Research Paper: Delayed Hemiarthroplasty in Elderly Patients With Intertrochanteric and Femoral Neck Fractures

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ABSTRACT

Introduction: In developing countries, the hemiarthroplasty surgical procedure is applied for many patients with hip fractures. These surgical interventions occur with a delay because of various reasons, including insufficient hospital facilities and the deficiency of the ICU beds. Therefore, this study aimed to assess the consequences and complications of delayed hemiarthroplasty in the elderly (>60 years of age) with intertrochanteric and femoral neck fractures, regarding a 1-year follow-up.

Methods: This retrospective cross-sectional study evaluated 392 patients (59.2% female and 40.8% male; Mean±SD age: 69.9±4.7 years) according to the presence or absence of postsurgical complications, including the limbs shortening, infection, hematoma, symptomatic pulmonary embolism, Harris hip score, and the number of deaths following cemented bipolar hemiarthroplasty.

Results: The majority of the patients (82.9%) underwent surgery in public hospitals, and 34% of them had femoral neck fractures. The evaluation of the trauma-surgery time interval index revealed that 39% of patients had delayed surgery (24% of which received surgery on the third day and 15.1% on the fourth day after hospital admission). The trauma-surgery time interval was significantly associated with infection (6.6%), hematoma (4.1%), embolism (2.8%), and deep vein thrombosis (4.8%) ($P<0.05$). The mortality rate was 0.5% (2 cases), 1% (4 cases), and 1.3% (5 cases) in the first month, 1 to 6 months, and 6 to 12 months, respectively. Also, in the first month, this analysis showed a significant ($P<0.05$) association between mortality rate and increased trauma-surgery time interval. According to the functional outcomes, patients with delayed surgery represented the decreased levels of Harris hip score.

Conclusion: Rapid preparation of elderly patients for hemiarthroplasty is considered an effective factor to reduce morbidity and mortality rates.

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1. Introduction

The incidence of femoral fractures is estimated to increase from 1.26 million people in 1990 to 4.5 million by 2050 [1]. In the elderly population, hip fractures affect 18% and 6% of women and men, respectively. In other words, the rate of hip fractures in women is 2 to 3 times higher than in men [1]. Also, the risk of bone fracture is duplicated every 10 years after the fifth decade of life [2], owing to the falling and the presence of osteoporosis as an age-related pathologic condition [3]. In these patients, nonsurgical treatments are closely associated with the prolonged time of immobility, the appearance of bedsores, and cardiopulmonary complications. Thus, almost all elderly patients strictly need orthopedic surgery after femoral fracture [4]. Arthroplasty (total or hemiarthroplasty) is a preferred invasive intervention for femoral neck fractures in elderly patients over 60 years of age [5, 6].

In most cases, the cementum is used to fix the femoral stems [7, 8]. Also, hemiarthroplasty procedure is preferred over total arthroplasty for many elderly patients [9, 10]. Based on the results of various papers, the surgical intervention for hip fractures in the elderly must be performed within 48 hours of patient admission to hospitals to achieve fewer postsurgical complications and appropriate outcomes [11, 12]. However, in developing countries, surgical procedures are performed with delay due to various reasons, including inadequate hospital facilities and the lack of ICU beds. A study in India showed that the mortality rate was increased following a 48-hour delay in surgical procedures [13]. In our clinical centers, a significant number of hemiarthroplasty candidates following hip fracture undergo surgery with delay due to limited hospital and financial resources. Therefore, considering a 1-year follow-up in this study, we investigated the consequences and complications of delayed hemiarthroplasty in elderly patients with femoral neck and intertrochanteric fractures.

2. Materials and Methods

Study protocol

This retrospective cross-sectional investigation included elderly patients (>60 years of age) with femoral and intertrochanteric fractures who underwent cemented hemiarthroplasty using a bipolar prosthesis.

Inclusion and exclusion criteria

Inclusion criteria were the age of over 60 years for patients, femoral neck and unstable intertrochanteric fractures (types II-IV of fracture according to Boyd and Griffin classification), and bipolar cemented hemiarthroplasty. Besides, exclusion criteria included fractures in multiple trauma, pathological fractures, and a history of surgery in the same fracture area.

Data collection

The sampling and access to patients' information were performed based on the ethical considerations under the supervision of the University Ethics Committee. In this method, we collected the medical information of 392 patients with cemented hemiarthroplasty using bipolar prosthesis surgery, for 11 years (2009-2020), in both private and public health centers. Besides, checklists were used to record various information, including patient's demographic characteristics (age, sex, and type/side of fractures), date of trauma and surgery, and location of surgery (private or public hospitals). Also, we recorded the presence or absence of postsurgical complications, such as limb shortening (both limb length differences >10 mm), infection, hematoma, Deep Vein Thrombosis (DVT), symptomatic pulmonary embolism, and the number of deaths. All surgeries were performed by a single orthopedist. The "delayed surgery" patients were individuals with surgery after 48 hours of hospital submission. An orthopedist performed clinical examinations for all patients, at three specific times: the first month, months 1 to 6, and months 6 to 12. During the clinical examinations, the participants also completed the Harris Hip Score (HHS) questionnaire (including four criteria of pain, function, deformity, and range of movement). The maximum score of HHS is 100, and a higher score indicates better pelvic function.

Surgical technique

All the general or spinal anesthetized patients underwent surgical interventions in posterior approaches. Following the dissection and release of short external rotator muscles, the joint capsule was opened according to the T-shape approach, and the femoral head was excised. The standard femoral stem was placed in the femoral canal by cementum. The head of bipolar was also inserted based on the levels of hip stability and limb length. In intertrochanteric fractures, the greater trochanter was fixed to the shaft of the femur by a wire in the form of 8. Finally, the joint capsule and short external rotators were repaired surgically.

Statistical analysis

The obtained data were analyzed using SPSS v. 21 and presented as Mean±SD. Due to data abnormality, the Mann-Whitney test was used to compare the trauma-surgery time interval (hemiarthroplasty) in different clinical outcomes. Also, the Spearman correlation coefficient was used to determine the correlation between HSS and hemiarthroplasty time interval. The significance level was considered as $P<0.05$.

3. Results

Out of 392 patients, 59.2% were female and 40.8% were male; the age range of the patients was 69.9 ± 4.7 years. Also, 39% of the patients received delayed surgery, according to the trauma-surgery time interval. Moreover, 24% of the patients with delayed surgical interventions received surgery on the third day and 15.1% on the fourth day onward. The Mean±SD of trauma-surgery time interval index was 2.24±1.04 days. Table 1 summarizes the demographic and radiographic characteristics of the patients.

Table 2 reports postsurgical complications and the comparison of the delayed trauma-surgery time interval. Of 392 patients, 72 individuals (18.4%) represented one of the postsurgical complications. The differences in trauma-surgery time intervals were statistically significant ($P<0.05$), considering the occurrence of infection, hematoma, embolism, and DVT. The mean time interval was higher in patients with postsurgical complications than in patients with no complications, indicating that the patients with more time intervals also had more complications. Generally, the mean trauma-surgery time interval was three days in patients with complications and two days in patients with no complications (Table 2).

Out of 11 patients (2.8%) who died following the delayed intervention ($P=0.03$), two individuals (0.5%) died in the first month. Thus, it was concluded that delayed surgical intervention could potentially increase the mortality rate in the first month of post-surgery. Four patients (1%) died in a period of 1 to 6 months, of which two cases were in the delayed group ($P=0.661$). Five patients (1.3%) died from six months to one year, in which three cases were in the group with delayed surgery procedure

Table 1. Demographic and radiographic characteristics of patients

Variables		No.(%)
Age group (y)	60-69	213(54.3)
	≥70	179(45.7)
Gender	Male	160(40.8)
	Female	232(59.2)
Type of hospital	Private	67(17.1)
	Public	325(82.9)
Type of fracture	Neck of femur	123(31.4)
	Intertrochanteric (type II)	99(25.3)
	Intertrochanteric (type III)	89(22.7)
	Intertrochanteric (type IV)	81(20.7)
Side of limbs	Right	218(55.6)
	Left	174(44.4)
Diabetes	Yes	164(41.8)
	No	228(58.2)
Trauma-surgery interval time (day)	≥2	239(61.0)
	<2	153(39.0)

Table 2. Frequencies and the comparison of trauma-surgery time interval based on the type of postsurgical complications

Variables		No.(%)	Trauma-Surgery Time Interval (day)	
			P (Mann-Whitney U Test)	Mean (Q1-Q3)
Complications	No	320(81.6)	<0.001	2 (1-3)
	Yes	72(18.4)		3 (3-4)
Short limbs	No	(100) 392	0.774	2 (2-3)
	Yes	(0) 0		2 (1-3)
Infection	No	366(93.4)	<0.001	2 (1-3)
	Yes	26(6.6)		3 (3-4)
Hematoma	No	376(95.9)	<0.001	2 (1-3)
	Yes	16(4.1)		3 (3-4)
Embolism	No	381(97.2)	0.002	2 (1-3)
	Yes	11(2.8)		3 (3-4)
Deep Vein Thrombosis (DVT)	No	373(95.2)	0.003	2 (1-3)
	Yes	19(4.8)		3 (2-4)

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(P=0.217). Generally, no significant differences (P>0.05) were found among trauma-surgery time interval index in comparison with mortality rate.

Following HHS assessment, this index represented an incremental trend from 79.7±6.4 (mean score=80) in the first month to 87.6±7.5 (mean score=88) in a year. Also, the spearman correlation coefficient revealed a strong inverse linear correlation between the trauma-surgery time interval and the HHS scores in whole time-points (one month, 1-6 months, and 6 months to one year). Thus, by increasing the time interval, the results of this factor were weaker (r<0.91, P<0.001). In other words, patients with delayed surgery represented poor functional scores (Figure 1).

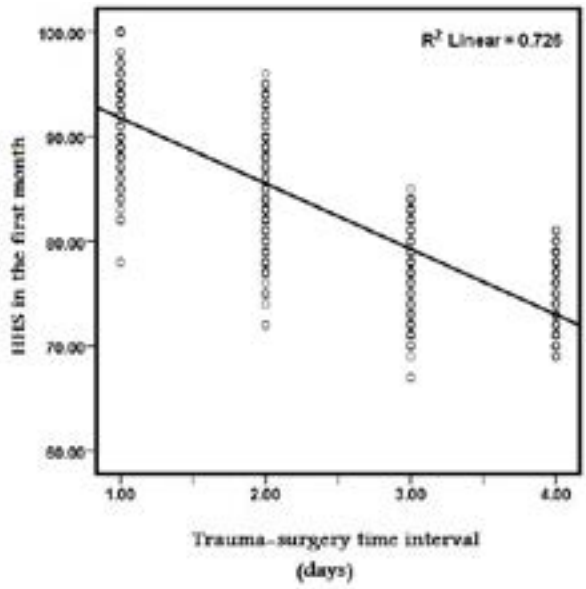

Figure 1. Distribution of correlation between trauma-surgery time interval and HSS index

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4. Discussion

The results of the present study showed that the mortality rate and postsurgical complications were increased only in the first month of surgery in patients with the delayed surgery of intertrochanteric and femoral neck fractures. Also, these patients represented poor functional outcomes.

The evaluation of trauma-surgery time interval showed that 39% of patients had delayed surgery. According to Carretta et al. [14], 43.5% of patients had delayed surgery, while in the study of Lizaur-Utrilla et al. [15], in 2016, the majority of patients (71.4%) represented this index. They found that the mean time interval was 3.6 days, 28.6% of cases underwent surgery during the two first days after trauma, 44.7% of cases received surgery between 3 to 4 days, and 26.7% of patients had surgery within at least five days after trauma. The main reasons for the time delay in surgery return to insufficient hospital resources, the patient's health status at the time of hospital admission, the perception of hip fractures by the patient and his family members, the preference of the patient for the selection of treatment options, and the time spend for the acceptance of anesthesia permission. Among the patients in South Korea, Choi et al. [16] found that 18.5% of surgeries were performed in the first three days of post-injury, while in the United Kingdom or other European and American countries, this rate was approximately 40%.

The HSS index showed an increasing trend in the assessment of functional musculoskeletal outcomes. Also, the results of this index were weaker as the trauma-surgery time interval increased. Butler et al. [17] reported that patients with surgery of more than 12 hours after hospital admission had decreased performance levels six weeks after the surgery. They also found the patients' ability to return to life in a negative correlation. Song et al. [18] studied 47 patients with femoral neck fractures and hip arthroplasty and categorized them into the control group (7 days) and delayed group (patients with chronic fractures in 21 days). These authors concluded that the HHS score was affected by the time of operation, which could be slower in the delayed group. Delay in surgery will lead to less effective rehabilitation and more pain owing to prolonged inactivity and reduced joint movement, which ultimately leads to decreased quality of life.

The assessment of mortality rate showed that 0.5%, 1%, and 1.3% of patients died in the first month, 1 to 6 months, and six months to one year, respectively. Also, delay in surgery increased the mortality rate in the first month of post-surgery. Carretta et al. [14] reported a 30-day mortality rate of 3.5%, which was higher than the present results. They also stated that the patients should have surgery within two days after hospitalization to reduce the 30-day mortality rate. The survey by Lizaur-Utrilla et al. [15] showed that the mortality rate was 3.4% in one month and 13.6% in one year. They concluded that the delay in surgery (up to 4 days) had an insignificant association with a higher mortality rate. A meta-analysis conducted by Moja et al. [19] on 35 published papers showed that older people with earlier surgery (within two days) had significantly lower mortality rates than those with delayed surgery; this difference was still significant after age and sex adjustment. The studies of Kendrick et al. [20] and Nawaz et al. [21] showed that the mortality rates were 5.7% and 4.4% in the first month and 29.2% and 11.2% in the first year, respectively. The differences between these results and the present results return to the fact that we used cemented hemiarthroplasty with the bipolar prosthesis, as DeRogatis et al. [7] suggested that hemiarthroplasty in the elderly should be performed with a cemented stem (else in patients with cardiopulmonary risk factors).

Out of the studied patients, 18.4% had complications (infection, hematoma, embolism, and DVT), but no cases of limb shortening were observed. These complications (except short limbs) had significant relationships with trauma-surgery time intervals. Thus, following a delay in surgery, the incidence of complications was also increased. Consistent with our findings, Poh et al. [22] concluded that delay in surgery was associated with a higher rate of complications. The most common complications were urinary tract infection (24%) and DVT (8.6%), which were higher than our results.

However, Lizaur-Utrilla et al. [15] found no significant differences among postsurgical complications with early surgery. Moerman et al. [23] reported that cemented hemiarthroplasty in elderly patients had fewer complications, compared with an uncemented hemiarthroplasty. Also, the rate of complications, including pulmonary emboli (5.5%), and hematoma (5.5%) in the mentioned study were higher than in our study, but DVT level (0.9%) was lower than our findings. In elderly patients, prolonged presence in bed and delay in surgery can decrease muscle strength and increase the incidence of complications, such as embolism and DVT. Vascular fragility in the elderly and the presence of underlying vascular disease are also prominent factors in the occurrence of hematoma in the surgery site.

5. Conclusion

Findings showed that early preparation of elderly patients for hemiarthroplasty could be considered as an effective factor to reduce morbidity and mortality rates. One of the limitations of our study was the retrospective overview. Also, hospital databases were not created exclusively for epidemiological analysis. For example, we had no access to other underlying diseases except diabetes. However, one of the advantages of this study was that all patients were operated on by a single orthopedic surgeon.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed of the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information. They were free to leave the study whenever they wished, and if desired, the research results would be available to them. Written consent has been obtained from the subjects.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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