Surgery Journal 3 (4): 74-77, 2008
ISSN: 1816-3211

Undreamed Tibial Nailing: A Goog Choice in Tibial Shaft Fractures

J. Soleimanpour, J. Ganjpour, M.A. Mohseni, A.R. Sadeghpour, A. Moradi and A. Arzrumchilar
Department of Orthopaedics, Faculty of Medicine, Shohada Hospital,
Tabriz Universitey of Medical Science, Tabriz, Iran

Abstract: Tibia is the most frequently fractured long bone in the body. Intramedullary nails have become the popular choice of implant in the treatment of tibial shaft fractures. Most orthopeadic surgeons are of the opinion that the use of unreamed nailing can be recommended in tibial fractures, especially for open fractures and fractures with severe soft tissue damage. Our aim was to achieve a base-line data about the general consequences of Unreamed Tibial Nailing (UTN). From March 2001 to March 2003,67 patients with tibial fractures who were admitted to emergency ward of Shohada hospital, Tabriz and were operated with UTN method during the following 48 h after the injury were enrolled into the cross sectional study. Demographic data, type of fracture, surgical complications (such as neurological deficits, surgical site infection, implant failure, delayed union, non-union and malunion) were recorded during hospitalization and 9 months follow-up. The mean age was 38.3±14.1 years and 82% of the participants were male. Open fractures accounted for almost two third of fractures (almost 30% of type 3a Gustillo-Anderson). Hospitalization time was less than a week in 77.6%. Only 1 non-union and 3 delayed-unions were recorded. There was no case of mal-union, infection and neurological deficits. Five patients had to undergo a second surgery (four cases due to failure of distal locking screws, one due to nail breakage). The results of this study show that the UTN technique is effective and safe in high energy tibial fractures due to high rates of union and low rates of complications.

Key words: Tibal fracture, undreamed tibial nailing, bone, injury, surgical

INTRODUCTION

Tibia is one of the most common bones to sustain open injury because of its superficial nature. Tibial shaft fractures are often the result of high-speed trauma but can also be insidious in onset, such as stress fractures in active individuals (Court-Brown and McBirnie, 1995). Intramedullary nailing is widely accepted as "a treatment of choice" for the fixation of unstable tibial shaft fractures. Nail insertion successfully stabilizes and aligns the tibial shaft. In fact, several clinical series have reported union rates of greater than 95% and excellent alignment (Littenberg *et al*., 1998). Unfortunately, consensus on the optimal procedure of bone stabilization, mainly the use of intramedullary nail with or without reaming for tibial fractures has still not been reached (Forster *et al*., 2005).

The different alternatives have their own pros and cons and accurate comparison with the various treatment options reported in the literature is open to questions. Laboratory studies indicate that after insertion of smaller-diameter nails without reaming there is a more rapid revascularization of the intramedullary blood supply, which may lead to earlier union compared with reamed nailing. Avoiding reaming may also lead to fewer embolic phenomena, which are thought to be important in patients with associated pulmonary injuries. Omitting reaming also makes the operative procedure quicker and easier. Reaming disrupts the intramedullary blood flow and the insertion of a tight-fitting nail delays revascularization of the endosteal canal (Joshi *et al*., 2004). Most orthopeadic surgeons are of the opinion that the use of unreamed nailing can be recommended in tibial fractures, especially for open fractures and fractures with severe soft tissue damage (Runkel *et al*., 1994; Gopinathan, 2005).

To achieve a base-line data about the general consequences of Unreamed Tibial Nailing (UTN), we conducted a cross sectional study on 67 patients with tibial fractures who underwent surgery using UTN method.

MATERIALS AND METHODS

From March 2001 to March 2003,67 patients with tibial fractures who were admitted to emergency ward of Shohada hospital, Tabriz and were operated with UTN method during the following 48 h after the injury were

Corresponding Author: J. Soleimanpour, Department of Orthopaedics, Faculty of Medicine, Shohada Hospital,
Tabriz Universitey of Medical Science, Tabriz, Iran

enrolled into the study. All cases suffered from open or closed tibial fracture and were indicated by the orthopaedic surgeons for interlocking intramedullary nailing without reaming. The nail was 9 mm in diameter in all cases.

Demographic data, type of fracture (classified according to Gustilo and Anderson) and surgical outcomes were recorded by the authors at the time of surgery and during the course of 9 months follow-up. The classic classification for open fractures was described by Gustilo as follows:

Type I: The wound is clean and is shorter than 1 cm.

Type II: The wound is longer than 1 cm and does not have extensive soft tissue damage.

Type IIIa: This fracture type is a wound associated with extensive soft tissue damage usually larger than 10 cm with periosteal coverage. This fracture type also includes less traumatic fractures with increased chances of complications, such as gunshot wounds, farmyard injuries and fractures requiring vascular repair.

Type IIIb: This type is defined as bone with periosteal stripping that must be covered; these fractures nearly always require flap coverage.

Type IIIc: This type of injury requires vascular repair.

In general, patients were seen by the same orthopeadic surgeon who had operated on them every two weeks for a minimum of four weeks after being discharged from the hospital and monthly intervals thereafter.

Patients were assessed for showing any sign of neurological deficits, surgical site infection, implant failure, delayed union, non-union and malunion. Superficial infection was defined as local erythema or swelling, which resolved with antibiotic therapy. Deep infection was defined as continuing wound drainage of pus or a positive bacteriological culture. Delayed union was defined as lack of significant union within 6 months postoperatively and nonunion as having no signs of union after nine months. Radiographic evidence of union was defined by the presence of bridging callus. Malunion was defined as a rotational deformity of more than 10°, an angulation deformity of more than 10° or shortening by more than 10 mm.

RESULTS

Sixty seven patients (82% male and 18% female, mean age 38.3±14.1 years) with tibial fracture underwent surgery with UTN method from March 2001 to March 2003 in orthopeadic ward of Shohada hospital, Tabriz. Open fractures, which accounted for almost 2/3rd of fractures, were classified as mentioned above according to Gustilo and Anderson. Table 1 shows the details of fractures' classification. Motor accidents were the most common cause of injury which led to all cases of open tibial fractures and the majority of closed fractures. Almost one third of patients had another site of fracture either in other long bones or in pelvis.

Table 1: Classification of fractures

Type of fracture	N (%)
Closed	22 (32.8)
Type 1	14 (20.9)
Type 2	10 (14.9)
Type 3a	16 (23.9)
Type 3b	5 (7.5)
Total	67 (100.0)

Table 2: Complications after using UTN method for tibial fractures

Post surgical complications	N (%)
Delayed union	3 (4.4%)
Non-union	1 (1.5%)
Mal-union	-
Superficial surgical site infection	-
Deep surgical site infection	-
Neurological deficits	-
Compartment syndrome	-
Sepsis	-
Failure in nail	1 (1.5%)
Failure in screws	4 (6%)

On average, the patients were discharged from the hospital after 5.6±2.3 days. Only 5% of patients had to stay in hospital for ten days or longer and 77.6% were discharged in a week. During their stay in hospital after the surgery, no surgical complication such as early surgical site infection (whether superficial or deep), sepsis, compartment syndrome or neurological deficits were reported.

During the course of 9 months follow-up, 95.5% of patients showed radiological signs of callus formation at the end of 6 months. Only 3 patients were diagnosed to have delayed union. Non-union was diagnosed in 1 case at the end of 9 months follow up. There was no case of rotational deformity, angulation deformity or shortening of limb. The time needed to achieve union increased significantly with age ($p<0.05$). No case of infection or compartment syndrome was reported by the physicians.

During the follow up period, 5 patients (7.5%) showed radiological signs of implant failure (four cases due to failure of distal locking screws, one due to nail breakage). Since callus formation was complete long before the mentioned failures, there was no need for the patients to undergo re-operation. Other details are mentioned in Table 2.

DISCUSSION

The tibia is the most frequently fractured long bone in the body (Court-Brown and McBirnie, 1995). Our study indicates that UTN has a valuable place in the early management of tibial fractures.

In a prospective study, 63 tibial shaft fractures were managed by intramedullary nailing with a solid nail inserted without reaming. The patients were followed to union or a definitive outcome. Ninety-three percent of fractures united at a mean of 21.1 weeks (Angliss *et al*., 1996). This is consistent with our study and the study preformed by Essoh *et al*. (2006) which showed 5.5% of delayed union at the end of 6 months. In a study preformed by Joshi *et al*. (2004) the union rate at the end of 8 months was reported to be 80%. The observed difference may be due to different definitions used by the researchers for delayed union and non-union, differences in surgical techniques and also characteristics of study subjects.

In our study, the fractures which developed delayed union were of types 2 and 3a which is similar to the study of Joshi *et al*. (2004).

In the present study,the average length of hospital stay was 6 days which is less than the 15 days reported by Essoh *et al*. (2006).

The authors reported no case of mal union which is in contrast with Bassi *et al*. (2001) who reported a 10% rate of mal union and also Wisniewski who reported varus/valgus angulations in 12 (6%) of his study subjects (Wisniewski, 2005). On the other hand, Ketterl *et al*. (1994) didn't encounter any axis deviation in their study. This again may be due to different ways in which patients were assessed and also to limited number of our study sample.

Ketterl and Leitner (1994) concluded that the rate of infection seen in open fractures was reduced by using an UTN for the tibia (4.5% using RTN versus 1.3% using UTN in primary implantation). The UTN does not disturb the healing of the fracture and there is no increased risk of axis deviation (Ketterl and Leitner, 1994). The authors found no case of infection during hospitalization and follow-up period. According to another study in Spain, intramedullary nailing without reaming has resulted in low infection rates, favoring bone consolidation and soft-tissue healing. The results of this study show that the UTN technique is effective and safe in high energy tibial fractures (Miralles-Munoz *et al*., 2004). Another study in Spain concluded that nonreamed flexible locked nailing provides effective control of axial and rotational stability in unstable Grades I to IIIA open tibial fractures (Darder-García *et al*., 1998).

Keating *et al*. (1997) reported a 2.2% nail brakage and 29% screw breakage in their study (Keating *et al*., 1997). According to authors, only 1 patient (1.5%) was re-operated due to nail breakage and 6% due to screw breakage which indicates better results, maybe due to intense monitoring and good patient counselling.

CONCLUSION

In conclusion, this study has shown unreamed nailing can be satisfactorily used to treat high energy tibial shaft fractures with the advantages of technical simplicity, acceptable risk of implant failure, high union rate and low risk of complications. The authors recommend that other comparative studies be preformed in order to highlight the advantages (and probable disadvantages) of UTN method versus other surgical techniques such as Reamed Tibial Nailing, Ender pins or external fixation.

ACKNOWLEDGEMENT

The authors wish to thank the colleagues in orthopeadic ward and also surgery ward of Shohada hospital, Tabriz.

REFERENCES

Angliss, R.D., T.A. Tran, E.R. Edwards and S.G. Doig, 1996. Unreamed nailing of tibial shaft fractures in multiply injured patients. Injury, 27 (4): 255-260.

Bassi, J.L., Y. Yamin, H.S. Selhi and S. Goel, 2001. Unreamed tibial interlock nailing in tibial shaft fractures without image intensifier. Indian J. Orthopaedics, 35 (2): 20-24.

Court-Brown, C.M. and J. McBirnie, 1995. The epidemiology of tibial fractures. J. Bone Joint Surg., 77: 417-21.

Darder-García, A., A. Darder-Prats and F. Gomar-Sancho, 1998. Nonreamed flexible locked intramedullary nailing in tibial open fractures. Clin. Orthop. Relat. Res., 350: 97-104.

Essoh, J.B., I. Sié, M. Bamba, Kodo, Aka D. Kacou and Y. Lambin, 2006. Primary unreamed And unlocked intramedullary nailing for open tibial fractures. Nigerian J. Orthopaedics Trauma, 5 (2): 29-33.

Forster, M.C., A.S. Bruce and A.S. Aster, 2005. Should the tibia be reamed when nailing? Injury, 36 (3): 439-444.

Gopinathan, P., 2005. Reamed Or Unreamed Nailing In Open Fractures Of Tibia-Current Concepts. J. Orthopaedics, 2 (3): e1.

Joshi, D., A. Ahmed, L. Krishna and Y. Lal, 2004. Unreamed interlocking nailing in open fractures of tibia. J. Orthopaedic Surg., 12 (2): 216-221.

Keating, J.F., P.J. O'brien, P.A. Blachut and R.N. Meek, 1997. Broekhuyse HM. Locking Intramedullary Nailing with and without Reaming for Open Fractures of the Tibial Shaft. A Prospective, Randomized Study. J. Bone Joint Surg., 79: 334-341.

Ketterl, W.R. and A.W. Leitner, 1994. Reducing the risk of infection by use of an unreamed intramedullary nail in open tibial fractures. Zentralbl Chir., 119 (8): 549-555.

Littenberg, B., L.P. Weinstein and M. McCarren *et al*., 1998. Closed fractures of the tibial shaft. A meta-analysis of 3 methods of treatment. J. Bone Joint Surg. Am., 80 (2): 174-183.

Miralles-Munoz, F.A., A. Lizaur-Utrilla and D. Bustamante-Sua´rez, 2004. Treatment of tibial fractures using an unreamed intramedullary nail technique. Revista de Ortopedia y Traumatologia, 48 (6): 443-448.

Runkel, M., K. Wenda, A. Stelzig, B.A. Rahn, S. Storkel and G. Ritter, 1994. Bone remodeling after reamed and unreamed intramedullary nailing. A histomorphometric study. Unfallchirurg, 97 (8): 385-390.

Wisniewski, T., 2005. Open tibial fractures treated by delayed undreamed nailing: experience with the first 200 fractures. J. Bone Joint Surg. Br., 87 (B), Issue SUPP_I: 14.