Comminuted tibial shaft fractures treated by closed intramedullary nailing and functional cast bracing

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Abstract

Sixteen patients with comminuted tibial shaft fractures were treated by closed unlocked Kuntscher nailing and functional cast bracing. The mean follow-up period was 9.31 months. The average time required for fracture healing was 13.56 weeks. There was one delayed union. Shortening of more than 1 cm was present in 3 cases. Two patients had more than 10 degree of limitation of knee and ankle movement.

Keywords: Comminuted tibial shaft fracture; closed intramedullary nailing; functional cast bracing.

Introduction

Comminuted tibial shaft fractures have been treated in the past by prolonged traction, open nailing and circlage wiring, and open reduction and internal fixation with plates and screws. With its introduction, the locking tibial nail has become the most commonly used form of treatment at most centres. However, locked nailing significantly increases the radiation exposure to the surgeon's hand and is more difficult to perform and requires prolonged operative time. Alternatively, such fractures may be treated by closed unlocked nailing followed by mobilization of the patient in a functional cast brace.

However, very few studies have been published reporting on the results of this method of treatment. The present study was carried out to assess the usefulness of closed intramedullary unlocked nailing and cast bracing for comminuted tibial shaft fractures.

materials and methods

Sixteen patients with comminuted tibial shaft fractures were treated by closed kuntscher nailing and functional cast bracing.

There were 13 male patients and 3 female patients with an average age of 35.81 years (Range, 20-60 years); 37.50% of these patients were in the fourth decade of life. The right tibia was fractured in 7 cases and the left in 9 cases. Eleven patients were involved in motor vehicle collision, 68.75 percent of the patients had associated injuries (Table I). The comminution of the tibial fracture was graded according to Winquist's classification. In the present study we include only Grade I and Grade II comminuted tibial shaft fractures (Table II).

Table I: Associated Injury

Associated injury	*Number*
Head Injury	3
Facial Injury	3
Fracture forearm bone/bones	2
Fracture Humerus	1
Chest Injury	1
Blunt Injury abdomen	1
Fracture Metatarsal	1
Fracture clavicle	1
Fracture meta carpal	1

Table II: Grade of Comminution

Grade of Comminution	*No. of Cases*
I	5
II	11
Total	16

The upper third of the tibia was fractured in 2 cases; the middle third was involved in 7 cases, and the lower third was also involved in 7 cases. All the patients were operated upon at the earliest possible time depending upon their general condition; it was possible to nail all the fractures within the 3 weeks of injury. Closed unlocked nailing without over-reaming was performed in the usual way with the patient in the supine position, with 400 flexion at the hip and 900 flexion at the knee. Post operatively, above knee plaster of paris posterior slab was given in all patients, stitches removed on the 12th day and non weight bearing exercise was started till 900 flexion at the knee was achieved. At this stage, a pateller tendon bearing cast with ankle hinge was applied and progressive weight bearing was started. The cast brace was discarded after 10-12 weeks or longer depending on the progress of fracture healing. The patients were followed for an average of 9.3 months with a range of 4 months to 15 months.

Operative Procedure

First we estimated the appropriate length of nail by measuring the distance from the intercondylar area of the head of the tibia to the lower articular facet on the malleolar side on the intact leg. Subtracted 3-4 cm. Then 5-6 cm long incision was given, one finger breadth medial, to the most prominent part of the tibial tuberosity. The cortex of tibia was perforated with an awl and guide wire was inserted. The fracture was reduced by manipulation and traction. The position of guide wire was checked by taking per operative X-ray then Kuntscher nail of appropriate size and length was inserted into medullary canal into distal fragment. Check X-ray done and the wound stitche and above knee posterior plaster of Paris slab was given.

Follow-up

Patient was seen every fortnightly as an out patient, on each time cast brace was checked for its fitting and looseness and it was changed if required. Cast brace was continued till clinical and radiological signs of union of fractures. Full weight bearing was started after complete radiological union.

Fig. 2: Pre-operative X-ray of right leg lateral and AP view, showing comminuted fracture both bone middle 1/3rd.

Fig. 2: Immediate post-operative X-ray showing fixation of tibial fracture by kuntscher nail with increase in comminution.

Fig. 3: X-ray after 11 months follow-up showing complete bony union.

Fig. 4: Clinical photograph taken 2 days after application of functional cast brace showing partial weight bearing.

Fig. 5: Clinical photograph showing full unsupported weight bearing.

Results

The patients were followed-up for an average period of 9.31 months (4-15 months). We estimated the time required for union of the fracture and looked for post-operative complication. We think the fracture united when the callus matured and the fracture line was obliterated in at least three quarter of the bone circumference. The average healing time in simple fracture was 12.25 weeks. In Grade-I compound fractures, the average duration of healing was 14.4 weeks, and in Grade-II compound fractures the average duration of healing was 17.5 weeks. The average duration of healing in Grade-I comminuted fractures was 11.6 weeks and in Grade-II comminution was 14.45 weeks. The overall functional results were excellent to good in 75% cases and moderate results in 25% cases.

Complication

In our series, 3 cases got superficial infection, it was cured by dressing and antibiotic in a short period of time; 3 cases complained of pain around knee; 2 cases developed limitation of knee and ankle movement; shortening more than 1 cm was noticed in 3 cases. In one case Grade-II comminution was converted into Grade-III comminution after nailing. Mild oedema of the ankle was the commonest complication due to functional cast brace, 2 cases developed plaster sore. In one case, ankle hinge got broken and one case got delayed union.

Discussion

Closed intramedullary nailing is the most commonly employed form of treatment for tibial shaft fractures. In recent years, locked nailing is being used at most trauma centers for fixation of comminuted tibial shaft fractures because it offers several technical advantages. It maintains satisfactory rotational alignment and limb length, the duration of hospital stay is shortened, and no supplementary external splintage is necessary. Moreover, fracture healing can be stimulated by dynamizing the locked nail. However, there are certain disadvantages associated with this technique. It is an expensive and technically more demanding procedure, which requires considerable surgical expertise for the distal locking, and the operative time is prolonged with a resultant higher risk of infection. It is not possible to correct any malrotation or limb length discrepancy that has not been taken care of intraoperatively. Most importantly, the current techniques of distal locking lead to a significantly higher radiation exposure to the operating team and especially to the surgeon's hand. Moreover, a second operation maybe required to remove the static locking screw before weight bearing is begun.

Also closed unlocked nailing and functional cast bracing can be a useful alternative, at least until improved locking techniques are available. Unlocked nailing is less expensive, requires a shorter operating period, and most surgeons are familiar with the technique. Rotational instability is uncommon despite a smaller diameter nail, presumably because of the intact musculoperiosteal sleeve and relatively undisturbed fracture haematoma. Any residual rotational malalignment and limb length discrepancy can be checked and corrected postoperatively. The cast brace provides stability, maintains alignment, and permits movements of the knee and ankle joints. At the same time it stimulates bone healing by protected weight bearing in a nonrigid environment. Most patients readily accept the cast brace splintage.

Our results with closed intramedullary Kuntscher nailing and cast bracing are comparable with those in the most series with locked nailing and better than those with other less commonly used methods such as traction treatment and compression plating. The only disadvantage of unlocked nailing is the slightly longer period of hospitalization. However, the simplicity of this type of treatment and the satisfactory outcome in most instances outweigh the disadvantage.

References

1. Alum, M. *et al.* (1962): Medullary nailing for fracture of the shaft of the tibia. J.B.J.S. Vol. 44-B., p. 328-339.

2. Anderson L.D. (1965): Compression plate fixation and the effect of different types of internal fixation on fracture healing. J.B.J.S. Vol. 47-A, p. 191-208.

3. Austin R.T. (1981): The Sarminto tibal plaster - a prospective study of 145 fractures. Injury. Vol. 13, p. 10.

4. Baur C.H., Edwards, P. (1965): Fracture of the shaft of the tibia - incidence of complication as a function of age and sex. Acta Orthop. Scandinav. No. 36, p. 95-103.

5. Bone L.B., Johnson K.D. (1986): Treatment of tibial fracture by reaming and intramedullary nailing J.B.J.S. (Am.), Vol. 68 A, p. 877-87.

6. Brown P.W., Urban J.G. (1969): Early weight bearing treatment of open fractures of tibia. J.B.J.S., Vol. 51-A, p. 59-15.

7. Carpenter, B., Richmond (1966): Management of fractures of the shaft of the tibia and fibula. J.B.J.S. Vol. 48-A, p. 1640-1646.

8. Court Brown C.M. (1990): Closed Intra-medullary tibial nailing. J.B.J.S., Vol. 72B No. 4, p. 605.

9. Elli H. (1958): Disabilities after tibial shaft fractures, J.B.J.S. Vol. 40-B, p. 190-197.

10. Ellis H. (1958): The speed of healing after fractures of tibial shaft. J.B.J.S., Vol. 40-B, p. 42-46.

11. Graf P., Babin S.R., Vidal P., Schvinqt E. (1984): Nailing for alignment combined with the Sarmiento method. Rev Chrir Orthop (France) Vol. 70 (6), p. 457-64.

12. Hassenhuttl K. (1981): The treatment of unstable fractures of the tibia and fibula with flexible medullary wires. J.B.J.S., Vol. 63-A, p. 921-931.

13. Michael W. Chapman (1980): The use of immediate internal fixation in open fractures. O.C.N.A. Vol. 11, No. 3, p. 579.

14. Merianos P., Cambouridis P., Smyrnis P. (1985): The treatment of 143 tibial shaft fracture By Enders nailing and early weight bearing. J.B.J.S., Vol. 67-B, p. 576.

15. Nath R., Gupta A.K. (1994): Evaluation of functional cast bracing for diaphysial fracture of long bones in lower limb. Indian Journal of Orthop., Vol. 28, p. 21-25.

16. Nicoll E.A., (1964): Fractures of the tibial shaft: A survey of 705 cases. J.B.J.S. Vol. 46-B, p. 373.

17. Orso, C.A., Calabrese *et al.* (1990): Bifocal fractures of the leg. Ann., Ital. Chir (Italy) Vol. 61 (3), p. 293-5.

18. Pagie, Whittle M.D. *et al.* (1992): Treatment of open fractures of tibial shaft with the use of interlocking nailing without reaming. J.B.J.S. Vol. 74-A, p. 1162.

19. Renaldi E., Marenghi P., Carradi M., (1987): The treatment of tibial fractures by Elastic Nailing and functional plaster cast. Ital. J. Orthop., Traumatol., Vol. 13, p. 173.

20. Ruedi T, Webb JK, and Allgower M. (1976): Experience with the dynamic compression plate (D.C.P.) in 418 recent fractures of the tibial shaft. Injury 7, p. 252.

21. Sarmiento A. (1970): A functional below knee brace for tibial fractures. J.B.J.S., (Am.) Vol. 52-A, p. 295-311.

22. Sarmiento A., Larry M. *et al.* (1989): Tibial shaft fractures treated with functional braces. J.B.J.S. Vol. 71-B, No. 4, p. 602.

23. Sarmiento A. (1967): A functional below knee cast for tibial fracture J.B.J.S., (Am.), Vol. 49A, p. 855-75.

24. Sarmiento A., Sobol P.A., Sew Hoy, *et al.*, (1984): Prefabricated functional brace for the treatment of fracture of the tibial diaphysis. J.B.J.S., Vol. 66-A, p. 1328-39.

25. Sarmiento A. (1974): Fracture braing of tibial fractures. Clin. Orthop. No. 105, p. 202-219.

26. Sharma J.S., Gupta S.P.: Comminuted femoral shaft fracture treated by closed intramedullary nailing and functional cast bracing. The Journal of Trauma, Vol. 34, No. 6, p. 786.

27. Smith J.E.M. (1974): Results of early and delayed internal fixation for tibial shaft fractures. J.B.J.S., Vol. 56-B, p. 469-477.

28. Weissman S.L., Herold H.Z. *et al.* (1966): Fractures of the middle two thirds of the tibial shaft, J.B.J.S. Vol. 48-A, p. 257-267.

29. Zych G.A., Zagorski J.B., Latta L.L., Mc Collough
NC. (1987a): Modern concepts in functional
fracture bracing - lower limb, chapter 25. AAOS, Chicago (AAOS instructional course lecture), Vol. XXXVI.