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Case Report

Bilateral Floating Knee Injuries in an Infant: A Case Report and Literature Review

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Abstract

Background: Floating knee injury is defined as ipsilateral fractures of the femur and tibia. It was mostly seen among young men and is generally caused by high-velocity trauma such as motor vehicle accidents and falling from height. Although isolated fractures of the femur or tibia are relatively common in children, floating knee injuries are rare in adolescents and even less frequent in younger children.
Case Report: In this study, we reported a case of bilateral floating knee injuries of a 10-month old girl infant. Radiographic examinations revealed diaphyseal fracture of the left femur and proximal metaphyseal fracture of tibia compatible with floating knee injury type B according to the classification proposed by Letts et al. To the best of our knowledge, there was not any previous report of bilateral infantile floating knee injury in the literature.
Conclusion: Pediatric floating knee injuries are relatively uncommon and extremely rare among infants. The preferred method of treatment is a surgical fixation for all fractures of all ages.

Keywords: Bone; Knee Injuries; Pediatric Emergency Medicine; Tibial Fractures

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Background

The floating knee injury was first described by Blake and McBryde in 1975 as concomitant fractures of the ipsilateral femur and tibia. It was mostly seen among young men and is generally caused by high-velocity trauma. Due to the high energy mechanism of trauma, concomitancy of floating knee injury with other major injuries is noticeable (1). On the other hand, child abuse related fractures of long bones should be considered, especially among infants. Physeal fracture of the distal femur or proximal tibia might lead to a floating knee injury among children and consequently, disturbance of the growth plate (2). Although isolated fractures of the femur or tibia are relatively common among children, floating knee injuries are rare in adolescents and even less frequent in younger children (3).

The classifications given by Letts et al. (4) and Chalidis et al. (1) are popular in pediatric floating knee injuries. Letts et al. classified floating knee injuries of children into five groups: diaphyseal fractures of the tibia and femur (Type-A), metaphyseal fracture of tibia or femur accompanied by diaphyseal fracture of the other bone (Type-B), diaphyseal fracture of tibia or femur accompanied by epiphyseal fracture of the other bone (Type-C), Type-D including open fracture at one site, and Type-E defined as open fractures of both sites.

Prevalence of floating knee injury is extremely rare in children, especially among infants. To the best of our knowledge, there was not any report of bilateral infantile floating knee injuries in the literature. In the present study, we present a case of bilateral floating knee injuries in a 10-month old infant.

Case Report

A 10-month old girl was admitted to the emergency room due to falling from height of 9 meters. The patient was completely conscious but irritable. Initial evaluation and management were performed based on the advanced trauma life support (ATLS) protocols. Trauma series radiographs revealed no pathologic findings. After initial resuscitation, radiographic imaging of both lower extremities was requested due to detecting bony tenderness and deformity in lower limbs. Radiographic examinations ascertained diaphyseal fracture of the left femur and proximal metaphyseal fracture of tibia compatible with floating knee injury Type-B according to the classification by Letts et al. (4). Furthermore, radiologic assessment of right lower extremity revealed physeal fracture of the distal femur and metaphyseal fracture of distal tibia compatible with floating knee injury Type-C according to this classification (Figures 1 and 2).

Figure 1. Radiologic anteroposterior (AP) view of both lower limbs demonstrated left femoral shaft fracture, metaphyseal fracture of the left proximal tibia, physeal fracture of the right distal femur, and metaphyseal fracture of the right distal tibia (bilateral floating knee injuries).

Figure 2. Radiologic lateral view of both lower limbs demonstrated bilateral floating knee injuries.

Cast splints were applied for temporary fixation of the fractures. Consultation with forensics service was applied to rule out child abuse events. Eventually, after 48 hours, the patient was cleared from neurosurgery and general surgery services for definite orthopedics treatment. We preferred to fix all the fractures surgically.

Under general anesthesia and C-arm control, diaphyseal fracture of the left femur was reduced and fixed with two elastic nails. Physeal fracture of the right distal femur was reduced in a closed manner and fixed with two crossed pins. Metaphyseal fractures of the left proximal tibia and right distal tibia were also fixed with crossed pins after closed reduction. Afterward, both lower extremities were immobilized with hip spica casting (Figures 3-5).

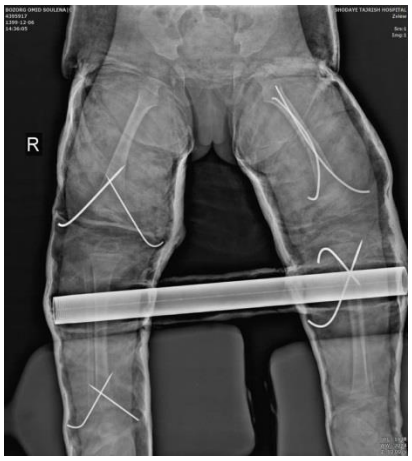

Figure 3. Postoperative radiologic anteroposterior (AP) view of both lower limbs in a spica cast demonstrated fixation of left femoral shaft fracture with elastic nails and other fractures with crossed pins.

All the crossed pins and spica cast were removed 6 weeks after the first surgery, and the elastic nails were removed in the 12th week after the surgery. Progressive weight-bearing and active knee range of motion (ROM) were started after the 6th week following the surgery. All fractures were completely healed in 3 months after the surgery without any significant complication like pin tract infection or knee joint stiffness. The parents of the infant were informed about the possibility of growth disturbance, subsequent deformities, and also the chance of further surgical interventions, especially in the right distal femur area.

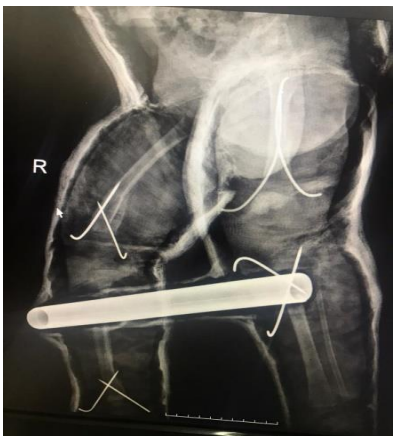

Figure 4. Postoperative radiologic lateral view of right lower limb demonstrated fixation of the right distal femur and distal tibia fractures with crossed pins.

They were advised to refer for follow-up visits every 6 months until 2 years following the surgery and further annual control visits up to the age of skeletal maturity.

Figure 5. Postoperative radiologic lateral view of left lower limb demonstrated fixation of left femoral shaft fracture with elastic nails and left proximal tibia fracture with two crossed pins.

Discussion

Pediatric floating knee injuries are relatively uncommon and mostly caused by the high-energy mechanism of trauma, such as motor vehicle accidents followed by falling from height (5). Bilateral floating knee injuries in children are completely rare, and there is no report of bilateral infantile floating knee injury in the literature. As they are high-velocity injuries, associated injuries such as head injuries and solid organ damages are common, which should be noticed and assessed (1).

In the current case, the mechanism of injury was falling from height of 9 meters, and the patient was cleared from other trauma services, including general surgery and neurosurgery services. However, there were not any associated injuries detected but bilateral floating

knee injuries. Considering child abuse probability, consultation with forensics was conducted.

Although few classifications have been described for pediatric floating knee injuries, none are therapeutic and prognostic (2). Letts et al. (4) defined open injuries as Type-D and Type-E. However, the exact location of open injury than physis remained unclear. Moreover, there are some patterns of injury that are not categorized with current classifications. As an example, in the current case, the injury of the right lower limb included epiphyseal fracture of the femur, and metaphyseal fracture of distal tibia could not be classified precisely with the classifications presented by Letts et al. (4) and Chalidis et al. (1). Therefore, a new modification of previous classifications seems required to describe these injuries more accurately.

The other controversial issue in pediatric floating knee injury is the treatment of choice. There are few case series about pediatric floating knee injuries due to the rarity of cases. Historically, these injuries were treated with traction and spica casting. Anari et al. reported a higher rate of nonunion, malunion, and limb length discrepancies among adults and children with floating knee injuries due to non-operative treatment (2). Letts et al. studied 15 children with floating knee injuries (4). The authors recommended rigid internal fixation for at least one of the fractures.

In another study, Yue et al. reported a high rate of malunion due to non-operative treatment. They recommended internal fixation of at least one of the fractures and both fractures preferentially (5). Furthermore, in the current case, bilaterality of injuries and juxta-physeal locations of most fractures were the other reasons for surgical fixation of all fractures.

Conclusion

Pediatric floating knee injuries are relatively uncommon and extremely rare among infants. However, in most floating knee injury cases, beside a high-energy mechanism of trauma, child abuse events should also be considered, particularly in infants. The current classifications are not accurate enough to define all patterns of these injuries. The preferred method of treatment is a surgical fixation for all fractures of all ages.

Conflict of Interest

The authors declare no conflict of interest in this study.

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