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Original research article

Tibial diaphyseal fracture among children: Clinical profile

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Abstract
Most tibial fractures in children under 11 years of age are caused by a torsional force and occur in the distal third of the tibial diaphysis. These oblique and spiral fractures occur when the body rotates with the foot in a fixed position on the ground. If there is not an associated fibula fracture the intact fibula prevents significant shorting of the tibia. Patients were assessed for pain, limb length discrepancy, varus/valgus malalignment, surgical wound complications, nail prominence and range of movements at knee joint. Regular follow up and physiotherapy for the patients treated to study functional outcome. In our study most common mode of injury was RTA out of 23 cases, 16 cases (69.6%) cases resulted from RTA,4 cases (17.4%) cases from sport related activities and 3 cases (13%) due to fall from height.
Keywords: Tibial diaphyseal fracture, children, clinical profile

Introduction

Tibial and fibular fractures are the third most common paediatric long bone injuries (15%) after femoral and radial/ulnar fractures. The prevalence of tibial fractures in both boys and girls has increased since 1950. The average age of occurrence is 8 years, and the frequency of occurrence does not change significantly with age. Seventy percent of paediatric tibial fractures are isolated injuries; ipsilateral fibular fractures occur with 30% of tibial fractures. 50 to 70% of tibial fractures occur in the distal third, and 19% to 39% in the middle third [1].

The least commonly affected portion of the tibia is the proximal third, yet these may be most problematic. rotational forces produce an oblique or spiral fracture and are responsible for approximately 81% of all tibial fractures that present without an associated fibular fracture. Most tibial fractures in children's 4 to 14 years of age are the result of sporting or traffic accidents. The tibia is the second most commonly fractured long bone in abused children. Approximately 11% to 26% of all abused children with a fracture have an injured tibia. Concomitant fractures of the ankle and foot are the most common injures associated with fractures of the tibia and fibula followed by humeral, femoral and radio and ulnar fracture. Thirty-five percent of paediatric tibial fractures are oblique, 32% comminuted, 20% transverse, and 13% spiral [2].

The fractures can be incomplete [torus, green stick] or complete. Most tibial fractures in children under 11 years of age are caused by a torsional force and occur in the distal third of the tibial diaphysis. These oblique and spiral fractures occur when the body rotates with the foot in a fixed position on the ground. if there is not an associated fibula fracture the intact fibula prevents significant shorting of the tibia. However, varus angulation develops in approximately 60% of isolated tibial fractures within first 2 weeks after injury in these cases, forces generated by contraction of the long flexor muscles of the lower leg are converted into an angular moment by the intact fibula producing varus malalignment. Transverse fractures of the tibia with intact fibula are generally stable and seldom displace significantly. A tibial diaphyseal fracture with an associated displaced fracture of the fibula often results in valgus malalignment because of the action of the muscle in the anterolateral aspect of the leg. Open fractures of tibia results from high velocity /high energy injures and associated soft tissue injures are classified using the GUSTILO &ANDERSON classification system [3, 4].

Methodology

Type of study: Prospective, observational study.

Statistical methods

Sample size estimation: Sample size.

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P (prevalence) =15%.
Alpha (level of significance) = 5%.
d (absolute error) = 15%
Estimated sample size is 23.
Study size calculated using estimation technique after taking prevalence of tibial fracture in children's 15% (P = 0.015) alpha = 5% (level of significance), 15% absolute error, sample size is 23, as per the information provided by me, statistical technique provided based on the objectives given.

Statistical technique: Frequency, proportion, chi-square test for proportion, pie chart, line chart, and related statically technique using R software.

Inclusion criteria
1. 5-15 years of age.
2. Diaphyseal fractures of tibia.
3. Closed fractures.
4. Open fractures in gustilo Anderson type 1 and type 2.
5. Tibial fracture with polytrauma.

Exclusion criteria
1. Metaphyseal fractures.
2. Open fractures gustilo Anderson type 3.
3. Pathological fractures.
4. Parents not willing for operative treatment.
5. Segmental and comminuted fractures.

Method of collecting data
Clinical study was through questionnaire, interview, radiological assessment and clinical examination.
All patients underwent preoperative and post-operative x-ray investigations.
Surgical management of the fracture by closed reduction and internal fixation with titanium elastic nails.
Post-operative observation of patients at 3, 6, 9, 12 weeks and 6 months until signs of complete union were seen on x-ray.
Patients were assessed for pain, limb length discrepancy, varus/valgus malalignment, surgical wound complications, nail prominence and range of movements at knee joint. Regular follow up and physiotherapy for the patients treated to study functional outcome.
As soon as the patient was brought to casualty, patient's airway, breathing and circulation were assessed. Then a complete survey was carried out to rule out other significant injuries. Plain radiographs of AP and lateral views of the leg including knee and ankle to assess the extent of fracture comminution, the geometry and the dimensions of the fracture. On admission to ward, a detailed history was taken, relating to the age, sex, and occupation, mode of injury, past and associated medical illness. Routine investigations were done for all patients.

Results
The patients in this study were aged between 6 to 14 years.
Most of the patients were in age group of 6-10 years (43.5%) and >10 years (52.2%).

Table 1: Age distribution

Age in Years	Number	Percentage
≤6 Years	1	4.3%
6-10 Years	10	43.5%
>10 Years	12	52.2%
Total	23	100%

Study consisted of 15 males and 8 females.

Table 2: Sex distribution

Gender	Number	Percentage
Male	15	65.2%
Female	8	34.8%
Total	23	100%

The patients in this study sustained the tibial fractures by one of the modes: Road traffic accidents (RTA), Sports injuries or by fall from height.

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Table 3: Mode of injury

Mode of Injury	Number	Percentage
RTA	16	69.6%
Sport Related Injury	4	17.4%
Fall from Height	3	13%
Total	23	100%

Table 4: Side of fracture

Side involvement	Number	Percentage
Right	14	60.9%
Left	9	39.1%
Total	23	100%

Patients presented with various levels of fracture of the shaft tibia, but most of them Sustained a fracture in the middle one-third.

Table 5: Level of fracture

Level of Fracture	Number	Percentage
Proximal Segment	2	8.7%
Middle Segment	13	56.5%
Distal Segment	8	34.8%
Total	23	100%

Table 6: Fracture pattern

Fracture pattern	Number	Percentage
Transverse	9	39.1%
Oblique	8	34.8%
Spiral	6	26.1%
Total	23	100%

Discussion

In our study age of patients range from 6 to 14 years and average age was 10.5 years, 4.3% of the patients were ≤6 years, 43.5% between 6 to 10 years and 52.2% patients were >10 years.
Srivastava *et al*. [5] conducted a study on children with age ranging from 4 years 6 months to 16 years 4 months and mean age was 11 years.
J. Heo *et al*. [6] study shows patients age range from 5 to 10 years and mean age was 7 years.
Wudbhav N. Shankar *et al*. [7] study shows patients age range from 7 years 2 months to 16 years and mean age 12.2 years.
In our study of 15 males (65.2%) and 8 females (34.8%), incidence of fracture was seen to be more in males, probably due to outdoor activities.
Srivastava *et al*. [5] study shows 21 male patients and 3 female patients out of 24 patients.
J. Heo *et al*. [6] study shows 9 male patients and 7 female patients.
V.R.P Vallamshetla *et al*. [8] study shows 43 male patients and 11 females.
Similar to our study, other studies also show as increased incidence of tibial fracture in male population as compared to females.
In our study most common mode of injury was RTA out of 23 cases, 16 cases (69.6%) cases resulted from RTA, 4 cases (17.4%) cases from sport related activities and 3 cases (13%) due to fall from height.
Wudbhav N. Shankar *et al*. [7] study shows 10 cases from RTA, 6 cases from sport related activities and 3 from others injuries.
Kapil Mani KC *et al*. [9] study shows 18 cases from RTA, 8 cases from fall from height and 7 cases from sport related activities.
From the above studies and from other study [10], it is clear that the most common mode of injury is RTA.
In the present study most common level of fracture was middle one third followed by distal one third and least common being proximal one third. V.R.P Vallamshetla *et al*. [8] study also showed a similar pattern but Jeong Heo *et al*. [6] study showed that the most common level was distal one third.
In our study the most common fracture pattern was transverse fracture, 9 cases were transverse fracture (39.1%), oblique 8(34.8%) and spiral fracture was 6 cases (26.1%).

Conclusion

Most common level of fracture was middle one third, (13 cases accounting for 56.5 %), followed by

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distal one third (8 cases (34.8%)) with least common being proximal one third (2cases (8.7%)). Most common pattern of fracture was transverse (9 cases (39%)), oblique (8 cases (34.8%)) and spiral (6 cases (26.1%)). Six cases (26.1%) had fibula fractures and 2cases had associated head injury, one case had metacarpal fracture and one case forearm fracture.

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