



A STUDY ON OUTCOME OF SURGICAL TREATMENT OF COMPOUND TIBIA FRACTURES BY INTRAMEDULLARY NAILING AFTER PRELIMINARY EXTERNAL FIXATION – SHORT TERM RETROSPECTIVE AND PROSPECTIVE ANALYSIS

Orthopaedics

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ABSTRACT

About 23% of all tibial fractures are open and most of these are Gustilo grade III. This study was done to evaluate the functional outcome of surgical treatment of compound tibia fractures by intramedullary nailing after preliminary external fixation as a short term retrospective and prospective analysis. From February 2012 to November 2013, a short term retrospective and prospective analysis was done in The Institute of Orthopedics & Traumatology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai. We did secondary interlocking nailing after preliminary external fixation for grade II to grade III B open tibia fractures in 31 patients for 31 fractures (Box 1 shows the inclusion and exclusion criteria). Out of these 31 patients, we lost follow-up of 4 patients and analyzed the results with the average follow-up of 12 months and minimum follow up of 5 months. Data was tabulated and analysed using Microsoft excel 2003. Functional outcome of secondary intra medullary nailing after external fixation was far better than in primary interlocking with primary closure in our institution. Although the superficial infection is there and there is delay in definitive procedure in the management of compound fractures, this can be improved by early surgical intervention, timely secondary procedures and accurate assessment of soft tissue injury. The final outcome is mainly depends on the age of the patient, time of admission since injury, type of injury.

KEYWORDS

Compound Tibia Fractures, Intramedullary Nailing, Prospective Study, India

INTRODUCTION

The tibial shaft is one of the most common sites of an open fracture. About 23% of all tibial fractures are open and most of these are Gustilo grade III¹. Most of them are due to road traffic accidents followed by fall, sports activities, blow / assault, gunshot injuries and other rare injuries like blasts.

Open injuries of tibia are associated with twice the amount of contamination than other open fractures. With better understanding of the importance of serial wound debridement and early soft tissue cover for open fracture good results have been achieved^{2,3}. Subcutaneous nature of the tibia makes the secondary reconstructive procedures difficult. But the advent of free flaps and advancement made in the micro-vascular techniques has led to reliable cover of traumatic musculocutaneous defects. Progressive refinements in the fixation of fractures and early bone grafting have resulted in a shorter time to union. The combined treatment of both the soft-tissue and skeletal components of severe open tibial fractures by dedicated teams commonly the orthopedic surgeon and plastic surgeon has further improved outcomes and reduced morbidity^{4,6}.

This study was done to evaluate the functional outcome of surgical treatment of compound tibia fractures by intramedullary nailing after preliminary external fixation as a short term retrospective and prospective analysis.

MATERIALS AND METHODS

From February 2012 to November 2013, a short term retrospective and prospective analysis was done in The Institute of Orthopedics & Traumatology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai. We did secondary interlocking nailing after preliminary external fixation for grade II to grade III B open tibia fractures in 31 patients for 31 fractures (Box 1 shows the inclusion and exclusion criteria). Out of these 31 patients, we lost follow-up of 4 patients and analyzed the results with the average follow-up of 12 months and minimum follow up of 5 months. Data was tabulated and analysed using Microsoft excel 2003.

Box 1: Inclusion and Exclusion Criteria

Inclusion criteria

- 1) Any Gustilo and Anderson Grade II, III A and III B compound tibial fractures presenting to our institute within 48 hours of injury.
- 2) Tscherne classification Grade I & 2.

Exclusion criteria:

- 1) Patient presenting more than 48 hours of injury

- 2) Grade I and Grade III C open tibial fractures.
- 3) Segmental fractures
- 4) Medical co-morbidities like Diabetes, Renal disease.
- 5) Patients treated by LRS, Plating, Ilizarov.
- 6) Severe soft tissue wound / infection elsewhere in the body.

RESULTS

The age of the patients ranged between 18 and 70 years with a male preponderance. Road Traffic Accidents was the predominant cause of injury. (2 wheeler Vs 6 wheeler was the most common). Around 23% of the patients had Associated Injuries. Nearly half (45%) of the patients were referred from other hospitals. Average time to admission after injury was 9 hours (Minimum of 1½ hours to 45 hours). In cases referred from outside Chennai average time to admission after injury was 15½ hours. Table 1 shows the sociodemographic characteristics of the study participants. We classified the open fractures of tibia according to the Gustilo and Anderson classification (Table 2). Around 40% of fractures were comminuted (Table 3). In our series, most of the fractures were in middle half of the tibia (Table 4). Table 5 shows the findings of the patients after management. Outcome was assessed with Karistorm-Olerud criteria (Table 6). Table 7 shows the complications.

Table 1: Sociodemographic Characteristics of the Study

S.No	Parameters	Categories	Frequency	Percentage
1	Age	21-30	15	48.39
		31-40	4	12.9
		41-50	8	25.8
		51-60	1	3.2
		61-70	3	9.7
2	Gender	Male	28	90.32
		Female	3	9.7
3	Mode of Injury	Road Traffic accidents	25	80.64
		Fall of heavy weight	2	6.4
		Industrial	1	3.2
		Assault	1	3.2
		Buffalo stampede	1	3.2
		Wood cutter injury	1	3.2
4	Place	Chennai	17	54.8
		Referred from outside Chennai	14	45.2
5	Side	Right	18	58.1
		Left	13	41.9
6	Associated Injuries	Head Injury	2	6.4

	Posterior Dislocation Hip	1	3.2
	Tibial plateau	1	3.2
	Metatarsal fracture	1	3.2
	Distal radius fracture	1	3.2

Table 2: Grading of the injuries

S.No	Grade	Frequency	Percentage
1	II	15	48.39
2	IIIA	12	38.7
3	IIIB	4	12.9
	Total	31	100

Table 3: Anatomy of the fracture

S.No	Anatomy of fracture	Frequency	Percentage
1	Transverse	8	25.8
2	Oblique	9	29.03
3	Comminuted	12	38.7
4	Segmental	1	3.2
	Total	31	100

Table 4: location of fracture

S.No	Location of fracture	Frequency	Percentage
1	A (Proximal 1/4)	1	3.2
2	B (Upper Middle 1/4)	14	45.2
3	C (Lower Middle 1/4)	11	35.5
4	D (Distal 1/4)	4	12.9
	Total	31	100

Table 5: Findings of the study after management

S.No	Type of Fracture	Observation
1	Type II Fractures	Union was observed in 11 of the 13 patients. The mean time to union was 27 weeks (range 20 weeks to 40 weeks). Dynamisation alone was done in one patient. Dynamisation followed by bone grafting was done in other patient. For infective non-union seen in one patient, posterolateral bone grafting was done and for non-union in other patient bone grafting was done. Results of these patients were awaited. No patients had undergone implant exit and LRS, Ilizarov after nailing
2	Type III A Fractures	Union was observed in 7 of the 10 patients. The mean time to union was 31 weeks (23-37 weeks). Prophylactic bone grafting was done in 1 patient. Aseptic nonunion was seen in one patient in which bone grafting was done. Infective non-union was seen in two patients, for which antibiotic exchange nailing has been planned.
3	Type III B Fractures	Two of the four type III B fractures united in average time of 47 weeks. Out of the 4 patients muscle flaps was done in 2 patients and fasciocutaneous flaps in 2 patients. 3 patients developed infection, for which appropriated antibiotics were given. One patient required wound debridement. Dynamisation was done in 1 patient. Union achieved in 1 infected patient following posterolateral bone grafting. Wound debridement and bone grafting was done in 1 patient and wound debridement, antibiotic coated exchange nailing with bone grafting in 1 patient. Results are awaited for the 2 patients.

Table 6: Outcome assessment with Karistorm-Olerud criteria

Grade	No. of Cases	Union	Dynamisat	Bone Gra I onft	Time (Wks)	Deep Infection	No n Union	Aseptic Non Union
II	13	11	2	3	27	1	1	1
IIIA	10	07	1	1	31	2	2	1
IIIB	04	02	1	3	47	3	2	-
Total	27	20	4	7	35 (Average)	6	5	2

Table 7: Complications

Time	Complication
Early	Alcoholic delirium developed in three patients. They were treated with I.V.Fluids and diazepam. Fasciocutaneous flap necrosis occurred in two patients. Superficial infection was seen in five patients. Split skin graft necrosis occurred in one Grade IIIA patient and one Grade IIIB patient which were allowed to granulate because of Superficial infection.
Late	Deep infection developed in six patients (Grade II-1, Grade IIIA – 2, Grade IIIB – 3) and all developed Non-union. Aseptic Non-union in two patients.
	Ankle stiffness in 1 patient and movement restriction was noted in 3 patients. Anterior knee pain was observed in 4 patients. Hyper pigmentation of flap was noted in 2 patients.

DISCUSSION

External skeletal fixation has become the established treatment for severe open tibial fractures despite the problems of malunion and pin-track sepsis associated with its use. In early years intramedullary nailing using unreamed unlocked nails had produced good results in type III open tibial fractures but the method did not adequately stabilize comminuted or segment fractures. Then reamed interlocking nailing have become the answer for this without increasing the rate of infection (J.F.Keatings et al, 1997)⁷. Recently treatment for open tibial fractures has evolved into a stage where primary nailing and immediate/early soft tissue cover became the prime method of treatment⁸.

In our hospital immediate wound debridement with or without external fixation and cast immobilization followed by elective interlocking nailing is the routine for grade I and grade II open tibial fracture. Wound debridement and External fixation followed by repeat wound debridement after 72 hours and elective delayed primary cover followed by internal fixation is the method of treatment for grade III fractures.

The timing of secondary intramedullary nailing in our study shows that Grade II open fractures underwent nailing with average of 11.8 days with the range of 6 -20 days. Grade III A fractures have undergone nailing with average of 30 days with the range of 14 – 48 days. For grade III B fractures nailing was done with the average of 32.5 days ranging from 28– 45 days. We have done 31 cases out of which we have lost the follow up of 4 patients. We have analyzed union, infection and functional outcome in the remaining 27 patients. In our study average time to union was 35 weeks (grade II – 27 weeks, grade IIIA – 31 weeks, grade IIIB- 47 wks) Grade II fractures results were comparable with the previous studies (Averaging 23.5 weeks in Court-Brown et al)⁹⁻¹¹. One required dynamisation and another required dynamisation and bone grafting. Grade III fractures union time is comparable with the previous studies. One Gr III A and one GrIII B patient had bone grafting. Dynamisation was done in one GrIII B patient.

Comparing with other studies our union rate was on par with other studies⁹⁻¹¹. Infection was noted in 6 patients, 5 were early infections (Gr II- 1, GrIII A-2 and GrIII B-3) and one (GrIII A) being late.. Three of them were (Gr II-1,GrIII A- 1, GrIII B-1) taken up for external fixation after twenty four hours and all of them were referred from places outside Chennai. Probably this delay in initiating the treatment could have been the reason for infection. Two of the three Gr III compound fractures developed infection following flap necrosis.

Comparing the other studies the infection rate following sequential nailing was comparable or better^{12,13}. Non-union developed in 7 patients out of which 2 being aseptic non-union. These two aseptic non-union were diagnosed to have delayed union for which bone grafting was advised but the patients were not willing to undergo any procedure at that time. Bone grafting was done in these two patients later after a trial of dynamisation.

In our study nonunion rate was similar to the external fixation group but morbidity associated with external fixator was there. On comparing with other studies, high rate of nonunion was due to delay in secondary intervention¹⁴. In 5 out of the 7 cases secondary intervention has been done and results are awaited . Though there is high rate of non-union, functional outcome assessment by Karlstrom & Olerud

score was excellent to satisfactory in 25 patients and poor in only two patients. Anterior knee pain was noticed in four patients but all of them were done through medial Para-patellar approach.

CONCLUSION

Primary interlocking and primary closure produces excellent results in Grl and GrII fractures as compared to any other modality of treatment. Primary interlocking nailing and primary closure as a single staged procedure required less number of secondary procedures as compared to external fixation and secondary nailing.

Due to various reasons like delayed referral, heavy contamination with road traffic accidents, emergence of multi resistant organisms, the compound wound requires thorough wound debridement, multiple liberal and repetitive wound wash with skeletal stabilization by external fixation. Functional outcome of secondary intra medullary nailing after external fixation was far better than in primary interlocking with primary closure in our institution.

Although the superficial infection is there and there is delay in definitive procedure in the management of compound fractures, this can be improved by early surgical intervention, timely secondary procedures and accurate assessment of soft tissue injury.

The final outcome is mainly depends on the age of the patient, time of admission since injury, type of injury. Good result is favoured by the debridement technique, appropriate selection of timing for external fixation and intramedullary nailing. Early intervention and aggressive soft tissue management in open tibial fractures result in decreased number of procedures, minimal hospital stay and early return to their daily routine.

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