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Does the Direct Anterior Approach Offer an Advantage Over the Lateral Approach for Hemiarthroplasty of the Hip

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ABSTRACT

Femoral neck fracture is the most common fracture in the elderly population. Hemiarthroplasty is accepted as the gold standard procedure for displaced femoral neck fractures in the elderly worldwide but there is disagreement regarding the optimal surgical approach for the procedure. One of the most commonly used approaches for hip replacement arthroplasty is the Direct Lateral approach or Hardinge approach, which provides excellent exposure but requires partial dissection of gluteus medius muscle insertion, resulting in post-operative abductor dysfunction. This complication could be avoided by using an alternative approach, the direct anterior approach (DAA), which is a muscle-sparing approach. Recent studies indicate that this technique benefits the patient's recovery and reduces the incidence of complications. This study aimed to compare hip function, postoperative complications and patient mobility after hemiarthroplasty via the direct anterior or lateral approach for a displaced femoral neck fracture in elderly patients. Evaluation of 38 patients randomly allocated into two groups: A Direct Anterior Approach (DAA) (Group 1, n = 18, 7 males, 11 females) or a Hardinge approach (Group 2, n = 20, 10 males, 10 female) was done with a follow up of 6 months. Operative parameters which were reported in the previous literature, like the length of the incision, intraoperative and postoperative complications, amount of blood loss as determined by a drop in haemoglobin and need for blood transfusion and rate of dislocation, were compared. The hip function was compared using the Harris hip score (HHS) at 10 days, 6 weeks, 3 months and 6 months. Harris Hip Scores of the anterior group were 21.8±2.1 at 10 days, 59.3±2.0 at 6 weeks, 78.4±4.0 at 10-12 weeks and 95.3±1.3 at 6 months. In the latral group, the score was 20.1±2.9, 58.4±5.7, 79.1±3.8 and 95.3±2.1, respectively at 10 days 6 weeks 10-12 weeks and 6 months, respectively. Harris hip scores between the two groups showed a significant difference only at day 10 ($p = 0.044$) in favour of the direct anterior group. The average incision length was 12.3±3.9 cm in the direct anterior approach group, while the lateral group had a length of 17.26±3.2 cm. It was found to be statistically significant with $p<0.01$. Both surgical approaches showed similar clinical outcomes regarding hip function and incidence of complications. The Direct Anterior Approach is minimally invasive as a smaller skin incision was needed and used an intermuscular plane to approach the hip.

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Key Words
DAA, hardinge, harris hip score, heuter approach

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INTRODUCTION

Intracapsular femoral neck fractures account for 50% of all hip fractures in the elderly[1]. The demographic changes in the world population increasing life expectancy can be expected to cause the number of hip fractures to increase from 1.66 million in 1990 to 6.26 million in 2050[2]. Though hemiarthroplasty is considered the gold standard in the treatment of femoral neck fractures in the elderly there is no consensus regarding the optimal surgical approach. The selection of a surgical approach should consider the patient's condition and their functional demands[3]. One of the most commonly used approaches for hip replacement arthroplasty is the Direct Lateral or Hardinge or the Transgluteal Approach, which provides excellent exposure of both the proximal femur and acetabulum but requires partial dissection of the gluteus medius muscle insertion for adequate exposure of the capsule with consequent abductor muscle dysfunction. To avoid the disadvantages of the lateral approach, the Direct Anterior Approach was utilised in total hip arthroplasty with successful patient-related outcomes[4]. Muscle-sparing nature of the approach can benefit the patient by less incidence of complications, improved post-operative rehabilitation, reduced need for hospital stay and ultimately improved quality of life. The main disadvantage of this approach is the limited exposure of the hip joint with difficulty in accessing the medullary cavity, especially in obese patients. Our study was designed to find out the benefits and difficulties associated with hemiarthroplasty using the anterior approach and also to find out the difference in patient outcome compared with the Direct lateral approach.

MATERIALS AND METHODS

We prospectively evaluated 38 patients who underwent cemented bipolar hemiarthroplasty for neck of femur fracture by DAA (Group 1, n = 18, 7 males, 11 females) or a Hardinge approach (Group 2; n = 20, 10 males, 10 female) from February 2019 to August 2020. The institutional ethics committee approval was attained with reference number PIMSRC/E1/388A/11/2019.

The lateral approach was done through the modified Hardinge approach. The patient was positioned in the lateral decubitus position. A longitudinal incision was made extending 3-5 cm proximal and about 5-8 cm distal to the tip of the greater trochanter. The fascia lata was incised in line with the skin incision and centred over the greater trochanter. The gluteus medius tendon was incised in a C shape, leaving the posterior half still attached to the trochanter. The incision was carried proximally in line with the fibres of the gluteus medius at the junction of the middle and posterior thirds of the muscle. Distally, the incision was carried anteriorly in line with the fibres of vastus lateralis muscle. After performing the capsulotomy, the hip was dislocated by flexion and external rotation of the femur. After delivering head and sizing it, femur neck cut was made and femoral canal was prepared. After inserting the prosthesis, the tendinous tissue was re-attached at the greater trochanter and the wound was closed in layers. Careful attention was taken when closing the gluteus medius tenotomy to prevent post-operative abductor insufficiency.

The direct anterior approach (DAA)/Heuter approach is a minimally invasive technique for total hip arthroplasty popularized by Light and Keggi. The patient was placed supine with the anterior superior iliac spine at the level of table break so that the operating limb could be hyperextended. The skin incision was placed lateral to the interval between tensor fascia latae and sartorius to avoid injury to the lateral femoral cutaneous nerve. The incision was started 3 cm distal and 3 cm lateral to the anterior superior iliac spine and was extended distally and slightly lateral for 8-12 cm. The fascia over the muscle belly of fascia lata fibres was divided and blunt dissection was done in the interval between the tensor fascia latae and sartorius. The ascending branches of lateral circumflex vessels were identified and cauterised. After incising the capsule, a revision osteotomy parallel to the fracture site was done and the “napkin ring” segment was removed with a threaded pin. The femoral head was extracted with a corkscrew. The femur was adducted slightly and externally rotated for 90 degrees with the knee extended to expose the proximal femur. The operated hip was then hyper-extended by “breaking” the table. The femur was elevated laterally and upward with a bone hook. The femur was then prepared and the prosthesis was implanted. After reduction, a secure closure of the capsular flaps was done.

All patients received standard antibiotic and antithrombotic prophylaxis. The postoperative mobilisation protocol was also the same for both groups. Follow-up was done at 10 days, 6 weeks, 3 months and 6 months and outcome measures were evaluated. A standard anteroposterior and lateral x-ray of the operated hip was done to assess implant positioning or any other changes that suggest infection or loosening. The Harris Hip Score assessed the function of the hip and the Visual Analogue Score was used to assess pain[5]. Categorical variables were analysed by chi-square test and expressed in frequencies and percentages. Continuous variables were expressed in mean and standard deviation. The comparison was made by independent t-test/Mann Whitney U test. A probability of value <0.05 was considered significant for all statistical evaluations.

RESULTS

Out of the 38 patients who underwent hemiarthroplasty, 18 were treated with DAA and 20 were treated with a lateral approach. Excluding the 6 deaths that occurred in the study period, all were followed for 6 months. Most of the patients were in the 70-79 age group (14 no); the mean age of the DAA group was 73.72±8.14 and the lateral group was 74.6±8.76, the youngest being 61 years and the oldest being 95 years. There were 17 males and 21 females in the study group. Of the 38 patients, the right side was involved in 19 (50%) and the left side in 19 (50%). 77.8% of patients in the DAA group and 80% of patients in the lateral group were independent ambulators before the trauma (Table 1).

73% of cases were operated within 72 hrs. The average incision length was 12.3±3.9 cm in the direct anterior approach group, while the lateral group had a length of 17.26±3.2 cm. It was found to be statistically significant with p<0.01. The duration of surgery for the anterior group was 103.0±3.6 minutes, while the time required for the lateral group was 74.9±3.2 min. This was found to be statistically significant with p<0.01.

The drop in haemoglobin in the direct anterior approach group 1.5±0.2 was statistically significant with a p<0.01 compared to the drop of 1.9±0.1 in the lateral approach group. 27% of patients in the direct anterior group and 50% in the lateral group required blood transfusion post-operatively. 71% of the patients were mobilized within 4 days and there was a delay in the rest owing to their bad general health. However, this was also found to be equally distributed among the groups (p = 0.547). During the 6-month study period, a total of 6 deaths were registered, 3 from each group and the cause was unrelated to the fracture (Table 2).

The direct anterior approach is minimally invasive and thus it was found to be difficult to extract the head. Difficulty in extracting the femoral head was seen in 16% of the direct anterior group patients; in the lateral group, only 5% of patients were found to be complicated. This was found to be statistically insignificant (p = 0.242). A superficial wound infection in the direct lateral and two cases of haematoma in the direct anterior group showed no statistical significance. There was one intraoperative fracture in the direct anterior group. The femoral stem penetrated the posterior cortex of the femur. This was due to the limited visibility and less accessibility to the femoral canal, as the direct anterior approach was minimally invasive. It was detected in intra-operative fluoroscopy and was revised immediately. A posterior approach was opted for; the prosthesis was removed and inserted correctly after placing a bone block in the fractured region. There was only an incomplete break of the cortex and hence didn't need any additional fixation. This case has been excluded from this study since this was finally done through a posterior approach. Superficial hematoma was seen only in 2 patients in the direct anterior group and was found to be statistically insignificant (p = 0.126). He was managed conservatively and it subsided in a few days (Fig. 1 and 2).

The mean VAS score for the direct anterior group at 10 days was 5.8 and for the lateral group was 6 and the difference was found to be statistically insignificant (p = 0.595). Harris Hip Scores of the anterior group were 21.8±2.1 at 10 days, 59.3±2.0 at 6 weeks, 78.4±4.0 at 10-12 weeks and 95.3±1.3 at 6 months. In the lateral group, the score was 20.1±2.9, 58.4±5.7, 79.1±3.8 and 95.3±2.1, respectively at 10 days 6 weeks 10-12 weeks and 6 months, respectively. Harris hip

Table 1: Demographic data

	DAA n = 18	Lateral n = 20	p-value
Gender n (%)			
Male	7 (38.9%)	10 (50%)	0.49
Female	11 (61.1%)	10 (50%)	
Age (years, Mean±SD)	73.72±-8.14	74.6±8.76	0.75
Mobility before injury n (%)			
Independent	77.8%	80%	
Assisted	22.2%	20%	0.87
Side n (%)			
Right	61.1%	40%	
Left	38.9%	60%	0.19

Table 2: Outcome measures

	DAA	Lateral	p-value
Incision length cm (Mean±SD)	12.3±3.9	17.26±3.2	<0.0100*
Duration of surgery, minutes (Mean±SD)	103.0±3.6	74.9±3.2	<0.0100*
Hb drop (Mean±SD)	1.5±0.2	1.9±0.2	<0.0100*
Blood transfusion (n/%)	5 (27%)	10 (50%)	0.1602
Difficulty in head extraction (n/%)	3 (16%)	1 (5%)	0.2420
VAS score at 10 days	5.8	6.0	0.5950
Harris hip scores			
10 days	21.8±2.1	20.1±2.9	0.044*
6 weeks	59.3±2.01	58.4±5.7	0.564
3 months	78.4±4.0	79.1±3.8	0.620
6 months	95.3±1.3	95.3±2.1	0.9660

*Statistically significant

Fig. 1: X-ray of the patient who had an intraoperative fracture

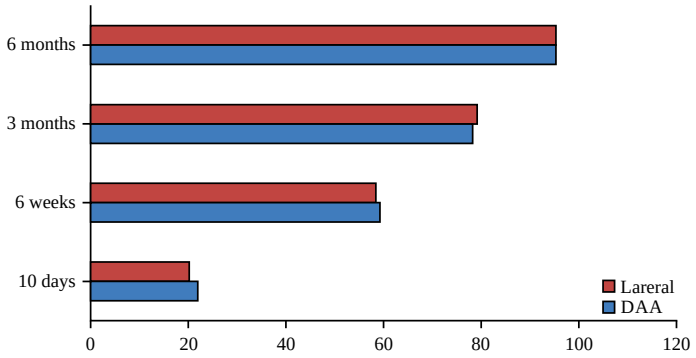

Fig. 2: Harris hip score

scores between the two groups showed a significant difference only at day 10 (p = 0.044) in favour of the direct anterior group.

DISCUSSIONS

Published literature comparing the outcome of surgical approaches in hemiarthroplasty for fracture neck of femur in the elderly has focused on one parameter: The immediate and long-term stability provided to the artificial joint, as depicted by the rate of dislocation associated with it. Our study aimed to evaluate the minimally invasive nature of the Direct Anterior Approach with the widely accepted Direct lateral approach with a low dislocation rate compared with other surgical approaches[6,7].

Unger *et al*.[8] in a consecutive cohort of 180 patients, found the minimally invasive nature of the Direct Anterior Approach in total hip arthroplasty in terms of the length of the incision was beneficial, as depicted by better patient satisfaction scores. Our study confirmed that the length of the skin incision was significantly smaller, 12.3±3.9 cm in the Direct Anterior Approach compared to the Direct lateral approach, 17.26±3.2 cm. The same results were obtained by Schneider *et al*.[9] in their evaluation of 86 patients who underwent monopolar hemiarthroplasty in elderly patients with neck of femur fracture.

In a recent study done by Lee *et al*.[10], it was found that the mean duration for the direct anterior approach was 74±29 min, while in the lateral group, it was 55±28 min. The findings were similar in our series, where the mean duration of surgery for the anterior group was 103.0±3.6 min, while the time required for the lateral group was 74.9±3.2 min. This was found to be statistically significant with p<0.01.

A total of 17 patients received blood transfusion postoperatively. 27% of the patients in the direct anterior group and 50% in the lateral group required blood transfusion postoperatively (p = 0.162). In a study by Desai *et al*.[11], 26% of the patients with femoral neck fractures required blood transfusion postoperatively. The haemoglobin drop in the direct anterior group was 1.5±0.2 and in the lateral group was 1.9±0.1. The haemoglobin drop was seen more in the lateral group and was statistically significant (p<0.01) compared to the anterior group. The lateral

approach, being a more invasive approach, led to more blood loss. This was comparable to a study done by Kunkel *et al*.[12] where the mean haemoglobin drop in the direct anterior was found to be 1.5, while in the lateral group was 1.951.

Nogler *et al*.[13] in comparison of four surgical approaches, reported better patient satisfaction and a lower complication rate in the DAA group compared to the posterior, Hardinge and anterolateral approaches. The pain score in the immediate postoperative period was significantly lower in the Direct Anterior Approach group. Our study also showed a lower VAS score in the Direct Anterior Approach group, which was statistically significant. The study reported difficulty in reducing the hip after placing the prosthesis due to a reduced space available for the prosthesis to negotiate the bulky rectus femoris muscle. The problem we encountered in the direct anterior approach was the difficulty in extracting the femoral head because of the minimally invasive nature of the approach. Although, we faced more difficulty in extracting the heads in 16% of the direct anterior group patients and lower (5%, p = 0.242) in the lateral group, difficulty in reduction was not observed between the groups.

One of our patients had an intraoperative penetration of the posterior cortex of the femur and it was revised by extraction and revision implantation through the posterior approach. The direct anterior approach is a minimally invasive approach with limited accessibility, we suggest extreme precaution while inserting the prosthesis, especially in osteoporotic patients.

As assessed by Harris Hip Score for the direct anterior group, the hip function was better at 21.8 compared to the lateral group, with a mean score of 20. (p = 0.044). By six weeks, the direct anterior group score was 59.3 and the lateral group was 58.4. Once mobilization was initiated, the patients in both groups experienced less pain; hence, both groups could cover a reasonable distance by 6 weeks. There was an improvement of 37.5 points in the direct anterior group compared to 38.3 points in the lateral group. By 3 months, both groups showed a mean 20 point improvement and had good outcomes. Towards the end of the study, almost all patients had excellent outcomes in both groups with similar Harris hip scores. The functional outcome was significant only in the first follow-up (10 days) but did not show any statistical significance in the rest of the follow-ups. The results were similar to the meta-analysis by Zhao wang *et al.*, in a study which compared both approaches, concluded that there was no significant difference between the direct anterior and lateral approaches.

CONCLUSION

The lateral approach took significantly less time than the DAA. The minimally invasive nature of the DAA needed smaller incisions and was associated with less blood loss. DAA showed better function of the hip and less pain in the early postoperative period.

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