ORIGINAL ARTICLE

Comparison of Clinical and Radiological Outcome Between Minimally Invasive Plate Osteosynthesis and Open Reduction and Internal Fixation in Distal Tibial Fractures

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ABSTRACT

Objective: To compare the clinical and radiological outcome between minimally invasive plate osteosynthesis and open reduction and internal fixation in distal tibial fractures.

Methods: This randomized controlled trial study was conducted in the department of Orthopedics, Sir Ganga Ram Hospital, Lahore from September from September 2013 to March 2015. Forty patients presenting with closed, displaced, distal tibial fractures without ankle involvement were divided into two groups using lottery method. Group-A underwent ORIF and Group-B underwent MIPO. A written informed consent was taken from every patient.

Results: The mean age of the patients was 42.45±8.25 years in Group-A and 41.35±9.56 years in Group-B (p=.699). There were 13 (65%) male and 7 (35%) female patients in Group-A and 14 (70%) male and 6 (30%) female patients in Group-B (p=.736). Mean operative time was insignificantly higher in Group-B (73.90±5.15 vs. 70.75±6.10 minutes; p=.086) as compared to Group-A. Mean VAS score for post-operative pain (6.40±1.05 vs. 4.45±.95; p=.000) and mean length of hospital stay (4.35±1.04 vs. 2.70±.73 days; p=.000) was significantly higher in Group-A as compared to Group-B. 6 patients in Group-A developed flap necrosis compared to none in Group-B (30% vs. 0%; p=.008). 5 Patients in Group-A developed wound infection in 2nd post-operative week compared to only 1 patient in Group-B (25% vs. 5%; p=.077). On 12th post-operative week, radiological union was evident in all the patients (100%) of Group-B compared to 16 patients (80%) of Group-A, and this difference was statistically significant (p=.035).

Conclusion: Though associated with insignificantly longer operative time, MIPO is associated with significantly decreased post-operative pain and length of hospital stay. MIPO offers the advantage of soft tissue protection thus minimizing infection.

Keywords: Distal Tibial Fracture, Minimally Invasive Plate Osteosynthesis, Open Reduction & Internal Fixation

INTRODUCTION

Management of unstable distal tibial fractures continues as a surgical challenge for orthopedic surgeons.[1,2] Osteosynthesis techniques available include open reduction and internal fixation (ORIF), external fixation with or without limited internal fixation, intramedullary (IM) nailing or, more recently, minimally invasive plate osteosynthesis (MIPO).[3-5] Because such fractures result from high energy trauma with extensive soft tissue injury and the bone is already more subcutaneous in this part, soft tissue coverage is a crucial issue in such patients.[6,7] Open reduction and internal fixation adds to this soft tissue injury and results in flap necrosis and implant exposure in majority of cases which is a grave complication.[7] Intramedullary nailing is also not an ideal choice in such patients due to concerns regarding biomechanical stability of fixation and risk of malunion or nonunion. Also, IM nailing cannot be performed when fracture line is less than 5 cm proximal to the ankle joint.[5,8,9] Minimally invasive plate osteosynthesis (MIPO) as the name implies is a minimally invasive technique which preserves vascularity of the soft tissue envelope and decreases the soft tissue complications associated with open reduction and internal fixation.[10-13] Although there was a lot of research available on clinical and

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radiological outcome of MIPO alone[14-17] or in comparison with conventional plating in distal tibial fractures[7,18-20], yet the available evidence contained conflicting results. Furthermore, as MIPO requires special surgical skills, the purpose of the present study was to compare MIPO with conventional open reduction and internal fixation in our setup to determine the better treatment approach in future practice.

METHODS

Forty patients presenting in the emergency of Orthopedic Department, Sir Ganga Ram Hospital, Lahore with displaced distal tibial fractures without ankle joint involvement were included in this study. Immuno-compromised patients (diabetics, HIV positive, steroid therapy), those presenting ≥6 hours after injury and with open fractures were excluded. Detailed history and written informed consent was taken from all the patients. Patients were randomly divided into two groups using lottery method. Group-A underwent ORIF and Group-B underwent MIPO.

A single surgical team to eliminate bias performed all the surgeries. Confounding variables were controlled by exclusion. Duration of surgery in minutes was noted in both the groups from skin incision to skin stitches. Patients were followed in ward for post-operative pain at 24 hours using Visual Analogue Scale (VAS) and length of hospital stay in days. Discharge criteria was patient mobile in bed with pain controlled on oral paracetamol 2 tabs x 8hrly. Patients were followed in outdoor weekly for wound infection and radiological union.

RESULTS

The mean age of the patients was 42.45±8.25 years in Group-A and 41.35±9.56 years in Group-B as shown in Table 1. There were 13 (65%) male and 7 (35%) female patients in Group-A and 14 (70%) male and 6 (30%) female patients in Group-B as shown in Table 2. However, there was no significant difference between the two groups in terms of age (p=.699) and gender (p=.736) which confirms effective randomization of study sample.

Table 1: Descriptive statistics for age (in years)

	Study Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Age	Group-A	20	42.45	8.249	1.845	.699
	Group-B	20	41.35	9.555	2.136	

Table 2: Gender distribution between the groups

			Gender		Total	P value
			Male	Female		
Study Group	Group-A	Count	13	7	20	.736
		% Group	65.0%	35.0%	100.0%	
	Group-B	Count	14	6	20	
		% Group	70.0%	30.0%	100.0%	
Total		Count	27	13	40	
		% Total	67.5%	32.5%	100.0%	

Mean operative time was higher in Group-B (73.90±5.15 vs. 70.75±6.10 minutes; p=.086) as compared to Group-A, however the difference was statistically insignificant as shown in Table 3. Mean VAS score for post-operative pain was significantly higher in Group-A (6.40±1.05 vs. 4.45±.95; p=.000) as compared to Group-B, as shown in Table 4. Mean length of hospital stay was also significantly longer in Group-A (4.35±1.04 vs. 2.70±.73 days; p=.000) as compared to Group-B as shown in Table 5.

Five Patients in Group-A developed wound infection in 2nd post-operative week; 3 patients had superficial and 2 patients had deep infection. Infection settled in 2 patients with superficial infection after a

course of antibiotics. The other patient acquired deep infection raising the number of patients with deep infection in Group-A to 3. These 3 patients finally developed flap necrosis. The frequency of infection was lower in Group-B (5% vs. 25%; p=.077) where only 1 patient acquired superficial infection which settled with antibiotics as shown in Table 6. 6 patients in Group-A developed flap necrosis compared to none in Group-B (30% vs. 0%; p=.008) as shown in Table 7. In 4 patients it was partial and implant was not exposed while it was complete in 2 patients where it resulted in complete exposure of the implant (Fig. 1). All the patients with flap necrosis were aged above 60 years.

Table 3: Comparison of Operative Time (minutes) between the groups

	Study Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Operative Time	Group-A	20	70.75	6.103	1.365	.086
	Group-B	20	73.90	5.149	1.151	

Table 4: Comparison of Post-op Pain (VAS score) between the groups

	Study Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Post-Op Pain	Group-A	20	6.40	1.046	.234	.000
	Group-B	20	4.45	0.945	.211	

Table 5: Comparison of Length of Hospital Stay (days) between the groups

	Study Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Length Of Stay	Group-A	20	4.35	1.040	.233	.000
	Group-B	20	2.70	0.733	.164	

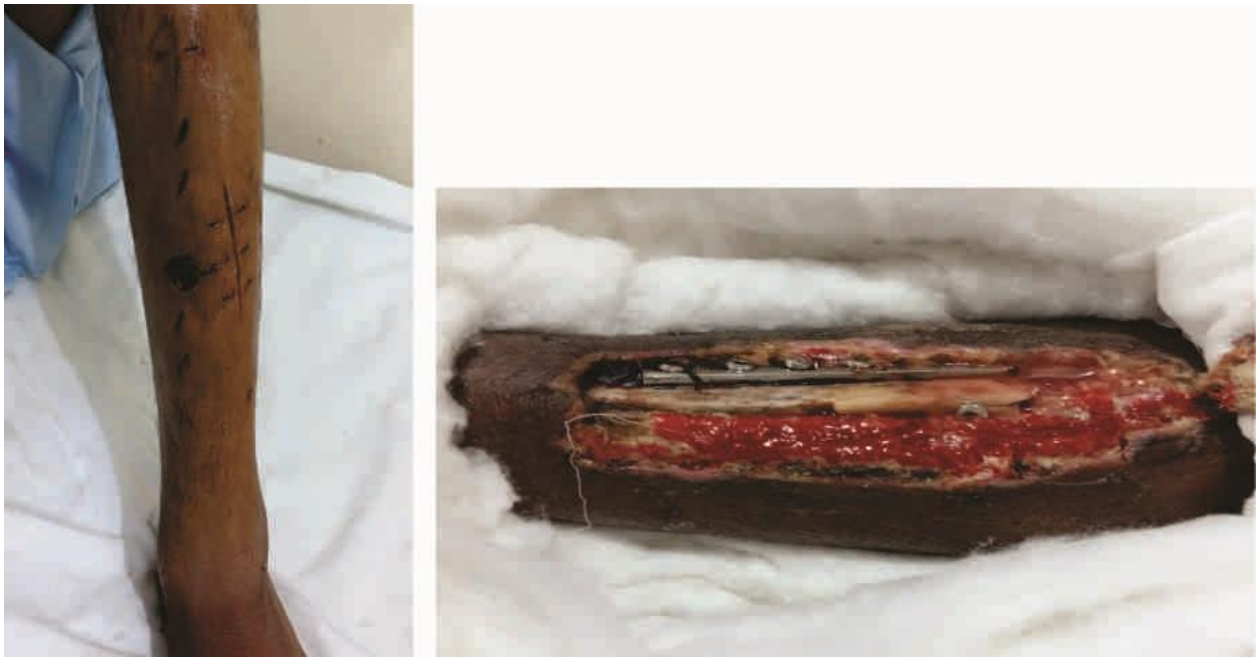

Figure 1: A-Healthy Flap after MIPO, B-Complete flap necrosis with implant exposure after ORIF.

On 12th post-operative week, radiological union was evident in all the patients (100%) of Group-B compared to 16 patients (80%) of Group-A, and this difference was statistically significant (p=.035) as shown in Table 8.

Table 6: Comparison of Wound Infection between the groups

			Wound Infection			
			Yes	**No**	**Total**	**P value**
Study Group	Group-A	Count	5	15	20	.077
		% Group	25.0%	75.0%	100.0%	
	Group-B	Count	1	19	20	
		%Group	5.0%	95.0%	100.0%	
Total		Count	6	34	40	
		% Total	15.0%	85.0%	100.0%	

Table 7: Comparison of Flap Necrosis between the groups

			Flap Necrosis			
			Yes	**No**	**Total**	**P value**
Study Group	Group-A	Count	6	14	20	.008
		% Group	30.0%	70.0%	100.0%	
	Group-B	Count	0	20	20	
		%Group	.0%	100.0%	100.0%	
Total		Count	6	34	40	
		% Total	15.0%	85.0%	100.0%	

Table 8: Comparison of Radiological Union between the groups

			Rad. Union			
			Yes	**No**	**Total**	**P value**
Study Group	Group-A	Count	16	4	20	.035
		% Group	80.0%	20.0%	100.0%	
	Group-B	Count	20	0	20	
		% Group	100.0%	.0%	100.0%	
Total		Count	36	4	40	
		% Total	90.0%	10.0%	100.0%	

DISCUSSION

In patients with distal tibial fractures, choosing the right surgical approach is of significant importance mainly due to poor soft tissue availability for implant coverage.[6,7] Conventional open reduction and internal fixation, itself damages the vascular supply of soft tissue envelope and promotes the risk of flap necrosis and implant exposure.[7] MIPO in comparison saves as much soft tissue as possible minimizing these complications.[10-13] In the present study, MIPO was associated with insignificantly longer operative time as compared to ORIF (73.90±5.15 vs. 70.75±6.10 minutes; p=.086). Our results match with those of Kiriwichian (2013)[20] who observed similar difference (73.0±15.2 vs. 70.7±9.3 minutes; p=1.00) in operative time between the two techniques. Zou et al. (2013)[19] however observed shorter operative time with MIPO (56 vs. 65 minutes; p<.001) as compared to ORIF. This conflict can be due to difference in surgical skills of the operating surgeon. MIPO was associated with significantly reduced post-operative pain (6.40±1.05 vs. 4.45±.95; p=.000) and mean length of hospital stay (4.35±1.04 vs. 2.70±.73 days; p=.000) as compared to ORIF. However, insignificant difference was reported by Cheng et al. (2011)[7] in terms of post-operative length of hospital stay between the two group (p=0.896). Frequency of flap necrosis (0% vs. 30%; p=.008) and wound Infection (5% vs. 25%; p=.077) was also lower with MIPO as compared to ORIF. We observed a 20% non-union rate with ORIF as compared to 0% with MIPO. Similar difference was observed previously by Zou et al. (2013)[19] in terms of infection (0% vs. 4.8%; p≤.05) and non-union (1.9% vs. 9.5%; p≤.05) between MIPO and ORIF.

Thus MIPO was found to be better than conventional ORIF in terms of post-operative pain, length of hospital stay, flap necrosis, wound infection and radiological union. Though it was associated with longer operative time.

A very important limitation of our study is that we only included closed and extra articular fractures and we only considered clinical and radiological outcome while function outcome was overlooked. Whether MIPO is equally safe and effective in open and articular fractures and is it also superior in terms of functional outcome is yet to be determined. Therefore such a study in future is highly recommended.

CONCLUSION

Though associated with insignificantly longer operative time, MIPO is associated with significantly decreased post-operative pain and length of hospital stay. MIPO offers the advantage of soft tissue protection thus minimizing infection and flap complications without any compromise in radiological healing of distal tibial fractures.

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