral and anterior. All of them seem to have several advantages and every modification leads to different new problems. Most studies comparing surgical approaches include only Total Hip Arthroplasty and are not necessarily valid for Hemiarthroplasty [8].

The surgical approach used for hemiarthroplasty is expected to affect the treatment outcomes, in terms of dislocations, performance in daily activities and quality of life after the procedure and the learning curve for surgeons. The purpose of this prospective study is to compare outcomes of hemiarthroplasty using Modified Hardinge's approach with Moore's approach.

2) MATERIALS AND METHODS

Prospective interventional study was conducted at Raja Rajeswari medical college and hospital, Bangalore for a period of one year from May 2020 – April 2021. Sample size was calculated using formula $n=Z^2*(SD)^2/L^2$ where Z is desired Significance level, SD is taken as SD of time of healing and L= 10% of mean [3]. Permission for the study was obtained from institution ethical committee [RRMCH IEC/23/2018-19] and all patients gave informed consent prior to inclusion in the study. Study includes 43 cases of Fracture neck of femur in elderly aged more than 55y, who were divided into 2 groups by Simple random sampling. The Group A(n=23) patients were treated by hemiarthroplasty using Moore's approach whereas the Group B(n=20) was treated using Modified Hardinge's approach.

Inclusion criteria: a) Subjects who have sustained fracture neck of femur and undergoing hemiarthroplasty within 3weeks of injury, b) Subjects who gave consent. Exclusion criteria: a) Subjects who had pathological fracture other than osteoporosis, b) Subjects who were non ambulatory, prior to the fracture, c) Subjects who have sustained polytrauma, d) Subjects with more than 3 weeks old fracture neck of femur. Out of 80 patients who got operated during the study period, 43 patients were included and 37 patients were excluded from the study.

Patients who have sustained fracture neck of femur were examined and interviewed on the day of admission and patients were categorised into two groups. Primary hemi replacement hip arthroplasty was performed by a consultant orthopaedic surgeon. The Hemiarthroplasty was performed using uncemented bipolar prosthesis which was implanted according to the surgeon's preference either via the Moore's approach or the Modified Hardinge's approach with patient lying in lateral decubitus position[table/figure.1a]. The Moore approach was performed by splitting the Gluteus maximus[table/figure.1b] and reflecting short external rotators, the posterior capsule was visualized. After capsulotomy the joint was visualized. The prosthesis was implanted and short external rotators were resutured to Greater trochanter. The Modified Hardinge approach was performed by making a V-shaped incision over the Gluteus Medius muscle[table/figure.2a] and the anterior capsule was visualized. After capsulotomy the joint was visualized[table/figure.2b]. After implantation of the prosthesis, the V-Shaped incision was resutured. Intra-operative parameters like duration of surgery, amount of blood loss, length of incision, intra-operative fractures and difficulty reductions were recorded. Antibiotic prophylaxis was given as per the institutional Guidelines. The immediate post-op parameters like VAS score,

Day of mobilization and duration of stay at hospital was recorded. Patients were evaluated according to Harris hip scoring system for pain, limp, the use of support, walking distance, ability to climb stairs, ability to put on shoes and socks (in our study for some patient's ability to cut toenail was enquired) sitting on chair, ability to enter public transportation, deformities, leg length discrepancy and movements. Patients hip function was evaluated using Harris Hip Score at 6weeks, 3months and 6months post-operatively [15].

Statistical analysis was performed using SPSS version 22. Before applying parametric methods, the data was checked for normality. If there was significant deviation from normality or the data was ordinal, then non-parametric tests were used. The student's t-test was used for normally distributed data and the Mann-Whitney U test for ordinal data. The chi-squared test or Fisher's exact test were used for nominal data. All tests were two-sided. p-value of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

3) RESULTS

3.1) Study subjects and descriptive data: The average age of the patients is 70.46years (SD=9.05), with most patients between 65-75years. Maximum age was 97years and minimum age was 55years, with mean age of 71.25years in male and 69.96years in females. There were 27 female and 16 male patients. This shows preponderance of females over male patients. There were 31 (72.09%) fractures on left side and 12 (27.9%) on right side. No significant difference detected between Group A and Group B in terms of Age(p=0.7), Gender(p=0.97) and Side(p=0.78).

3.2) Morbidity: Associated disorders like Diabetes Mellitus, Hypertension, Chronic obstructive Pulmonary Disease, Cerebrovascular Accident, Ischemic heart disease, Anemia, were present in about 22 cases (51.16%). These patients were evaluated and treated by physician in the early period of hospitalization. 30 (70%) patients had chest x-ray changes like increased bronchovesicular markings and emphysematous changes.

3.3) Outcome: The mean duration of surgery was 91.30 minutes (SD-16mins) in Group A and 113.25 minutes (SD-7 minutes) in Group B with p-value <0.001. The mean length of incision was 12.95cms in Group A and 10.3cms in Group B with p-value <0.001. Indicating Group A required longer incision and short period of time for surgery when compared to Group B. Post-operative VAS score was lower in Group B (2.05) than Group A (3.35) and patients in Group B had early post-operative mobilization. Patients in Group A (13.83 days) had longer duration of stay in hospital compared to Group B (10 days) [Table/figure 8].

Patients in both groups were assessed using Harris hip score at 6weeks, 3months and 6months post-operatively. Harris hip score was statically higher in Group B at 6weeks and 3months compared to Group A whereas at 6months it was similar in both Group A and Group B [Table/figure 9].

3.4) Complications [Table/Figure 11]: Complications were divided into three categories – Intra-operative, early post-operative and late post-operative.

Intra-operative - 3 cases of Hypotension due to blood loss, these patients needed ICU admission for further management and 3 cases of difficulty reduction of prosthesis in Group A. In the Group B, 3 cases of difficulty reduction.

Early post-operative – one case of surgical site infection (superficial SSI), Patient was treated with wound debridement and higher antibiotics as per the culture and sensitivity reports in Group A.

Late post-operative – two cases of posterior dislocation of hip in Group A. Closed reduction was done in both the cases followed by 3 weeks of skeletal traction. Patients were mobilized with hip abduction brace. One patient had recurrent dislocation of hip, patient didn't return to regular follow up in Group A after 3 weeks post-operatively.

Over all the complications rate were higher in Group A compared to Group B.

4) DISCUSSION

In this prospective interventional study of elderly patients who underwent hemi replacement hip arthroplasty for fracture neck of femur, the Moore's approach and Modified Hardinge's approach had comparable intra-operative and post-operative parameters. The overall functional outcome was better in Group B in terms of HHS and complications rate. The comparison between the posterior approach (Moore) and direct lateral approach (Hardinge) is well documented in literature, however the comparison between Modified Hardinge and Moore approach is insufficient and most studies comparing surgical approaches include Hardinge approach in Lateral approach Group which are not necessarily valid for Modified Hardinge Group. In literature studies demonstrated that the lateral approach increases the risk of damage to the superior gluteal nerve and the Gluteus Medius muscle, which leads to limping secondary to abductor weakness in 4%–20% patients. Abductor weakness may increase the need for ambulatory aids among hip fracture patients operated on using the lateral approach but these complications are avoided by using Modified Hardinge approach.

A Retrospective study done by Ozan F et.al. [9] evaluated the post-operative complications in hemiarthroplasty patients. Their results showed infection in 3 (3.4%) and 11 patients (7.4%) in Hardinge group and Moore group, respectively ($\chi^2 = 0.112$, $P = 0.737$), and hip dislocation in four (4.6%) and 17 patients (11.5%), respectively ($\chi^2 = 0.680$, $P = 0.409$). A significantly increased mortality rate was found with increase in the number of comorbidities in Hardinge group ($\chi^2 = 12.791$, $P = 0.012$), whereas no significant increase was detected in Moore group ($\chi^2 = 1.254$, $P = 0.869$). An evaluation of the relationship between elapsed time until operation and mortality revealed that length of elapsed time until operation did not increase mortality significantly in either group.

A Prospective study by S. Mukka et.al [10] showed that the mortality was high regardless of surgical approach. Seventy-two (39.3%) of the patients died during the study period with no statistically significant difference between the groups ($P = 0.43$). Twenty-four (12.9%) hips required reoperation at least once including closed reduction due to dislocation. The rate of reoperation was lower in the Direct Lateral group compared to the Posterior Lateral group (9 hips [8.8%] vs. 15 [18.1%]).

A Retrospective cohort study done by Roland Biber et.al [4] comparing the complications between the approaches found no significant difference in overall complication rate (10.5 vs 9.7

%). However, the rates of the types of complications examined varied significantly, the dislocation rate was higher after a dorsal approach (3.9 vs 0.5 %) but, the rate for haematoma was less (1.2 vs 5.5 %). The rates for infection, seroma and perioperative fracture did not differ significantly. Thus, a decision in favour of one surgical approach cannot be based on evidence on early surgical complication rates alone.

A Prospective cohort study done by Stain et.al [11] found there were no differences between the groups regarding surgical site infection, perioperative complications, postoperative periprosthetic fractures or mortality. A higher risk was found for prosthetic dislocation in the posterior group, both as a one-time event and for the risk of recurrent dislocations.

A study in Norwegian based on Hip Fracture register data [12] showed mean age of patients in this study was 83years with female predominance and there was shorter duration of surgery (67 min vs. 76 min) in the posterior group than in the lateral group. These results were similar to the present study. Patients reported more pain and less satisfaction with the operated hip after the direct lateral approach than after the posterior approach. Better quality of life (EQ-VAS and EQ-5D index score) was found with the posterior approach, but with statistically significant differences only after 12 months. The functional outcome assessed using HHS had better outcome in modified Hardinge approach and less pain score when compared to posterior approach. There were more reoperations after the posterior approach than after the direct lateral approach, which was similar in present study.

More recently, Parker [13] published a study in patients treated with a Hemi Arthroplasty after FNF. Patients were randomized to the DL or PL approach. The author either performed or supervised all procedures and patients that were operated on by others were excluded. We think this might introduce a performance bias that may limit the generalizability of the obtained results. The author did not find any difference in functional outcome or complications.

In a recent study from the Swedish Hip Arthroplasty Register [14] including patients 70 years and above who were treated with a HA, the authors found no association between the surgical approach and quality of life, residual pain or patient satisfaction.

5) LIMITATIONS OF STUDY

First, the follow-up time is relatively short. Second, we had small sample size.

6) CONCLUSION

Using Modified Hardinge approach, post-op limp and use of ambulatory aids can be completely eradicated. This approach had less complications and statistically significant better early functional outcome, which is required in elderly population suffering from fracture neck of femur. Based on study results, Modified Hardinge approach is better in the management of fracture neck of femur in elderly.

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8) TABLES AND FIGURES



Table/Figure 1a. Position of patient Table/Figure 1b. Splitting G. Maximus in Moore's approach



Table/Figure 2a. "V" Shaped cut of G. Medius in MH approach



Table/Figure 2b. Exposure of capsule.



Table/Figure 3a. Pre-operative X-rays of Group A. Table/Figure 3b. Post-operative X-rays of Group A



Table/Figure 4a. Pre-operative X-rays of Group B. Table/Figure 4B. Pre-operative X-rays of Group B



Table/Figure 5a,5b,5c. Examination of Range of moments post-operatively



Table/Figure 6a. Pre-reduction x-ray of Posterior dislocation of hip in Group A



Table/Figure 6b. Post-reduction x-ray of Posterior dislocation of hip in Group A



Table/Figure 7. Surgical site infection in Group A.

Parameter	Group-A	Group-B	P-value
Length of incision	12.95 cms(12-15)	10.30 cms (9-12)	<0.001
Duration of surgery	91.30 mins (60-120)	113.25 mins (100-125)	<0.001
Amount of blood	2.44 mg/dl (1.8-3)	1.51 mg/dl (1-1.9)	0.03

loss			
VAS on POD1	3.35 (2-6)	2.05(1-3)	<0.001
POD mobilization	2.04	1.65	0.002
Duration of stay	13.83 (10-25)	9.9 (8-15)	<0.001

Table/Figure 8. intra-operative and immediate post-operative parameters

Follow-up	Posterior approach Group A		Lateral approach Group B		Mann Whitney U test	
	Mean	Range	Mean	Range	U statistic	p-value
6weeks	65.42	56.85-71.85	70.69	64.85-80	125	0.03
3months	71.22	60.85-80.85	76.35	61.85-85.85	100	0.004
6months	85.14	73-91	85.9	82-90	207	0.94

Table/Figure 9: Functional assessment using Harris Hip Score.

		Approach		Total	Chi Square test	
		Posterior Group-A	Lateral Group-B		Chi square value	p-value
Sex	F	16	11	27	0.97	0.32(NS)
		69.6%	55.0%	62.8%		
	M	7	9	16		
		30.4%	45.0%	37.2%		
Side	Left	17	14	31	0.08	0.78(NS)
		73.9%	70.0%	72.1%		
	Right	6	6	12		
		26.1%	30.0%	27.9%		

Table/Figure 10. Demographic distribution of patients.

Distribution of complications Results					
Complications	Posterior		Lateral		Fisher extract test
	Frequency	Percentage	Frequency	Percentage	p-value
Intra-operative hypotension	3	13%	0	0	0.65 (NS)
Periprosthetic fracture	0	0	0	0	
Difficulty reduction	3	13%	3	15%	
Injury to neurovascular structures	0	0	0	0	
Deep Infection	0	0	0	0	
Superficial Infection	1	4.3%	0	0	
Dislocation	2	8.6%	0	0	
Bed Sore	0	0	0	0	

Table/Figure 11. Distribution of sample by complications