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Our Results On Cancellous Screw Fixation Of Femoral Neck Fractures In Adults

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ABSTRACT

Femoral neck fractures are among the common types of hip fractures. There is no ideal treatment option with consensus for the treatment of these fractures. There are various surgical treatment methods depending on patients' age, general status etc. Studies have reported advantages and disadvantages for each treatment method. In this study, we aimed to evaluate treatment outcomes and complications in patients who were treated with cancellous screw fixation method.

A total of 17 patients treated in the orthopedics and traumatology clinic of our hospital between January 2016 and December 2018 were included in the study. Patients' age, gender, fracture side, mechanism of fracture, duration of hospitalization, postoperative Harris hip score, union status and postoperative complications were recorded.

According to the Garden's classification, 6 patients had garden Type I and II displaced fractures, and 11 patients Garden Type III and IV nondisplaced fractures. Postoperative Harris hip score was found as 'excellent' in 47.1%, 'good' in 35.3%, 'moderate' in 11.8% and 'poor' in 5.9% of the patients. Postoperatively 5.8% of the patients developed wound site infection, 5.8% nonunion, 11.7% implant failure and 5.8% avascular necrosis.

Cancellous screw fixation of femoral neck fractures, which can be inserted with minimal invasive techniques with relatively low complications, seems a safe and beneficial method.

Key Words: Femoral neck, fractures, cancellous screw

Introduction

Increased life expectancy and thus elderly population have led to an increase in the incidence of hip fractures worldwide. Hip fractures account for about 20% of all surgical fractures. Approximately 1.6 million hip fractures occur annually (1). This number is expected to reach 2.6 million in 2025 and 4.5 million in 2050 (2).

Femoral neck fractures are a specific type of intracapsular hip fractures (3, 4). These fractures are the most commonly seen fracture type among all hip region fractures, accounting for about 50% of hip fractures (5). Femoral neck fractures remain a clinical problem in orthopedics and traumatology, and are the most common type of trauma in elderly. Femoral neck fractures are associated with osteoporosis, which is resulted from advanced age, and low-energy falls in elderly people. Whereas in young people, these fractures are usually caused by high-energy traumas such as falling from height and traffic accidents or an underlying pathology (1, 6). In addition, increased interest to extreme sports is an important factor causing high-energy trauma among young people. In conclusion, femoral fractures are an important cause of morbidity and mortality in all age groups. Following hip fractures, mortality has been reported between 20-30% within 1 year depending on age (7). These fractures are likely to result in nonunion and avascular necrosis (8). Risk factors for femoral neck fractures include female gender, whit race, advanced age, smoking and alcohol consumption, previous fractures, a history of falling, decreased mobility, low bone density and low estrogen levels in women (9, 10).

Methods used in operative treatment of femoral neck fractures include hip hemiatroplasty, total hip arthroplasty, proximal femoral nailing, and cancellous screw fixation. Among the treatment options for internal fixation of femoral neck fractures, cancellous screw method made of Ti6A14V or stainless steel material is widely used (11). This method provides earlier mobility, easier care and shortened hospitalization. Studies have reported that cancellous screw fixation for femoral neck fracture is associated with relatively low rates of complications and revision even in elderly (12).

The objective of this study was to evaluate postoperative outcomes and complications of cancellous screw fixation method that we performed in patients who presented with femoral neck fractures.

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Figure 1 A. Postoperative AP **B.** Postoperative lateral X-ray images following cancellous screw application

Material and Methods

A total of 17 adult patients treated with cancellous screw fixation due to femoral neck fractures in the orthopedics and traumatology clinic of our research hospital between January 2016 and December 2018 were included in this study. Patients' epicrisis reports and X-ray images were retrospectively screening via ICD-10 codes and SUT codes from the hospital records. Patients aged 18-94 years with femoral neck fracture and treated with cancellous screw fixation method were included in the study. Three cancellous screws were used in each patient. Patients with pathologic femoral neck fractures, patients with a fracture occurrence of more than 2 weeks, patients younger than 18 years of age at the time of trauma and patients with mental disorders were excluded from the study. After retrospective analysis, data of 28 patients were obtained. Three patients were excluded because of conservative follow-up, 6 patients because different surgeries, and 2 patients due to lack of data. The remaining 17 patients were included in our study. X-ray images of the patients included in the study were analyzed retrospectively and classified according to the Garden Classification system and postoperative Garden Alignment Indexes were measured and recorded. In addition, age, gender, fracture side, pattern of fracture formation, number of days of hospitalization, postoperative Harris hip scoring, presence of union, and postoperative complications were recorded. Ethics committee approval was received from our hospital before the study (Date: 12.06.2019, Decision No: 2019-12) and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Surgical Technique: As a standard technique, a 4-6 cm incision was made beginning from the base of the large trochanter and extending to the distal. The superficial fascia, tensor fascia lata and vastus lateralis were then dissected along the skin incision. A positioning guide wire is installed using an electric drill. This wire stabilizes the head to prevent displacement or rotation of the head during the placement of other guide wires. The second guide wire was inserted in the postero-superior part. The third guide wire was placed in the antero-superior part.

The screws were inserted as close as possible to the cortical bone. The position of the guide wire was confirmed with both AP and lateral images using a C-arm intensifier.

Insertion depth of the three guide wires was determined with the measurement device. Drilling depth was calculated by subtracting 10 cm from this measurement. This is for prevention penetration into the joint. Screw length was found by adding 5 cm to the drilling depth to keep the screw out of the surroundings of the cortex. Care was taken not to change the direction of the drill and follow the guide wire. 5-10 mm of the screw was inserted until remaining out of the cortex using a cannulated hexagonal screwdriver. The position of the screw was confirmed with both AP and lateral images using a C-arm intensifier (13, 14). Postoperative AP and lateral images of the cancellous screw application are given in Figure 1 (Figure 1).

Statistical Analysis: Data were analyzed using IBM Statistical Package for Social Sciences (SPSS) Statistics v.22 software (SPSS Inc, Chicago, IL, USA).

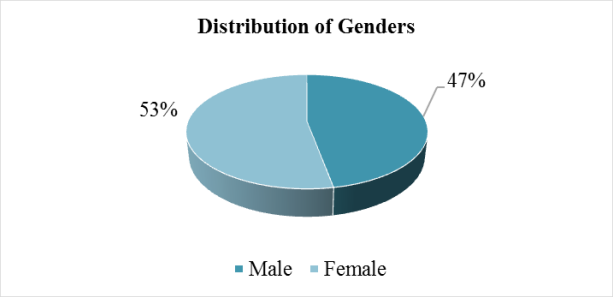

Chart 1. Distribution of genders

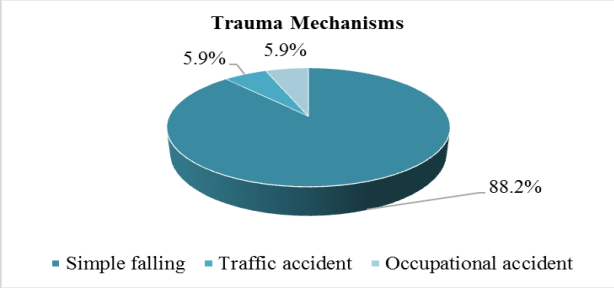

Chart 2. Distribution of trauma mechanisms

Normality of the variables was analyzed with Shapiro-Wilk test. Non-parametric tests were used for non-normally distributed variables. Categorical data were compared with Chi-square test and Fisher's exact test. Quantitative data are expressed as mean, standard deviation, minimum and maximum values. $p<0.05$ values were considered statistically significant.

Results

The mean age of the patients included in the study was 46.7±16.6 (min-max: 18-94) years. Of the patients, 88.2% (n=16) aged under 60 years, while 11.8% (n=2) aged above 60 years. Eight of the patients were male and nine were female (M/F: 0.75/1). Fractures were at the right side in 23.5% (n=4) and at the left side in 76.5% (n=13) of the patients (Chart 1).

Mechanism of trauma was found as simple falling in 88.2% (n=15), traffic accident in 5.9% (n=1), and occupational accident in 5.9% (n=1) of the patients (Chart 2).

The mean duration of hospitalization was 3±0.9 days. When patients included in the study were examined according to the Garden's classification; 6 patients (35.3%) were found to have Garden Type I and Type II displaced fractures and 11 patients (64.7%) Garden Type III and Type IV fractures (Table 1).

Except one patient, the remaining 15 patients were operated within the first 24 hours following fracture occurrence. Only one patient was operated on the 8th day of the trauma because of presentation one week after the fracture occurrence.

Garden Alignment Index (GAI) values of the patients were found as "good" in 15 (88.2%) patients and "poor" in 2 (11.8%) patients. Postoperative Harris Hip Score was found as "excellent" in 8 (47.1%) patients, "good" in 6 (35.3%) patients, "moderate" in 2 (11.8%) patients and "poor" in one (5.9%) patient.(Table 2)

There was no statistically significant difference between Garden non-displaced fractures (Type I and Type II) and unstable fractures (Type III and Type IV) in terms of Harris Hip Scores (p=0.683). Harris Score was "poor" in one patient with Garden Type IV fracture (Table 3).

No statistically significant difference was found between the patients with Garden non-displaced fractures (Type I and Type II) and those with unstable fractures (Type III and Type IV) in terms of postoperative complications (p=0.102).

Postoperative complication was not developed in 12 patients, while one patient developed wound site infection at the 5th week, one patient developed nonunion, two patients implant failure and one patient avascular necrosis at the 9th month of the operation. One of the patients who developed implant failure underwent DHS plaque and union was observed in the fracture of this patient. The other patient underwent PFN at the 4th week of the operation, but this patient developed avascular necrosis at the 12th month and underwent total hip replacement. Total hip replacement was performed at the 6th month of the operation in patient who developed nonunion. The union rate was 82.3% (n=14) at follow-up.

Discussion

Numerous studies have been performed about the outcomes of fixation in femoral neck fractures (7, 15, 16). All these studies have reported results in favour of treatment with fixation of femoral neck fractures with cancellous screw. The main goal of the management of these fractures is to increase the quality of life of the affected patient. A healed femoral neck fracture before the development of osteonecrosis will lead to good functional outcomes. First fracture displacement and impaired blood supply the femoral head are non-surgical factors. However, obtaining a good outcome by reducing the rates of implant failure and nonunion depends on the factors that can be controlled by the surgeon such as obtaining a stable fixation quality (14).

There are many classification systems used for femoral neck fractures. Among these, the most common is Garden's classification (17). Eliasson-

Table 1. Distribution of the patients according to Garden's classification

Garden Classes	Number of Patients (n)	Percentage (%)
Type I	1	5.9
Type II	5	29.4
Type III	4	23.5
Tip IV	7	41.2
Total	17	100

Table 2. Comparison of Garden' Classification and Harris Hip Score

Garden Class	Harris Scoring			
	Excellent	Good	Moderate	Poor
Type I	5.9% (n=1)	0	0	0
Type II	17.16% (n=3)	11.8% (n=2)	0	0
Type III	11.8% (n=2)	11.8% (n=2)	0	0
Type IV	11.8% (n=2)	11.8% (n=2)	11.8% (n=2)	5.9% (n=1)

Table 3. Comparison of Garden groups type I-II and Type III-IV' Classification and Harris Hip Score

Garden Class	Harris Scoring				
	Excellent	Good	Moderate	Poor	P Value
Type I-II	50% (n=4)	%33.3(n=2)	0	0	
Type III-IV	50% (n=4)	%66.7(n=4)	%100(n=2)	%100(n=1)	P:0.683

Eisgjaer and Ostgard recently showed that treatment or outcomes do not differ in Garden I fractures compared to Garden II fractures and in Garden III fractures compared to Garden IV fractures. Therefore, the authors recommended to divide femoral neck fractures simply as non-displaced (Garden I and II) and displaced (Garden III and IV) fractures (18). In our study, we also preferred to divide femoral neck fractures as non-displaced and displaced fractures. Accordingly, Garden Type I and Type II non-displaced fractures were found in 35.3% (n=6) and Garden Type III and Type IV fractures in 64.7% (n=11) of our patients.

There are studies reporting higher rates of revision, complications, nonunion, delayed union and worse functional outcomes with screw fixation method in elderly patients (19, 20). However, on the other hand some studies reporting that age is not associated with implant failure or ultimate functional outcomes (21, 22). In our study, 11.8% of the patients aged over 60 years, and good outcomes were obtained in 88.2% of the patients. The mean age of the patients treated with cancellous screw method was reported as 42.1 years by Ye et al., 41.9 years by Schwartsmann et al., and 53.7 years by Thein et al. (23, 24, 25). In our study the mean age of the patients was 46.7 years.

Femoral neck fractures are more common in women. Several studies have reported different rates of male and female patients who were operatively treated due to femoral neck fractures. In their study, Terry et al. reported a close rate of male and female patients (13). In our study, 47% of the patients were male and 53% were female.

Outcomes of the treatment of femoral neck fractures with cancellous screw fixation were evaluated using postoperative Harris Hip Scores and Garden Alignment Index. Accordingly, GAI scores were "good" in 88.2% (n=15), and "poor" in 11.8% (n=2) of the patients. Postoperative Harris Hip Scores were found as "excellent" in 47.1% (n=8), "good" in 35.3% (n=6), "moderate" in 11.8% (n=2) and "poor" in 5.6% (n=1) of the patients.

In a study by Singhh et al. with 50 adult patients, Harris Hip Scores of cancellous screw fixation for femoral neck fractures were found as "excellent" in 76%, "good" in 18%, "moderate" in 2% and "poor" in 4% of the patients (14). In a study by Al-kelabi et al. with 23 patients, Harris Hip Scores were found as "excellent" in 26.1%, "good" in 39.1%, "moderate" in 8.7% and "poor" in 26.1% of the patients (26).

Complications seen in the treatment of femoral neck fractures with screw fixation include avascular necrosis, implant failure, nonunion, and need for revision. In the literature, overall rate of avascular necrosis has been reported between 3.8% and 10.8% (27, 28). In our study, 5.1% of the patients developed

avascular necrosis with cancellous screw fixation. One of the complications seen with cancellous screw is nonunion. Studies have reported the rate of nonunion with this method between 8.2% and 36%. In a study by Petel et al. the rate of nonunion was reported as 4.8% (29). Similarly in our study the rate of nonunion was found as 5.1%. Studied in the literature have reported the rate of revision with screw fixation method between 7.2% and 16.2% (19, 20). On the other hand, these are studies reporting higher rates of revision. In a study by Gem et al., the rate of revision was reported as 35% with cannulated screw fixation (30). In our study, revision was needed in 17.6% (n=3) of the patients.

There is still debate in the literature about which of the operative and nonoperative methods as well as internal fixation methods are the most ideal options for the treatment of femoral neck fractures. On the other hand, new techniques of fixation with cancellous screws are developed every passing day. Longer follow-up results are needed in order to determine the effectiveness of routine use of cancellous screw fixation in clinic practice.

This study has some limitations. First, the study was designed as retrospective and the number of patients is relatively small. Second, other patients undergoing total hip replacement etc could be included for comparison. However, we believe that our results would provide contribution to the existing results in the literature on this issue. However, further multicenter comparative studies with larger sample size are warranted.

In conclusion; fixation of femoral neck fractures with cancellous screw, which can be inserted with minimal invasive techniques, seems a reliable and beneficial operation. The rates of morbidity, mortality and complications are lower with this method. In fact, in our study no mortality was seen and treatment outcomes are largely satisfying. We believe that our results would be guiding for future studies.

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