

Early Outcome of Reamed Interlocking Nail for Non-Union of Tibia

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Summary

Aseptic non-union is a major problem following complicated fracture tibia, which carries significant morbidity and prolonged course of treatment. Plate fixation and autogenous bone grafting has been established as a method of treatment. However the risk of infection, implant failure and donor site morbidity are high. We reviewed twelve consecutive cases of established non-union tibia treated by closed reamed interlocking nail in our centre. All patients had clinical and radiological union at three months. Three patients were complicated with infection and one required removal of implant and re-reaming to eradicate infection. Reamed interlocking nailing is an alternative treatment for selected non-union of fracture tibia with promising results.

Key Words: Aseptic non-union, Tibia, Reamed interlocking nail

Introduction

Non-union of tibial fractures is a relatively common problem and its incidence is higher than in other long bone fractures¹. Most patients with this problem have been incapacitated for between six to twelve months². Furthermore scarring from previous surgery and generalised osteopenia secondary to prolonged immobilisation are important factors to be considered in further surgical management³.

Reamed intramedullary nailing offers the advantages of stable fixation, realignment of the intramedullary canal, and dynamic compression at the non-union site by early weight bearing. Success rates as high as 94-100% have been reported in some series^{3,4}. However, generalized intra-medullary osteomyelitis following reaming is the most worrying complication.

We conducted this study to determine the outcome of the reamed intra-medullary procedure in aseptic non-union tibia, in our setting.

Materials and Methods

Between January 2001 and December 2004, twelve consecutive patients with aseptic non-union of the tibia were treated in our centre with the reamed interlocking technique. Their average age was 38 years (range 17 to 70 years). There were nine males and three females patients. The average follow-up was eight months (range between 6 to 36 months).

The initial fracture was closed in seven patients and open in five patients. Eight fractures were in the lower third area of the meta-diaphyseal region and the other four were in the mid-shaft. The primary treatment had been with external fixator in all open fractures, plating in two and plaster cast in five patients. The patients had to undergo an average of three surgical procedures prior to non-union treatment. Two patients underwent bone grafting for bone loss but failed to unite. There were ten atrophic and two hypertrophic non-unions. The average interval between initial fracture and treatment of non-union was eight months (range 6-14 months).

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The erythrocyte sedimentation rate and the C-reactive protein level were within normal limits in all patients prior to surgical intervention. Closed intramedullary technique was attempted in all cases, except in two in whom the open procedure was done to achieve a better alignment and to facilitate removal of plate. Fibular osteotomy was essential and was performed at the start of the procedure via a separate incision in nine cases. The proximal entry of the guide wire was performed through a patella tendon splitting incision. A non-ball tip guide wire was introduced until the non-union area, and the fracture alignment was then confirmed by image intensifier. The reamer was carefully introduced to beyond the fibrous union, ensuring the disruption of the fibrous tissue to facilitate the further advancement of the guide wire. This procedure was a crucial part of the surgery to ensure the guide wire could be passed across non-union sites. Reaming of the intramedullary canal was performed in 0.5mm increments to the largest diameter. The nails were locked distally and proximally with two screws for stability. Partial weight bearing was started immediately in all cases regardless of static or dynamic locking pattern

Results

Union was defined as radiological evidence of solid bridging callus formation and painless limb on full weight bearing. All non-union of tibial fractures healed at average of 16 weeks (range 12-30 weeks). Dynamisation of the distal locking screw was done in one patient at 16 weeks, and the fracture healed at 30 weeks.

Infection developed in three patients; two were in grade III open fracture and another one in a patient with infected non-union following plate fixation. Two had acute infection of the wound postoperatively which resolved after irrigation and administration of antibiotics. Low-grade infection with chronic discharge developed in one patient; however the fracture united at four months. Removal of implant and re-reaming with prolonged antibiotic treatment was done to eradicate the infections.

Discussion

Several surgical treatments have been advocated for the treatment of non-union of fracture of the tibia. These

include compression plating, fibular osteotomy, cancellous bone grafting, illizarov method and intramedullary nailing. Treatment by internal fixation with plate and bone graft, which was widely recommended, sometimes carries a higher risk of failure particularly in disuse osteoporosis. Furthermore, open surgery in previously scarred tissue carries a higher risk of infection and donor site morbidity.

Many authors with successful strategies have advocated the use of intramedullary nailing for non-union of the tibia^{3,4,5,6}. Interlocking intramedullary nailing with reaming offers the advantages of stable fixation, adequate alignment, minimum shortening, good rotational control, early weight bearing and high rate of union. The union rates have been reported as high as 94 to 100 percent with this method^{3,4,5,6}.

The periosteal blood supply is left undisturbed in closed reaming. Furthermore, reaming will induce better periosteal circulation and provide stimulus by activation of osteogenic material in the fibrous nonunion^{7,8}. We highlighted a case with a one cm gap who had complete healing without bone grafting to support the above theory. (Case 1) Fibular osteotomy should be performed routinely to facilitate anatomical alignment, and load transfer from the fibula to the tibia^{4,5,6}. The fibula was osteotomised in nine of the cases; in the others a defect or a non-union was already existing at the fibula as result of previous operative procedures.

Intramedullary nailing with reaming, however is not technically simple. The procedure requires the use of specialized instruments and techniques, including fluoroscopy image assistance. The risk with intramedullary nailing is the threat of infection, which is higher in cases with open fracture treated previously with external fixator and previous infection^{4,5}. Thorough evaluation before surgery and longer antibiotic cover in these cases will reduce the infection risk. Low-grade infection also did not hinder union in our series provided this was well controlled by antibiotics and stable fixation.

Conclusion

Reamed intramedullary nailing is an effective treatment for aseptic non-union. This method achieved high union rate with minimal early and late complication.

Fig. 1: Series of Patients Tibial Non-union Treated with Reamed Interlocking Nail

Age	Sex	Initial injury	Previous treatment	Number of surgery	Duration (months)	Site	Type	Surgery	Duration union / weight bearing (weeks)	Complication
49	M	Open Grade IIIB	EF	4	14	M	Atrophic	FO Closed	16	Infection - Removal nail
53	M	Closed - Osteomyelitis	Plate & EF	3	12	M	Hyper	FO Closed	8	Local infection - antibiotics
20	M	Open Grade IIIB	EF - Cast	3	10	M	Atrophic	FO Closed	8	
19	M	Open Grade IIIB	EF - Bone graft - Cast	3	9	M	Hyper	FO Closed	12	
70	F	Closed	Cast	0	6	L	Atrophic	FO Closed	12	
17	F	Closed	Neglected	0	6	L	Atrophic	FO Open	10	
19	M	Open Grade II	EF- Cast	1	6	L	Atrophic	FO Closed	16	Infection - removal distal screw
65	M	Closed	Cast	0	5	L	Atrophic	FO Closed	12	
56	M	Closed	Cast	0	6	L	Atrophic	Closed	9	
25	F	Closed	Cast	0	7	L	Atrophic	FO Closed	8	
17	M	Open Grade I	EF - Cast	1	7	L	Atrophic	Closed	10	
45	M	Closed	Plate	1	6	L	Atrophic	Open	12	

FO - Fibular osteotomy
 M: Middle third
 EF: External fixator
 L: Lower third

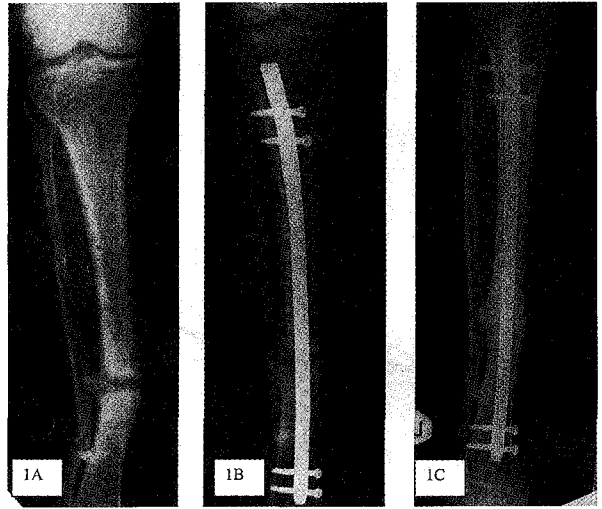


Fig 1: A case of closed fracture tibia treated with plate and screw complicated with acute infection and finally non-union. Radiograph of closed reamed interlocking nail with fibular osteotomy at three months showed bridging of callus (B) and six months later complete osseous transformation of fibrous fracture gap. (C)

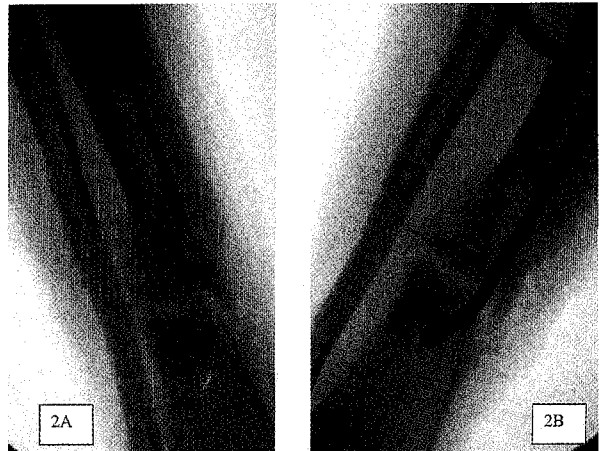


Fig 2: Surgical technique Image intensifier radiograph shows non-ball-tip guide wire introduced to the non-union site. The fibrous tissue was perforated with the reamer until distal the medullary canal.

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