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Frequency of Hip Hemiarthroplasty Complications and Cemented / Uncemented Methods in Patients with Femoral Neck Fracture: A Comparative Study

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Study Area: Zahedan, Iran

Coordinates: 29°29'47"N; 60°51'46"E

Key words: Orthopedic traumas, Retrospective study

The ethical considerations were approved by the Research Ethics Committee of Zahedan University of Medical Sciences.

Abstract

Hip hemiarthroplasty is a common method for treatment of femoral neck fracture in the elderly people. Few reports of functional recovery using the cemented method are available though, several complications are also associated while using this method. In this analytical retrospective study, we compared the complications raised due to the cemented / uncemented Hip hemiarthroplasty in the patients with the femoral neck fracture. We assessed 107 patients treated with hemiarthroplasty methods, among which 53% were male, rest were female. No significant mortality rate was seen between two groups. There were also no significant differences between two groups in the cardio-pulmonary complications, received blood volume by the patients, prosthesis surrounding thigh fracture during operation, and hemodynamic changes were evidenced. The results of the present study indicated that two cemented and uncemented operation methods have no significant differences towards the complications, mortality rates, and hemodynamic changes including blood pressure and heartbeat rate. Generally, both the methods could result in good consequences in the femoral neck fracture surgery.

Introduction:

Hip fracture forms 20% of orthopedic traumas, and intra-capsular femoral neck fracture is the output of 50% of hip fracture cases. This fracture in 15% of the cases has no dislocation. It often happens in the elderly people due to mild trauma, which is related to the osteoporosis in the ages over 60 years old. However, it could be rarely seen in the children and juveniles due to severe traumas (Rogmark & Leonardsson, 2016; Chammout *et al.*, 2017; Bartels *et al.*, 2018).

Hip fracture in the elderly people can raise many problems for the health system and result in a high mortality rate (13-17%). Hip fracture includes intertrochanteric and femoral neck fractures because of the intra-capsular status of femoral neck fracture and limited bloodstream in it, the possibility for fracture repair becomes lower than usual, and may also result to late-onset femoral neck necrosis as well as segmental collapse. Although there is controversy about the best treatment for such patients, most orthopedic surgeons use fracture fixation via internal fixators' method for fractures without

dislocation, and hemiarthroplasty and/or total hip arthroplasty for fractures with dislocation. The aim of this treatment is to estimate the recovery function of the patient as fast as possible, and return it to the condition before fraction (Bartels *et al.*, 2018; Govindarajan *et al.*, 2018) by the most suitable system. In cemented hemiarthroplasty, bone cement (a specific chemical that is made of methacrylate) is used for connecting the artificial joint components to the bone. In an uncemented method, the surface of the prosthesis has micropores which directly place within bone medullary canal, and the thigh bone grows into them for several months after surgery (Miyamoto *et al.*, 2008).

Some evidence suggests that uncemented implants in hip hemiarthroplasty result to the limitation of patient movement after surgery, and long thigh pain which raises some worries about using these implants in osteoporosis patients (Figved *et al.*, 2009).

Cemented arthroplasty may increase the mortality rate because of complications of cementation process e.g. bone cement implantation syndrome. The increased risk

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of complications such as long thigh pain and prosthesis surrounding fracture is also seen in the uncemented method. Bone cement implantation syndrome is detected by some signs such as hypoxia, hypotension, and reduced level of consciousness, and is an essential mortality cause in a cemented method. A retrospective study performed in Sweden on 1016 patients treated by cemented hemiarthroplasty showed that the syndrome was seen in at least 28% of patients with different degrees, which indicated a high prevalence of the complication. In the higher degrees of the syndrome, 88% of mortality was reported. Old age, severe osteoporosis, severe cardiovascular diseases, disrupted hemodynamic, and femoral tumors, are the risk factors of the syndrome (Taylor *et al.*, 2012; Yu *et al.*, 2012).

Some measures could be taken to decrease the complications of cementing in the operation room, which includes; evaluation of patients for current risk factors by the anesthesia team before the operation, and selection of the appropriate operation and anesthesia techniques by consultation of the surgeon and the anesthesiologist. The sufficient oxygen should also be provided for all the patients during cementing. Using intravenous catheters in the operation room, and transesophageal ECG are recommended for high-risk patients (Luo *et al.*, 2012).

For decreasing the risk, some actions should be performed during operation, which includes; femoral medulla lavage, preparing sufficient homeostasis before cement implantation, reducing the prosthesis size (preferably using uncemented prosthesis). In the case of cement use, its injection using syringe, and retrograde cement placement are recommended to reduce the risk of bone cement implantation syndrome (Luo *et al.*, 2012).

Some actions could be taken to overcome the complications against cementing in the operation room, such as evaluation of patients for current risk factors by the anesthesia team before an operation, and selection of the appropriate operation and anesthesia techniques by consultation of the surgeon and the anesthesiologist. The sufficient oxygen should also be provided for all patients during cementing. Using intravenous catheters in the operation room, and transesophageal ECG are recommended for high-risk patients (Luo *et al.*, 2012).

For decreasing the risk factor, some actions should be taken during the operation, such as femoral medulla lavage, preparing sufficient homeostasis before cement implantation, reducing the prosthesis size (preferably using uncemented prosthesis). In the case of using the cement, relevant syringe, and retrograde cement placement are recommended to reduce the risk of bone cement implantation syndrome (Luo *et al.*, 2012).

Complications of cementation are heart arrhythmias and cardiopulmonary collapse that could be life-threatening. The results of such happenings are whether embolism due to the entrance of bone marrow products

into the systemic bloodstream, or toxic effect of the bone cement itself (Langslet *et al.*, 2014).

A futuristic study in 2012 for assessing the differences between two cemented and uncemented hemiarthroplasty on 1116 patients in Norway revealed that uncemented hemiarthroplasty operation increased 2.1 times the risk for repeated operation, as comparison to cemented hemiarthroplasty. Repeats in such operation were mostly occurred because of prosthesis surrounding fracture, loose prosthesis, hematoma formation, surface infections, and dislocation (Scott *et al.*, 2018).

There are few studies about complications of cemented and uncemented hemiarthroplasty in Iran, and because of approximately high prevalence of bone cement implantation syndrome and its consequent mortality, and also the prevalence of complications such as dislocation and lose prosthesis, probably need to repeat the operation in uncemented hemiarthroplasty, we decided to have a comparison between two mentioned method for selecting the best choice in different patients (Scott *et al.*, 2018).

The aim of this study was to assess the differences in the prevalence of complications (e.g., severe hypotension, heart failure, pulmonary embolism, and prosthesis surrounding fracture) just after surgery in two cemented and uncemented groups. Our aim was also to compare the hemodynamic changes such as blood pressure and heartbeat rate including the morbidity and mortality in two groups.

Methodology:

This analytical retrospective study was carried out on 107 patients suffering from femoral neck fracture and a history of cemented and/or uncemented hemiarthroplasty, referred to Khatamolanbia hospital of Zahedan, Iran, during the year 2005- 2015. To conduct the data analysis, the SPSS Software (Version-18) was used including descriptive statistics (frequency and percentage) and analytical ones (Chi-square test) considering the significance level of 0.05.

Results:

Mean age of the assessed patients was 63.09 ± 9.48 years. The oldest assessed patient was 91 years old and the youngest one was 41 years old. Total 51 patients were female (47%), and 56 patients were male (53%). Among them, thirty patients were treated using cemented hemiarthroplasty (28%), and 77 of them were treated using uncemented hemiarthroplasty (72%). There were not statistically significant differences between the frequency mortality in two studied groups during and/or after operation until discharging (Table-1).

There were no statistically significant differences in term of severing hypotension and also heart failure in during operation and/or after operation until discharging was evidenced in between two studied groups (Table 2).

Table-1: Mortality frequency in two studied groups during and after operation

Cases	Study Groups	Dead	Alive	p value
During operation	Cemented	2 (6.7%)	28 (93.3%)	≥ 0.077
	Uncemented	0 (0%)	77 (100%)	
	Overall	2 (1.9%)	105 (98.1%)	
after operation till discharging	Cemented	1 (3.3%)	29 (96.7%)	≥ 0.670
	Uncemented	6 (7.8%)	71 (92.2%)	
	Overall	7 (6.5%)	100 (93.5%)	

Table-2: Heart failure during operation and after operation until discharging and severe hypotension between two studied groups

Variable		Cemented	Uncemented	p value
Heart failure in operation theatre	Yes	3 (10%)	1 (1.3%)	≥ 0.066
	No	27 (90%)	76 (98.7%)	
Heart failure after operation before discharge	Yes	2 (6.7%)	6 (7.8%)	≥ 1.000
	No	28 (93.3%)	71 (92.2%)	
severe hypotension in operation theatre	Yes	3 (10%)	1 (1.3%)	≥ 0.066
	No	27 (90%)	76 (98.7%)	

There were no statistically significant differences in term of prosthesis surrounding thigh fracture and pulmonary thromboembolism until discharging in two studied groups (Table 3).

Table-3: Heart failure during operation and after operation until discharging and severe hypotension between two studied groups

Variable		Cemented	Uncemented	p value
Prosthesis surrounding thigh fracture	Yes	0	3 (3.8%)	≥ 0.273
	No	30 (100%)	74 (96.2%)	
Pulmonary thromboembolism	Yes	2 (6.7%)	3 (3.9%)	≥ 0.542
	No	28 (93.3%)	74 (96.1%)	

Discussion:

Femoral neck fracture is a common fracture in the elderly people and there are many challenges regarding its treatment. The fracture is unstable because of its complications such as femur head avascular necrosis, and the need for re-operation due to the complications. Hemiarthroplasty is the most common treatment for femoral neck fracture especially in the elderly people. Bhandari et al. (2005) reported the functional recovery in the cemented hemiarthroplasty method. The aim of the current study was to comparison complications of cemented and uncemented hip hemiarthroplasty in the treatment of patients with femur fracture, during a short pursuit.

In our study, two patients of the cemented group passed away during surgery (6.7%), and at the discharging and after operation levels, in the cemented group, 1 of patients (3.3%), and in uncemented group, 6 of patients (7.8%) have passed away. However, there was no statistically significant difference in the mortality between two groups whether during operation or until discharge. The study of Figved et al. (2009) indicated that mortality rate didn't has any

connection between cemented and uncemented groups which support our findings.

Several studies have shown the physiological and pathological effects of cementing on the cardiovascular system, such as hypoxia, severe systolic and diastolic hypotension, and heart and lung failure (Clark et al., 2001; Figved et al., 2009). In our study, three patients of cemented group and one patient of uncemented group experienced severe hypotension, but such clinical findings were not statistically significant. The study of Lennox & McLauchlan, (1993) recommended not to use cemented method on the older patients because of hypotension and high mortality risks, which were not consonant to our study. Our findings were mainly consonant to the study of Figved et al. (2009), reported that 1.8% of patients treated by cemented method experienced hypotension, while in uncemented group no hypotension was recorded; similar to our findings that there is no significant difference between two groups regarding hypotension.

Khan et al. (2002) compared two hemiarthroplasty methods, in which the patients of two groups indicated no differences in hypotension, as well as cardiopulmonary complications. In cemented group 15.4%, and in uncemented group 12.4% of the patients experienced decreased saturation which was not statistically significant. In our study, pulmonary thromboembolism during operation was also recorded in uncemented (3 cases) and cemented (2 cases) groups that was not statistically significant.

Conclusion:

Our study revealed no significant difference in between cemented and uncemented methods regarding mortality rate, cardiopulmonary complications (heart failure and pulmonary embolism), the frequency of prosthesis surrounding thigh fracture, hemodynamic changes including blood pressure and heartbeat rate, and both methods do the same role in the patient recovery.

Acknowledgment:

Authors are thankful to Zahedan University of Medical Sciences for financial support of this research work..

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