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Impacts of Hip Hemiarthroplasty with Direct Lateral vs. Posterolateral Approach for Femoral Neck Fractures in the Elderly

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Abstract

Background: Hip hemiarthroplasty (HHA) is the selected procedure among patients with femoral neck fracture and aged over 70 years old. Lots of different approaches have been proposed for this operation. However, neither of them is confirmed to be superior.
Objectives: The purpose of this study was to compare the posterolateral vs. direct lateral approach with regard to dislocation and mortality rates.
Methods: For this retrospective study, 154 patients with femoral neck fracture were assessed from 2012 to 2018. Demographic data, surgical sheet reports, and plain radiography were evaluated. Postoperative dislocation, reoperation, infection, thromboembolic events, one-year mortality and total mortality rates were extracted through interviews and medical documents.
Results: There was no significant difference between these two surgical approaches in terms of age, gender, time delayed to perform the surgery, Garden classification, and the etiology of fracture. The duration of the surgery was longer in the posterolateral approach without statistical significance. 36 months later, dislocation, infection, and one-year mortality rates were higher in the direct lateral approach. Recurrent dislocation and total mortality rates were higher in the posterolateral approach. No statistical significance was found between the two groups regarding the above-mentioned variables.
Conclusion: The two HHA approaches were similar in terms of the duration of the surgery, dislocation, reoperation, and mortality rates. None of the approaches was superior to the other.

Keywords: Hemiarthroplasty, Dislocation, Mortality, Hip, Infection.

Introduction

Hip fracture is one of the most prevalent etiologies of hospital admissions among the old population.[1,2] The rate of hip fractures including intertrochanteric and femoral neck fractures (FNF) is increasing worldwide.[3-7]

According to the patients' age, physical activity, and displacement/undisplacement of the site of the fracture, varieties of surgical methods have been investigated for treating the FNF.[8] The optimal surgical approach for undisplaced FNF in old people is aimed to ambulate the patients as soon as possible after the surgery, have a minimal invasion, and therefore, have fewer surgery-related complications and hospitalization periods.[6] Hip hemiarthroplasty (HHA) is performed for displaced fractures for those over 70 years of age.[9-11] The advantages of HHA include minimal invasion in comparison with total hip arthroplasty, earlier ability of weight-bearing following the surgery, minimal risk of infection, and decreased duration of the hospital admission.[12,13] All of which leads to less morbidity and mortality.[10,14] Posterior, lateral, and anterior approaches are used for HHA.[15] One of the most significant complications due to HHA is a dislocation that poses a remarkable increase in rates of morbidity, mortality, and also numbers of hospital readmissions.[14,16] Several potential risk-factors have been proposed for each complication and a lot of studies have evaluated the outcomes of these surgical techniques. Nevertheless, there are still controversial results about the superiority of each approach to others due to the rates of postoperative difficulties.[9,17-21]

The selection of the best approach for the HHA is a significant matter of debate worldwide as it can reduce the costs of FNF for both patients and healthcare services.[15,22] In the current study, we aimed to evaluate and compare our two most frequent HHA approaches, posterolateral vs. direct lateral, regarding their rates of postoperative complications and mortality.

Materials and Methods

The data of this study were collected prospectively and analyzed retrospectively. Patients were selected using a simple sampling method without any randomization or matching. All of the medical records belonging to patients with FNF who were admitted to Alzahra or Kashani University-affiliated Hospitals (Isfahan, Iran) between January 2012 and December 2018 and were operated with HHA were reviewed for eligibility for this study. All procedures performed in this study were in accordance with the ethical standards of the institutional and national research committee and with 1964 Helsinki declarations and its later amendments. All of the procedures and operations performed after obtaining written informed consent. The study commenced after receiving its approval with a registration number of "IR.MUI.REC.1396.3.630" from the institutional review board of Isfahan University of Medical Sciences.

Considering alpha (type 1) error of 0.05, beta (type 2) error of 0.2, mean dislocation rate after posterior and lateral HHA approaches as 10% and 2% respectively, approximate 140 patients were considered to be sufficient.

The inclusion criteria were patients over 70 years old who had a non-pathologic displaced FNF and underwent primary HHA, while patients who did not willing to participate in this study, who did not receive HHA, documents with more than 20% missing data, patients or their families who failed to cooperate with the postoperative evaluations, and inability to get access to the medical records were excluded from the study. The dislocation and mortality rates were considered the primary and secondary outcomes of this study, respectively.

The required data were acquired using the Hospital Information System (HIS), Picture Archiving and Communicating System (PACS), asking on the telephone, and visited the included patients in the clinic or reviewed their medical documents individually.

Information including age, gender, the etiology of fracture, and the side of FNF was documented from the patients' medical records. The type of surgical approach, the delayed time from admitting to the hospital to the operating room, and the duration of the surgery were obtained from the surgical sheet report.

The variables, including the Garden type for FNF and central edge angle (CEA) were achieved using the PACS system. The anterior-posterior (AP) plain radiography was used for the assessment of the Garden type, which was categorized using the latest version of Garden classification criteria. Moreover, CEA was measured using the postoperative AP plain radiography of the operated fractured hip. This angle was measured based on the latest Stanford guideline. To measure the CEA, the Perkins line was drowned, and then an oblique line to the prosthesis center tangent to the lower outer acetabular edge was drawn as well. The angle between the mentioned two lines was automatically measured by the PACS system and recorded in the study checklist.

Next, the incidence of dislocation and hospital readmissions after the surgery were checked through the medical records using the patients' codes in the HIS. A similar process was performed for the assessment of surgical site infection. Also, the patients or their families were asked through phone calls to find if the patient has been hospitalized or reoperated in another hospital, due to infection or dislocation. Any intervention on the affected hip, which needed anesthesia was considered as reoperation. If it was needed, in cases with readmissions, the medical records and the surgical sheet reports were evaluated and recorded. Patients who had any postoperative complications or subjective problems were visited in our clinic for further evaluations.

Mortality and its etiology were assessed through the medical records or by asking on the telephone from their first-degree family. In cases who died somewhere other than selected university hospitals, the patient's family was requested to provide the death document and its certificate.

The venous thromboembolism (VTE) events, including deep venous thrombosis (DVT) and pulmonary thromboembolism (PTE), were sought from their medical records, the reports of computed tomography scan, lower extremity Doppler ultrasonography, or their echocardiography results.

In the case of telephoning, after introducing ourselves and the responsible orthopedic surgeon for the study, the reason for calling was explained and the patients were requested to respond to the questions if they had willingness. Moreover, if they were reluctant to answer, to respect their autonomy, further information about the nature of the research was explained and the telephone of the Research Committee was provided. Patients who suffered from severe pain, joint

deformity, or becoming bedridden were evaluated in the clinic. In their visits, the patients were examined completely and anterior-posterior plain radiography was obtained.

The obtained information was imported to the IBM SPSS software version 24 (Chicago, USA). Quantitative variables are expressed as mean and standard deviation. The qualitative variables are expressed as numbers and percentages. To compare each variable between two different surgical approaches, simple t-test and chi-square were used for quantitative and qualitative variables, respectively. P-value of <0.05 (2-tailed) was considered as statistically significant.

Surgical techniques

The direct lateral or transgluteal approach was achieved after placing the patient in the supine position and with a 12-cm incision over the greater trochanter. After dissecting the soft tissue and retracting both edges, the fascia lata was exposed, then vertically cut and pulled anteriorly, and the gluteus maximus was posteriorly retracted. Subsequently, the fibers of the gluteus medius were split into their lines after finding its superior gluteal nerve branch. The vastus lateralis was also split after finding its femoral nerve branch. To reveal the anterior aspect of the hip joint capsule, the gluteus minimus tendon was divided and then entered into the capsule using a longitudinal T-shaped incision. The femoral neck was cut with an oscillating screw and the femoral head was extracted using a cork screw. Additional retractors were used to optimize visualizing the acetabulum.

The posterolateral approach, which is a modification of the direct posterior approach, was started after placing the patient in the lateral position. The incision had a curved-shape, which was started after finding the vertical line between ASIS and greater sciatic notch and parallel to the posterior edge of the greater trochanter. The incision was extended over the greater trochanter and femoral shaft to approximately 10-cm. The femur was in the extension position until the posterior dissections were done. The subcutaneous and fascia were dissected along with the skin incision. The gluteus maximus was blindly split along with its fiber direction and was posteriorly pulled. Afterward, the knee was flexed and the femur was internally rotated while the hip was in extension, to expose the short external rotators. The sciatic nerve was palpable over obturator internus and the Gemelli muscles. Then, the short external rotators were divided and posteriorly reflected to protect the sciatic nerve. The interval between the superior capsule and gluteus minimus was bluntly cut. After exposing the whole area around the joint, the total aspects of the capsule were dissected. After measuring and documenting the leg length, the femur was flexed, adducted, and gently rotated internally while the hip was posteriorly dislocated. The femoral head was gently dislocated from the acetabulum by placing a bone hook beneath the femoral neck at the level of the lesser trochanter. The osteotomy level on the femoral neck was marked and cut with oscillating screw and the femoral head was extracted using a cork screw.

Ethical considerations

All procedures performed in this study were in accordance with the ethical standards of the institutional and national research committee and with 1964 Helsinki declarations and its later amendments. All of the procedures and operations performed after obtaining written informed consent. The study commenced after receiving its approval with a registration number of "IR.MUI.REC.1396.3.630" from the institutional review board of Isfahan University of medical sciences.

Results

195 patients underwent HHA in our centers. 41 patients were excluded from this study, due to having no radiography in the HIS system in eight cases, not cooperating in completing the study checklist in ten patients, and missing the data in four medical records. Besides, 19 patients were excluded because of alteration in their telephone number or address.

The remained 154 patients were included in the study, 99 of them (62.28%) were treated with the direct lateral approach and 55 patients (35.71%) were treated with the posterolateral approach. Among the studied population, 63 patients were male (40.90%). All patients were followed for approximately 36 months, and those with incomplete records were in-personally visited or telephoned. Among the telephoned patients, 12 ones had suspicious medical presentations, including 10 cases of bedridden, one hip deformity, and a patient with severe pain. A plain radiograph was obtained from the mentioned patients, and no evidence was detected in favor of dislocation.

There was no significant difference between these two groups in terms of selected variables including age (p=0.10), gender (p=0.49), involved side of the body (p=0.28), Garden type (p=0.27), and the etiology of fracture (p=0.55). Furthermore, CEA and time-delayed performing the surgery

after admitting to the emergency room showed no remarkable difference (p=0.66 and 0.88, respectively). The duration of the surgery was longer in the patients who were operated with a posterolateral approach (82.79 minutes vs. 75.32), however, it was not statistically significant (p=0.86) (Table-1).

Table-1. Demographic information of the patients in each group of approach for hip hemiarthroplasty

Variables (mean±SD)		Direct lateral (n=99)	Posterolateral (n=55)	P-value
Age (years)		77.97±9.1	75.43±9.1	0.10
Gender n, (%)	**Male**	40 (40.4%)	23 (41.8%)	0.49
	Female	59 (59.6%)	32 (58.2%)	
Follow-up duration (months)		36.46±19.48	36.70±16.64	0.92
Side of surgery n, (%)	**Right**	46 (46.4%)	29 (52.7%)	0.28
	Left	53 (53.6%)	26 (47.3%)	
CEA (degree)		50.86±8.32	50.85±7.22	0.66
delay time (days)		7.16±6.05	6.54±8.35	0.88
Garden Type of the fracture n, (%)	**1**	0 (0%)	1 (8.1%)	0.27
	2	9 (1.9%)	2 (6.3%)	
	3	26 (26.3%)	12 (21.8%)	
	4	64 (64.6%)	40 (72.7%)	
Reason of fracture n, (%)	**Falling**	95 (96%)	55 (55%)	0.55
	Motor to car accident	1 (1%)	0 (0%)	
	Motor to pedestrian accident	2 (2%)	0 (0%)	
	Car to car accident	1 (1%)	0 (0%)	
Duration of the Surgery (minutes)		75.32±8.41	82.79±5.63	0.86

SD, standard deviation; N, number of patients; CEA, central edge angle

After a mean of 36 months of follow-up, the dislocation rate was higher in the lateral approach (6.1% vs. 0%), and multiple dislocations were observed in one patient who was operated with the posterolateral approach. The rate of becoming bedridden was higher after the posterolateral approach (9.1% vs. 5.05%), more joints infected with the lateral approach (4% vs. 3.63%), the reoperation rate for infection was higher in the lateral approach, and the death rate due to the sepsis was higher in the lateral approach. Also, the overall-mortality rate during the follow-up was higher in the posterolateral approach (38.18% vs. 34.34%), however, the first-year-mortality rate was greater in the lateral approach (19.19% vs. 16.36%). Statistical analysis showed no significant difference between these two groups regarding the above-mentioned variables (Table-2).

The thromboembolic complications assessed in the current study were myocardial infarction, DVT, PTE, cerebral vascular attacks, and their related mortality. In those who were treated with the direct lateral approach, 26.47% of mortalities (9 out of 34 deaths) occurred because of PTE, 2.02% (2 out of 99) were presented with non-lethal PTE, and 5.9% (2 out of 99) had DVT. In the posterolateral approach, 28.57% (6 out of 21) of deaths occurred due to PTE, no one had non-lethal PTE and 4.8% (1 out of 55) were represented with DVT (Table-2).

Discussion

HHA as one of the prevalent orthopedic surgeries has multiple techniques and it is important to select the optimal surgical approaches. The most important findings of this study are, although dislocation, reoperation, mortality, VTE-related complications, surgical site infection, and bedridden rates were not statistically significant between these two groups, it is clinically noteworthy to emphasize the higher risks of dislocation, mortality, infection, DVT, and non-lethal PTE in direct lateral approach and higher rates of becoming bedridden and death due to PTE in the posterolateral approach.

Table-2. The patients' information of dislocation, etiology of mortality and other complications regarding two approaches of hip hemiarthroplasty

Variables n, (%)		Direct lateral (n=99)	Posterolateral (n=55)	P-value
Single Dislocation		6 (6.1%)	0 (0%)	0.06
Multiple dislocation		0 (0%)	1 (1.81%)	0.357
Bedridden		5 (5.05%)	5 (9.1%)	0.25
Mortality		34 (34.34%)	21 (38.18%)	0.598
The first year mortality		19 (19.19%)	9 (16.36%)	0.247
Mortality etiology	**Lethal PTE**	9 (26.47%)	6 (28.57%)	0.721
	MI	12 (35.29%)	7 (33.33%)	
	CVA	2 (5.88%)	1 (4.76%)	
	Sepsis	2 (5.88%)	0 (0%)	
	Renal failure	3 (8.82%)	3 (14.28%)	
	GIB	2 (5.88%)	1 (4.76%)	
	Pneumonia	2 (5.88%)	1 (4.76%)	
	Liver dysfunction	2 (5.88%)	0 (0%)	
	Cerebral shunt-related disorders	0 (0%)	1 (4.76%)	
	Prostate cancer	0 (0%)	1 (4.76%)	
Joint infection		4 (4%)	2 (3.63%)	0.634
Reoperation due to the infection		3 (3.03%)	1 (1.81%)	0.550
DVT		2 (2.02%)	1 (1.81%)	0.710
Non-lethal PTE		2 (2.02%)	0 (0%)	0.684

N, number; PTE, pulmonary thromboembolism; MI, myocardial infarction; CVA, cerebral vascular accidents; GIB, gastrointestinal bleeding; DVT, deep venous thrombosis.

Parker et al. represented no differences in terms of surgical-related complications, mortality rate, and postoperative disabilities. Therefore, they declared that none of the approaches was superior to the other, and selecting the appropriate approach depends on the surgeons' opinion and experience. Finally, according to their subjective experience, they reported that the lateral approach is easier than the posterior approach.[18] Kristensen et al.'s study represented that the posterior approach has less pain, better satisfaction, and better quality of life, but no differences were found considering reoperation requirement. Therefore, it was demonstrating that the two approaches were similar regarding the reoperation rate.[7] Svenøy et al. showed a significantly higher risk of dislocation and recurrent dislocations following the posterior approach, which made them be afraid of continuing the HHA with the posterior approach.[23] In the study by Unwin et al.[24] significant differences were revealed regarding the dislocation rate after the posterior approach vs. direct lateral approach, which is consistent with the Svenøy et al. study.[23] Biber et al. study was consistent with others regarding the dislocation rate in the posterior group. Furthermore, the infection rate was slightly higher in the lateral group; however, no significant differences were found between the two groups.[25] The study of Mukka et al. revealed that the posterolateral approach has higher risks of recurrent dislocation, reoperation rate, and deep infection. They indicated that both approaches have an acceptable one-year functional outcome. However, they supported direct lateral as a better option than another.[26]

In contrast to our discovery, although longer surgery time and recurrent dislocations were higher in the posterolateral approach, single dislocation and infection rates were higher in the direct lateral approach. This discrepancy could be explained by the limited numbers of the patients and can be resolved by larger, longer, and multicentric randomized trial studies. Thromboembolic events and first-year mortality were higher in the lateral group and no statistical significance was found between two surgical approaches regarding the aforementioned variables. Therefore, none of the surgical approaches was superior to the other one and no differences were found between two groups regarding the postoperative complications and the posterolateral approach, which can be

considered as a reasonable substitute, which needs further evaluation.

The most significant limitations of this study were retrospective methodology, not evaluating comorbidities, failure to assess the quality of life, the severity of pain, and the hip range of motion postoperatively. More studies in this term with larger populations are strongly recommended. It should be noted that FNF has mostly occurred due to falling, appropriate evaluations of the underlying reasons for falling in this vulnerable population, and making preventive schedules should be considered.

Conclusions

Each HHA approach, direct lateral or posterolateral, had its own complications and none of them was superior to the other one regarding the studied variables.

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Authors' Contribution

All authors pass the four criteria for authorship contribution based on the International Committee of Medical Journal Editors (ICMJE) recommendations.

Conflict of Interests

The authors declare no potential conflict of interest.

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