

Effects of Closed Reduction and Interlock Nailing of Femoral Shaft Fractures by Traction Table Vs Modified NA Fixator

TARIQ MAHMOOD, MUHAMMAD BADAR UD DIN ZAFIR, MUHAMMAD KHALID CHISHTI, SAEED AHMAD, AZMAT RASOOL, MUKHTAR AHMAD TARIQ

Department of Orthopaedics, Nishtar Medical University, Multan-Pakistan

Correspondence to Dr. Muhammad Badar ud Din Zafir, Email: drzafir77@yahoo.com Tel: +92-300-6306978.

ABSTRACT

Background: Femoral fractures are common fractures in orthopedics.

Aim: To study the outcomes in patients with fracture shaft of femur, managed by close reduction and Inter Locking nail by traction table versus modified Naseer Awais fixator.

Study design: Non randomized clinical study.

Methodology: One hundred patients (50 in each group) were included in present study. Inter Lock femoral nailing was done in group A by TM distractor. Traction table was used in group B for the same procedure. Number of fluoroscope images per procedure, operation duration/time, contact between fracture fragments after reduction, limb rotation, limb length discrepancy, union time (radiological) and frequency of infection occurrence was noted and compared between the above said two groups.

Results: Number of images per-operatively were 38.55±19.087, in group A 43.08±23.67, in group B 34.02±11.56 (P=0.017). The operative time in group A was 81.40±25.95 mins. The limb length discrepancy after surgery was 0.17±0.49 cm. The time of radiological union was 5.62±2.29 months in group A, versus 5.44±3.32 months in group B (P=0.753). **Conclusion:** We concluded that TM distractor group has comparable outcome with traction table group because there was no statistically significant difference in terms of operation duration/time, contact of major fracture fragments after reduction, limb length discrepancy (LLD), union (radiological), non-union and frequency of infection. However numbers of images in a procedure were less in traction table group in our study.

Keywords: TM Distractor, Femoral Nail, Traction Table, Modified NA Fixator and Inter Lock Nail.

INTRODUCTION

Femoral fractures are common fractures in orthopedics^{1,2}. Femur is one of the largest bones in human body and it is also bears the principal load of body². High energy trauma most commonly results in femoral fracture², with frequent involvement of diaphysis especially in younger adults. Most of the times, fractures of the femoral shaft also have some degree of comminution. Femoral fractures are presented with severe pain, varying degree of swelling and limb deformity. Ipsilateral femoral neck fracture occurs in about 10% cases¹. The femoral shaft fractures need early stabilization to alleviate pain and decrease ongoing loss of blood that makes the prompt nursing care easier.

Closed intramedullary inter lock nailing is usually preferred for the treatment of most of the femoral shaft fractures³. In 1940, first time kuntscher advocated nailing for femoral shaft fractures². Intramedullary nailing results in a short duration in hospital, rapid return of movements in all joints, early return to walking and a relatively less disability time in total. Proper length must be attained with traction before closed ante-grade intra-medullary nailing. Traction and thus reduction of fracture is achieved by using traction manually by assistant without fracture table^{4,5}, with formal traction table^{3,5} or femoral distractor by AO. Traction by assistant manually is not consistent and need strong force, traction table and AO femoral distractor are costly and not available in most centers of this region and they are inconvenient⁶ at few occasions. Traction table or manual traction cannot be used in unstable fractures of spine, ipsilateral fracture acetabulum, vertically unstable ipsilateral fracture pelvis, simultaneous surgeries on both legs, and multiple injuries on the same leg requiring surgeries.

The femoral distractor is helpful for femoral nailing in the above said conditions^{7,8}. Modification of NA fixator (TM distractor) that is easily available in a very economical price is a good tool to reduce fresh as well as old fractures without opening the fracture site. TM distractor (modified NA fixator) is applied on supine patient on radiolucent table to make the use of image intensifier easier while getting AP and Lateral views⁸. In the literature this modified NA fixator/TM distractor has shown satisfactory results in Inter Lock Nail for tibial shaft fractures as well⁹.

The objective of the study was to study the outcomes in patients with fracture shaft of femur, managed by close reduction and Inter Locking nail by traction table versus modified Naseer Awais fixator.

METHODOLOGY

This non-randomized clinical study was carried out in orthopedic department, Nishtar Medical University Multan Pakistan. A sample of 100 patients was estimated using epitool. They were recruited by non-probability convenient sampling after ethical approval and were equally divided in two groups Patients from both genders, between 17 to 65 years of age with femoral shaft fracture and less than 2 weeks old were included. All infected fractures, patients with previous surgery in the same region, unwilling patients, maltreated patients, obese patients, patients with associated vascular injuries, pathological fractures, combined neck and shaft fractures, peri-prosthetic fractures, ASA grade IV and above, ipsilateral femoral neck fracture were excluded from the study. Patients admitted through A/E department or outpatient department were prepared for surgery and spinal anesthesia by routine investigations or special investigations was opted. They were operated on elective list.

In **Group A**, modified NA fixator named Tariq Mahmood (TM) Distractor was used. The patient was positioned supine after spinal anesthesia. Entry in piriform fossa was made and checked under image intensifier and reaming the proximal fragment up to desired size accomplished. Then nail of same size was inserted in proximal fragment and 5.5mm schanz pin was inserted at lesser trochanter area just behind the guide nail after drilling with 3.5 mm drill bit under image intensifier (II) using the space behind the guide nail. Distally a 5.5 mm schanz pin was inserted just distal to proximal pole of patella under II. NA fixator that was modified by Dr. Tariq Mahmood (Associate Prof) is mounted on these two schanz pins as distractor. Distraction was given at fracture site and its position is checked under image intensifier on both AP & Lat views. When sufficient distraction was achieved that was assessed, guide nail removed and guide wire was inserted and checked under II and reaming of distal fragment was done. After nail insertion, TM distractor with schanz pins were removed and nail pushed further if desired, rotation of limb checked and locking done by freehand technique under II. In this way desired length of

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femur was also achieved in case fracture was comminuted. In transverse and short oblique fractures compression was given primarily through TM distractor.

In **Group B**, we included those patients who were treated with traction table. Patient was placed in supine position after spinal anesthesia. Nailing was done in ante grade fashion after make nail entry in Piriform fossa and checking the reduction under fluoroscope. Flexible reamers were used over guide wire and nail was inserted. Interlocking (IL) was done under fluoroscope by free hand technique. Outcome was measured in terms of operative time, number of images, contact between major fracture fragments after reduction, rotation of limb, radiological bone union time and nonunion and infection rate in patients of both groups. Follow up was conducted after 1 year.

Figure-1: Model of TM Distractor



Figure-2: TM Distractor Applied



Statistical Analysis: Data was entered into SPSS version 19.0 for analysis in terms of mean ± SD. Chi square test was used between groups. P-value ≤0.05 was taken as significant.

RESULTS

In our study, we found no significant difference in outcome between TM distractor group (A) and Traction table group (B) in terms of age, gender, time since injury, operative time, contact of major fragments after reduction, limb length discrepancy, radiological union, nonunion and infection. The numbers of images during procedure were more in group A as compared to group B (Table 1). The accepted rotation at fracture site after reduction was 15° and there was no mal-rotation in our study.

Table 1: Demographics and outcomes of TM Distractor group and traction table groups

Outcome Variables	TM-D rroup-A	TT Group-B	P-Value
Age (years)	35.36±12.52	31.86±12.79	0.170
Male	86%	84%	0.997
Female	14%	16%	
Time since injury (days)	6.78±3.81	8.12±3.31	0.064
No. of images	43.08±23.67	34.02±11.56	0.017*
Operative time (minutes)	81.40±25.95	84.70±17.88	0.461
Contact after reduction	11%	8%	0.611
Limb length discrepancy (cm)	0.13±0.43	0.21±0.55	0.425
Radiological union (months)	5.62±2.29	5.44±3.32	0.753
Non union	2%	4%	0.999
Infection	2%	4%	0.999

*Statistically Significant

DISCUSSION

Femoral shaft fractures are common and in adults most of the times they are managed surgically by intra-medullary nailing. The concept of closed nailing is not new and has many advantages over open technique. During closed nailing various methods can be used to reduce fracture and insertion of nail, traction table is considered essential part of this procedure but in some cases traction table can't be used or in certain setups it is not available

altogether so other effective methods are also in vogue like manual traction and AO femoral distractor. In this study we included 100 patients and same procedure that is static inter lock nailing was done in all patients. We used TM distractor (Tariq Mahmood distractor) in 50 patients (group A) and traction table in other 50 patients (group B). TM distractor is modification of NA fixator and was modified keeping in view the mechanism of AO femoral distractor.

The youngest patient in this study was 17 year old while 64 years was the maximum age, while mean age was 33.61±12.72 years. The age in group A 35.36±12.52 years and in group B 31.86±12.798 years was noted and the difference of age was not significant in two groups (p=0.170). Aiyer et al reported average age of 30 years in their study undergoing interlock nail femur⁴. Gagala J studied 44 patients with proximal fractures and included 18 to 95 year old patient in his study^{10,11}. Kumar J reported average age of 30.6 years in his study that is very close to our study¹². These findings are similar to that of our study. Male patients were more in our study as compared to females (5.66:1) (85% male vs 15% females) as most injuries occurred after road traffic accident and in our society usually males drive motor vehicles and so males are more vulnerable to these injuries. Gagala J reported 29 (66%) males and 15 (34%) females in his study¹¹. Kumar J studied 53 patients out of which 49 (92%) were males and 4 (8%) were females¹². These findings of Gagala et al and Kumar et al are similar to that of our study.

The time between injury and surgery was 7.45±3.619 days because we performed these surgeries on elective list and list is scheduled on alternate days and preparation of patient and his turn usually takes this much time. This time was 6.78±3.813 days in group A and 8.12±3.317 days in group B with no significant difference in both groups (p=0.064). Aiyer et al in his study done IL nail femur after 1-14 days post injury⁴. Winquist reported in his study that ideal time of surgery is immediately after resuscitation but depends on availability of skilled staff and implants as inter lock femoral nailing is dependent upon skill and equipment¹³.

The number of images were 38.55±19.087 per procedure in our study and number of images were significantly more in group A i.e. 43.08±23.672 as compared to 34.02±11.568 in group B (P=0.017). This may be due to a reason that TM distractor technique was relatively less familiar in our set up because number of images became less in later cases as compared to earlier ones. Another reason of slightly more images required in group A may be that 11% cases in this group were Winquist and Hansen type IV (no contact at all between two major fracture fragments) as compared to 8% such fractures in group B.

The operative time or duration of surgery was 83.05±22.23 minutes in our study and it was similar in both groups i.e. 81.4±25.952 minutes in group A and 84.70±17.88 in group B (P=0.461) that shows no significant difference between two groups. Aiyer et al reported that average time taken for surgery was 90 min⁴. Kumar J reported 119 min on average for locked nailing in adults¹². Shivashankarppa A reported 90 to 150 minutes surgery time with average of 120 minutes¹⁴. Reynders P reported that distractor does not lengthen the duration of procedure¹⁵ as it was observed in our study. Karpos PA reported 95 minutes average operated time for femoral nailing using manual traction and found significantly less time (P<0.05) in manual traction than fracture table¹⁶. Frit et al reported 98 minutes surgery time with traction table in SCLE (supine contralateral leg elevated) position⁵. The degree of rotation at fracture site was accepted up to 15° in our study and no mal rotation occurred as it was checked per-operatively in each case. Baumgaertel F reported 2 mal-rotations that were >15° in his study⁸. The limb length discrepancy was 0.17 ±0.49 cm in our study. In group A it was 0.13±0.43 cm while in group B it was 0.210±0.55 cm. This much limb length discrepancy was acceptable and there was no significant difference in two groups (P=0.425). Kumar J reported limb length discrepancy in 3.7% cases in his series¹². Shivashankarppa A reported limb length discrepancy (2.5cm) in 20% cases¹⁴. Karpos PA reported

<5mm shortening/lengthening in 27% cases and >5mm shortening/lengthening in 7% cases¹⁶.

Winquist and Hansen type IV fractures where there is no contact between two major fragments were 19% in our study while in group A they were 11% and in group B they were 8%. The difference between two groups was not statistically significant as p value was 0.611 but this may be the reason for slightly more number of images in group A patients. Reynders P reported in his series that distractor is safe and effective technique of reducing a femoral fracture¹⁵. Karpos PA reported 67% anatomical reduction using manual traction without fracture table¹⁶. The findings of Reynders et al and Karpos et al are similar to our study. Radiological union was observed after 5.53±2.84 months in our study while it was 5.62±2.29 months in group A and 5.44±3.32 months in group B with no significant difference between two groups (P=0.753). Baumgaertel F reported healing within 4 months after nailing⁸. Shivashankarppa A reported in his study that union occurred at 4 months in Bjorn O. Thoreson series and Robert J. Brumback series, at 3.5 months in Kneth D. Jhonson series, at 15 weeks in Robert A. Winquist series¹⁴.

Nonunion occurred in our study in 3 patients (3%, N=100) while it was observed in one patient (2%, N=50) in group A and 2 patients (4%, N=50) in group B, the difference between two groups was not significant (P=0.999). These patients were re operated with exchange of nail and bone grafting. Wolinsky reported 1.1% overall non-union in his study treated by interlocking nail with or without fracture table⁹. Baumgaertel F reported 1.78% nonunion after intramedullary nailing using AO femoral distractor⁸. Shivashankarppa A reported 95% union, 5% delayed union no nonunion in his study¹⁴. Winquist reported 0 to 2% nonunion after locked femoral nailing¹³. Wolinsky et al, Baumgaertel et al, Shivashankarppa et al reported comparable results as found in our study.

In our study infection occurred in 3 patients (3%, N=100) while it was in one patient (2%, N=50) in group A and two patients (4%, N=50) in group B. The difference between two groups is not significant (P=0.999). Two of these patients in group A had infection at distal locking screws that were removed at 3 months and infection settled down. One patient in group B got sub-acute medullary infection that was successfully managed with three weeks of antibiotics. Wolinsky reported 1.08% infection in his series in close fractures after nailing¹⁰. Baumgaertel F reported no infection in his study of describing the technique of AO distractor⁸. Kumar J reported 3.7% infection rate in his study of 53 patients¹². Winquist reported 1% infection rate in his series¹³. Wolinsky et al, Baumgaertel et al, Kumar et al, Shivashankarppa et al reported comparable results as found in our study. Wolinsky studied results of reamed intramedullary nailing in 551 cases and found no difference in outcome between fracture stabilized with or without a fracture table⁹. Baumgaertel F used AO femoral distractor for femoral nailing and recommended the AO distractor as alternate of fracture table with an added advantage that distractor does not depend on intact adjacent structures to distract the main fracture fragments⁸. He further emphasized that distractor facilitated in reduction intra-operatively and created no problem in locking⁸.

Meferran MA used a femoral distractor and routine operation table instead of fracture table for interlock nailing of acute femoral shaft fracture and found no significant difference between two groups in terms of operation time, estimated blood loss, alignment and complications¹⁷. He found distractor method more difficult as reduction is done during the procedure but found less operation time in ipsilateral acetabulum fracture, simultaneous operation on both limbs, obesity and unstable spine fracture. Palmer JS found the femoral distractor useful in osteoporotic periprosthetic fractures¹⁷. Dahners LE used radiolucent distractor in his study and found that fracture table is expensive, cumbersome and needs adjustments during surgery by non-scrubbed personnel while distractor is sterile device in surgical field¹⁸.

Limitations: The study has few limitations as well. The size of the sample was not enough to generalize the results over all patients. Limited resources were available.

CONCLUSION

We concluded that TM distractor has similar outcome as compared to traction table as there was no statistical difference in both groups in terms of operative time, contact after reduction, limb length discrepancy, radiological union, non-union and infection rate.

Authors' Contribution: **TM&MBZ:** Conceptualized the study, analyzed the data, and formulated the initial draft, **MKC&SA:** Contributed to the histomorphological evaluation, **AR&MAT:** Contributed to the analysis of data and proofread the draft

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