Role of Dynamization in Fracture Healing of Femoral Shaft Fracture Fixed with Interlocking Intramedullary Nail

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ABSTRACT

Objective: To determine the role of dynamization in fracture healing of femoral shaft fracture fixed with interlocking intramedullary nail.

Methods: This prospective comparative study was conducted between January 2015 to July 2016 orthopedics department of Pakistan Institute of Medical Sciences hospital (PIMS). Inclusion and exclusion criterion were determined. Patients were stratified randomly into non dynamized (Group A) and dynamized (Group B) groups. At six weeks dynamization was performed.

Results: A total **of** 60 patients (30 in each group) were included in the study. The mean age was 34.16±10.03 years. In group A, 21(70%) patients were male and 9(30%) were female. In group B, 23 (76.7%) patients were male and 7 (23.3%) were female. Fracture union rate was compared between the two groups.

Conclusion: Although Dynamization reduces the time of union of fracture, it has no effect on rate of fracture healing,

Key words: SIF (self-dynamisable internal fixator), ILN (interlocking intramedullary nail), femoral shaft fractures, RTA (road traffic accidents).

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INTRODUCTION

Femoral shaft fractures are among the common fractures faced by orthopedic surgeons.[1] It causes great disability and mortality in young adults. The common cause is due to high energy trauma.[1] In elderly population, pathological fractures must be ruled out. While in children possibility of child abuse should be considered.[2] the incidence of femoral shaft fractures is reported as one fracture per 10,000 people.[3] Diagnosis of femoral shaft fracture is usually easy. Patient is usually having a history of Road Traffic Accident or fall or physically assault and presents with pain, gross deformity, swelling and shortening of affected limb and inability to bear weight on the effected extremity. Neurovascular status should be assessed, ipsilateral hip and knee should be examined.[4]

Amongst the various classification systems used for femoral shaft fractures, Winquist and Handson[5], and AO classification is the most commonly used. Various treatment options are available in adults like traction, platting, open nailing, close nailing, external fixation and interlocking intramedullary nailing.[6] Interlocking nailing has become the gold standard for treating femoral shaft fractures.[7,8] The major advantages of close interlocking nail are minimally invasive operating technique, preservation of fracture hematoma, decreased impairment of perfusion at fracture site, high biomechanical stability and the complications are low.[9]

There is a new concept of self-dynamisable internal fixator (SIF). It provides three-dimensional stability. The SIF is a kind extra medullary bar where interference with pin tract can be avoided because the bar is narrow and can be introduced in different direction and because the components of the SIF (clamps)can slide and rotate into the bar. It is especially for complex fractures.[10]

Various studies have been done to show the effect of dynamization of interlocking nail in the treatment of femoral shaft fracture. Some advocate the routine dynamization while others don't. Some

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even consider it harmful for the fracture healing.[11,12] The aim of our study is to know the role of dynamization on fracture healing in femoral shaft fracture fixed with ILN.

METHODS

This prospective comparative study was conducted Orthopedics department of PIMS hospital from Jan, 2015 to July 2016. The inclusion criteria were patient's age 18-60 years, fresh fractures, having AO classification 32A3 close diaphyseal fractures. The exclusion criteria were polytrauma, pregnant females, infected cases, pathological fractures, smokers and fractures treated elsewhere. The ethical review committee (ERC) approval was taken before study. Informed and written consents were taken from the patients. The patients were randomly divided into two groups. In group A there were non-dynamized patients (static) and in group B dynamized patients were included. Patients were called after six weeks for dynamization and distal or proximal interlocking screws were removed under local anesthesia. At six weeks, partial weight bearing was allowed in both groups. At three months, both groups were assessed clinically and radiologically for signs of fracture healing. Data was analyzed by using SPSS Ver.16. The outcomes were compared by using Chi square test. P value of less than 0.05 was considered significant.

RESULTS

We had a total number of 60 patients of both genders, 30 patients in each group. In group A, patients were treated without dynamization and group B was with dynamization. Regarding the age of the patient, they were divided into two groups. The first age group patients aged 18-40 years (n=44) 73.3%. The second age group patients aged 40-60 years (n=16) 26.7%. The mean age was 34.16±10.03 years.

There were 21 males (70%) and 9 females (30%) in group A while in group B, there were 23 males (76.67%) and 7 females (23.33%). In group A, there were 18(60%) fractures on right side and 12(40%) on left side. In group B, there were 16(53.33%) on right side and 14(46.67%) on left side.

The fracture union rate was compared between the two groups. Union was present in total 51(85%) patients, 25(41.6%) not dynamized and 26(43.3%) were dynamized. Union was absent in 9(15%) patients, 5(8.3%) patients were non dynamized and 4(6.7%) were dynamized.

The union rate of fracture in different age groups was compared and calculated (table 1), While the union rate was compared in male and female as well (table 2).

Table 1: Fracture union rate in different age groups

Fracture union	Non dynamized	Dynamized	Total	Chi-square P Value
Yes, Age of subjects 18-40 years	18 (72%)	18 (69.2%)	36 (70.6%)	$X^2 = 0.047$
41-60 years	7 (28%)	8 (30.8%)	15 (29.4%)	P= 0.828
Total	25 (100%)	26(100%)	51 (100%)	
No, Age of subjects 18-40 years	4(80.0%)	4(100%)	8(88.9%)	X^2=0.900
41-60 years	1(20.0%)	0(.0%)	1(11.1%)	P=0.343
Total	5(100%)	4(100%)	9(100%)	

Table 2: Fracture union rate in male and female

Fracture Union		Group		Total	Chi –square P Valve
		Non dynamized	Dynamized		
Yes	Male	19(76.0%)	23 (88.5%)	42 (82.4%)	X^2=1.362
	Female	6 (24.0%)	3 (11.5%)	9 (17.6%)	P=0.243
	Total	25(100%)	26(100%)	51(100%)	
No	Male	2 (40%)	0 (0%)	2(22.2%)	X^2=2.057
	Female	3(60%)	4(100%)	7(77.8%)	P=0.151
	Total	5(100%)	4(100%)	9(100%)	

DISCUSSION

There are many factors which affect healing of the fracture. There are local and systemic factors. But the mechanical factors greatly affect the fracture healing. These mechanical conditions are determined by the stiffness of fixation and limb loading.[12] Dynamization is

the technique in which the screw farthest from the fracture site is removed some weeks after fixation so the fracture stiffness is changed from stiff to flexible to stimulate the fracture healing. It also prevents the fixation device from breakage.[11]

In our study, the rate of nonunion was high in younger age group people (18-40 years), both in nondynamized as well as dynamized group. The actual reason for this was not known. But it might be because of the high magnitude of energy required for causing fractures in young population. Nonunion rate was equal in both groups in younger population.

In the current study, age of the patients in both groups was slightly variable as it was 34±10.07 years. However, majority of the patients 44(73.3%) in both groups were between 18 and 40 years of age. In a study by Mohammad[6] 77.19% patients were between 15 and 40 years. In a study by Enninghorst N, the mean age was 38 years [13]. In a study by MK Deepak, the mean age is 27.4 years.[14] In Tigani study, the mean age was 30 years. These results are almost comparable with our study population's age.[11]

In our study, gender of the patients was found variable in both study groups. In group A there were 70% male and 30% female. In the study of Enninghorst N, the gender distribution was male 64% and female 36%.[13] Which are comparable to our results. While Khalid showed that 89.1% patients were male and 10.9% were female.[9]

In our study, there were 60 % right sided fractures and 40% left sided fractures in group A while in group B, right sided fractures were 53.33% and left sided were 46.67%. These findings are comparable with that determined by MK Deepak[14] which was 60% fractures on right side and 40% on left side. In Taj Mohammad et al study, the left sided fractures are 56.14% and right side fractures are 43.86% .[6]

In our study, union was present in 51(85%) out of 60(total) cases at six months. Out of which 25(49%) were static (group A) and 26 (51%) were dynamized (group B). Union was absent in 9 (15%) at six months. Out of which 5 (55.6%) were static, while 4 (44.4%) were in dynamized group. 83.3% (25 out of 30) fractures showed union in static group, while in dynamized group the union rate was 86.7% (26 out of 30). Basumallic and Bandupadhyay[15] in their study, showed a union rate of 95.5% in static locked interlocking nails and 96% in dynamized group. Both results are comparable.

At six months, 9(15%) patients did not show any signs of union. Eight patients were in age group of 20-40 years, one patient was in age group of 41-55%. In seven patients, exchanged nailing and reaming was done. In two patient nails were removed and plating along with bone grafting was done. All patients healed with secondary procedures. No other complications like LLD, nail breakage, infection or malunion was present.

CONCLUSION

The femoral shaft fractures are common in younger age group. Intramedullary interlocking nail is safe and effective treatment modality for the treatment of the femoral shaft fractures. Dynamization of nail at six weeks has no effect on union rate in simple femoral shaft fractures. But it reduces time to union.

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Authorship and Contribution Declaration

Yad Zaman Khan, Conception and design, acquisition of data
Hidayat Ullah, Drafted the manuscript
Waqar Alam, Revised the manuscript critically for important intellectual content, Final approval of the version for publication
Naeem Shah, Interpreted the data