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Reamed Interlocking Nailing in Aseptic Non-Union of Tibia, A Prospective Study

KEYWORDS: Tibia, Non-union, Open Nailing, Fibulectomy.

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ABSTRACT **Objective**: To study the clinical and radiological outcome of reamed interlocking nailing in aseptic non-union of tibia

Materials and Method: We Prospectively evaluated 32 patients who had aseptic non-union of tibia between the period December 2011 to January 2015 at govt. medical college Kozhikode. All of the patients undergone reamed interlocking nailing after obtaining informed consent.

Result: 29 non-unions(90.6%) went on for radiological union within a period of 8 months with an average time of 5.7 months from the time of nailing with most of them having excellent or good functional results.

Conclusion: In the absence bone loss reamed interlocking nailing is an excellent method of treatment in aseptic tibial non-union.

Introduction

Tibia, being a subcutaneous bone, is fairly commonly fractured. Because the soft tissue coverage is minimal, especially at the distal third, non union following a tibial fracture is not rare[1].The surgical treatment of non-union has advanced from insertion of seton and application of caustics or other irritants to stimulate callus formation performed in 19th century[2] to the modern treatment of bone grafting, fibulectomy, external fixation, plating and intramedullary nailing. Since the advent of reamed interlocking nailing for the treatment of acute tibial fractures it is widely being used for the treatment of non-union as well[3]. Cited advantage of this implant is that it is a load sharing device and because of that patients are allowed at least partial weight bearing[1,3] during the healing process, which is a significant advantage in those unfortunate patients who are incapacitated by the non-union. Other advantages are stable fixation, good rotational control and adequate alignment of the limb[3].Reaming allows to put a larger diameter nail which gives more stability to the non-union site and also reaming materials acts as a bone graft, all of which are cited as the cause for high union rate following this modality of treatment[1,3].

Materials and Method

Study group were selected from patients who came for treatment of non-union of tibia at govt medical college, Kozhikode between December 2011 and January 2015.

Only those patients who had passed at least 4 months since the injury and did not show progressive evidence of bridging callus in AP and Lateral X-rays and the non-union site is between 4 cm below the tibial tubercle and 5 cm above the tibial plafond are included in the study. Infected non-union, gap non-union of more than 2 cm, non-union following a pathological fracture and non-union in patients less than 18 years are excluded from the study.

We had a total of 32 patients who fulfilled these criteria. Average age of the patients was 41 years with a range of 19 years to 60 years. 24 patients (75%) were males and in 17 patients (53%) right tibia is involved. Mean time from original injury to reamed interlocking is 7.3 months. Prior to the reamed nailing 13(40.6%) patients were under the treatment of traditional bone setter, 8 patients(25%) were treated with plaster cast, 4 patients(12.5%) had undergone intramedullary nailing, 6 patients (18.75%) had plating and one patient had undergone external fixation application which was later changed to a plaster cast. In 20(62.5%) patients fibula is either intact or united prematurely.16(50%) patients had non union of lower third of tibia,10(31.25%) had upper third non union and 6(18.75%) had middle third non-union.

Table1Details of patients included in the study

Total Patients	Age range	Sex	Side	Fibula	Level of Nonunion	Prior Treatment
32	19-60	24 males	Right 17	Intact/ United 20	Upper 1/3rd 10	TB 13 C 8
		8 Females	Left 15	Non-union12	Mid 1/3rd6	N 4 P 6 E 1
					Lower 1/3rd 16	

TB=Traditional Bone Setter, C=Plaster Cast, N=Intramedullary Nail, P=Plate and Screws, E=External Fixator

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Figure 1 Preop Deformity

Figure 2 Preop Xray

After proper pre anaesthetic evaluation and informed consent all patients had undergone open nailing under appropriate anaesthesia as decided by the anaesthetist. In those patients who already had implants in situ, they were removed at the time of surgery using appropriate approach before the insertion of nail. In all cases nail was inserted through patellar tendon splitting incision and all were dynamically locked. Fibular osteotomy was done through a separate incision if it was found intact or prematurely united. All cases undergone iliac bone grafting. Perioperative antibiotics were used, 1st dose given half hour before incision and further two more doses repeated at approximately 12 hours interval. Sutures were removed at 10th day. AP and Lateral X Rays of the leg were taken before suture removal. Follow up examination was done at monthly interval. During these visits patients are evaluated clinically and radiologically. Patients were kept non weight bearing crutch walking during 1st month. After that progressive weight bearing was allowed as per the radiological signs of healing. Unprotected weight bearing was allowed only after fracture was united radiologically. Radiological union was defined as presence of bridging callus in three of the four cortices in AP and Lateral radiograph[4].Functional results were graded into excellent, good or fair as per Johnson and Marder criteria[1].

Result

29(90.63%) patients attained radiological union at an average time of 5.7 months with a range of 3 months to 8 months. Three non-unions failed to unite due to infection. Two were early infection within 6 weeks of nailing and one at two months time. Initially we treated them with debridement and antibiotics but failed to control infection. We had to remove the implant and the patients required ilizarov external fixator for a successful outcome.

Both the patients who had early surgical infection had undergone prior surgery for their fracture, one with a plate and the other with an external fixator. There was one more infection apart from these three cases, but we could attain union with retention of nail.

Table 2 Results of the treatment

Functional Results	Radiological Union	Anatomical alignment
Excellent 19 Patients	29 Patients at average of 5.7 months	Anatomical Alignment 27 patients
Good 8 patients	Failure 3 patients(Infected non-union)	Malunion 2 patients
Fair 2 Patients		

Functionally, as per Johnson and Marder grading[1], 19 (59.38%) patients had excellent result,8 (25%) patients had good result. Two patients had malunion of around 15 degrees valgus at upper third tibia; both of them are graded as fair result. Three failures were excluded from the functional assessment.93% of patients who attained successful union of their non-union had either excellent or good result functionally.

Figure 3 Bone alignment at union

Figure 4 Functional assessment Knee flexion

Figure 5 Functional Assessment Ankle Dorsiflexion

Figure 6 Functional Assessment Ankle Plantar Flexion

Discussion

As seen in our study reamed interlocking nailing results in high union rate in aseptic tibial non-union. This is previously reported in other studies[1, 3-5].

Table 3 Comparison of our results with other studies

Study	Union Rate(%)	Time for radiological Union	Number of patients in anatomical alignment of union(%)
Johnson EE[1]	100	Not Available	95
Mc Laren[12]	92.9	8 Months	Not Available
Kempf et al.[6]	94.8	Not Available	82.1
Mayo KA[3]	93	9 months	Not Available
Rosson JW[4]	91.7	9 months	100
Sledge SL et al.[5]	96	7 months	94.1
Our series	90.63	5.7 months	93.1

All of our cases we did open nailing with addition of iliac crest bone grafting. Though closed nailing is possible in the treatment of non union as reported by some of the authors[6], it is technically demanding to open the sclerotic medullary canal. Even in open nailing opening the medullary canal requires sharp heavy instruments like bone awl and mallet. There may be several reasons for high union rate following reamed nailing. One of the major advantage of reamed nailing is that the reaming products will act as a bone graft[1,3,5], but in open nailing that advantage is probably lost .Anyhow in our series we used cancellous auto graft in all of our patients. Other reasons quoted are intramedullary reaming increases periosteal blood supply[7,8]and after reaming we can introduce thicker and stiffer nail which gives more stability to the non-union site[9]. None of the patients required plaster cast following surgery and all of them has progressed at the least to partial weight bearing within two months from surgery. Some of the previous authors have allowed full weight bearing as per the tolerance of the patients irrespective of the radiological status of non union.[5] Compared to the plating this is a significant advantage. Even in open nailing incision required to expose the non union is much less compared to plating and periosteal stripping is minimal. Our method of treatment does not result in further loss of range of

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movement. Stress shielding, which is a major drawback in plating which frequently results in refracture after implant removal,[10] is also not seen here. We believe the improved functional results seen in our study as well as in other studies may be due to early mobilisation.

Anatomical alignment of the limb following open nailing is excellent[1].Once we osteotomized the intact/prematurely united fibula correction of the deformity is easy.

We had only two valgus malunion, both of them were at the upper third tibial non-union. We believe it is due to our failure to put the nail more laterally than the conventional method.[11] Though open nailing has some disadvantage regarding fracture healing and infection, as far as the deformity correction is considered it has significant advantage over closed nailing, which is technically demanding and results in eccentric reaming with the result of a nail in an eccentric position.

In our series we had significant number of patients whose fibula was intact or prematurely united, like many authors we also believe that intact fibula is a cause for nonunion[13, 14]. We routinely osteotomized intact/united fibula before nailing. This probably results in greater contact at the non-union site.[14] but some of the authors have raised the concern of making the non-union site more unstable.[15] But we did not found that much of a concern. However all of our fibular osteotomy was at a site distant from the non-union area.

Conclusion

Reamed nailing of aseptic tibial non-union results in high union rates with excellent or good functional results in vast majority of patients. In upper third non union we should be careful in getting a lateral entry for nailing to prevent malunion.

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