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## Diaphyseal fractures of femur and tibia in children: Clinical profile

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### Abstract

In children, bone changes from primarily weak woven to strong lamellar bone through remodeling during childhood. The lower limb buds appear during the fourth week of gestation, during the following mesenchyme condensation takes place. During sixth week it undergoes chondrification to form the initial model of femur. During 8th week, primary ossification occurs in shaft, during 8th month secondary ossification center starts in last two months of gestation. All children and adolescent patients between 5-16 years of age with diaphysis fractures of femur and / or tibia admitted at Institute Of Medical Sciences And Research, meeting the inclusion and the exclusion criteria during the study period were the subjects for the study. In the present study 13(43.3%) of the patients were 5-8 years, 7 (23.3%) were 9 to 12 years and 10(33.3%) were 13 to 16 years age group with the average age being 9.8 years. In the present study RTA was the most common mode of injury accounting for 16 (53.3%) cases, self-fall accounted for 11 (36.7%) cases and fall from height accounted for 3 (10%) of the cases.

**Keywords:** Diaphyseal fractures, femur, tibia

### Introduction

The femur or thigh bone is the longest and strongest bone in the body. Its shaft is almost cylindrical in most of its length and bowed with forward convexity. Its proximal end has a rounded articular head, projecting medially on short neck of bone formed by the medial inclination of the upper part of the shaft. The distal end is more massive being in the form of double knuckle or condyle articulating with tibia <sup>[1]</sup>.

The upper end of the femur comprises a head, neck, a greater and a lesser trochanter. The head of the femur is more than half sphere. It is directed upwards, medially and slightly forwards to articulate with the acetabulum. It has an ante version of 15°

The neck of femur which is about 5cm long connects the head and shaft which it forms an angle between 125° to 135°. The anterior surface of the neck is flattened and at its junction with the shaft is marked by a prominent rough ridge termed intertrochanteric line. The posterior surface of the neck at its junction with the shaft is termed as intertrochanteric crest <sup>[2]</sup>. The greater trochanter is a large quadrangular portion at the upper part of the junction of neck with shaft. It provides insertion for most of the muscles of gluteal region. The apex of the trochanter overlies trochanteric fossa.

In children, bone changes from primarily weak woven to strong lamellar bone through remodeling during childhood. The lower limb buds appear during the fourth week of gestation, during the following mesenchyme condensation takes place. During sixth week it undergoes chondrification to form the initial model of femur. During 8th week, primary ossification occurs in shaft, during 8th month secondary ossification center starts in last two months of gestation <sup>[3]</sup>.

Initially formed woven bone predominates during the first eighteen months of life. As the child increases in size and weight, woven bone gradually converts to a more rigid bone which has lamellar structure.

The shape of femur changes during growth period. In frontal plane the neck shaft angle gradually decreases from approximately 155° to 130° at skeletal maturity. The slight lateral convexity of the femoral shaft straightens with the growth. Transverse plane changes occur accompanied by a gradual reduction of femoral ante version from about 110° at birth to

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approximately 100° in males and 150° in females at skeletal maturity [4].

Growth rate is very rapid during early infancy and in the adolescent period. The femur makes up approximately 26% of the total height.

The tibia is the weight bearing bone of the leg and is therefore much larger than the fibula. Above, it takes part in the formation of the knee joint and below it forms the medial malleolus and most of the bony surface for articulation of the leg with the foot at the ankle joint.

The shaft of tibia is triangular in cross-section and has anterior, interosseous, and medial borders and medial, lateral, and posterior surfaces.

The soleal line descends across the bone from the lateral side to the medial side where it merges with the medial border. In addition, a vertical line descends down the upper part of the posterior surface from the midpoint of the soleal line. It disappears in the lower one-third of the tibia.

The shaft of the tibia expands at both the upper and lower ends to support the body's weight at the knee and ankle joints [5].

The distal end of the tibia is shaped like a rectangular box with a bony protuberance on the medial side (the medial malleolus). The upper part of the box is continuous with the shaft of the tibia while the lower surface and the medial malleolus articulate with one of the tarsal bones (talus) to form a large part of the ankle joint.

## Methodology

All children and adolescent patients between 5-16 years of age with diaphyseal fractures of femur and / or tibia admitted at Institute Of Medical Sciences And Research, meeting the inclusion and the exclusion criteria (As given below) during the study period were the subjects for the study.

## Study design

An outcome surgical study with 30 patients with Diaphyseal fractures was undertaken to study the outcome of Titanium elastic nails fixation in Lower limb,

## Inclusion Criteria

- Children and adolescent patients from 5 to 16 years with diaphysis closed fractures of femur and tibia.
- Both the sexes are included in the study

## Exclusion Criteria

- Patients unfit or not willing for surgery
- Open fractures
- Old fractures

## Results

In the present study 13(43.3%) of the patients were 5-8 years, 7 (23.3%) were 9 to 12 years and 10(33.3%) were 13 to 16 years age group with the average age being 9.8 years. There were 9 (30%) girls and 21 (70%) boys in the present study.

In the present study RTA was the most common mode of injury accounting for 16 (53.3%) cases, self-fall accounted for 11 (36.7%) cases and fall from height accounted for 3 (10%) of the cases.

In our study, transverse fractures accounted for 10 (33.3%) cases, comminuted fractures- 8(26.7%), oblique fractures - 7(23.3%), spiral fractures-5(16.7%) and there were no segmental fractures.

Fractures involving the middle 1/3rd accounted for 15 (50%) cases, proximal 1/3rd – 9 (30%) and distal 1/3rd–6 (20%) of cases in our study.

**Table 1:** Age distribution of patients studied

Age in years	Number of Patients	%
5-8	13	43.3
9-12	7	23.3
13-16	10	33.3
Total	30	100.0

**Table 2:** Gender distribution of patients studied

Gender	Number of Patients	%
Male	21	70.0
Female	9	30.0
Total	30	100.0

**Table 3:** Mode of Injury of patients studied

Mode of injury	Number of Patients	%
RTA	16	53.3
Self-fall	11	36.7
Fall from height	3	10.0
Total	30	100.0

**Table 4:** Bone affected

Bone affected	Number of Patients	=%
Femur	13	43.3
Tibia	17	56.7
Total	30	100.0

**Table 5:** Side affected

Side affected	Number of patients	%
Right	8	40
Left	12	60
Total	20	100.0

**Table 6:** Pattern of fracture

Pattern of fracture	Number of patients	%
Transverse	7	35
Oblique	4	20
Spiral	3	15
Segmental	0	0.0
Comminuted	6	30
Total	20	100.0

**Table 7:** Level of fracture

Level of fracture	Number of patients	%
Proximal 1/3rd	6	30.0
Middle 1/3rd	10	50.0
Distal 1/3rd	4	20.0
Total	20	100.0

## Discussion

In the present study 13(43.3%) of the patients were 5-8 years, 7 (23.3%) were 9 to 12 years and 10(33.3%) were 13 to 16 years age group with the average age being 9.8 years.

J. N. Ligier *et al.* studied children ranged from 5-16 years with a mean of 10.2 years [6]. Wudbhav N Sankar *et al.* studied children ranged from 7.2-16 years with a mean of 12.2 years [7]. There were 9 (30%) girls and 21 (70%) boys in the present study.

The sex incidence is comparable to other studies in the literature.

In their study JN. Ligier *et al.* out of 118 cases, had 80 (67.7%) boys and 38 girls [6].

In their study, Gamal El-Adl *et al.* out of 66 patients, there were 48 (72.7%) male and 18 (27.3%) females and in other studies [8-10].

In the present study RTA was the most common mode of injury accounting for 16 (53.3%) cases, self-fall accounted for there were 9 (30%) girls and 21 (70%) boys in the present study

J. M. Flynn *et al.* in their study assessing 234 cases, 136 (58.1%) were following RTAs, 46 (19.6%) were following self-fall and remaining 43 (28.8%) were as a result of fall from height. 7 We studied 13 (43.3%) femoral and 17 (56.7%) tibial fractures.

In their study, Gamal El-Adl *et al.* had 48 (65.7%) femoral and 25 (34.3%) tibial fractures [8].

In our study, transverse fractures accounted for 10 (33.3%) cases, comminuted fractures- 8(26.7%), oblique fractures-7(23.3%), spiral fractures-5(16.7%) and there were no segmental fractures.

In their study J. N. Ligier *et al.* out of 123 femoral fractures studied 47 (38.2%) were transverse fractures, comminuted fractures- 25 (20.3%), oblique fractures-7 (23.3%), spiral fractures-19 (15.4%) and 4 (3.2%) were segmental fractures [6].

Wudbhav N. Sankar studied 19 tibial shaft fractures out of which 9 (47.3%) were transverse, 7 (36.8%) were oblique, 2 (10.5%) were spiral and 1 (5.2%) was comminuted.<sup>7</sup>

Fractures involving the middle 1/3rd accounted for 15 (50%) cases, proximal 1/3rd-9 (30%) and distal 1/3rd-6 (20%) of cases in our study.

In their study JN. Ligier *et al.* among 123 femoral shaft fractures, 42 fractures were in the proximal 1/3rd, 45 in the middle 1/3rd and 36 were in the distal 1/3rd [6].

Wudbhav N. Sankar studied 19 tibial shaft fractures out of which 15 were middle 1/3rd, 2-proximal 1/3rd and 2 were distal 1/3rd [7].

## Conclusion

Children and adolescents aged between 5 to 16 years were included in the study. 76.6% of patients were between 5-8 years (43.3%) and 13 to 16 years (33.3%) age group with the average age being 9.86 years. 70% of the patients was boys. RTA was the most common mode of injury accounting for 16 (53.3%) cases followed by self-fall- 11 (36.7%).

Transverse fractures accounted for 10 (33.3%) cases, comminuted fractures-8(26.7%), oblique fractures - 7(23.3%) and spiral fractures-5(16.7%). Fractures involving the middle 1/3rd accounted for 15 (50%) cases.

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