

## Fracture union in closed interlocking nail in tibial shaft fracture

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**Introduction:** The objective of this study was to find the outcome of interlocking nail in fracture tibia.

**Methods:** This study was conducted in the Department of Orthopaedic Surgery in RIMS Ongole, from July 2016 to July 2019. Forty patients were recruited from emergency and outpatient department having closed fracture of tibial shaft. The clinical results of our study were rated on the basis of the criteria of union, nonunion, delayed union, or malunion. All patients were operated under general or spinal anesthesia. All patients were followed for 9 months.

**Results:** Nearly 70% (28/40) patients had union in 90–150 days. Union was achieved in 15% (6/40) patients in 95–109 days. About 12.5% (5/40) had delayed unions and 2.5% (1/40) had nonunion which were treated with dynamization and bone graft.

The results were excellent in 70% (26/40) and good in 15% (8/40) patients. All of our patients had full range of motion of their knees and ankles.

**Conclusion:** We concluded that this technique is advantageous because of early mobilization (early weight-bearing) and less complication with good results and is economical.

**Keywords:** Closed reamed interlocking nail, dynamization, tibial shaft fractures, union

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### I. Introduction

Tibia is the most commonly fractured long bone in the body. The annual incidence of tibial shaft fractures is 2/1000 individuals. The complications of the nonoperative treatment of displaced tibial shaft fractures that are the result of high-energy forces are associated with a high prevalence of malunion, stiffness of the joint, and poor functional outcome. Closed displaced tibial shaft fractures have been internally fixed with plates or with intramedullary fixation devices such as centromedullary nails (K-nails and V-nails), interlocking intramedullary nails (reamed or unreamed), or multiple flexible intramedullary pins, for example, Ender nails. Intramedullary interlocking (IMIL) tibial nailing is considered the best modality of treatment of diaphyseal tibial fractures. It has a biological and biomechanical advantage over plate osteosynthesis. Various studies regarding the safety and effectiveness of closed IMIL nailing have been done. The C-arm image intensifier is generally used for closed reduction, closed nailing, and locking bolts proximally and distally. The objective of this prospective study is to achieve the ultimate goal of fracture union and early rehabilitation, short hospitalization, and good fracture healing response.

### II. Methods

This prospective study was carried out at Orthopaedics Department in RIMS Ongole, from July 2016 to July 2019. A total of 40 patients with fracture shaft of tibia admitted to our institute were included in the present study. A written informed consent was obtained from all the patients; they were explained about treatment plan, cost of operation, hospital stay after surgery, and complications of anesthesia. They were followed up after surgery and were clinically and radiologically assessed for fracture healing, joint movements, and implant failure. According to the criteria, the results are graded as excellent when the fractures unite within 16 weeks without any complication, good when union occurs within 24 weeks with treatable complications such as superficial infection and knee/ankle stiffness, and poor when union occurs before or after 24 weeks with one or more permanent complications such as infection (osteomyelitis), implant failure, nonunion, limb shortening, and permanent knee/ankle stiffness. Delayed union was recorded when the fracture united between 3 and 6 months while nonunion was noted when union had not occurred after 8 months of treatment. Follow-up was done. Patients with closed tibial fracture with age more than 16 years, patients who presented within a week of the injury, and patients who did not have any previous surgical treatment for the fracture were included in the study. Malnourished patients and those with open fractures, pathological fractures, and fracture nonunion were excluded from the study. Examination of patients was done thoroughly at the time of admission to exclude other injuries. In majority of the patients, closed reamed interlocking nailing of the tibia was performed within the 3

days of injury. In patients who were not fit for surgery due to associated injuries to vital organs, were hemodynamically unstable or due to active infection at injury site, or were pyrexial, delayed interlocking nailing was performed when their overall condition improved. The patients were placed supine on a normal table. The tibia was approached with the midline patellar incision which extends from the lower pole of the patella to just 1 cm distal to the tibial tuberosity. The entry point was made after retracting the patellar tendon in line with medial half of tibial tuberosity about 1.5–2 cm distal to the joint line. Care was taken to flex the knee joint while making the entry point. After the entry point was connected to the medullary canal, an olive-tipped guidewire was passed. The fracture was reduced by longitudinal traction and manipulation under image intensification. After reduction, the guidewire was passed in the distal fragment and centered in anteroposterior and lateral projections. After sequentially incremental reaming, the guidewire was exchanged and appropriately sized nail inserted. Proximal locking was done by means of the jig, the fracture was impacted, and distal locking was done by freehand technique. All patients were followed for a minimum of 9 months. There were 14 static nails used and 26 dynamic nails used. Proximal locking was done with jig and distal locking with freehand technique. Wound was closed with suction drain in standard manner, and antiseptic dressing was done. Drain was removed on the 2<sup>nd</sup> postoperative day. Rehabilitation such as touch-down weight-bearing was started on the 2<sup>nd</sup> postoperative day, and sutures were removed on the 14<sup>th</sup> postoperative day. These patients were assessed clinically and radiologically for union timing at 9 months following surgery. Patients were assessed for delayed union (more than 4–6 weeks postoperative) and nonunion (9 months following surgery). Statically analysis was limited to calculation of percentage of patients who had unions, malunions, delayed unions, or nonunions and excellent, good, and poor outcomes. Functional outcomes were evaluated according to the Johner and Wruhs criteria.

OUT COMES	n (%)
Excellent	26(86.33)
Good	12 (11.36)
Poor	2 (2.31)

### III. Discussion

IMIL nailing has become a popular and effective procedure for the treatment of tibial shaft fractures. Interlocking nails are generally performed using an image intensifier. In our study, the vehicular accident injury was the most common mode of injury consisting of 59.13%. The other modes of injury were 6.25% due to fall, 3.84% due to labor accident, and 30.76% due to direct force injury or physical assaults. There were 42% transverse, 32% oblique, 10% spiral, 4% segmental, and 12% comminuted fractures. Hooper *et al.* (1991) reported transverse (48%), oblique (42%), spiral (6%), and segmental (4%) fractures in their series. In this series, tibial fractures were the most common at middle third (64.74%) and upper third (19.42%), followed by lower third (15.82%). Larsen *et al.* studied 45 patients with reamed interlock nail in whom average time to fracture healing was 16.7 weeks and had two malunion, while in our study, union occurred in 90–150 days with a mean of 110.68 days with no malunion which is very close to other studies. In our study, we did nailing after reaming the canal. This is a routine protocol in our center. There are various reported literature which show increased blood loss, increased operating time, increased risk of pulmonary embolism, and adult respiratory distress syndrome after reamed interlocking nail. We have a reasonable policy to wait and stabilize the patient who has certain risk factors such as associated chest trauma and anemia. When the patient is stable and fit for surgery, we perform closed reamed statically locked intramedullary nail. The complication such as infection was encountered, consisting of 12 cases superficial infections (4.31%) which were treated with appropriate antibiotics for the period of 2 weeks. In our center, we routinely perform the locking in static mode. In this study, all the fractures were treated with statically locked intramedullary nail. 28 out of 40 patients were united without any complication. 6 of our patients needed dynamization, i.e., removal of proximal or distal screw before starting partial weight-bearing. 5 showed no radiological signs of union at the 4<sup>th</sup> month. They were dynamized and were encouraged to walk with bearing full weight. 1 of our patients had nonunion. He was treated with bone graft. In our study, union rate is 86.33% which is very close to the reported series. Various studies have documented 97%–100% union rate after reamed locked nailing of tibial shaft fractures. Ekeland recommends conversion of static nailing to dynamic nailing at 3 months for better consolidation of the fracture, and in case of comminuted fractures, we can increase the time to 5 months. The functional outcome of patients with tibial shaft fracture is probably the most important consideration when deciding on the best mode of treatment for a particular fracture pattern. Successful early fracture union in tibial shaft fracture is the most demanding outcome for good function in addition to other factors. A potential limitation of our study was the absence of a control group treated by a different modality. In a subjective measure of outcome at follow-up, 26 (86.33%) of the patients were excellent and 26 (9.35%) good; no patients or parents reported their outcome as not satisfied. At follow-up, all patients went on to osseous union and regained a full range of movement after rehabilitation.

#### IV. Conclusion

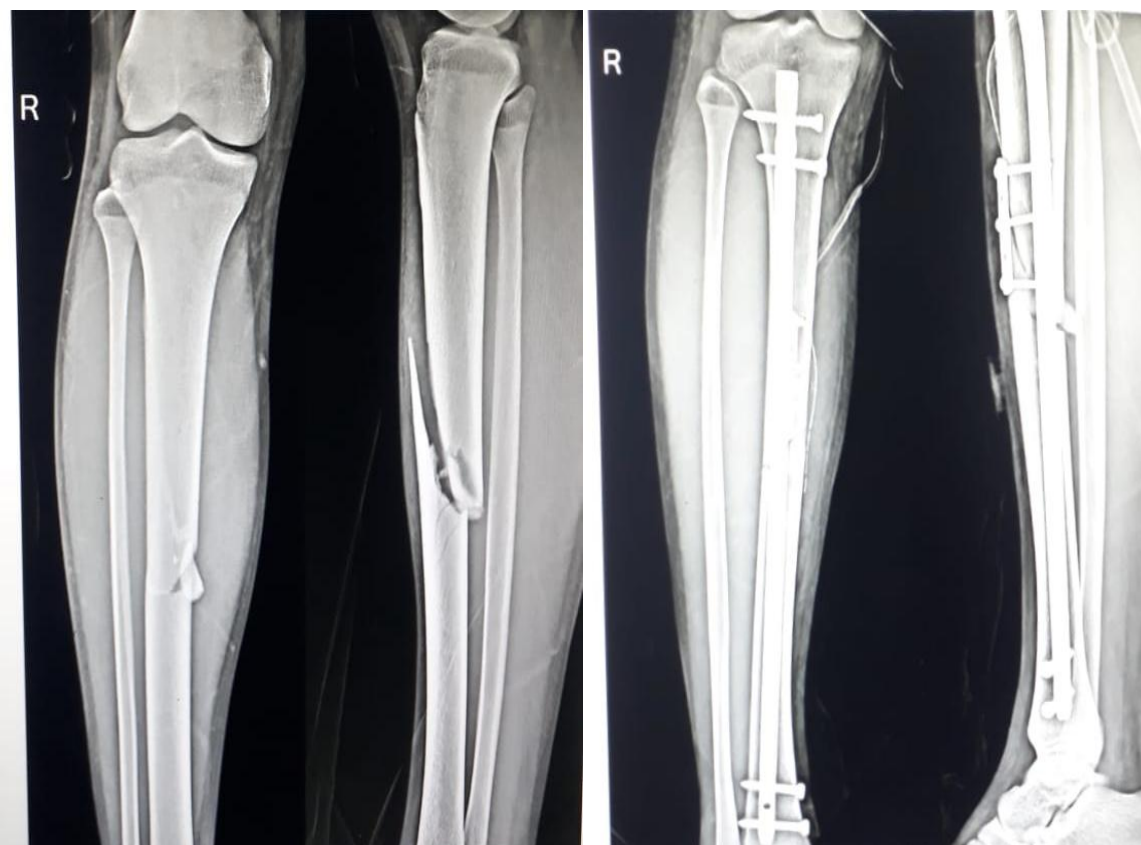
Closed interlocking nailing in tibial shaft fracture allows earlier weight-bearing leading to earlier fracture union with less morbidity. Because of the high union rate and low infection rate, we consider closed interlocking nailing as the best mode of treatment for tibial shaft fractures

**DIAGNOSIS:** Preoperative anteroposterior and lateral views of fracture shaft of the tibia of 19 years of male.

**TREATMENT GIVEN:** Postoperative views of fracture shaft of the tibia treated with interlocking nail

PTPATIENT NAME	P. KATHIK
AGE	19/Y MALE

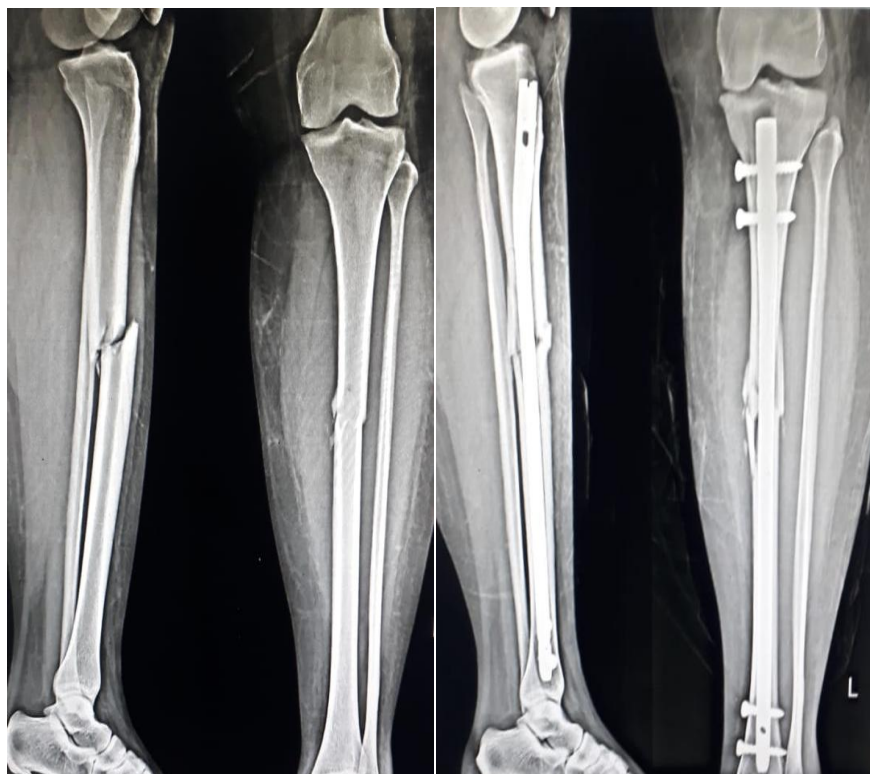
<b>PRE OP</b>	<b>POST OP</b>
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*Fracture union in closed interlocking nail in tibial shaft fracture*

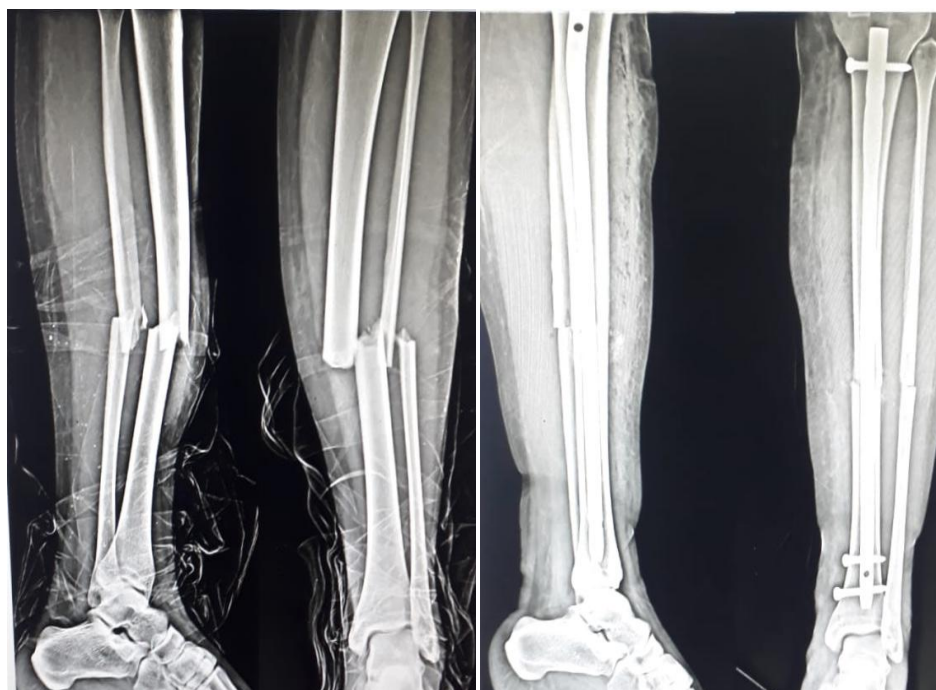
<b>PTATIENT NAME</b>	<b>K.DURGA BHAVANI</b>
<b>AGE</b>	<b>52/Y FEMALE</b>

<b>PRE OP</b>	<b>POST OP</b>
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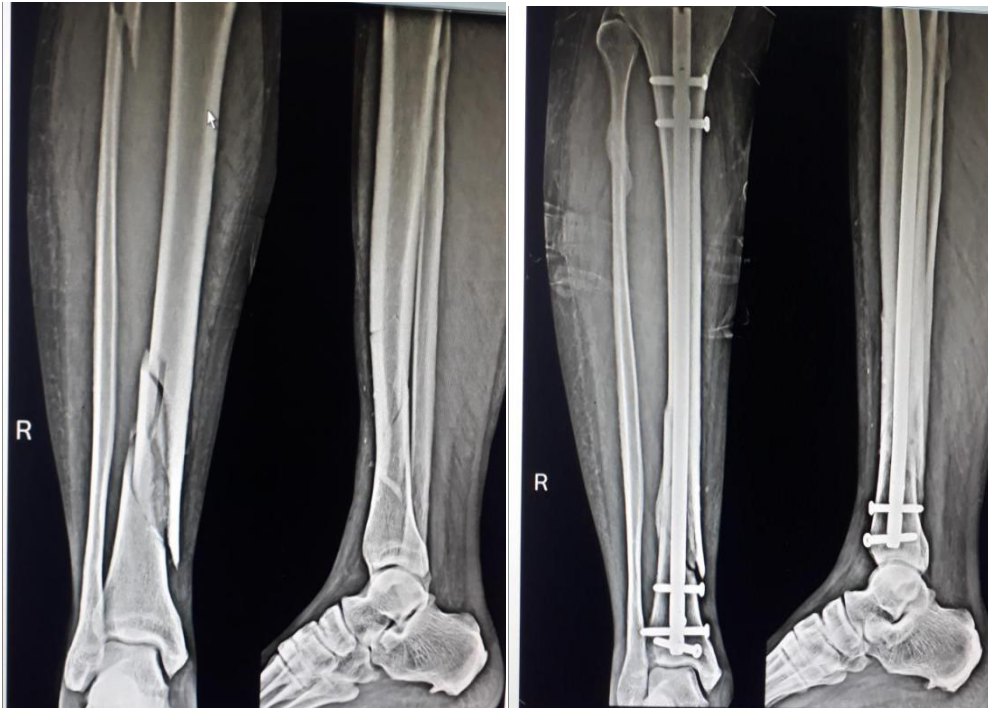
<b>PTATIENT NAME</b>	<b>M. GAYATHARI</b>
<b>AGE</b>	<b>18/Y FEMALE</b>

<b>PRE OP</b>	<b>POST OP</b>
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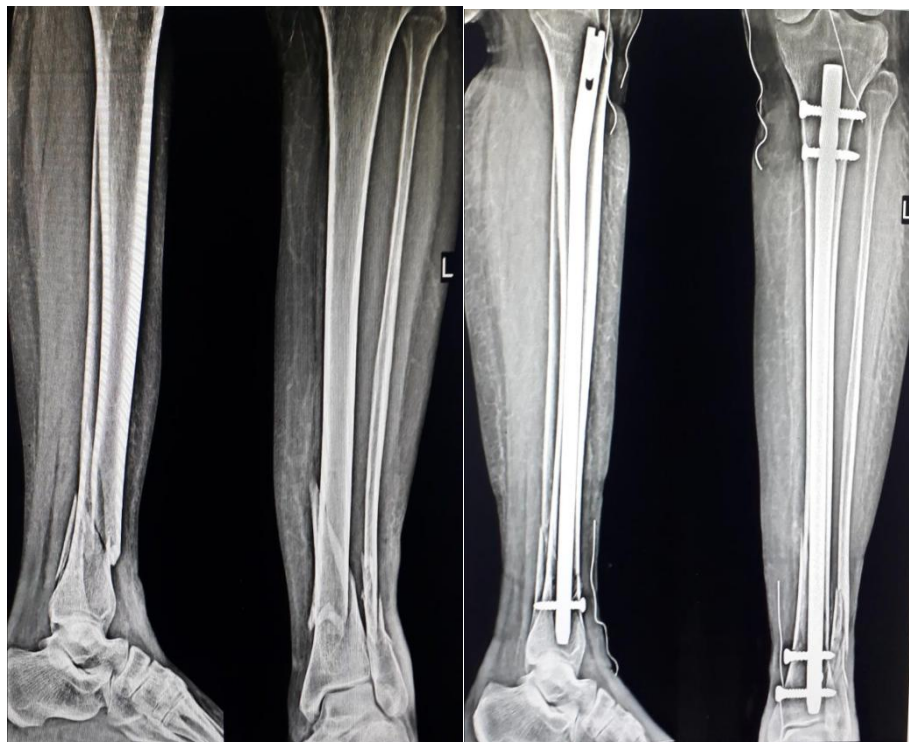
<b>PTATIENT NAME</b>	<b>CH. PRAKASH</b>
<b>AGE</b>	<b>42/Y MALE</b>

<b>PRE OP</b>	<b>POST OP</b>
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<b>PTATIENT NAME</b>	<b>SHAFFINUNNISA</b>
<b>AGE</b>	<b>54/Y FEMALE</b>

<b>PRE OP</b>	<b>POST OP</b>
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OUT COMES	n (%)
Excellent	26(65%)
Good	12 (30%)
Poor	2 (5%)

## V. Discussion

IMIL nailing has become a popular and effective procedure for the treatment of tibial shaft fractures. Interlocking nails are generally performed using an image intensifier. In our study, the vehicular accident injury was the most common mode of injury consisting of 59.13%. The other modes of injury were 6.25% due to fall, 3.84% due to labor accident, and 30.76% due to direct force injury or physical assaults. There were 42% transverse, 32% oblique, 10% spiral, 4% segmental, and 12% comminuted fractures. Hooper *et al.* (1991) reported transverse (48%), oblique (42%), spiral (6%), and segmental (4%) fractures in their series. In this series, tibial fractures were the most common at middle third (64.74%) and upper third (19.42%), followed by lower third (15.82%). Larsen *et al.* studied 45 patients with reamed interlock nail in whom average time to fracture healing was 16.7 weeks and had two malunion, while in our study, union occurred in 90–150 days with a mean of 110.68 days with no malunion which is very close to other studies. In our study, we did nailing after reaming the canal. This is a routine protocol in our center. There are various reported literature which show increased blood loss, increased operating time, increased risk of pulmonary embolism, and adult respiratory distress syndrome after reamed interlocking nail. We have a reasonable policy to wait and stabilize the patient who has certain risk factors such as associated chest trauma and anemia. When the patient is stable and fit for surgery, we perform closed reamed statically locked intramedullary nail. The complication such as infection was encountered, consisting of 12 cases superficial infections (5%) which were treated with appropriate antibiotics for the period of 2 weeks. In our center, we routinely perform the locking in static mode. In this study, all the fractures were treated with statically locked intramedullary nail. 28 out of 40 patients were united without any complication. 6 of our patients needed dynamization, i.e., removal of proximal or distal screw before starting partial weight-bearing. 5 showed no radiological signs of union at the 4<sup>th</sup> month. They were dynamized and were encouraged to walk with bearing full weight. 1 of our patients had nonunion. He was treated with bone graft. In our study, union rate is 86.33% which is very close to the reported series. Various studies have documented 97%–100% union rate after reamed locked nailing of tibial shaft fractures. Ekland recommends conversion of static nailing to dynamic nailing at 3 months for better consolidation of the fracture, and in case of comminuted fractures, we can increase the time to 5 months. The functional outcome of patients with tibial shaft fracture is probably the most important consideration when deciding on the best mode of treatment for a particular fracture pattern. Successful early fracture union in tibial shaft fracture is the most demanding outcome for good function in addition to other factors. A potential limitation of our study was the absence of a control group treated by a different modality. In a subjective measure of outcome at follow-up, 26 (60%) of the patients were excellent and 2-(30%) good; no patients or parents reported their outcome as not satisfied. At follow-up, all patients went on to osseous union and regained a full range of movement after rehabilitation.

## VI. Conclusion

Closed interlocking nailing in tibial shaft fracture allows earlier weight-bearing leading to earlier fracture union with less morbidity. Because of the high union rate and low infection rate, we consider closed interlocking nailing as the best mode of treatment for tibial shaft fractures

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