Original Research Paper

Volume - 13 | Issue - 04 | April - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Orthopaedics

COMPARISON OF INTERLOCK NAILING IN TIBIA FRACTURE IN DYNAMIC VS STATIC MODE

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ABSTRACT

Introduction: The basic principle of Intramedularry nailing in fracture treatment is to restore the original anatomical alignment of fractured fragments through various techniques without direct access to the fracture and without further traumatizing of tissues. Union rates have significantly increased to 90%-100% with intramedullary nailing of femur and tibia. Two mode of intramedullary osteosynthesis are used: with dynamic or with static intramedullary nail depending on the locking screw used. Dynamization includes conversion of static nail by removing screws from the longest fracture fragment. **Aim:** The present study will be undertaken to compare the functional outcomes of static vs dynamic IMN osteosynthesis in long bone shaft fractures in adults with stable internal fixation and union and assess specific and general complications encountered in both groups. **Material And Methods:** The present study was carried out in the Department of Orthopaedics, Government Medical College and Rajindra hospital, Patiala from March 2021 to Dec 2022.The study was prospective, manipulative, controlled a total of 40 cases of tibia diaphyseal fracture who presented to the Orthopaedics department were taken up for the study and randomly divided into two groups i.e., patients treated with static IMN and patients with dynamic IMN. Fractures were classified according to AO fracture classification. **Result:** Average time to union in the dynamic groupwas 15.60 weeks (SD=1.27) and 17.15 weeks (SD=1.35) weeks in the static group. A strong trend was seen in favour of the dynamic nailing group ($p < 0.01$) statistically significant difference was observed. Sixteen out of the 40 patients (40%) had at least one complication.We can conclude that dynamic intramedullary nailing osteosynthesis allows micromotion between fracture fragments which directly stimulates bone formation and formation of callus. **Conclusion:** When used for closed or open (upto Gustilo 3A) tibial diaphyseal fractures with minimal comminution (types A and B according to the AO classification), dynamic nailing assembly in intramedullary nailing is safe.

KEYWORDS :

With the increasing number of vehicles on Indian roads, complex trauma cases caused by road traffic accidents have increased progressively. Tibia being subcutaneous in location makes it one of the commonest bones to be fractured and is seen commonly in orthopaedic practice. [1] Open fractures are more common, as most of the tibial surface is subcutaneous throughout most of its length. The blood flow of the tibia is also less secure than that of bones encased in dense muscles. The existence of hinge joints at the knee and ankle prevents any modification for post-fracture rotatory deformity. [1] Delayed union, non-union and infection are relatively frequent complications, especially after open fractures of the shaft of tibia.It has developed into a significant source of temporary disability and morbidity due to its frequency, topography, and method of injury.Hence, the widest experience, the greatest wisdom and the nicest of clinical judgement is required to choose the most appropriate treatment for a particular pattern of injury. [1]

The major goal in the treatment of fracture tibia is achieving a functionally useful and stable extremity and early mobilization. Yet, the spectrum of injuries is so great that no single method of treatment is applicable to all fractures.

Management of these fractures has remained a controversial subject despite advances in both non-operative and operative care.

In 1961, Sir John Charnley said that there was still a long way to go before the best approach to treating a fracture of the tibia shaft could be determined definitively. Numerous published articles regarding treatment of fractures of the shaft of the tibia have shown that closed treatment of fractures has excellent results. The use of closed interlocking intramedullary nailing, which has produced outstanding results, was ultimately decided upon due to the drawbacks of prolonged healing time, fracture disease, malalignment, and patient non-compliance. [2] Nowadays, the well laid principle of biological osteosynthesis is rightly applied in long bone fracture healing and hence we selected closed intramedullary interlocking nailing in this study. [3]

The study aimed to analyse and compare the clinical and functional outcomes of shaft tibia fractures treated with IMN using static or dynamic locking option in the North Indian population which has not been carried out in previous studies.

MATERIALS AND METHOD

The present study was carried out in the Department of Orthopaedics, Government Medical College and Rajindra hospital, Patiala. The study was prospective, manipulative and controlled. The study was performed on 40 patient with tibia diaphyseal fracture involving different segments of bone,fracture was classified according to AO[4] classification system. The study included patients irrespective of their gender and age (excluding patients less than 18 years of age). All closed and open fractures upto Gustilo 3A[5] were included in our study, shaft fractures with intra-articular extention and periarticular fracture were excluded.In 20 patients, IMN was done in static mode in which the nail was fastened with 3 or 4 screws on both ends and in patients with IMN with dynamic mode, a single screw was inserted in a proximal oval slot.

The clinical and radiological findings of fracture healing in each patient are used to determine the success and length of time for tibia fractures treated with static or dynamic intramedullary osteosynthesis.Clinical examination in the two groups are performed by a single examiner. From clinical signs of healing emphasize: the rigidity and lack of crepitation at the fracture site, no tenderness at the site of the fracture with palpation and percussion , and the absence of pain in full weight bearing irrespective of support.Radiological analysis by mRUST [6](modified radiographic union score for tibia) in which a score is given to the visible cortices in 2 orthogonal radiographs (anteroposterior and lateral) taking into consideration the callus and visisble fracture line, final score is sum of 4 cortex score,united fracture was considered with a score of 4.

RESULTS

Out of 40 patients in our study group who met the inclusion criteria were randomly assisgned one of the two group depending upon the osteosynthesis technique used the static group (20 cases) with atleast one screw in one fragment and dynamic group (20 cases) with the proximal screw in oval slot.Demographic details and clinical characteristics were homogeneous and comparable between the 2 groups of patients (Table 1).

Table 1. Demographic Details And Clinical Characteristics

Parameter	Group	
	Static	Dynamic
Male	15 (75%)	14 (70%)
Female	5 (25%)	6 (30%)
Age (Mean±SD)	34.50±10.99	35.50±9.39
Mode of Injury		
RSA	3 (15%)	2 (10%)
Fall	17 (85%)	18 (90%)
AO Classification		
A1-A3	11 (55%)	17 (85%)
B1-B3	6 (30%)	3 (15%)
C1-C3	3 (15%)	0

Gustilo		
Closed	14 (70%)	13 (65%)
1	3 (15%)	3 (15%)
2	2 (10%)	3 (15%)
3a	1 (5%)	1 (5%)

In our study, the average fracture healing time was 17.15 weeks in static group and 15.60 weeks in dynamic group. The difference in the fracture healing time when compared between the two groups was highly significant (p value 0.001).

Table 2. Fracture Union Time(In Weeks)

Parameter	Group	Total Patients	p value
Union time in weeks	Static 17.15±1.35	Dynamic 15.60±1.27	0.001(HS)
mRUST			
1	3 (15%)	1 (5%)	0.119 NS
2	3 (15%)	0	
3	1 (5%)	3 (15%)	
4	13 (65%)	16 (80%)	

Sixteen out of the 40 patients (40%) had at least one complication (Table 3), with 10 patients belonging to the static group and 6 to the dynamic group. Five cases of nonunion were detected, four in the static group and one in the dynamic group. There were three cases of delayed union in the static group and none in the dynamic group. In the dynamic group there were three mechanical complications of shortening with collapse in an oblique fracture pattern. Overall, eleven patients required some form of surgical intervention throughout treatment. In 8 cases (7 from the static group and 1 from the dynamic group) an intervention was necessary due to a biological complication (delayed union and/or nonunion), and 3 in the dynamic group due to a mechanical cause. This difference between the two groups did not reach a statistical significance of p = 0.878.

Table 3. Complications

Complications	Static Group Patients	Dynamic Group Patients
Delayed Union	3 (15%)	0
Non-Union	4 (20%)	1 (5%)
Valgus Deformity	1 (5%)	1 (5%)
Varus Deformity	2 (10%)	1 (5%)
Shortening	0	3 (15%)
No Complication	10 (50%)	14 (70%)
Total	20 (100%)	20 (100%)
p value	0.878 (NS)	

DISCUSSION

Of the 40 patients, 29 were males and 11 were females. The incidence of males is higher because of their more outdoor activities, while women confine themselves to domestic activities. Similar male involvement has been seen in study conducted by DanielHernandez-Vaquero et al.[7] In our study, the majority of the patients were in the age group of 31-45 years. There were 18 (45%) patients in this age group in our study. The average number of the patients in our study was 34.50 years and 35.50 years in the static and dynamic group respectively. Diaphyseal fractures of tibia were seen in theyounger age group as they are most physically active and engaged in increased various outdoor activities and, as a result, most of the injuries sustained were high-velocity injuries.Similar results were seen in study conducted by Irfan Aziz Khan et al.[8] The majority of the tibial diaphyseal fractures occurred due to road traffic accidents (35 patients). In the majority of cases, they involved patients who were motorists, while the remaining patients tended to be pedestrians or motor vehicle occupants. This can be attributed to the poor road traffic sense and poor quality of roads, leading to a higher incidence of road traffic accidents in our country.similar results reported by Reddy et al.[9]

Fracture union was considered when patient was full weight bearing without pain, fracture site was not tender on palpation and radiograph showed osseous union. In our series, the majority of fractures in static group united within 18 weeks (10 patients) and within 16 weeks (11 patients) in dynamic group. The difference in fracture healing when compared between two groups was statistically highly significant (p value <0.001).Similar results were observed by Vaquero et al[7] and Somani et al[10] in their study.

Sixteen out of the 40 patients (40%) had at least one complication, with 10 patients belonging to the static group and 6 to the dynamic group (p=0.878). Five cases (12.5%) of nonunion were detected, four in static group and one in dynamic group which were treated with exchange nailing with fibula osteotomy and auto-graft. There were three cases of delayed union in the static group which were treated by removal of proximal static locking screw and fibular osteotomy and screw removal in one case. In the dynamic group there were three mechanical complications of shortening with collapse in an oblique fracture pattern. Several other studies noted the risk of shortening with dynamization, and it appears that the fracture pattern is the greatest factor in determining whether a fracture will shorten after dynamization.Similar results were obtained by Vaquero et al[7] and Somani et al[10] in their study.

CONCLUSION

A minimally invasive surgical technique called intramedullary nailing does not expose any bone fragments and does not cause significant bleeding.Intramedullary nailing has a multi-purpose capabilities, usually is the definitive solution for the treatment of fractures of the femur and tibia, allows early mobilization and early rehabilitation, all of which contribute to an earlier load and reliance on a limb, or the acceleration of bone healing.The inability to move between fragments caused by static intramedullary nailing directly promotes the development of angiogenic minimal callus with sharp edges and a dense structure. The best suggestions for treating comminuted fractures include static intramedullary osteosynthesis, which solves the issues of stabilizing the fracture, limb shortening, and fragment rotation.A large (stimulus) callus with hazy outlines and turbulent structure is produced by dynamic intramedullary osteosynthesis, which applies force to the fracture.

Our research confirms the idea that the dynamic mode configuration should be used with the new intramedullary nail designs that are currently accessible.

Despite the fact that not all patients with delayed union or nonunion should receive dynamization, it is still preferred to compression plating, exchangenailing, and bone grafting due to its low morbidity, speedy healing, and simplicity of use.

REFERENCES

1. Bong MR, Koval KJ, Egol KA. The history of intramedullary nailing. Bulletin of the NYU hospital for joint diseases. 2006 Dec 22;64(3-4):94-.
2. Egol K, Koval KJ, Zuckerman JD. Handbook of fractures. Lippincott Williams & Wilkins; 2012 Mar 28.
3. Groves EW. On the application of the principle of extension to comminuted fractures of the long bone, with special reference to gunshot injuries. Journal of British Surgery. 1914 Jan;2(7):429-43.
4. Garnavos C, Kanakaris NK, Lasanianos NG, Tzortzi P, West RM. New classification system for long-bone fractures supplementing the AO/OTA classification. Orthopedics. 2012 May 1;35(5):e709-19.
5. Kim PH, Leopold SS. Gustilo-Anderson Classification (vol 470, pg 3270, 2012). Clinical Orthopaedics and Related Research. 2012 Dec 1;470(12):3624-.
6. Plumarom Y, Wilkinson BG, Willey MC, An Q, Marsh L, Karam MD. Sensitivity and specificity of modified RUST score using clinical and radiographic findings as a gold standard. Bone & Joint Open. 2021 Oct 1;2(10):796-805.
7. Hernández-Vaquero D, Suárez-Vázquez A, Iglesias-Fernández S, García-García J, Cervero-Suárez J. Dynamisation and early weight-bearing in tibial reamed intramedullary nailing: its safety and effect on fracture union. Injury. 2012 Dec 1;43:S63-7.
8. Khan IA, Ahmad S, Shah MA, Ahmed S, Shafiq M, Shafaq SA. Static versus dynamic interlocking intramedullary nailing in fractures shaft of femur. Gomal Journal of Medical Sciences. 2015 Jun 30;13(2).
9. P.Ashok Reddy PKR. Closed Intra-Medullary Interlocking Nail Improves Surgical And Functional Outcome Of Diaphyseal Fracture Of Tibia – Our Experience. int.jour.sci.res.mana. [Internet]. 2015 Apr. 1 [cited 2023 Feb. 23];3(4).Somani AM, Saji MA, Rabari YB, Gupta RK, Jadhao AB, Sharif N. Comparative study of static versus dynamic intramedullary nailing of tibia. Int J Orthopaed. 2017;3(3):283-6.