

## Outcome of external fixation in pediatric femoral shaft fractures

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### Abstract

**Objective:** To evaluate the outcome of external fixation in pediatric femoral shaft fractures.

**Design:** Prospective observational study.

**Setting and Duration:** Agency Headquarter hospital Landikotal, from May 2021 and November 2022.

**Material and Methods:** This study involved 20 children with an isolated femoral shaft fracture between the ages of 6 and 11 years who were treated with External Fixator. The children's ages ranged from 6 to 11 years, and the period of follow-up was 6 months. All the patients underwent external fixation. The outcomes were assessed based on the clinical and radiology findings.

**Results:** The healing time averaged 77.5 days. 2 patients had a pin site infection, 1 loss of reduction with pin breakage and 4 case of decreased knee ROM. All the complications were addressed accordingly.

**Conclusion:** External fixation is an effective treatment option for treating femoral shaft fractures in children because it has fewer complications.

**Keywords:** Pediatric femoral shaft fracture, pin site infection, external fixation.

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### Introduction:

In children, fractures of the femoral shaft have been traditionally treated with immobilization in a spica cast, either immediately or after a period in traction. Recently, newer techniques have been chosen according to the patient's age, location of the fracture, associated injury, the experience of the surgeon and degree of soft tissue injury.<sup>1-4</sup> The distribution of femoral fractures is bimodal, with peaks at the age of 2 and during adolescence.<sup>5</sup>

Several methods have been currently recommended. The most conservative treatment with previous traction and plaster of Paris cast or immediate plaster of Paris cast has been the most supported. However, it is not free from complications, the most frequent ones being reduction loss resulting in shortenings and angular deviations, and long periods of home confinement,

a common complaint in older children. During the last decades, an increase in the indication of internal and external fixation for these fractures has been seen because of the complications mentioned above.<sup>6,7</sup> External fixation is an accepted method for managing diaphyseal femur fractures in Europe but is used less often in the United States. Use of external fixation is typically limited to severe polytrauma scenarios or open fractures with severe soft-tissue injuries.<sup>8</sup> The most significant drawbacks to use of external fixation, particularly for femur fractures, are pin-site infections and perceived risk for refracture.<sup>9-11</sup> Recent studies have used external fixation in older children and adolescents with isolated femoral fractures.<sup>12-14</sup> The authors have reported that the main advantages of this therapeutic modality are short hospital stay, stabilization without the risk associated with open surgery, low incidence of complications, easy

cleanness, specialized nurses being not required, good tolerability to heat, ear return to daily and school activities, as well as low cost.<sup>15,16</sup>

The objective of this study is to evaluate the outcome of uniplanar external fixators in the treatment of paediatric femoral fractures.

#### **Material and Methods:**

This study involved 20 children with an isolated femoral shaft fracture between the ages of 6 and 11 years, who were treated with external fixator between May, 2021 and November, 2022 in Agency Headquarter hospital Landikotal. 12 boys and 8 girls were included in the study. Patients having age 6-12 years with no other bony or soft tissue trauma were included in the study. Mechanism of injury and geometry of the fracture was not taken in to account. Open fractures and patients who had bilateral femoral fractures were also excluded from the studies. Thirteen cases were midshaft fractures, 3 were proximal, and 4 cases were distal fractures.

The patients were admitted via casualty department in to orthopaedic unit of the hospital after thorough resuscitation and optimization of the patient in the casualty department. Radiographs were taken and the patient was submitted to skin traction. Surgery was carried out under general anesthesia within 24 hours after admission. Due to the unavailability of traction table and image intensifier in the hospital, open reduction and external fixation were performed after disinfection and aseptic cleaning of the leg. Two Schanz screws were placed both proximal and distal to the fracture site with a total of four Schanz screws. They were then fastened with two parallel lateral bars. Post-operative anteroposterior and lateral radiographs were taken. All the patients were discharge from the hospital after 48 hours after educating them with hip, knee and ankle physiotherapy and pin site care. All the patients were reviewed on monthly basis for 6 months. Partial load was allowed within 40 days on average and the total load was allowed within 60 days following surgery. The dynamization of fixators was carried out within 60 days on average (range: 30 to 110 days). The time until fix-

ator removal ranged from 63 to 135 days with a mean of 87 days. The external fixator was removed after confirmation of fracture consolidation (bone callus formation) on x-ray.

#### **Results:**

Twenty pediatric patients (12 boys, 8 girls) with lower extremity long bone fractures were treated. Mean age was 8.4 years. All of the fractures were uncomplicated closed femoral shaft fractures. For all fractures, the mean time to union was 77.5 days, which corresponded to total time spent in the external fixator. Final radiographs showed mean (range) sagittal plane deformity was 4.5° (0°-20°), and their mean (range) coronal plane deformity was 3.7° (0°-10°). One patient required a simple frame adjustment to correct unacceptable angulation. The surgical adjustment was made 1 week after initial application of the construct. This patient required no further procedures, and healing was uncomplicated. There was no clinically symptomatic leg-length discrepancy or limp at latest follow-up. In addition, no clinically symptomatic rotational mal-alignment was evident during examination, whether by dial testing, hip rotation testing, or assessment of foot progression angle.

There were 7 complications: 1 loss of reduction with pin breakage, 2 pin-site infections, and 4 case of decreased knee ROM. The patient with loss of reduction underwent fixator revision. The patients with pin-site infections were re-educated about pin-site care and given 7 days' worth of oral antibiotics; in each case, the infection resolved. Lastly, the patients with decreased knee ROM had knee ROM less than 45° in all 4 cases. The presumed cause of loss of ROM was disuse. These patients were advised vigorous physiotherapy. Two patients recovered full range of knee movement while the remaining 2 cases were subjected to careful manipulation under anaesthesia. These 2 patients never reported back.

#### **Discussion:**

Although femoral fractures in children have been treated without surgery with good results, Recently, for children aged between 6 to 11

years there has been a growing trend towards surgical treatment for isolated femoral shaft fractures, which is beneficial in shortening the time of knee, and hip immobilization and allowing early ambulation, which will have economic and sociopsychological effects on the children and their families.<sup>17</sup>

Several surgical techniques have been used, including fixation with a plate, intramedullary nail, and external fixation, each of them with advantages and disadvantages. Not only surgeon's expertise and patient selection play an important role, but also socioeconomic aspects should be also taken into account.

Despite the fact that early reports associated fracture fixation with a plate with negative results, according to Ziv e Rang<sup>18</sup> better results have been obtained and reported by several authors<sup>19</sup> in recent years. Despite these reports, such procedures have not been used very often due to the need of great exposure, a higher risk of infection, as compared to that associated with other methods, as well as to the need of another operation for plate removal and technical limitations as far as comminuted and juxtaarticular fractures are concerned.

Rigid intramedullary nailing has its own advantages but it might cause trochanteric growth arrest and avascular necrosis of the femoral head.<sup>20,21</sup>

The use of an external fixator is technically easy to carry out and has been associated with low rates of complications. Another advantage of external fixation is the short hospital stay, thus resulting in lower costs, as compared to those of other interventional techniques. Reported complications of external fixation are; pin site infection, loss of reduction, metal breakage and the presence of an external device that causes apprehension in the patient.

In this study, bone union took an average of 77.5 days, and pin track infection was observed in 2 cases. One patient had pin breakage and 4 case of decreased knee ROM, the results being com-

parable to studies done by Aronson and Tursky,<sup>1</sup> and Kim et al.<sup>22</sup> The mean time of fixator removal was 87 days which was quite comparable with other studies in the literature Davis et al<sup>5</sup> and Miner and Carrol.<sup>23</sup>

#### **Conclusion:**

External fixation is an effective treatment option for treating femoral shaft fractures in children because it has fewer complications.

**Conflict of interest:** None

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#### **Role and contribution of authors:**

Muhammad Imran Khan, collected the data, references and did the initial writeup.

Muhammad Saqib, helped in collecting the data and also helped in introduction writing.

Zeeshan Faisal, helped in collecting the references and also helped in abstract writing.

Quratulain Shafique, helped in collecting the data and also helped in discussion writing.

Nida Shahid, collected the references and also helped in material and methods writing.

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