MATERIAL AND METHODS
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The proposed study "Closed Intramedullary Nailing In the Treatment of Fresh Simple Fracture of Shaft of Tibia" was conducted in the department of Orthopaedics at M.L.Z. Medical College and associated Hospitals, Jhansi through the concerned outdoor patient department and the casualty department. A total of 14 cases of fracture of tibial shaft were treated with the above said method from July, 1987 to June, 1988.

All the adult patients with fracture of tibial shaft attending the orthopaedic department, irrespective of sex were included in the study.

CRITERIA FOR SELECTION OF CASES

All the patients with fresh simple fracture or Grade I type of compound injury and had passed the age of skeletal maturity were selected for the study.

In our study contraindications for closed tibial nailing were as follows:

1. Children.
2. Compound injury (except Grade I) punctured wound.
3. Unsuitable condition of neighbouring skin abrasions, blisters, burns etc.
4. Type of fracture:
   a. Too near to either end of bone.
   b. Gross comminution.
   c. Long oblique and long spiral fractures.
MANAGEMENT OF FRACTURE

As soon as the patient was admitted, he was given first aid management in form of plaster of paris above knee slab along with analgesics and anti-inflammatory drugs.

Cases who were fit for nailing underwent following pre-operative evaluation.

1. General assessment of vital parameters.
   a. General condition of patients.
   b. Blood pressure.
   c. Pulse.
   d. Routine examination of other systems.

2. Local examination of skin at and away from fracture site including examination for associated neurovascular involvement.

3. Radiological examination done by placing Vernill gauge and metallic measuring scale by the side of the affected limb.
   a. For the type and site of the fracture.
   b. Size and diameter of the nail required.

4. Investigations:
   a. Routine.
   b. Specific.

After the above procedures were done the data were collected and recorded as follows:

Case No.
MRD No.
Name of the patient:
Address:
Date of admission

Brief History:

Date of injury:

Mode of injury:

Any other associated injury:

FR acture

Side: Right/Left/Both

Site: Proximal/Middle/Distal

Bone involved: Tibia/Tibia and fibula

Nature: Simple/Grade I (Penetrated wound)

G oordination: Present/not present

Fracture line: Transverse/Short oblique/Short spiral.

Date of first aid treatment:

and POP slab application:

APPARATUS AND INSTRUMENTS

Apart from the general set of instruments, the following are specially required:

1. A metal ruler which could be autoclaved and cast shadow on X-ray as to measure the length of the nail required.

2. Kuntscher nail gauge to assess the diameter of the nail per operatively and the diameter of medullary canal radiologically.

3. Kuntscher medullary nails of various size and diameter.

4. Funeral nail.

5. Guide wires.
Date of admission

Brief History :

Date of injury :

Mode of injury :

Any other associated injury :

FRACTURE

Side : Right/Left/Both

Site : Proximal/Middle/Distal

Bone involved : Tibia/Tibia and fibula

Nature : Simple/Grade I (Penetrated wound)

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5. Guide wires.
Fig. 1: **Special required instruments:**

1. Femoral bone awl.
2. Kuntscher nail Gauge.
7. Calibrated metal ruler.
7. Driving punch for the nail.
10. Straight chisels and gauges.

PRE-OPERATIVE ASSESSMENT OF THE SIZE OF NAIL

A. Length of Nail

A metallic rod of 16" length was carved deep enough all around its circumference at a spacing of 1" so as to cast shadow in the radiogram. This served as a metal ruler to measure the length of the nail required pre-operatively.

Splintage was removed on X-ray table and the metal ruler was strapped by the side of the limb parallel to the bone in such a way that its shadow would not superimpose upon that of underlying bone and the magnification of the ruler would be same as that of the bone. In anteroposterior view ruler was strapped laterally and in lateral view anteriorly or posteriorly as per convenience. By seeing the X-ray required length of the nail could be readily calculated.

B. Diameter of Nail

Various nail gauge which had calibrated holes ranging from six in diameter with an increment of one on each up to 14 mm was placed by the side of limb in such a way to give the same magnification of medullary canal as that of calibrated holes. The holes were marked with
the narrowest diameter of medullary canal on roentgenogram to give the required width of nail

**OPERATIVE PROCEDURE**

After appropriate anesthesia was given the patient was laid supine on the ordinary operation table. The part was painted and draped from lower thigh to just above the ankle.

Knee of the injured side was flexed to about 135 degrees, about two centimeters vertical incision was given just medial to the ligamentum patellae. The retropatellar pad of fat was exposed and the deep infrapatellar bursa opened taking care not to open the knee joint.

A suture was passed through the skin incision and displacing the ligamentum patellae internally and striking the tibial plateau over anterior end of intercondylar ridge about two centimeters behind the anterior border of tibia. This site is extra articular. the was thrust further along the long axis of proximal fragment of tibia thus making the pilot track for the guide wire.

Guide wire was passed down the pilot track just short of the fracture site.

Link was allowed to suspend vertically down by the side of the table with knee resting on the edge. Closed manipulation of fracture done and reduction was achieved and held in position.

Guide wire was passed further by the assistant to engage the medullary canal of the distal fragment.
Fig. 2a: Part painted and draped.

Fig. 2b: Pilot track being made through prespinal surface of tibial plateau
Fig. 2a:
Guide wire being passed in the proximal fragment of tibia.

Fig. 2d:
Guide wire has been passed in the distal fragment after manipulative reduction had been achieved.
Fig. 2e:
K-nail being hammered home with the help of another Kuntscher nail.

Fig. 2f: Wound closed.
Knee was again flexed at 135 degrees. Kuntscher clover leaf nail of appropriate size threaded over the guide wire and hammered home taking care of patella and second toe to lie in the same line.

Guide wire was withdrawn and wound was stitched back in single layer and dressed.

Long leg above knee plaster or paris slab was given.

**POST-OPERATIVE MANAGEMENT**

Post operative chest X-rays were taken and if there was any distraction it was corrected at the earliest by giving short acting general anaesthesia in the operation theatre and applying pressure at the heal with an assistant giving counter pressure by holding the knee of the affected side. If the nail was found to lie out of the distal fragment and had passed in the soft tissue it was extracted and reinserted by the same procedure mentioned above.

Stitches were removed after 10 to 14 days and long leg above knee plaster cast or patellar tendon bearing cast was given depending upon the type of fracture and the fixation of nail. Usually patient was made to walk with the help of walker with plaster incorporated. Unassisted weight bearing became possible within one to two weeks.

**FOLLOW UP**

Patients were discharged at a suitable time after operation with detailed instructions regarding do's and dont's and were followed up clinically and radiologically at three, six, twelve and twenty weeks interval.
All relevant data was filed and tabulated in the following way so as to reach the final result.

b. Callus: Palpable Radiologically
   Weeks: 3
   6
   12
   20

c. Movements of knee joint measured in degrees.

<table>
<thead>
<tr>
<th>Knee Joint</th>
<th>Ankle Joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Plantar</td>
</tr>
<tr>
<td>Extension</td>
<td>Dorsiflexion flexion</td>
</tr>
</tbody>
</table>

3 weeks
6 weeks
12 weeks
20 weeks
d. Form and duration (in weeks) of external splintage
   i. Long leg dorsal slab:
   ii. Long leg plaster:
   iii. Long leg walking plaster:
   iv. Patellar tendon bearing:
   v. Assisted weight bearing:
   vi. Unassisted weight bearing:
   vii. Unprotected weight bearing:
   viii. Return to employment in weeks:

Fractures were called united when the fracture line was not clearly visible and the traversing trabeculae at the fracture site had appeared.
EVALUATION OF RESULTS

The results were evaluated as excellent, good or poor on the basis of various parameters given below.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Excellent</th>
<th>Good</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squatting after a month of removal of external splintage</td>
<td>Normal</td>
<td>With some difficulty</td>
<td>Unable to squat</td>
</tr>
<tr>
<td>Pain at fracture site after 3 weeks</td>
<td>None or slight</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
<tr>
<td>Difficulty in walking</td>
<td>None</td>
<td>Mild</td>
<td>Severe limp.</td>
</tr>
<tr>
<td>Work and activity</td>
<td>Unchanged</td>
<td>Slightly compromised</td>
<td>Unable to do work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signs</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin condition including stitch line</td>
<td>Healthy</td>
<td>Superficial infection</td>
<td>Deep infection</td>
</tr>
<tr>
<td>Deformity</td>
<td>None</td>
<td>Slight</td>
<td>Easily noticeable</td>
</tr>
<tr>
<td>Shortening</td>
<td>None</td>
<td>≤ 1 cm</td>
<td>7 ≤ cm</td>
</tr>
<tr>
<td>Loss of knee movement</td>
<td>0 or ≤ 10°</td>
<td>10-30°</td>
<td>7 10°</td>
</tr>
<tr>
<td>Loss of ankle movements</td>
<td>0 or ≤ 5°</td>
<td>5 to 10°</td>
<td>7 10°</td>
</tr>
</tbody>
</table>

Radiology

| Formation of bridging callus                  | 3 weeks   | 4 to 6 weeks | 7 to 9 weeks |
| Gradual disappearance of fracture line       | 6 weeks   | 7 to 8 weeks | 7 to 8 weeks |