International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2019; 5(4): 184-187

www.orthopaper.com
Received: 11-08-2019
Accepted: 15-09-2019

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Outcome of antibiotic impregnated intramedullary nails in compound tibial fractures

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DOI: https://doi.org/10.22271/ortho.2019.v5.i4d.1670

Abstract
Background: Fracture is defined as a soft tissue injury compounded by a break in the continuity of a bone, is common following accidents. By its very location the tibia is exposed to frequent injuries. So, fracture of shaft of tibia are among the most common long bone fractures presenting for treatment. Compound fracture is one in which either the bone pierces the skin and come out or the fracture communicates with a wound elsewhere. Compound fractures are very commonly seen in fracture tibia.
Material and Methods: In the present study 25 adults of either sex having compound tibial shaft fractures of Gustilo grade I and II were treated with antibiotic impregnated intramedullary nails to see the outcome of this newer modality.
Results: Functional Results Following Tibial Interlocking Nailing In 25 Patients

Grade	No. of cases	Percentage
Excellent	18	72.0
Good	5	20.0
Fair	1	4.0
Poor	1	4.0

Conclusion: The antibiotic impregnated interlocking nail gave commendable results in present series. All cases united with no non union. In our opinion if full care of asepsis is taken along with this implant, antibiotic interlocking nailing is the treatment of choice for compound tibial shaft fractures Gustilo grade I and II.

Keywords: antibiotic impregnated, intramedullary nails, compound tibial

Introduction
Compound fractures are very commonly seen in fracture tibia. In recent years the treatment of fractures of the tibia shaft has become one of the most controversial subjects in orthopaedic surgery. Many orthopaedic surgeons are scared by high rates of infection & failure of fixation due to technical errors, advocate primary conservative approach for the treatment of these fractures. Because of long period of recumbency & associated socioeconomic burden imposed by these fractures, there have been constant efforts to develop methods of treatment which reduce the period of hospitalization & rate of contamination too. Conservative methods are no longer acceptable to the patients & the community, particularly where the end results are marred by high rates of joint stiffness, shortening & malunion. The management of compound tibial fractures is one of the most challenging clinical situations faced by orthopaedic surgeons despite major advances in fixation, soft tissue management & antibiotic therapy
So this has led over the years to a number of different forms of internal fixation techniques viz. intramedullary nailing, compression plating, interlocked intramedullary nailing, advocated for selected open fractures especially as modern surgical technique and antibiotics have successfully contained the infection even in open fractures. In order to maintain good bone structure, to enhance resistance against infection and to provide best conditions for early bone healing and maintaining sufficient stability while using any technique of internal fixation, emphasis must be on vascular support of bone and soft tissue. Preservation of biological reaction requires minimum exposure, careful handling of fracture and particularly the least

possible damage to periosteum, which is the major blood supply to bone after the fracture. As application of a compression plate requires the dissection of soft tissue over a wide area, it damages one of the better sources of blood supply to bone i-e periosteal, which is not the case with the medullary devices.

Intramedullary devices like kuntscher, enders nails tends to give shortening or rotational deformities in unstable and comminuted fractures, so these have now been given up as a treatment of shaft fractures in favour of interlocking nailing by most of the trauma centres in the world. This form of internal fixation has become the treatment of choice for closed fractures of tibial shaft in adults 4cm distal to tibial tuberosity and 4cm proximal to ankle. Delayed interlocked nailing can be safely and effectively undertaken in most grade 1 and grade 2 open fractures and after healing of wound.

Material and Methods

In the present study 25 adults of either sex having compound tibial shaft fractures of grade Gustilo Type I and Type II were treated with antibiotic impregnated intramedullary nails to see the outcome of this newer modality.

Exclusion criteria

1. Tibial intra articular fracture around knee.
2. Malignancy (Primary or metastatic tumour).
3. Intra articular fractures of distal 1/3rd of tibia near ankle joint.
4. Closed tibial fractures.
5. Gustillo Anderson type III.

Initial management of fresh injuries was started at emergency services. Detailed history regarding mode & mechanism of injury before this injury was taken as per proforma attached. This was followed by standard emergency assessment and investigations as per required.

Open fractures were treated by wound toilet, debridement, primary suturing where possible, antibiotics, POP back splint, cultures were sent before starting the treatment. X-rays were done to know the level and type of fractures. If the pus cultures were sterile then the patients were planned for surgery.

All the patients in this study were operated under spinal anaesthesia. The affected limb of the patient is hanged at the caudal edge of the table at 90º of flexion at knee or it is hanged on the leg support at 90º of flexion at knee. Portal of entry is made with curved bone awl to open the medullary cavity. Beaded guidewire is entered through the thin portal of entry. Manual reduction is done with vertical traction and little manipulation. The beaded guidewire is inserted in central position and is checked with C-arm in both views of leg and 2 cm short of joint line. Reaming is done over the guide wire either with motorised reamer or with hand reamer starting with 8 mm then increasing 0.5/1 mm diameter till optimal reaming is achieved. Then beaded guidewire is exchanged with non beaded guide wire.

After mounting nail over jig, nail is inserted by partial rotating method till it crosses the fracture site. Nail is further inserted to get subchondral placement. Guidewire is removed. Position of nail is checked with C-arm. Free hand locking of distal end is done with two screws either mediolaterally or one mediolaterally and other anteroposteriorly depending upon the site and stability of the distal fragment.

Whenever required, flicking of the distal fragment was done with the device. Proximal locking with two screws is done through jig. Wound is closed.

Postoperative X-rays were done. Static exercises started on the second day and touch down weight bearing with walker started on third day. Sutures removed after 10 days.

All the cases were followed up in the OPD every 3 weeks until clinical and radiological union was judged to have occurred.

Results

Of the twenty five patients treated all cases were fresh fractures and compound with different grades of Gustilo Anderson classification.

Table 1: Distribution of cases according to Gustilo Anderson classification

Grade of injury	No. of cases	Percentage
Gustilo Anderson I	9	36%
Gustilo Anderson II	16	64%
Total	25	100%

Fibula was intact in 2 (8%) cases, fractured at another level in 8 (32%) cases and at the same level in 15 (60%) cases.

Fracture was situated in upper one third junction of upper and middle thirds in 3 (12%) cases, middle third in 13 (52%) cases, lower third/junction of lower and middle third in 9 (36%) cases.

Table 2: Showing type and location of 25 tibial shaft fractures under study

Site of fracture	No. of cases	Percentage
Upper 1/3 / junction of upper 1/3 and middle 1/3	3	12.0
Middle 1/3	13	52.0
Lower 1/3 junction of lower and middle 1/3	9	36.0
Total	25	100.0

Radiological union was achieved in about 15.55 weeks (12 weeks to 18 weeks) in all AO group A, group B fractures with Gustilo type I injury. Complex (AO group C), or Gustilo type II took on the average of 16.69 weeks (12 to 22 weeks) for radiological union. The shortest time to union was 12 weeks in group A fractures with Gustilo type I injury and longest was 22 weeks in group B Gustilo type II fracture, there were cases showed delayed union (beyond 20 weeks).

Table 3: Showing time for union of fractures

Time in weeks for union	No. of cases	Percentage
<12	0	0
12-20	24	96.0
>20	1	4.0

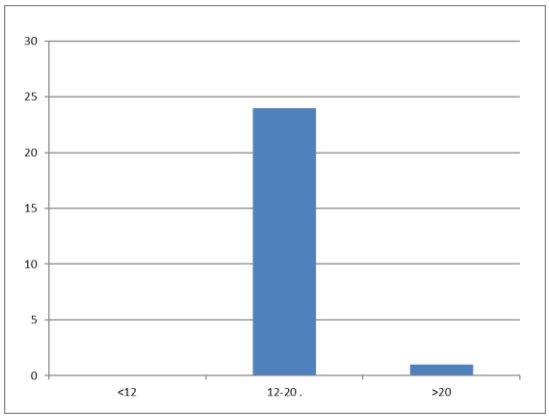

Fig 1: Showing time for union of fractures

We distinguished between superficial and deep infection. Superficial infection includes redness, erythema of skin with or without localised breakdown of skin and wound or serous discharge. Deep infection on the other hand implied frankly purulent discharge from wound, osteomyelitis, necessitating implant removal. Deep infection in our series occurred in only 1 case. In these cases, implants were removed after sound clinical and radiological union occurred. Infection was controlled in both these cases after removal of implant.

Complications In 25 Cases Of Compound Tibial Shaft Fracture Treated With Antibiotic Impregnated Interlocking Nailing In This Study

Table 4: Complications in 25 cases of compound tibial shaft fracture treated with antibiotic impregnated interlocking nailing in this study

Complications	No. of cases	Percentage
Infection leading to osteitis or seqestrum	1	4.0
Non union	-	-
Delayed union	1	4.0
Migration of nail	-	-
Breakage or bending or nail	-	-
Common pereneal nerve palsy	1	4.0
Anterior knee pain	7	28.0
Hypertrophy of scar	1	4.0
Calf muscle atrophy	2	8.0
Systemic complications	-	-

Results were reported as according to the Lysholm scale. Results were considered good when the score is 90-100. Considered good with a score of 84-89. Considered fair when the score is 65-83 and poore when the score is <64.

Case 1

Fig 2: Preoperative xray

Fig 3: postoperative xray

Fig 4: xray at 3 weeks

Fig 5: xray at final follow up

Case 2

Fig 6: Preoperative xray **Fig 7:** Postoperative xray **Fig 8:** Xray at final follow up

Discussion

The main aim of the treatment of the fracture is not only achieving union but to preserve the optimum function of the adjacent soft tissue. Proper reduction of the fragments and rigid fixation of the fragments is of utmost importance if early movements are to be instituted to prevent complications.

In our study 25 cases of compound fractures of the tibia were treated with antibiotic impregnated intramedullary nail. Our experience with this type of method of fixation has given favourable results. The findings, the end results and various other data are analysed and compared in the following discussion.

In this series twenty five cases of compound tibial shaft fractures, treated with antibiotic impregnated, interlocking nail were taken. Antibiotic impregnated interlocking nailing was done in all cases.

- Of the 25 cases, all were fresh fractures. Out of these 25 cases 9 were Gustilo type I and 16 were Gustilo type II injuries.
- Of the 25 cases classified according to A/O classification, 20 were of A/O type A, 4 of type B and 1 of type C.
- Of these 3 were in upper 1/3rd or at the junction of upper and middle third, 13 were in middle third, 9 were in lower 1/3 or at the junction of lower and middle thirds.
- Out of these 25 patients, 21 were male and 4 females with age ranging from 22 to 65 years. Road side accidents were the commonest mode of injury accounting for 20 cases (80%) due to fall, 3 (12%) cases and due to direct trauma 2 (8%).
- All fresh compound fractures brought to emergency were first treated of thorough wound irrigation with 2-3 litres of saline, debridement and suturing. Antibiotics and POP back splint were given.
- Antibiotic nailing was done with image intensifier control after closed reduction preferably and open reduction where necessary. Distal locking was done in all cases with free hand technique and proximal locking with the help of jig.
- Patients were discharged on the average of about 12 days after operation after removal of suture and were followed every month in OPD till union of fractures.
- Partial weight bearing at 5.14 weeks and full weight bearing at 10.48 weeks after fixation as guided by the evidence of union.
- All cases united on the average of 20.28 weeks with no non union 1 cases showed delayed union. No malunion was observed.
- Deep infection developed by 1 patient (4%). Fracture showed delayed union. Infection was controlled with regular dressings and antibiotics.
- Common peroneal nerve palsy occurred in 1 case which was present before surgery and which recovered its function in 2 months of expectant treatment.
- Scar hypertrophy causing no pain or disability to patient developed in 1 (4%) patient of parapatellar incision scar.
- Anterior knee pain developed in 28% of patients.
- Some loss of knee and ankle movements occurred in 2 patients who were on long bed rest due to instability of fixation.
- In spite of above complications functional results were found to be excellent to good in 92% cases.
- Among other advantages were earliest return to work (12 weeks on average) and excellent ankle and knee movements.
- In our experience the antibiotic impregnated interlocking nailing of compound tibial shaft fractures proved to be very satisfactory for internal fixation and control of infections.

Conclusion

In our opinion if full care of asepsis is taken along with this implant, antibiotic interlocking nailing is the treatment of choice for compound tibial shaft fractures Gustilo type I and II.

It has got the following advantages

1. Antibiotic is delivered right at the site of wound so it controls the rate of infections more effectively as compared to I/V or oral antibiotics.
2. Greatly improves rotational and axial stability of the fractures.
3. Early range of motion exercises of joints and early weight bearing can be permitted as compared to plating.
4. As the rate of infection is very much decreased, ratio of non union and delayed union is also very low compared to other methods of fixation.
5. Breakage of implant is very uncommon.
6. Can be easily used in osteoporotic and osteomalacic bones.
7. Can be effectively used in severely comminuted segmental fractures and fractures with bone loss.
8. Blood loss is less.

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