

<http://www.pjbs.org>

**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Efficacy of Reverse Triangle Screw Fixation in Patients Suffering from Femoral Neck Fractures

<sup>1</sup>Jafar Ganjpour Sales, <sup>1</sup>Jafar Soleymaopour, <sup>1</sup>Alireza Sadeghpour,  
<sup>2</sup>Shabnam Sharifi, <sup>2</sup>Shahin Rouhani and <sup>3</sup>Mohamad Goldust

<sup>1</sup>Department of Orthopedic, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>2</sup>Tabriz University of Medical Sciences, Tabriz, Iran

<sup>3</sup>Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran

**Abstract:** Although the fractures of femoral neck are not so common, their accompanying complications are more frequent and important. This research aims at studying the results of reverse triangle screw fixation in patients suffering from femoral neck fractures in two groups with perfect and imperfect position of the mentioned screw. In a cohort study, 51 patients with femoral neck fracture appointed for the so-called reverse triangle screw fixation were divided into two perfect and imperfect groups considering surgeon comment on position of the screws. The patients were followed up for 12 months and the resulted outcomes were compared. There were 34 patients in the perfect group with mean age of  $48.7 \pm 18.6$  (18-80) and 17 patients in the imperfect group with mean age of  $50.4 \pm 15.9$  (19-80) years old. Both groups were the same considering underlying causes and fraction grades. The overall frequency of nonunion and avascular necrosis was 7.8 and 3.9%, respectively. These rates were 2.9 and 0% in the perfect group and 17.6 and 12.5% in the imperfect group, respectively ( $p > 0.05$ ). The mean Harris hip score and motion range of the hip at different directions in the perfect group were substantially higher than those of the imperfect one. According to present results, position of the screws determined by the surgeon after operating the reverse triangle screw fixation in femoral neck fractures may significantly affect the prognosis of patients.

**Key words:** Femoral neck fracture, bone screws, fracture fixation, complication, triangle screw fixation

### INTRODUCTION

Femoral neck fracture is a hip fracture in which the neck of the femur is partially or completely broken. Hip fractures are associated with a substantial mortality, as many as 15-20% dying within one year of the fracture. Generally, femoral neck fractures are observed in two groups: young and active individuals and also athletes following a high-energy trauma and with less prevalence of stress fractures and old persons suffering from osteomalacia (Kainth *et al.*, 2011). Sometimes, no blood is supplemented to femoral head in complete or incomplete femoral neck displaced fractures (Seyfettinoglu *et al.*, 2011). Considering the above-mentioned conditions, immediate treatment and fixation of femoral neck is very important (especially in youth) to prevent the most important complication of this fracture, i.e., Avascular Necrosis (AVN) of femoral head as possible (Muller *et al.*, 2011). In 1564, Pare was the first who described femoral proximal fractures. But, this was Cooper who first differentiated intracapsular and extracapsular fractures in

1882 (Vallamshetla *et al.*, 2010). Different implants to fix the fracture have been more used in femoral neck fractures than other kinds of fracture (Huang *et al.*, 2010). Applying cannulated screws have significantly improved results of screw fixation. In this fixation method, several factors including number of screws, their position and direction affect the treatment results (Garcia-Mata and Hidalgo-Ovejero, 2010). Most studies recommended use of three cannulated screws in a reversed triangle form (Lin *et al.*, 2010; Rogmark *et al.*, 2010; Tai *et al.*, 2010). According to our knowledge, no study has theoretically and practically considered screws' position in fixation of femoral neck fracture. Evidently, accurate measuring of deviation is not possible in most therapeutic centers. It is not clear that whether qualitatively defining perfect or imperfect position of screw by the surgeon and using AP and lateral graphs will be effective in conditions of patient and surgery. This study aimed at evaluating this subject. The results of reverse triangle screw fixation in patients suffering from femoral neck fractures in two groups with perfect and imperfect position of the mentioned screw.

**MATERIALS AND METHODS**

**Methods:** In this cohort study, 60 patients with mean age of 49.12±16.8 with femoral neck fracture appointed for reverse triangle fixation participated from April 2008 to April 2011 in orthopedic department of Tabriz Shohada Hospital for a 36 month period. Nine patients were excluded due to abnormal reduction. Finally, the left 51 patients were divided into two perfect (34 patients) and imperfect (17 patient) groups considering surgeon comment on position of screws after fixation. The results were compared in two groups during one year follow-up. The present study has been confirmed by ethical committee of Tabriz university of medical sciences. Study exclusion criteria include patients suffering from osteoporosis, those suffering from diabetes mellitus, patients with major trauma, those who are younger than 18 years old and patients who cannot be followed up. There were 51 patients suffering from one-sided femoral neck fracture treated by reverse triangle screw fixation entered the study through frequent sampling and using simple method. After surgery, Anterior Posterior (AP) and lateral graphs of the operated area were analyzed by 3 orthopedic specialists. They reported the screw positions as perfect and imperfect. If there were at least two similar reports, they will be regarded as the patient's condition by the orthopedist. It should be mentioned that these three orthopedists were not aware of each other's comments and none of them was the related surgeon. After surgery, the patients were visited at 1, 3, 6 and 12 month intervals. After reduction, the fractured area was fixed using three 6.5 mm cancellous screws such that two screws was placed in proximal section at a 0.5 cm distance of anterior and posterior of subchondral bone. Another screw was centrally placed at distal section. These three screws are placed divergently. Concurrent existence of four following radiological conditions means perfectness of screw position:

- Distance of screws from femoral subchondral bone should be 5-10 mm
- One screw will be at inferior section not lower than small trochanter
- The screws should be placed divergently
- The upper screws (2 screws) should be parallel in AP graph

Lack of each of the above-mentioned conditions places the patient at imperfect group. The studied factors included age, gender, damage mechanism, damage

to surgery interval, type of fracture, nonunion, AVN, Range of Motion (ROM), Harris Hip Score (HHS) and difference found between two limbs.

**Statistical analysis:** The data stated as Mean±SD (standard deviation), frequency and percentage. SPSS™ 15 was used as the statistical program. The quantitative data was compared using independent sample t-test or Mann-Whitney U-test. Chi-square test or fisher exact test were used to compare qualitative data. In all cases, p<0.05 was regarded as significant.

**RESULTS**

A total of 60 patients were studied. Nine patients (5 from group A and 4 from group B) were not able to return after the first follow-up examination and were therefore excluded from the study. The remaining 51 patients consisted of 37 males (88%) and 14 females (12%). Considering surgeon comment on position of screws, there were 34 patients in the perfect group with mean age of 48.7±18.6 (18-80) and 17 patients in the imperfect group with mean age of 50.4±15.9 (19-80) years old. Patients' features and basic information of both groups were summarized and compared in Table 1. In this regard, there was no statistically difference between two groups. Follow-up results of the patients are summarized and compared in Table 2. Accordingly, mean of HHS in

Table 1: Features and basic information of the patients

Characteristics	Perfect n = 34	Imperfect n = 17	p-value
Age	48.7±18.6	50.4±15.9	0.761
Gender			
Male	25.0 (73.5)	12.0 (70.5)	0.537
Female	9.0 (26.5)	5.0 (29.5)	
Damage mechanism			
Falling	22.0 (64.7)	12.0 (70.5)	0.674
Accident	12.0 (35.3)	5.0 (29.5)	
Interval between damage to surgery	18.0±14.8	16.2±3.8	0.103
Type of fracture			
II	6.0 (17.6)	4.0 (23.5)	0.587
III	8.0 (23.5)	2.0 (11.8)	
IV	20.0 (58.8)	11.0 (64.7)	

Values in parenthesis are percentage

Table 2: Results of patients' follow-up in both groups

Parameters	Perfect n = 34	Imperfect n = 17	p-value
Nonunion	1.0 (2.9)	3.0 (17.6)	0.12
AVN	0.0 (0)	2.0 (12.5)	0.102
HHS	75.5±2.3	68.1±3.9	0.007
<b>ROM</b>			
Abduction	38.9±8.7	30.0±14.6	0.011
Adduction	19.5±4.1	14.1±8.2	0.003
Internal rotation	38.0±8.9	25.9±12.9	<0.001*
Flexion	90.9±10.3	66.3±20.3	<0.001*
Extension	7.8±4.1	3.4±4.7	0.001*
External rotation	36.4±9.4	23.4±12.5	0.001*
Size difference of two limbs (mm)	0.3±0.4	0.6±0.9	0.100*

AVN: Avascular necrosis, HHS: Harris hip score, ROM: Range of motion, \*Non-parametric test, Values in parenthesis are percentage

perfect and imperfect group was  $75.5 \pm 2.3$  and  $68.1 \pm 3.9$ , respectively. There was a significant difference in this regard ( $p = 0.007$ ). Also, mean of ROM was significantly more in the perfect group considering all cases ( $p < 0.05$ ). No statistically significant difference was observed in other characters. Nonunion was observed in 1 (2.9%) of the perfect group and 3 (17.6%) of the imperfect group. There was not any significant different in this regard ( $p = 0.102$ ). AVN was registered in 2 (12.5%) of the imperfect group and none of the perfect group and there was not any significant different in this regard ( $p = 0.102$ ).

### DISCUSSION

This study considers results of femoral neck fracture treatment through placing three cannulated screws using the reversed triangle method. According to the results of our study and in comparing two groups with perfect and imperfect screw position from the surgeon's viewpoint, no statistically significant difference was observed considering frequency percentage of nonunion and AVN. But, mean HHS and joint range of motion in all directions was substantially more in the group with perfect screw position. It should be noted that nonunion and AVN manifestation in the perfect group was more than the imperfect one but the difference was not substantial. It seems that this is due to small size of the studied sample especially in the group with imperfect results. It seems that comment of the surgeon in this regard significantly affects prognosis of the surgery. Therefore, the necessary actions required to improve the patients' conditions can be taken considering this result. Nonunion and AVN were observed in 7.8 and 3.9% of cases, respectively. In a study different methods of femoral neck fracture fixation was evaluated. Accordingly, the amount of nonunion was varied from 10-20% in these studies and different therapeutic methods (Raaymakers, 2006). Results of this study were more than this study considering malunion which is due to differences found in sample size, fixation methods, studying approaches and patients' features (such as age and gender). In a previous study, AVN has been reported about 11% which was more than those of our study (Asnis and Wanek-Sgaglione, 1994). It can be a result of shortness of this study follow-up period, non-benefiting of MRI in AVN diagnosis in weight intolerance areas and excluding younger than 18 years old patients with femoral neck fracture. In this study, HHS in the perfect group was significantly more than the imperfect group. The results of different studies in this area are varied. Different reasons including differences found in size of the studied sample, patients' features

(e.g., age and gender), severity of fracture, amount of primary displacement, study and follow-up methods, follow-up duration can be regarded as possible reasons in justifying these differences (Bouchoucha *et al.*, 2011; Morochovic *et al.*, 2011). It has been suggested that use of three screws instead of two in fixing this kind of fracture creates more stability (Rupprecht *et al.*, 2011). The present study is of special importance because of limited studies regarding results of this type of femoral neck fracture fixation and specially lack of any similar study in the country. This study mainly considers effects of surgery evaluation about screw position on conditions of the patients. No similar study has been conducted in this regard. In a previous study, the authors concluded that screw position in femoral neck fracture fixation may have a significant effect on stability (Lindequist, 1993). Screw position is effective in final prognosis, too. In some studies, it has been demonstrated that 5-10 degree of diversion is acceptable (Bojan *et al.*, 2010; Jansen *et al.*, 2011; Vukasinovic *et al.*, 2010).

### CONCLUSION

Comparing two groups with perfect and imperfect position of the screw, according to the surgeon's comment, no statistically significant difference was observed considering frequency percentage of nonunion and AVN. But, mean HHS and joint range of motion in all directions in the group with perfect screw position was significantly high. Therefore, it seems that amount of nonunion and AVN has no relation with screw position and anatomic reduction and rigid fixation is more effective in treatment results, according to the results of this study.

### REFERENCES

- Asnis, S.E. and L. Wanek-Sgaglione, 1994. Intracapsular fractures of the femoral neck. Results of cannulated screw fixation. *J. Bone Joint Surg. Am.*, 76: 1793-1803.
- Bojan, A.J., C. Beimeel, A. Speitling, G. Taglang, C. Ekholm and A. Jonsson, 2010. 3066 consecutive A nails. 12 years experience at a single centre. *BMC Musculoskeletal Disorders*, Vol. 11.
- Bouchoucha, S., M. Barsaoui, W. Saied, M. Trifa, K.S. Ben and M. Benghachem, 2011. Bilateral stress fractures of the femoral neck with no risk factor: A case report. *Tunis Med.*, 89: 295-297.
- Garcia-Mata, S. and A. Hidalgo-Ovejero, 2010. Valgus slipped capital femoral epiphysis. *Iowa Orthop. J.*, 30: 191-194.

- Huang, H.K., Y.P. Su, C.M. Chen, F.Y. Chiu and C.L. Liu, 2010. Displaced femoral neck fractures in young adults treated with closed reduction and internal fixation. *Orthopedics*, Vol. 33.
- Jansen, H., S.P. Frey and R.H. Meffert, 2011. Percutaneous screw osteosynthesis of femoral neck fractures in the elderly: Subtrochanteric fractures as severe complications. *Unfallchirurg*, 114: 445-451.
- Kainth, G.S., P. Yuvarajan, L. Maini and V. Kumar, 2011. Neglected femoral neck fractures in adults. *J. Orthop. Surg.*, 19: 13-17.
- Lin, S.Q., L.P. Peng and Z.C. Yao, 2010. Case-control study on cannulated screw fixation and percutaneous autogenous bone marrow grafting for the treatment of femoral neck fractures. *Zhongguo Gu Shang*, 23: 675-678.
- Lindequist, S., 1993. Cortical screw support in femoral neck fractures. A radiographic analysis of 87 fractures with a new mensuration technique. *Acta Orthop. Scand.*, 64: 289-293.
- Morochovic, R., R. Burda, C. Christie, N. Simkova and L. Lakyova *et al.*, 2011. Obturator artery injury after hip fracture surgery. *Hip Int.*, 21: 270-272.
- Muller, M.C., P. Belei, M. de la Fuente, M. Strake and K. Kabir *et al.*, 2011. Evaluation of a 2D fluoroscopy-based navigation system for insertion of femoral neck screws: An experimental study. *Der Unfallchirurg*, 10.1007/s00113-010-1915-4.
- Raaymakers, E.L., 2006. Fractures of the femoral neck: A review and personal statement. *Acta Chir. Orthop. Traumatol. Cech.*, 73: 45-59.
- Rogmark, C., C.L. Spetz and G. Garellick, 2010. More intramedullary nails and arthroplasties for treatment of hip fractures in Sweden. *Acta Orthop.*, 81: 588-592.
- Rupprecht, M., L. Grossterlinden, K. Sellenschloh, M. Hoffmann, K. Puschel *et al.*, 2011. Internal fixation of femoral neck fractures with posterior comminution: A biomechanical comparison of DHS<sup>®</sup>, and Intertan nail<sup>®</sup>. *Int. Orthop.*, 35: 1695-1701.
- Seyfettinoglu, F., O. Ersan, E. Kovalak, F. Duygun, B. Ozsar and Y. Ates, 2011. Fixation of femoral neck fractures with three screws: Results and complications. *Acta Orthop. Traumatol. Turc.*, 45: 6-13.
- Tai, T.W., F.C. Lien, P.Y. Lee, I.M. Jou, C.J. Lin and Y.H. Huang, 2010. Using a cannulated screw as a drill guide and sleeve: A simple technique for multiple-screw fixation for intracapsular femoral neck fracture. *Orthopedics*, Vol. 33.
- Vallamshetla, V.R., M.K. Sayana and R. Vutukuru, 2010. Management of ununited intracapsular femoral neck fractures by using quadratus femoris muscle pedicle bone grafting in young patients. *Acta Orthop. Traumatol. Turc.*, 44: 257-261.
- Vukasinovic, Z., I. Seslija and B. Dulic, 2010. Hip dislocation following the treatment of femoral neck fracture-case report. *Srp. Arh. Celok. Lek.*, 138: 248-251.