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Original Research Article

Comparison of Outcome of Locking Plate Fixation and Closed Intra-Medullary Interlocking Nail in the Management of Extra Articular Distal Tibial Fracture in Jharkhand Population

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Abstract:

Background: Tibial fractures delay in reunion and healing due to a lack of vascularity because of the least muscular coverings anteriorly; hence, they are also called as bones of tendons. Management of distal tibial fractures is quite challenging for orthopaedic surgeons. Hence, different techniques are used to treat tibial fractures.

Method: Out of 60 patients, 30 were operated on with interlocking mail and 30 with locking plate fixation. Patients were regularly followed up to 1 year post-operatively, assessed clinically and radiologically to rule out any complications, and treated the same.

Results: Duration of surgery: 40–60 minutes 21 (70%) ILN groups and 11 (36.6%) plating groups in 61–80 minutes 9 (30%) ILN groups, 11 (36.6%) plating groups and > 80 minutes in 8 (26.6%) plating groups were observed. Weight bearing after surgery in 8–10 weeks, 21 (70%) in the ILN group, 12 (40%) in the plating group, in 11–12 weeks, 9 (30%) in the ILN group, 12 (40%) in the plating group, in 13–14 weeks, 6 (20%) plating groups were observed. Duration of fracture union radiologically 17.9 (± 1.46) in the ILN group and 20.76 (± 1.80) I plating group, t test 62 and $p<0.001$, post-surgical complications were more or less the same in both groups.

Conclusion: In the present pragmatic study it is proved that closed Inter medullary nailing is preferable than plating technique because early union and decreased implant related problems.

Keywords: ILN (Inter plating Nail), Locking plate, distal tibia fracture, Jharkhand.

Introduction

Tibia fractures are commonly associated with soft tissue injuries. Along with fractures, the tissue must be treated properly; otherwise, it may cause substantial disability to the patient. High-energy mother vehicle trauma constitutes the commonest cause, followed by falls, direct blows, or sports injuries [1]. The distal tibial fracture varies from 0.6 to 0.7% and from 10% to 13% for the proximal and distal fractures [2]. Due to subcutaneous location, poor blood supply and decreased muscular cover anteriorly result in delay in union, non-union wound infection, and wound dehiscence, which are often challenges to the orthopedician. Minimally invasive plate osteosynthesis (plating) and intermedullary interlocking nail (ILN) are two widely accepted and effective techniques, but each has historically been associated with post-surgical complications and misalignment if knee and knee pain are frequently reported after IMLN [3,4]. Whereas wound complications and implant prominence have been associated with tibial plating. As a result, an attempt is made to evaluate and compare patients treated with techniques, as well as their future complication rate union and durations of union.

Material and Method

60 (sixty) patients admitted to the orthopaedic department of Mahatma Gandhi Memorial Medical College Hospital Jamshedpur were studied.

Inclusive Criteria: Patients aged between 18 to 48 years with a distal fragment of at least 3 cm in length without articular incongruity. Duration of injury: less than 2 weeks No involvement of neuro-vascular status

Exclusion Criteria: Patients with open fractures, intraarticular extension, or pathological fractures Poor medical health was excluded from the study.

Method: 60 patients with distal tibia extraarticular fractures Ao type 43A out of 60 patients, 30 were operated on with interlocking nailing and 30 with locking plates. Radiographic examination was done in the anterior-posterior (AP) view and the lateral view of the defected limb. Patients were operated on under spinal anaesthesia. Antibiotics of the third generation, cephalosporin, were given intravenously 15 minutes before surgery. A pneumatic / Esmarch rubber tourniquet was used in all patients.

The affected limb was thoroughly scrubbed from mid-thigh to foot with Betadine scrub and Savlon. The limb was painted with Betadine solution from the midthigh to the foot. The rest of the body and other limbs were properly draped with sterile drapes. Cases in which the fibula was fixed in addition to nailing or plating the tibia, were done either with a one-third semi-tubular plate, a reconstruction plate, or a rush nail. In cases fixed with plating, an incision was taken just posterior to the fibula, soft tissues were dissected, and the reduction of the fracture fragments was achieved after cleaning the fracture site. The fracture was fixed with a six- or seven whole plates with screws. In cases of rush nail fixation, It was passed percutaneously over a stab incision at the tip of the lateral malleolus after manual reduction of the fracture. The passage and location of the nail were checked under the image intensifier.

Surgical technique for intermedullary Nailing:- A vertical patellar tendon splitting incision over skin extending from the centre of the inferior pole of the patella to the tibial tuberosity was made about 3 cm long. The patellar tendon was split vertically in its middle and retracted to reach the proximal part of the tibial tuberosity. The next step was to determine the point of insertion. Essential for the success of the procedure is the correct choice of insertion point. After selecting the point of insertion, a curved bone awl was used to breach the proximal tibial cortex. In the metaphyseal concellous bone, an entry portal was created, making sure it was in line with the centre of the medullar canal. After widening the medullary canal with a curved awl, a guide wire of size 3 mm in diameter X 950 mm in length was passed into the medullary canal of the proximal fragment.

Accurate closed reduction of the fracture was verified under an image intensifier before insertion of the guide wire in the distal tibial metaphysis. After reduction, the tip of the guide wire was passed until it entered the subchondral bone of the distal tibia. The exact length of the nail was measured from the length of the guide wire remaining inside the medullary canal at the entry point. The size of the nail was assessed as one millimetre less than the diameter of the last reamer and passed into the medullary canal over the guide wire. Screw positions were confirmed under the C-arm image intensifier. After this, Zig was removed, and stability was checked by performing flexion and extension at the knee and ankle joints. All incisions were closed in layers. A sterile dressing was applied over the wound.

Surgical technique for locking plate fixation: The concept of this approach was to preserve the soft tissues and blood supply in the metaphyseal fracture area. A straight or slightly curved skin incision was performed on the medial aspect of the distal tibia. The length of the incision varied from 3-5 cm, depending on the type of the planned plate.

The incision was ended distally at the tip of the medial malleolus. The incision was carried out straight across the subcutaneous fat, preserving the great saphenous vein and saphenous nerve. They were held anteriorly with a blunt retractor. The dissection advanced down to the periosteum, which was completely preserved. In this anatomical space, the tunnelling towards the diaphysis was achieved with the blunt tip of the plate. For the insertion of the proximal screws in the diaphysis, separate stab incisions were made. The plate was inserted after proximal tunnelling with the plate itself. It is important that the plate and the proximal screw be centred on the tibia, particularly if locking head screws are planned.

Temporary fixation was performed with wires through the screw holes to approximate the final plate position before the screw insertion. For spiral and short oblique fracture patterns that were anatomically reduced, lag screws were placed to enhance stability. The screw was placed independently of the plate; a conventional screw was inserted in one of the most distal plate holes to approximate the plate close to the bone after achieving an accurate position of the plate. All the incisions were closed between the layers. In all patients, a sterile dressing was applied over the wound, and a plaster slab was applied below the knee.

Post-operatively, radiographs were taken. Passive knee and ankle range of motion was started in the 1st postoperative week, depending on the type of fracture and stability of fixation. Active moments started in the second week once the pain had subsided. The weight bearing was planned as per the type of fracture fixation and the general condition of the patient. Initially, partial weight bearing was advised between 4 to 8 weeks and then full weight bearing was advised when the formation of a callus and union of the fracture process were observed radiologically.

Clinical follow-up examinations were at 4 weeks, 6 weeks, 10 weeks, 3 months, 6 months, and 1 year. Every patient was assessed clinically and radiologically to rule out tenderness at the fracture site, abnormal mobility, infection, and pain on movement of the knee and ankle joints. The duration of study is from August 2019 to July 2022.

Statistical analysis: The results were compared with percentages, and the duration of union of the fracture was compared with the Z test. The statistical analysis was performed in SPSS software. The ratio of males and females was 3:1.

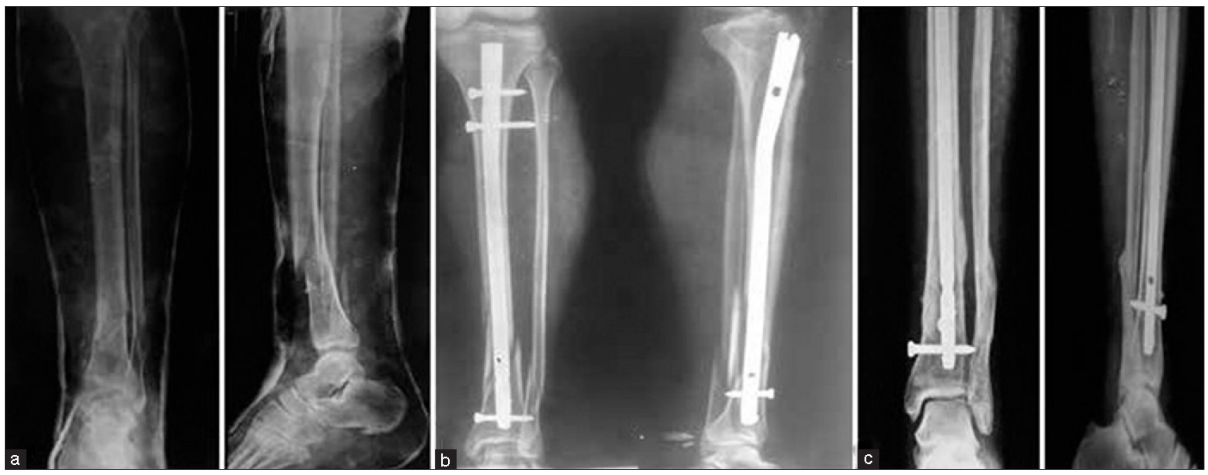

Figure 1: X-ray leg bones with ankle AP and lateral views – (a) pre-operative views showing fracture of distal end tibia, (b) immediate post-operative x-ray of IMIL nail group showing nail in situ, (c) At 1 year follow up showing sound union with intermedullary nail in siitu.

Figure: 2: (a) X-ray of leg bones with ankle AP and views showing distal tibial fracture, (b) X-ray AP and lateral views immediate postoperative after minimally invasive plate

Observation and Results

Table-1: AO classification

- In 43 A-1 type – 14 (46.6%) ILN, and 14 (46.6%) plating, for a total of 28 (46.6%).
- In 43 A-2 types of AO – 9 (30%) are ILN, and 7 (23%) are plating, for a total of 16 (26.6%).
- In 43 A-3, – 7 (23.2%) ILN, and 9 (30%) plating, for a total of 16 (26.6%).

Table-2: Comparison of the duration of surgery in both groups

- 40–60 minutes: 21 (70%) patients in the ILN group, 11 (36.6%) in the plating group.
- 61–80 minutes: 9 (30%) cases in the ILN group, 11 (36.6%) in the plating group.
- > 80 minutes: 8 (26.6%) in plating group

Table-3: Comparison of the duration of total weight bearing after surgery in both methods

- In 8–10 weeks duration – 21 (70%) were in the ILN group, 12 (40%) in the plating group, and a total of 33 (55%)
- In 11–12 weeks of duration – 9 (30%) in the ILN group, 12 (40%) in the plating group, and a total of 21 (31%)
- In 13-14 weeks duration – 6 (20%)

Table-4: Comparison of duration of fracture union (radiological study) – 17.92 (± 1.46) ILN group, 20.76 (± 1.80) plating group, t test 62 p<0.001

Table-5: Comparison of Post-Surgical Complications

- Pain in the knee – 7 (23.3%) in the ILN group, Superficial infection – 2 (6.6%) in the plating group.
- Deep infection, 4 (13.3%) in the plating group,
- Valgus > 50 angulations – 7 (23%) in the ILN group, 4 (13.3%) in the plating group.
- Stiffness of knee – 2 (6.6%) in the ILN group, 6 (20%) in the plating group.
- Stiffness of ankle – 2 (6.6%) in the ILN group, 6 (20%) in the plating group.
- Implant irritation – 6 (20%) in the plating group,
- Implant failure – 2 (6.6%) in the ILN group.
- Non-union – 2 (6.6%) in the ILN group

Table 1: AO Classification (ASIF)

Types of AO	Groups					
	ILN (30)	%	Plating (30)	%	Total (60)	%
43A.1	14	46.6	14	46.6	28	46.6
43A.2	9	30	7	23.3	16	26.6
43A.3	7	23.3	9	30	16	26.6

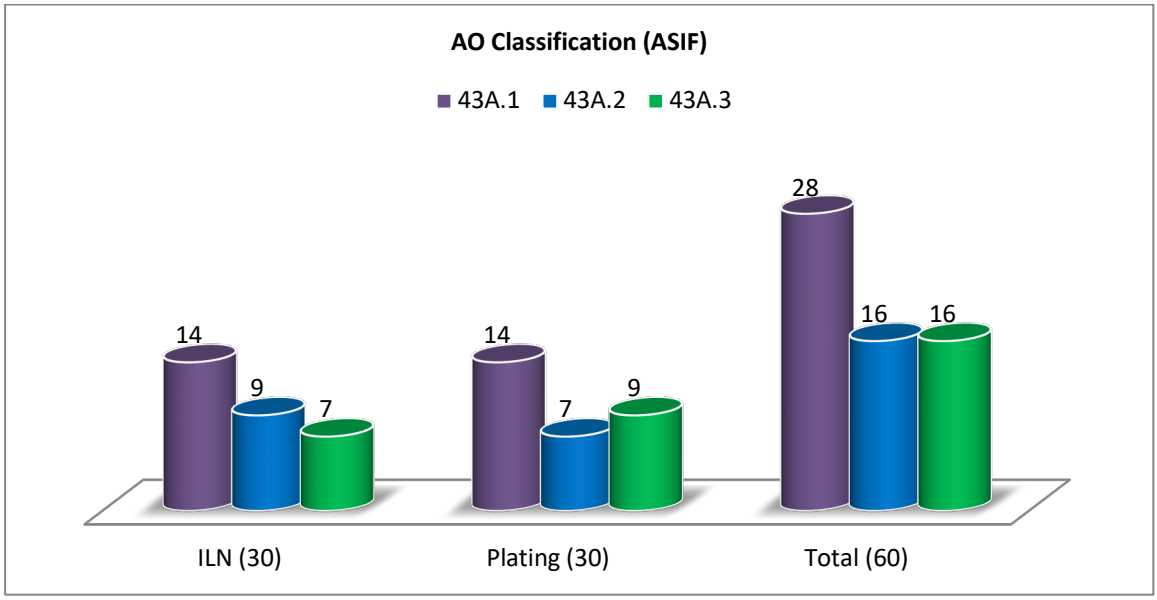

Figure 1: AO Classification (ASIF)

Table 2: Comparison Duration of Surgery in both groups

Duration (in Minutes)	ILN		Plating		Total	
	No	%	No	%	No	%
40-60 Min	21	70	11	36.6	32	53.3
61-80 Min	9	30.7	11	36.6	20	33.3
> 80	00	--	8	26.6	8	13.3

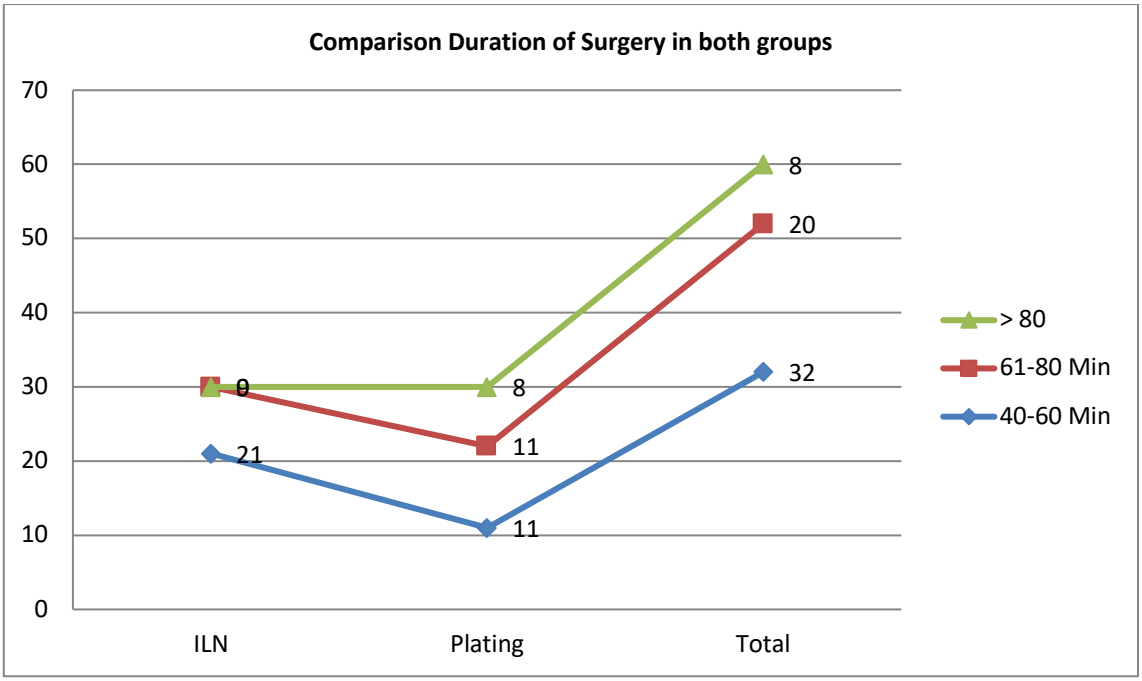

Figure 2: Comparison Duration of Surgery in both group

Table 3: Comparison of Duration of Total Weight Bearing After Surgery in Both Techniques

Duration (in Minutes)	ILN		Plating		Total	
	No	%	No	%	No	%
8-10 weeks	21	70	12	40	33	55
11-12 weeks	9	30	12	40	21	35
13-14 weeks	0	--	6	20	6	10
> 14 weeks	0	--				

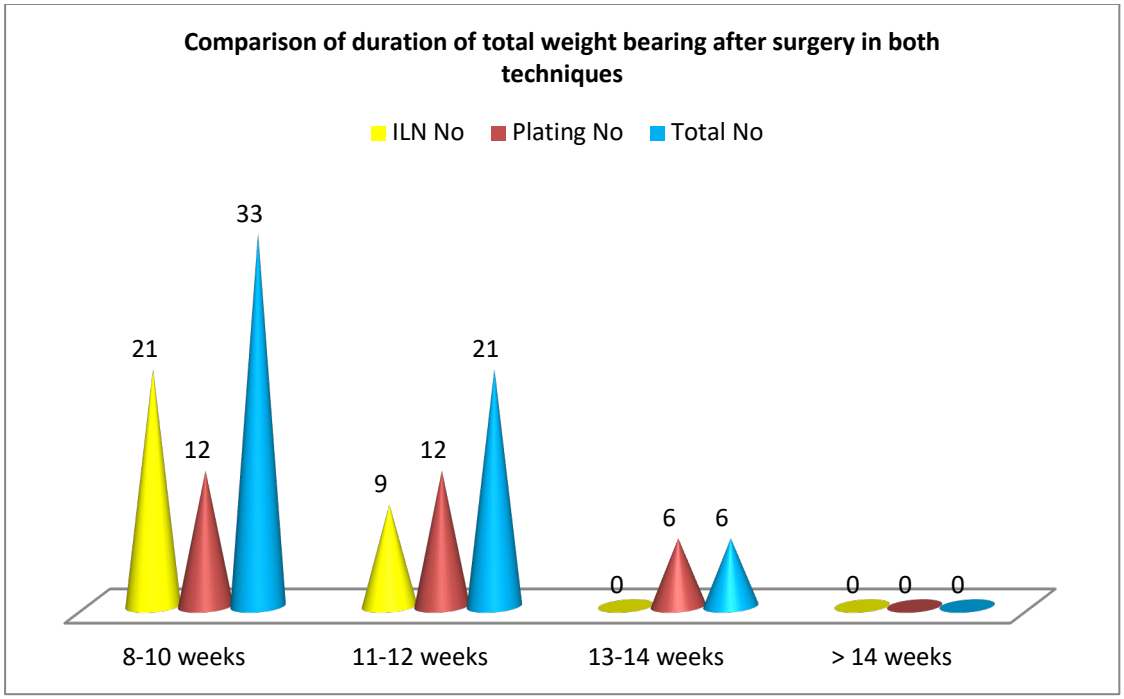

Figure 3: Comparison of duration of total weight bearing after surgery in both techniques.

Table 4: Comparison of duration of fracture union (radiological)

ILN	Plating	t test	P value
17.92 (± 1.46)	20.76 (± 1.80)	6.2	P<0.001

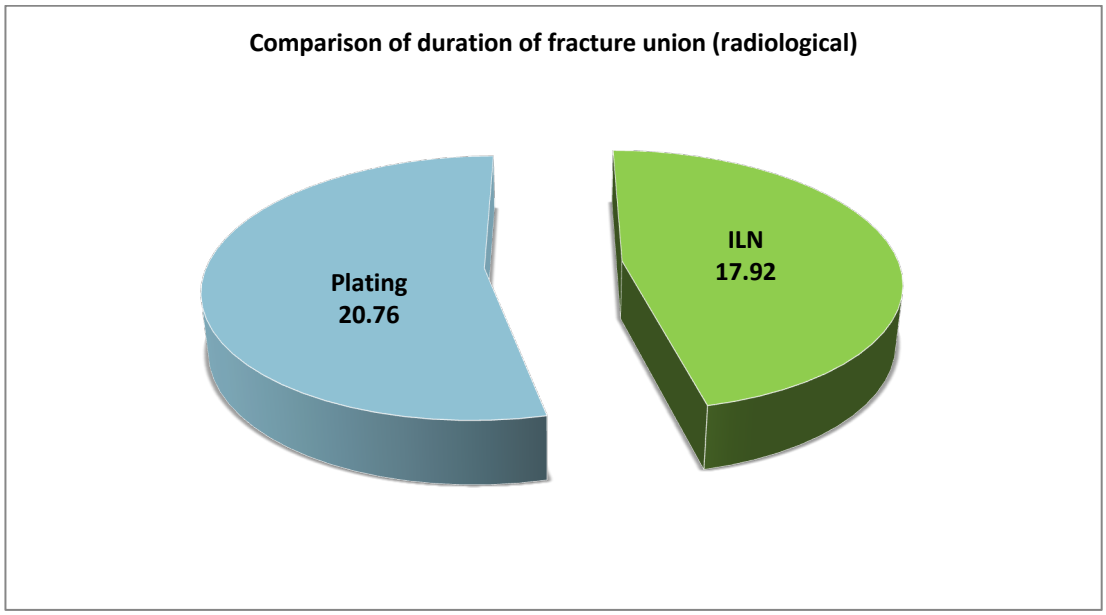

Figure 4: Comparison of duration of fracture union (radiological)

Table 5: Comparative Study of Post-Surgical Complications

Details	ILN	%	Plating	%
Pain in anterior knee	7	23.3	0	0
Superficial infection	0	-	2	6.6
Deep infection	0	--	4	13.3
Valgus > 50 (Angulation)	7	23.3	4	13.3
Stiffness of knee	4	13.3	0	0
Stiffness of ankle	2	6.6	6	20
Implant irritation	0	--	6	20
Implant failure	2	6.6	0	--
Non-union	2	6.6	--	

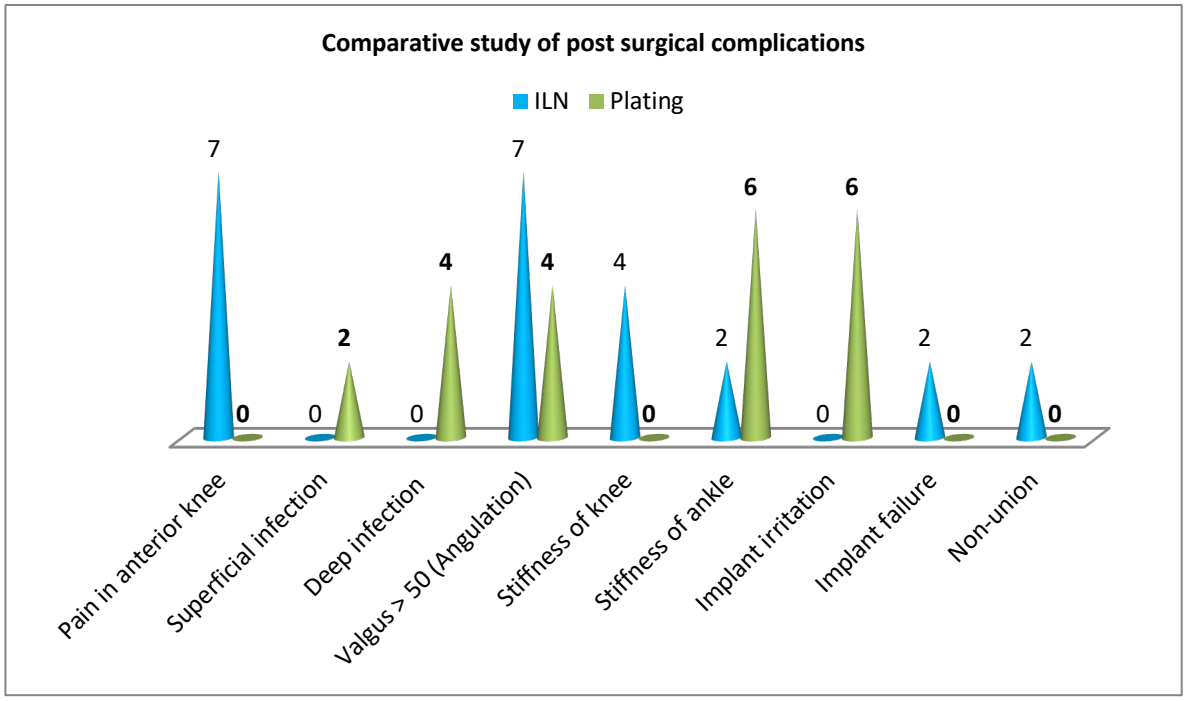

Figure 5: Comparative study of post-surgical complications

Discussion

A present comparative study of the outcome of locking plate fixation and closed intramedullary interlocking nails in the management of extra-articular distal tibia fractures in the Jharkhand population.

- AO classification had 43A-1-14 (46.6%) in the ILN group and 14 (46.6%) in the plating group.
- 43A-2 – type of AO, had 9 (30%) cases in the ILN group, 7 (23%) in the plating group.
- 3 – 7 (23.3%) cases in the ILN group, 9 (30%) in the plating group (Table 1).

In comparison to the duration of surgery in both groups 40–60 minutes duration – 21 (70%) cases in the ILN group, 11 (36.6%) in the plating group, 61–80 minutes – 9 (30%) cases in the ILN group, 11 (36.6%) in the plating group; above >80 minutes: 2 (26.6%) in the plating group (Table 2). In a comparison study of the duration of total weight bearing after surgery in both groups In 8–10 weeks, 21 (70%) cases were in the ILN group and 12 (40%) in the plating group. In 11–12 weeks after surgery, 9 (30%) cases were in the ILN group, 12 (40%) in the plating group. 13–14 weeks after surgery, there were 6 (20%) cases in the plating group (Table 3). The mean value of duration of fracture union (radiologically) was 17.92 (± 1.46) in the ILN group, 20.7 (± 1.80) in the plating group, t test 6.2, and $p<0.001$ (Table 4). Comparative study of post-surgical complications: pain in the anterior knee 7 (23.5%) in the ILN group, superficial infection 4 (13.5%) in the plating group, Deep infection 4 (13.3%) cases in the plating group, Valgus > 50 angulations 7 (23%) in the ILN group, 4 (13.3%) in the plating group Stiffness of knee 4 (13.3%) in the ILN group, stuffiness of ankle 2 (6.6%) in the ILN group, and 6 (20%) in the plating group Implant imitation was observed in 6 (2%) of the plating groups. Implant failure will be observed in 2 (6.6%) of the ILN group, and non-union in 2 (6.6%) in ILN group (Table-5) (Figures 1 and 2). These findings are more or less in agreement with previous studies [5,6,7] Distal tibial fractures are one of the most challenging fractures experienced by orthopedicians. It is due to its subcutaneous location, minimal vascularity, and reduced muscular cover. There are chances of complications such as non-union, delayed union, infection, and dehiscence [8,9]. The methods of ILN and plating are popularly used to treat distal tibial fractures, but these procedures are also associated with various complications. Non-operative treatment is also used in the case of stable fractures with severe morbidities, but complications like delayed union, malunion, and joint stiffness are very common. Locking plate fixation gives good rigidity, anatomical reduction, and biomechanical superiority to intramedullary nailing [10]; however, it results in extensive soft tissue dissection, resulting in wound complications and infections. Hardware complications are more prevalent in locking plates, warranting implant removal more frequently. With the use of minimally invasive techniques, the complications have been significantly reduced.

Intermedullary nails are commonly used for distal tibia fractures where the fracture is away from the plafond, allowing two or more distal locking points. Plates are technically more challenging to achieve and maintain reduction because of the anatomic characteristics of the distal tibia. Hence, management of distal tibia fractures with an intramedullary interlocking tibia nail gives better results compared to fractures managed with a distal tibia locking plate.

Summary and Conclusion

The results of the present study conclude that both closed intermedullary nailing and locking plate fixation are equally safe and effective for the management of extra-articular distal tibia fractures. But it is observed that interlocking nailing is better in terms of early weight bearing, fast union, and decreased risks of complications. Further, it is cost effective.

Limitation of study: Due to the tertiary location of the research centre, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

This research paper was approved by the ethical committee of Mahatma Gandhi Memorial Medical College Hospital, Jamshedpur.

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