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3 (40) 2016: 008-013 • ORIGINAL ARTICLE

The effect of delay time to internal fixation of the femoral neck fractures on development of femoral head avascular necrosis

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SUMMARY

Background. Avascular necrosis of femoral head (AVN) is a major complication of intracapsular femoral neck fractures. Some authors believe that early internal fixation can reduce the incidence of femoral head necrosis.
Objective. The aim of this study was to assess the effect of time of the trauma to surgery delay time on development of AVN in patients with femoral neck fractures.
Methods. We retrospectively analyzed 72 patients aged between 20 and 60 years who presented with intracapsular femoral neck fractures and had undergone screw internal fixation between March 2011 and March 2015. Thirty two patients whose fractures were fixed within 24 hours from injury and 40 patients whose fractures were fixed after 24 hours from injury (Max 3 days), constituted our two comparison groups in this study. All of patients were fallowed up for at least 18 months after surgery.
Results. Of 72 patients with intracapsular fractures who underwent screw internal fixation, 20 patients (27.8 %) developed AVN, 14 of whom were in the group whose fractures had been fixed after 24h of injury. We did not find the delay time to internal fixation to be a significant predictor of the development of AVN (p=0.126).
Conclusions. Our study demonstrated that delay in internal fixation has no significant effect on development of AVN in patients with femoral neck fractures.
Key words: Femoral Neck Fractures, Trauma to Surgery, Delay time, Avascular Necrosis

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Word count: 1363 **Tables:** 4 **Figures:** 6 **References:** 22

Received: 01.08.2016
Accepted: 30.08.2016
Published: 30.09.2016

BACKGROUND

Most authors agree that internal fixation is the best option for treatment of femoral neck fractures in patients under than 60 years of age [1,3], but replacement of the femoral head by arthroplasty in elderly patients (more than 60 years old), does the same[10,11].

Avascular necrosis of femoral head (AVN) is a major complication of intracapsular femoral neck fractures that creates a range of disability in patients. Some surgeons believe that early anatomic reduction and internal fixation of femoral neck fractures are the best ways to prevent late AVN of femoral head. Furthermore, poor reduction provides less surface area for revascularization into the femoral head, which increases the chance of AVN. Although there is consensus that internal fixation is the choice method for femoral neck fracture treatment, the exact time of surgery intervention is uncertain [12,13]. The incidence of AVN after femoral neck fractures has been estimated to be between 16% and 27% in less-than-60-year-old patients [2,5,9].The effect of several factors such as delayed surgery on development of femoral head necrosis has been recognized [4,7].

Some authors consider that the maximum acceptable delay in surgery that has minimal risk for post-operative AVN is 6 to 8 hours after trauma [16,17].

The purpose of this study was to evaluate the effect of timing of internal fixation of the intracapsular femoral neck fractures on the development of AVN.

MATERIAL AND METHODS

The databases of the patients with femoral neck fractures referred in two university hospitals in Ahvaz, south west of Iran, were used for this retrospective analysis. One hundred twenty eight patients were identified aging between 20 and 60 who presented with unilateral intracapsular femoral neck fractures had undergone internal fixation between March 2011 and April 2015. Incomplete recorded documents, patients with less than 1 year follow-up, positive diabetes mellitus(DM) history, sickle cell anemia, consumption of corticosteroid and unwillingness to cooperate in the study; were our exclusion criteria. Twenty eight patients were excluded because of incomplete recorded documents and less than 1 year follow-up. Seven patients had positive DM history and excluded. Two patients were excluded because of sickle cell anemia. Nineteen of 91 remaining patients had no interest in co-operating in the study. Therefore, 72 patients with a minimal 1-year follow-up were included. Mechanisms of injury ranged from low-energy injuries such as mechanical falls to high-energy traumas like road traffic accidents (Table 1). We used the Garden's classification of femoral neck fractures to divide patients into nondisplaced fracture (Garden I or II) and displaced fracture (Garden III and IV) groups. Twenty two patients were categorized as nondisplaced fracture and 50 patients were displaced fracture group. According to the recorded data from the included patients, we subdivided patients to the following two subgroups using time of fixation: less than 24 hours delay and more than 24 hours to maximum 3 days (see Table 1). All the patients were evaluated with clinical examination and pelvic radiography. The mean follow-up period was 18 months. AVN of femoral head was diagnosed both radiologically and clinically. We used the t-test, chi-square and Fisher's exact test in a univariate analysis. All analyses were performed using SPSS version 18 and the statistical significant level (p-value) was considered to be less than 0.05. this study was approved by Ethics committee at our university and a consent form was taken from all the patients.

RESULTS

The following results were obtained with regard to assessing the risk of AVN in our 72 patients with femoral neck fractures, who were treated with screw internal fixation. Their age ranged from 20 to 60, with a mean of 39(median age, 37). There were 55males and 17females. Fifty patients had displaced fracture and 22 patients had nondisplaced fracture.

Four (18.2%) patients with nondisplaced fracture and 16(32%) patients with displaced fracture developed the AVN (see Chart1) and it showed that displacement increases the chance of AVN by as much as about 2.12 times (Open reduction =2.12 Closed reduction =(0.615,7.299).

Tab. 1. Descriptive values of the patients

Factor	Amount	Percent
Gender		
Male	55	76.4
Female	17	23.6
Fracture displacement		
Displaced	50	69.4
Nondisplaced	22	30.6
AVN		
Yes	20	27.8
No	52	72.2
Trauma to surgery delay time		
Delay <24 hour	32	44.4
Delay > 24 hour(Max72h)	40	55.6
Trauma mechanisms		
MCA[i]	45	62.5
PCA[ii]	15	20.8
MMA[iii]	3	4.2
CCA[iv]	7	9.7
Falling	2	2.8

[i] = Motor to Car Accident, [ii] = Pedestrian to Car Accident, [iii] = Motor to Motor Accident, [iv] = Car to Car Accident

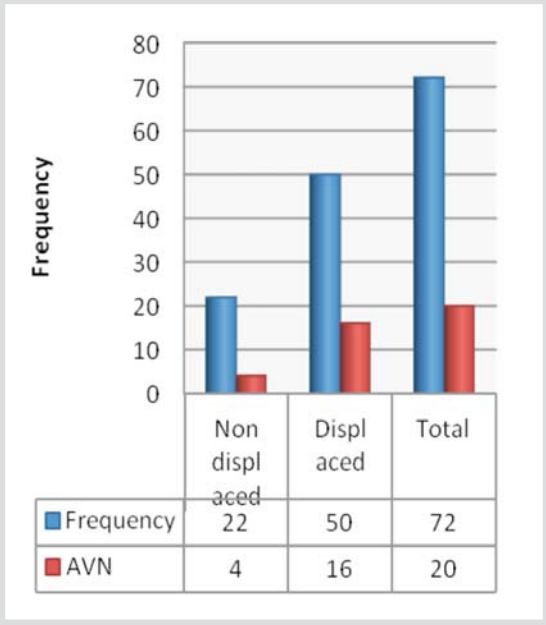
There was no significant difference in AVN incidence according to displacement of fracture (p-value=0.267). (Table 2).

As we see in Chart 2, from 32 patients who underwent internal fixation less than 24 hours after trauma, 6(18.8%) patients developed the AVN and from 40 patients who had delay surgery more than 24 hours 14(35%) patients were afflicted with the AVN(see Table2). (figure 1-5) and (figure 5, 6). The results showed that a delay time to surgery more than 24 hours increases the chance of AVN as much as about 2.33 times (OR=2.331, CI=(0.776,6.993)). There was , no significant difference in the AVN incidence according to time of fixation (p-value=0.126).

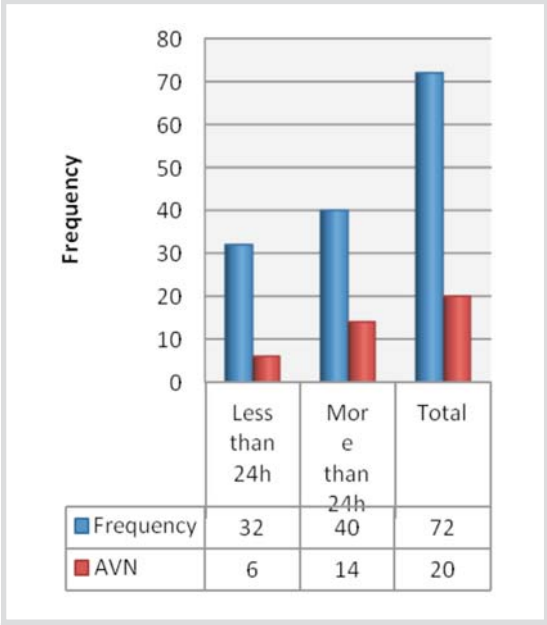
DISCUSSION

We could not achieve a significant pattern between increasing delay time to fixation (Max72h) or displacement and AVN of femoral head in our study. Similar to our findings, Karaeminogullari and colleagues (2004) gained the same results when studying AVN occurrence in patients whose fractures were fixed before or after12h from injury [18]. Before 12h, AVN occurrence was 12.5 % versus 14% after 12h, and that was not statistically significant.

In addition, Upadhyayand and colleagues (2004) found no difference in AVN rates for surgical operation before and after 48h [14], further endorsing our achievements.



Tab. 2. Fracture displacement and AVN Incidence



Tab. 3. Trauma to surgery delay time and AVN incidence

Tab. 4. Factors associated with femoral head necrosis

Factor	Mean (SD) or Freq (percent)	OR	P-Value
Gender		1.11	0.86
Female	5 (29.4)		
Male	15 (27.3)		
Fracture side		0.33	0.055
Right	15 (36.6)		
Left	5 (16.1)		
Fracture displacement		2.12	0.267
Displaced	16 (32)		
Non displaced	4 (18.2)		
Trauma to surgery delay time		2.33	0.126
Delay<24 h	6 (18.8)		
Delay >24 h	14 (35)		

Haidukewych and colleagues (2004) also found no discrepancy in AVN rate in patients even after 24h (20%and 25%) [2], which confirms our findings.

However, our finding is in contrast with Jain's study which contended the time of surgery is the only factor in developing AVN in less-than-60-year-old patients with femoral neck fracture [13].

In agreement with our study, Fathima Razik and colleagues (2012) had found no difference in osteonecrosis incidence for surgery delay less and more than 48 h [19].

Similar to our finding, Damany DS and colleagues (2005) have failed to demonstrate a clear relationship between timing of surgery and the risk of developing nonunion or AVN [21]. Also, Zetterberg CH and colleagues (1982) achieved the same result [22].

In 2012, Terdtoon Wongwai and colleagues [20], in a retrospective study of 26 patients with femoral neck fracture who underwent delay internal fixation from 2 to 30 days, AVN occurred only in 2 cases and this has no correlation with our study.

In contrast to our finding, You-Shui Gao and colleagues (2012) found in their study that trauma to surgery delay has no effect on the incidence of AVN [15].

Fig. 1. A 39y/o female with femoral neck Fx whose undergone CRIF after 36 hours

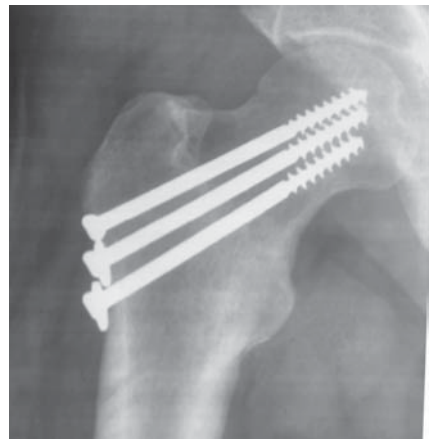


Fig. 2. Radiological aspects after 5 months

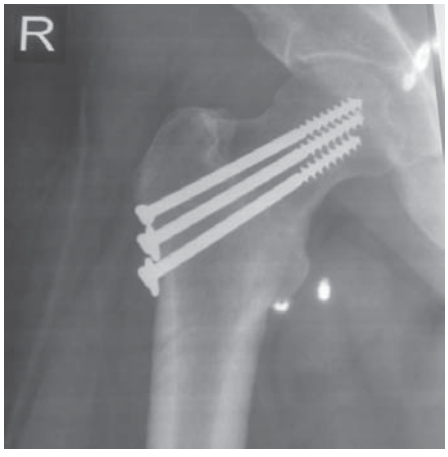


Fig. 3. Radiological aspects after 25 months shows union of the fracture without evidence of AVN

Fig. 4. A 39y/o female with femoral neck Fx whose undergone CRIF after 36 hour of fracture

In 2013, Schweitzer and colleagues [6] reported that only age has a significant impact on the amount of femoral head necrosis.

In concordance with our study, Costa Papkastydys and colleagues (2015) [8] found no credible evidence about the trauma to fixation delay and the impact of femoral head necrosis rate.

The findings of our study support the premise that progression of femoral head avascular necrosis is multifactorial and contribution of a single factor such as delay time to surgery is questionable. As we saw in this study, femoral neck fractures, occurred as a result of high energy trauma, and it has been considered that the destination of femoral head is partly defined at the time of trauma and in many patients this is probably the reason.

LIMITATIONS

Some of our patients had not completed the routine flow up and some of them did not cooperate in our study. That may be due to good results or absence of any AVN's symptoms.

Although our study has an extended period of data analysis (48 months), only 72 patients were Included in the data analysis, affecting our study's statistical power.

CONCLUSIONS

Although most surgeons believe that early internal fixation of the femoral neck fractures in patients less than 60 years of age in 6 hours and a maximum of 24 hours after the trauma will reduce the risk of femoral head necrosis, our study did not support their finding. However, further relevant studies might achieve stronger support to this current belief that early surgical fixation of neck of femur fractures would decrease the risk of AVN and bring about better management of our patients.

Acknowledgment

We would like to thank the authority of deputy research of Ahvaz Jundishapur University of Medical Sciences for their financial support. This study is based on the post graduate thesis of Dr. R Nazari with Ethic cod No: IR-AJUMS.REC 1395-157, that was conducted by the first author.

Fig. 5. Radiological aspects at 4 months after surgery shows union of the fracture

Fig. 6. Radiology of the same patient at 32 months after surgery, developed AVN

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