Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2021.59202.2099 Volume 30, Issue 1.1, -January 2024, Supplement Issue
Manuscript ID ZUMJ-2101-2099 (R1)
DOI 10.21608/ZUMJ.2021.59202.2099

ORIGINAL ARTICLE

Treatment of fracture distal third tibia by plating versus nailing: Comparative study.

[1]Aya A. Mahmoud, [2]Assmaa O. Selim, [3]Sally A. Selim, [4]Nahla E. Ibrahem
Department of Orthopedics, Faculty of Medicine, Zagazig University, Zagazig, Egypt

Corresponding author
Mahmoud Saad Ebeid, Department of Orthopedics, Faculty of Medicine, Zagazig University, Zagazig, Egypt

E-mail:
md.saad.144@gmail.com

Submit Date 2021-01-22
Revise Date 2021-02-14
Accept Date 2021-04-18

ABSTRACT

Background
It is often difficult to choose the optimal method for treating fractures of the lower third tibia due to its closeness to ankle joint, poor blood supply, decrease of the muscles covering anteriorly, complications, such as (delayed union, nonunion, wound dehiscence), and usually associated with comminution, and severe soft tissue injury. Therefore, the management of the fracture of lower third tibia remains a great challenge to surgeons. The aim of this study is to compare the results of the plate fixation, intramedullary nail for fractures of the distal tibia in adults.

Methods
Between January 2017-January 2020, 96 patients with distal tibial fractures were treated using either MIPO technique or Expert intramedullary nail technique, in a prospective study conducted in Zagazig University Hospitals; 48 patients treated by MIPO technique, and 48 patients treated by Expert intramedullary nailing.

Results
The average age was 45 years, the mean age in group A was 46.58±14.9, and in group B was 44.83±13.73. Patients' data were collected in terms of name, age, sex, occupation, address, special habits, and mechanism of injury, associated injury, and history of comorbidities, e.g. diabetes, hypertension, and peripheral vascular disease.

Conclusion
Distal tibial fractures often present a challenge to the orthopedic surgeon. The treatment of this type of fracture is of current research interest since there is no universally agreed treatment method. The choice of treatment must consider not only the stabilization of the fracture, but also the management of the soft tissue injury which is a frequent cause of subsequent complications.

Keywords: Extra-articular distal tibial fracture, expert intramedullary nail, minimally invasive plate osteosynthesis

INTRODUCTION

Fracture of the tibia was the most common due to its subcutaneous position in the leg, and lack of soft tissue surrounding it. Critical factor of fracture of the lower third tibia was 6% of all fractures of the whole body. It constitutes to approximately 10%–13% of all fractures of lower extremities and occurs more critically in men than women aged between 35-45 years. Fracture of the lower third tibia in adults had been defined as the area between 4 and 11 cm from the articular surface of ankle joint [1].

Fractures of the lower third tibia was often difficult to choose optimal method for management due to its closeness to ankle joint, poor blood supply, decreased muscular cover anteriorly, complications such as non-union, wound disease, and wound dehiscence, and usually associated with comminution soft tissue injury. As a result, management of the fracture of lower third tibia remains as a great challenge to the surgeon [2].Various methods of treatment of fracture of lower third tibia had been in practice including conservative treatment, external fixation, minimal

invasive plate osteosynthesis (MIPO), and expert intramedullary nail (Expert IM nail) [3].

MIPO fixation, expert intramedullary nail was well accepted and effective, though the best method of fixation had not been conclusive. MIPO fixation of fracture of lower third tibia could access anatomical reduction but might result in extensive soft tissue dissection, disruption of blood supply, nonunion, delayed union, and wound complication. Expert intramedullary nail could limit the soft tissue damage, and protect blood supply through minimal invasive technique, though might result in difficulty in distal nail fixation, mal union, breakage of locking distal screws, and risk of nail propagation into the ankle joint [2].

The best method for treating fracture of distal third tibia remains controversial; orthopedic surgeons over the last 20 years made attempts to treat this fracture with plate fixation, intramedullary nail but the best method of fixation was still unclear [4].

The aim of this study is to compare the results of the plate fixation (MIPO) and expert intramedullary nail for fractures of the distal tibia in adults.

Hypothesis of This Study: The outcomes appear to be similar between the two method groups. Thus, the patient's general and skin conditions and the surgeon's preference dictate the choice of surgical technique.

Research Question: Which of the Expert I.M. nailing or MIPO gives better outcomes and less complications in managing of fractures lower third tibia?

PATIENTS AND METHODS

Between January 2017-January 2020, 96 patients with distal tibial fractures had been treated using either MIPO technique or Expert intramedullary nail technique, in a prospective study conducted in Zagazig University Hospitals; 48 participants were treated by MIPO technique, and 48 participants were treated by Expert intramedullary nailing.

The mean age in group A was 46.58±14.9, and in group B was 44.83±13.73. Participants data had been collected in terms of name, age, sex, occupation, address, special habits, mechanism of injury, associated injury, and history of comorbidities e.g. diabetes, hypertension, and peripheral vascular disease.

Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion Criteria: Adult participant. Extra-articular closed fracture of lower third tibia; AO/OTA type 43A1, 43A2, or 43A3. The distal tibia was defined as the area between 4 and 11 cm from the articular surface of ankle joint. Recent fractures within two weeks. Follow-ups within 6 months.

Exclusion Criteria: Fractures extending to tibial plafond (fracture distal tibia involving articular cartilage).

Pathological fractures. Skeletally immature participants. Participants with open fractures.

Segmental fracture of tibia. Participants associated with general condition that affects bone mineralization e.g., renal, malnutrition, *and parathyroid hormone disturbance*. Follow-ups within less than 6 months.

Study Design: Randomized clinical trial (prospective study)

Preoperative Evaluation of Participants: After achieving hemodynamic stability according to ATLS, the participants' personal information was taken, general illness as diabetes mellitus or conditions such as smoking had been documented, inquiries were offered regarding the time, type, and mechanism of trauma.

The skin and soft tissues around the fracture were carefully examined for abrasions, bruises, contusions, and lacerations that might delay open procedures or interfere with the usage of internal fixation hardware.

Timing of Technique: The timing of technique of definitive treatment in distal tibial fractures was variable depending on the magnitude of injury, other associated injuries, and associated comorbidities. Delay ranged between few hours to seven days in distal tibial fractures.

Operative Technique: Under Spinal Anesthesia.

Minimal Invasive Plate Osteosynthesis (MIPO).

Expert Intramedullary Nailing.

Operative Technique in Plate Fixation: Anatomical locked distal medial plates through MIPO technique.

Participant Positioning: Supine positioning on a radiolucent table, where an assistant was instructed to perform limb traction in the axis, and rotational control. A rolled blanket bump was placed underneath the ipsilateral buttock to prevent limb lateral rotation commonly occurring in distal fractures. Fluoroscopy machine was placed from the contralateral side of the table [5].

Approach: In fractures of the distal tibia, a longitudinal medial incision, centered over the medial malleolus, made in the tibial axis. A 2-3 cm incision made from distal end of fracture line to the level of the medial malleolus, as well as a 2-3 cm incision proximal to the end of fracture line (the proximal incision might be done percutaneously) [6].

Procedures: The incision made straight across the subcutaneous fat, preserving the saphenous vein or nerve during the superficial dissection. Epiperiosteal plane approached without hampering the fracture hematoma using the implant (plate) or blunt dissector

to preserve the minimally invasive aspect of this surgery [7].

If the fracture nature is oblique, the reduction clamp would be used to maintain the reduction of the fracture, the lag screw would be threaded by percutaneous means, drilled in an anterolateral to posteromedial direction, the reduction clamp would be removed, and the plate would be inserted in epiperiosteal tunnel, and provisionally held with K-wires [8].

In spiral fracture, wedge fracture, and complex fracture, the plate was inserted without open incision on the site of fracture, without using a lag screw [7].

Three distal screws were inserted using direct visualization, while the proximal screws were percutaneously inserted using fluoroscopic guidance [9].

The wounds were then irrigated and closed. Before wound closure, final radiographs were taken while the participant was under anesthesia.

Operative Technique in Expert Intramedullary Nailing:Participant Positioning: Supine positioning on a radiolucent table with the removal of the end of the table, allowing the knee to flex over the end of the table. Place the contralateral leg in a support with the hip flexed and abducted, and the knee flexed. Do not use a tourniquet because of the high risk of thermal necrosis [10].

Incision and Surgical Approach: The incision extended from the tibial tubercle to the inferior aspect of the patella. The medial aspect of the patella tendon was identified, and the patella tendon reflected laterally.

A curved awl used to open the medullary canal at the junction of the anterior tibia, and knee joint. The exact point of the awl was determined on the anteroposterior lateral fluoroscopic views. In distal tibial fractures, the anteroposterior starting point should be in line with the center of the tibial shaft. On the lateral radiograph, the point of the awl should be just inferior to the joint line [10].

A bulb-tip guide wire was inserted down the medullary canal. A T handle used to control the guide wire. The guide wire advanced down to the fracture site, after the fracture has been reduced. The guide wire advanced under the image intensifier into the distal fragment to reach subchondral bone above the ankle joint to stabilize the bulb tip. A long ruler used to determine nail length externally and confirm it using an image intensifier [11].

Reaming is a critical part of the surgical technique. It must be done in a professional way to avoid complications. A skin protector should be used to prevent soft tissue damage around the skin incision. The surgeon started with a small diameter reamer (reamer 8 or 9), with 0.5-mm increments until cortical contact was reached. The fracture must be reduced, as the reamer was passed [10].

Before nail insertion, a plastic exchange tube was passed over the bulb tip, across the fracture site. The bulb tip was removed, a straight tip guide wire was inserted, and then the plastic tube was removed. The nail was introduced down the tibial canal over this guide wire.

The nail should be pushed posteriorly on the proximal end of the nail to minimize penetration of the posterior cortex. This nail should be inserted in slight external rotation approximately 10 degrees in relation to the long axis of the tibia.

In stable fracture patterns, traction could be released when the nail tip passed the fracture site by 1 cm. This allows fracture impaction and avoids distraction of the fracture. The tibia should be inspected proximally, and distally. If the nail was too short or too long, it should be removed, and replaced with another nail [12].

After the nail had fully seated, the proximal, and distal interlocking screws were inserted. Targeting devices that attach to the intramedullary nail were very successful in placing the proximal, and the distal tibial locking screws.

A freehand technique might be implemented for distal locking screw insertion (the anteroposterior and medio lateral holes). It requires targeting of the skin incision [12].

Then, wounds were irrigated and closed. Before wound closure, final radiographs were taken while the participant was under anesthesia.

Follow-Up of Participants:

Plain X-ray post operative, after two weeks, one month, two months, four months, and six months. Evaluation of clinical, radiological outcomes and complications.

Clinical Follow-up according to Olerud-Molander score (13) (table 1):

Functional Evaluation: Excellent (91-100), Good (61-90), Fair (31-60), and Poor (0-30).

Radiological follow up: Early post operative radiological evaluation:

Anatomical Reduction: Alignment with no gap at the fracture site.

Good Reduction: Alignment with small gap at the fracture site.

Fair Reduction: Deformity grade1, and grade2.

Poor Reduction: Deformity grade3, and grade4.

Radiographic union scale for distal tibial fracture Follow-up [13] (table 2):

Maximum score: 12 Minimum score: 4.

Complication outcome:Assessment of infection (superficial or deep), deformity, movement loss of ankle, implant breakage, malunion, delayed union, nonunion, and comparing outcomes of the two methods of fixation.

STATISTICAL ANALYSIS

The collected data have been coded, processed, and analyzed using the Statistical Package for Social Sciences (SPSS) V15 for Windows® (SPSS Inc., Chicago, IL, USA). Qualitative data presented as percent. Comparison between groups done by Chi-Square test. Quantitative data tested for normality by Kolmogrov-Smirnov test. Normally distributed data presented as mean±SD. P<0.05 considered to be statistically critical.

RESULTS

In group 1 (MIPO), excellent outcomes found in 28 participants (58.3%), good outcomes in 12 participants (25%), fair outcomes in 4 participants (8.3%), poor outcomes in 4 participants (8.3%). In group 2 (expert IM nail), excellent outcomes found in 28 participants (58.3%), good outcomes in 16 participants (33.3%), fair outcomes in 0 participant (0%), poor outcomes in 4 participants (8.3%) (table 3).

Assessment of parameters (pain, stiffness, swelling, stair climbing, running, jumping, squatting, support, and work) according to Olerud-Molander score indicated as shown in (table 4). P value in all of these parameters >0.05 (not critical).

No critical difference found in functional outcomes between the two groups (figure 1).

Mean time of healing (in weeks) in participants managed by MIPO was 14.42±3.75, in participants managed by I.L.N was 13.64±1.43. Main global score in participants managed by MIPO was 11.5±1.24, in participants managed by I.L.N was 11.42±2.02. No critical radiological postoperative difference found between the two groups.

In table 5, no critical complication difference found between the two groups.

In table 6, anatomical reduction had been achieved in both groups in 40 participants (32 participants had excellent results, 8 participants had good results). Good reduction had been achieved in 52 participants (24 participants had excellent results, 20 participants had good results, 4 participants had fair results, 4 participants had poor results). Fair reduction in 4 participants had poor results.

The starting partial weight bearing in nailing group was 6.17 weeks compared to 7 weeks in plating group (Partial weight bearing had been allowed only after signs of the union in form of bridging callus on at least three cortices out of four cortices on radiograph, clinically as the absence of tenderness, movement at the fracture site).

Full weight bearing, mean time of full union was 14.4 weeks for the nailing group, and 13.6 weeks for the plating group (Full weight bearing had been allowed depending on clinical and radiographic signs).

Smoking delayed time of union in both groups with statistically significance in plating group only (p value was 0.003).

Table 1: Olerud - Molender functional score

Parameter	Degree	Score
1-Pain	None	25
	While walking on uneven surface	20
	While walking on even surface outdoors	10
	While walking indoors	5
	Constant, and severe	0
2-Stiffness	None	10
	Stiff	0
3- Swelling	None	10
	Only evening	5
	Constant	0
4- Stair Climbing	No problem	10
	Impaired	5
	Impossible	0
5- Running	Possible	5
	Impossible	0
6- Jumping	Possible	5
	Impossible	0
7-Squatting	No problem	5
	Impossible	0
8-Support	None	10
	Tapping, wrapping	5
	Stick or crutch	0
9-Work	Same as before injury	20
	Loss of tempo	15
	Change to simple job/part time work	10
	Severely impaired work capacity	0

Table 2: Radiographic union scale for distal tibial fracture follow up

Cortex	Fracture Line Visible, No Callus Score 1	Visible Fracture Line, Callus Score 2	No Fracture Line, Visible Callus Score 3
Anterior	1	2	3
Posterior	1	2	3
Lateral	1	2	3
Medial	1	2	3

Table 3: Functional outcome according to Olerud and Molander score

Functional evaluation	Group1		Group2		χ^2	P value
	No	%	No	%		
Excellent outcome	28	58.3%	28	58.3%	1.143	0.767
Good outcome	12	25%	16	33.3%		
Fair outcome	4	8.3%	0	0%		
Poor outcome	4	8.3%	4	8.3%		

Table 4: Clinical follow up according to Olerud and Molander score

	Group 1 (n = 48)		Group 2 (n = 48)		χ^2	
	No	%	No	%		
Pain						
No	32	66.7%	24	50%	2.786	0.426
P	0	0%	4	8.3%		
while walking on even surface out doors	4	8.3%	0	0%		
while walking on un even surface	12	25%	20	41.7%		
Stiffness						
No	44	91.7%	44	91.7%	0.0	1.0
Stiffness	4	8.3%	4	8.3%		
Swelling						
No	20	41.7%	16	33.3%	0.202	0.904
Constant	8	16.7%	8	16.7%		
only evening	20	41.7%	24	50%		
Stair climbing						
no problem	32	66.7%	28	58.3%	0.210	0.901
Impaired	12	25%	16	33.3%		
Impossible	4	8.3%	4	8.3%		
Running						
Possible	44	91.7%	44	91.7%	0.0	1.0
Impossible	4	8.3%	4	8.3%		
Jumping						
Possible	44	91.7%	44	91.7%	0.0	1.0
Impossible	4	8.3%	4	8.3%		
Squatting						
Possible	44	91.7%	44	91.7%	0.0	1.0
Impossible	4	8.3%	4	8.3%		
Support						
None	32	66.7%	28	58.3%	0.210	0.901
Tapping	12	25%	16	33.3%		
Stick	4	8.3%	4	8.3%		
Work						
Same as before injury	32	66.7%	28	58.3%	0.210	0.901
Loss of tempo	12	25%	16	33.3%		
Severe impaired	4	8.3%	4	8.3%		
Olerud molander functional score	85.42 ± 23.98		80.42 ± 28.4		0.466	0.646

Table 5: Complications of fixation of fracture distal tibia

	Group 1 (n = 48)		Group 2 (n = 48)		χ2	P
	No	%	No	%		
Delayed union						
No	40	83.3%	44	91.7%	3.048	0.218
Delayed union	8	16.7%	0	0%		
non union	0	0%	4	8.3%		
Implant breakage						
No	48	100%	44	91.7%	1.043	0.307
distal screw breakage	0	0%	4	8.3%		
Late Infection						
No	24	50%	44	91.7%	5.137	0.077
Deep	4	8.3%	0	0%		
Superficial	20	41.7%	4	8.3%		
Deformity						
No	44	91.7%	48	100%	1.043	0.307
Deformity	4	8.3%	0	0%		
Movement loss ankle						
<10	40	83.3%	36	75%	0.386	0.824
<20	4	8.3%	8	16.7%		
>20	4	8.3%	4	8.3%		
Reoperation						
No	48	100%	44	91.7%	1.043	0.307
Yes	0	0%	4	8.3%		

Table 6: Results of distal tibia fractures according to the quality of reduction

Criteria	Anatomical		Good		Fair		Poor		Total
	Gr.1	Gr.2	Gr.1	Gr.2	Gr.1	Gr.2	Gr.1	Gr.2	
Excellent	16	16	12	12	0	0	0	0	56
Good	4	4	8	12	0	0	0	0	28
Fair	0	0	4	0	0	0	0	0	4
Poor	0	0	0	4	4	0	0	0	8
Total	40		52		4		0		96

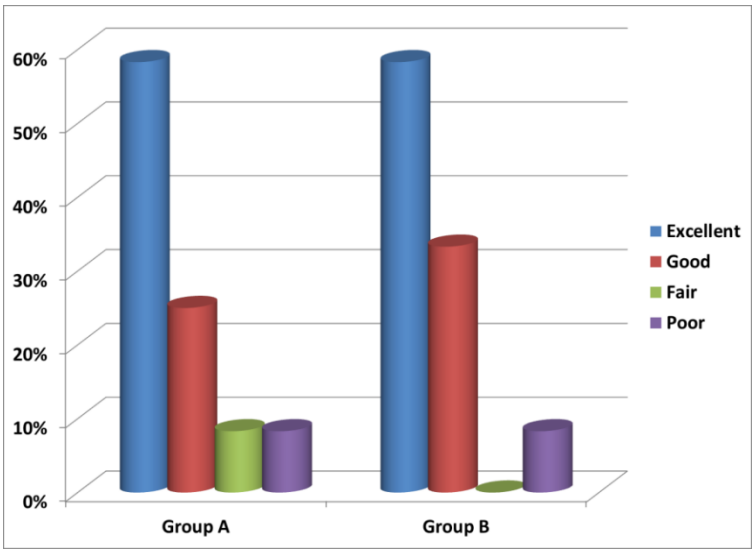

Fig. (1): analysis of functional outcome between the two groups

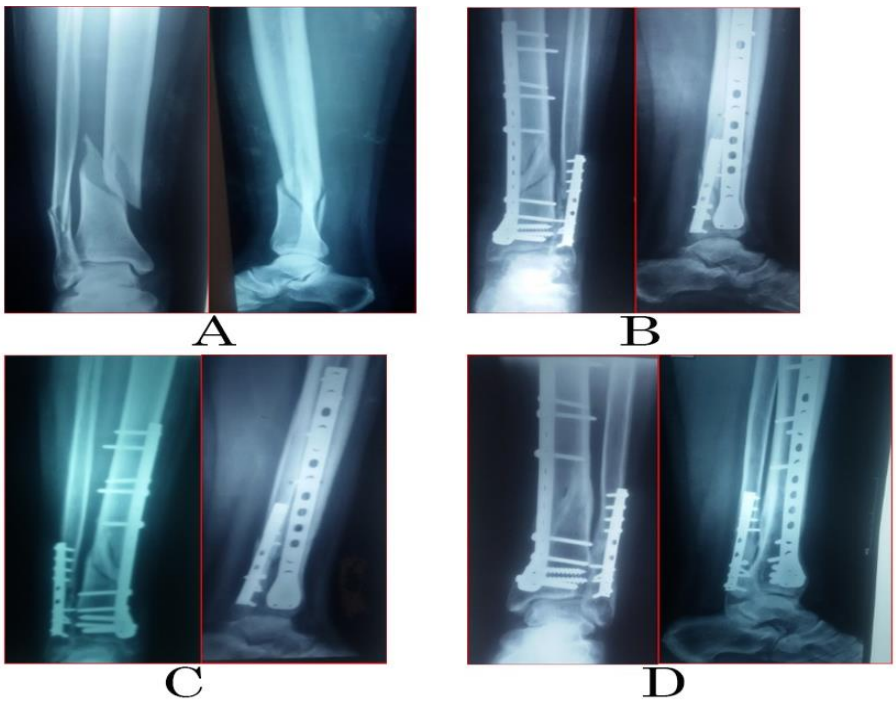

Fig. (2): Male patient number one 22 years old, no comorbidities, RTA, closed left fracture of lower third tibia 43A1 was fixed by MIPO, with fracture of fibula Webber C was fixed by 1/3 tubular plate
A: preoperative x-ray AP and lateral. **B:** postoperative x-ray AP and lateral. **C:** Follow up after 2 months AP and lateral. **D:** Follow up after 6 months AP and lateral. After 6 months Olerud and Molander score was excellent, and no complications was documented.

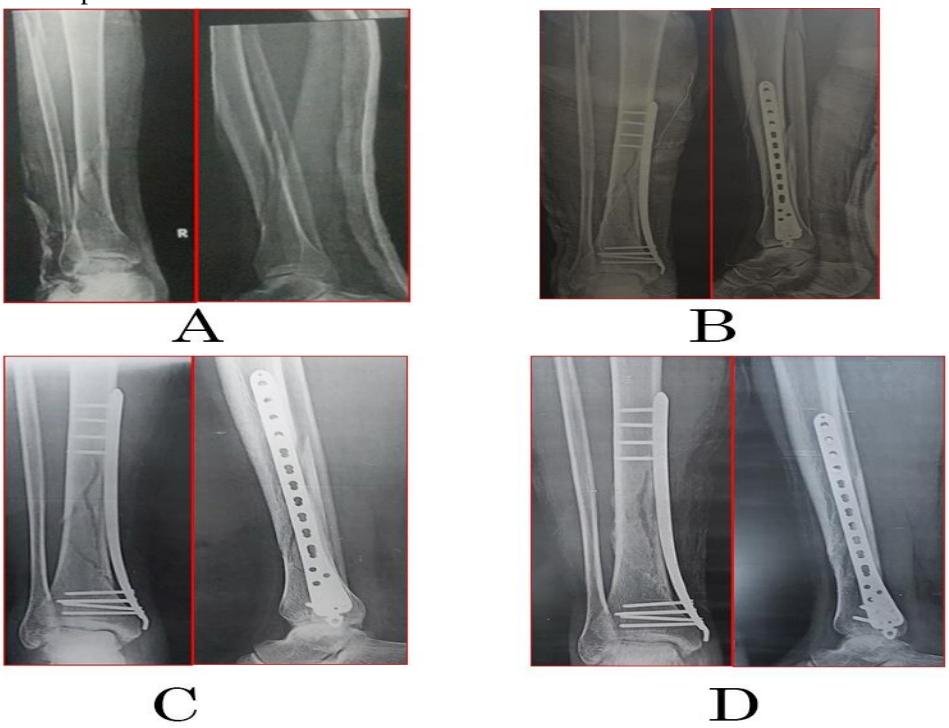

Fig. (3): Male patient number two 57 years old, diabetic and cardiac, RTA, closed right fracture of lower third tibia 43A1 was fixed by MIPO, with fracture of fibula Webber C not fixed
A: Preoperative x-ray AP and lateral. **B:** Postoperative x-ray AP and lateral. **C:** Follow up after 2 months AP and lateral. **D:** Follow up after 6 months AP and lateral. After 6 months Olerud and Molander score was excellent, and no complications was documented.

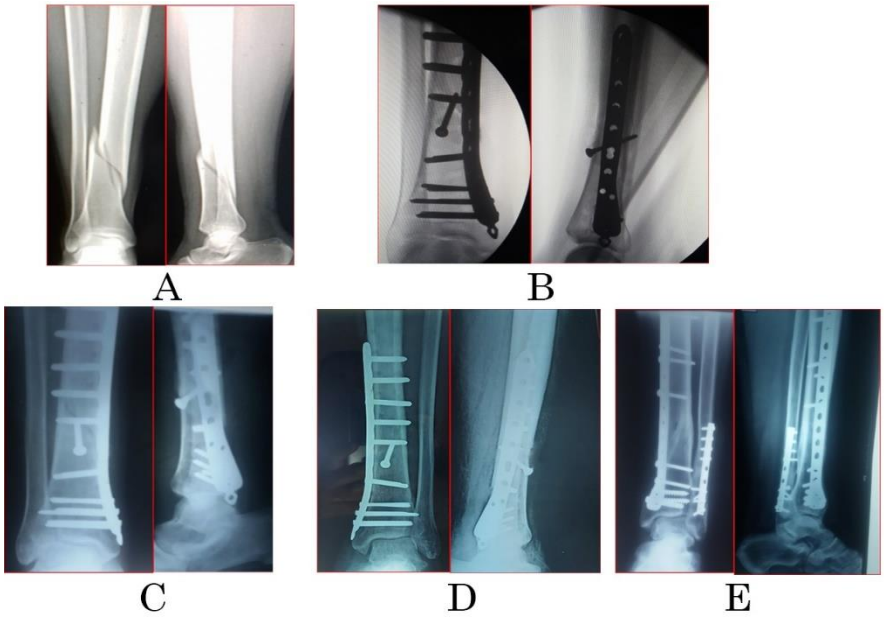

Fig. (4): Male patient number three 30 years old, no comorbidities, RTA, closed right fracture of lower third tibia 43A1 was fixed by MIPO, without fracture of fibula
A: Preoperative x-ray AP and lateral. **B:** Postoperative x-ray AP and lateral.
C: Follow up after 2 months AP and lateral. **D:** Follow up after 4 months AP and lateral, the patient had deep infection, we did debridement and he taken I.V. A.B. according to C&S. **E:** After 6 months AP and lateral, the patient had osteomyelitis, we did removal of plate and debridement of the infection at the end of the eighth months, Olerud and Molander score was fair.

Fig. (5): Male patient number four 18 years old, no comorbidities, RTA, closed right fracture of lower third tibia 43A1 was fixed by Expert nail, with fracture of fibula Webber C was not fixed
A: Preoperative x-ray AP and lateral. **B:** Postoperative x-ray AP and lateral. **C:** Follow up after 2 months AP and lateral. **D:** Follow up after 6 months AP and lateral. After 6 months Olerud and Molander score was excellent, and no complications was documented.

Fig.(6): Male patient number five 58 years old, no comorbidities, FFH, closed right fracture of lower third tibia 43A2 was fixed by Expert nail, with ipsilateral fracture of medial malleolus was fixed by percutenous screws, and fracture of fibula Webber C was not fixed

A: Preoperative x-ray AP and lateral. **B:** Postoperative x-ray AP and lateral. **C:** Follow up after 2 months AP and lateral, with broken of distal screws and the nail reached to the ankle joint. **D:** Revision post x-ray AP and lateral, removal of the nail and re fixation by plate and graft. Olerud and Molander score was poor (unstable fracture).

DISCUSSION

Extra-articular distal tibial shaft fractures had common fractures requiring operative treatment. Although several treatment methods exist, none of the fixation techniques was ideally suited for all combinations of bony soft tissue injuries. The decision to proceed with either MIPO or Expert nail was further complicated by evolving implant designs and surgical approaches [5].

Although open reduction with internal fixation could achieve optimal reduction and maintain anatomical fixation, and distal tibia reconstruction, the wound complication was resulted from this form of treatment due to increased soft tissue, and vascular disruption. So surgical advances were developed to improve plate fixation to limit iatrogenic soft tissue trauma and preserve blood supply to the fracture site using less invasive technique (MIPO) [6].

Distal tibial fractures occurring as a result of high energy mechanisms were typically associated with massive injury to skin and surrounding soft tissue. Early operation with MIPO through this traumatized soft tissue sleeve was deemed inadvisable because of the increased critical of local a wound complication and infection [7].

Although intramedullary nailing could limit wound complication, the delayed fracture healing and malunion had the most debated complication. Achieving and maintaining good reduction with IM nailing were notably difficult because of the anatomic characteristics of distal tibial fractures. So surgical advances were developed to improve IM nailing durability to aid fracture reduction, including blocking screws and multiple plane locking screws [9].

Distal tibial fractures occurring because of high energy trauma with complex fractures or close to ankle joint were typically inadvisable of fixation with IM nailing because of increased critical of mal reduction during operation and malunion post operative [14].

We compared the functional outcome and complication rate between the two techniques (nailing vs. plating) for the treatment of extra-articular fractures of the distal tibia in an adult population. To date, there is limited evidence to determine which of the procedures could provide better functional outcome and shorter time for bone union.

In our study, the mean age for the nailing group was 46 years while in plating group was 44 years. This could be explained because of active engagement, exposure to outdoor life, and road traffic accidents in this active age group.

According to AO classification, in nailing group, 32 participants were 43A1, and 16 participants were 43A2 while in plating group, 24 participants were 43A1, 20 participants were 43A2, and 4 participants were 43A3. However, there wasn't a statistically critical in effect of AO classification on Tscherne classification or on malalignment. In our study, fracture pattern didn't affect soft tissue condition neither the fracture malalignment.

In a previous study, no critical association between fracture type, severity, and malunions could be demonstrated [15].

In our study, we did not find a critical statistically difference in terms of time for partial, full weight bearing, union time, infection rate, and functional outcomes between the two groups.

In previous studies, the starting partial weight bearing in nailing group was 6 weeks compared to 8 weeks in plating group. This suggests that intramedullary nailing guarantees shorter partial, and full weight bearing time compared to plating. However, this was not statistically critical [16].

In our study, the effect of smoking on time of union, in nailing group, nonsmoker group united 2 weeks earlier than smoker group while in plating group nonsmoker united 4 weeks earlier than smoker group. This showed statistically critical in plating group (P-value was 0.003).

A previous study reported a critical difference in the percentage of smokers in the nonunion group compared with the percentage in the consolidation group ($p < 0.05$) [17].

In our study, plating group, superficial infection was seen in 20 participants (41.7%), deep infection was seen in 4 participants (8.3%) while in nailing group, no participant had deep infection, 4 participants (8.3%) were seen with superficial infection. Nailing group showed less infection rate than plating group. This might be due to more tissue dissection with plates.

A previous study reported a rate of late disease of 15% in MIPO fixation of a locking plate in distal tibial fractures [18]. In another study, 45 participants observed late disease reaching the metal implant that required admission, treatment at the septic ward in five participants (11.1%) [19].

In our study, functional outcome according to olerud, molander score was measured. No critical value of functional score was found between both groups.

In previous study, in group 1 (MIPO), excellent outcomes were found in 3 participants (15%), good outcomes were found in 15 participants (75%), fair outcomes were found in 2 participants (10%), and poor outcomes were found in 0 participant (0%). In group 2 (expert IM nail), excellent outcomes were found in 7 participants (35%), good outcomes were found in 13 participants (65%), fair outcomes were found in 0 participant (0%), and poor outcomes were found in 0 participant (0%). No critical value of functional score was found in both groups [20].

In our study, deformity was found in 4 participants of plate group (8.3%) compared to more than 5% but the fracture was 43A3 and no participants in nailing group.

In previous study, deformity was found in 2 participants of plate group (10%) and deformity was found in 5 participants of nailing group (25%) [20].

In our study, with respect to secondary procedures, debridement and removal of plate done to the infected site in 4 participants in plating group that showed signs of union later, and complete union occurred at 22 weeks. Removal of nail, re-fixated by plate in 4 participants in nailing group that showed distal screws breakage, nail reached the ankle joint, and sign of non-union. However, there wasn't any critical statistically difference.

In a previous study, 11 participants have gone through 15 secondary procedures after plating, while 5 of them have gone through prominent implant removal. This was not critically different from participants treated with nailing: 10 participants have gone through 14 procedures, while 5 of them have gone through prominent implant removal [21].

In participants of severe soft tissue injuries, large bare area of skin defect, bone exposed or complex fractures, none of MIPO or IM nailing was the good choice for the risk of disease, difficulty of reduction, and stability of fractures. So, the good choice of these participants was External Fixation. External Fixation seemed a rational approach to obtain and maintain alignment of the distal tibia through ligament taxis, thereby avoiding formal open reduction especially with type C distal tibial fractures. Later on, after achieving of formal reconstruction, alignment of type C distal tibial fractures or improving of soft tissue injuries, it was preferred to remove external fixation, doing MIPO or IM nailing to prevent pin tract disease and participant satisfaction.

To improve clinical decision making, surgeons need data based on randomized and controlled trials. Therefore, future studies should be based on an adequate sample size which allows a meaningful interpretation of the results, a strict inclusion, and exclusion criteria to overcome bias. External Fixation must be evaluated as part of the comparative research in future studies.

Furthermore, details regarding the rehabilitation regimen, the fracture type, the average X-ray exposure time, frequency, complications, and clinical outcomes should be fully reported.

CONCLUSION

Distal tibial fractures often present a challenge to orthopedic surgeons. The treatment of this type of fracture was of current research interest since there was no universally agreed treatment method. The choice of treatment must consider not only the stabilization of the fracture, but also the management of the soft tissue injury which was a critical cause of subsequent complications.

Our study suggests that both IM nailing and plating are appropriate treatments of extra articular distal tibia fracture (EDTF). Plate fixation and IM nailing

are safe and effective treatment options for EDTF because both of them could provide similar good function outcomes. IM nailing should be taken as a priority for EDTF with serious soft tissue injury. MIPO should be taken as a priority for EDTF with distal fragment that is not enough to be used with distal locking screws of expert nail.

Conflict of Interest: No financial or personal relationships with other people or organizations that could inappropriately influence the current study.

REFERENCES

1- Paige W. Fracture of lower extremity: tibia pilon fracture. In: Terry C. James B(eds) Campbell's operative orthopaedics, eleventh edition, Philadelphia: Mosby Elsevier 2010; 3118-19.

2- Tao YU, Qianming Li, Hongmou Zhao, Jiang Xia, Ashwin Aubeeluck, Guangrong Yu. Treatment of distal tibial fractures with intramedullary nail or plate: A Meta-Analysis. Pack J Med Sci 2012; 28(4): 580-585.

3- Boris Zelle A, Bhandari M, Espiritu M. Treatment of Distal Tibia Fractures without Articular Involvement: A Systematic Review of 1125 Fractures. J Orthop Trauma 2006; 20:76-79.

4- Brad Petrisor A, Bhandari M, Schemitsch E. Fracture of tibia, fibula, Rockwood & Green's Fractures in Adults, 6th Edition. Philadelphia, Lippincott Williams Wilkins 2006; 2084- 85.

5- Bedi A, Le TT, Karunakar MA. Surgical treatment of nonarticular distal tibia fractures.J Am Acad Orthop Surg 2006; 14(7): 406-16.

6- Richard RD, Kubiak E, Horwirtz DS. Techniques of surgical treatment of distal tibial fractures. OrthopClin North Am 2014; 45: 295-312.

7- Maffulli N, Toms AD, McMurtie A, Oliva F. Percutaneous plating of distal tibial fractures. Int Orthop 2004; 28(3): 159–162.

8- Shahid R, Mushtaq A, Sharma V, Maqsood M. Distal Tibial Fracture Fixation with Locking Compression Plate (LCP) through Minimally Invasive Percutaneous Osteosynthesis (MIPO) Technique. Injury Extra.2008; 39(5):202.

9- Bahari S, Lenehan B, Khan H, Mcelwain JP. Minimally invasive percutaneous plate fixation of distal tibia fractures. Acta Orthop Belg 2007; 73: 635-40.

10- Fan CY, Chiang CC, Chuang TY. interlocking nails for displaced metaphyseal fractures of distal tibia. Injury 2005; 36: 669-674.

11- Tyllianakis M, Megas P, Giannikas D, Lambiris E. Interlocking Intramedullary Nailing in Distal Tibial Fractures. Orthopaedics 2000;23(8):805-808.

12- Kwok CS, Crossman PT. Plate versus nail for distal tibial fractures: a systematic review and meta-analysis. J Orthop Trauma 2014;28(9):542-8.
evaluation after ankle fracture. Arch Orthop Trauma Surg 1984;

13- Olerud C, Molander H. A scoring scale for symptom evaluation after ankle fracture. Arch Orthop Trauma Surg 1984; 103:190 –4.

14- Bone L, Stegemann P, Mc Namara K, Siebel R. External fixation of severely comminuted, open tibialpilon fractures. Clin Orthop 1993; 292: 101-107.

15- Kruppa CG, Hoffmann MF, Sietsema DL, Mulder MB, Jones CB. Outcomes after intramedullary nailing of distal tibial fractures. Journal of Orthopaedic Trauma 2015; 29(9): e309-e15.

16- Nork SE, Schwartz AK, Agel J, Halt SK, Schrick JL, Winquist RA. Intramedullary nailing of distal metaphysealtibial fractures. JBJS 2005; 87(6): 1213-21.

17- Patel R, Wilson R, Patel P, Palmer R. The effect of smoking on bone healing: a systematic review. Bone & join research 2013; 2(6): 102-11.

18- Lau T, Leung F, Chan C, Chow S. Wound complication of minimally invasive plate osteosynthesis in distal tibia fractures. International Orthopaedics 2008; 32(5): 697.

19- Solanki MR, Patil SR, Chanchpara GC, Alwani PL, Pawar JB. A comparative study of plating versus nailing in distal tibia metaphyseal fracture. IJOS 2017; 3(2): 86-9.

20- Jayesh V, Bhoomika R, Girish R, Pradip R. Comparative study of plating versus nailing in distal tibial metaphyseal fractures. National journal of medical research 2014; 340-344.

Collinge C, Protzman R Outcomes of minimally invasive plate osteosynthesis for metaphyseal distal tibia fractures. Journal of Orthopaedic Trauma 2010; 24(1): 24-9.

How to cite

Ebeed, M., Khira, Y., Elzoheiry, M., el aidy, S. Treatment of fracture distal third tibia by plating versus nailing: Comparative study. *Zagazig University Medical Journal*, 2024; (130-140): -. doi: 10.21608/zumj.2021.59202.2099