Section: Orthopaedics

Case Report

DELAYED POST-TRAUMATIC GENU VALGUM SECONDARY TO PARTIAL DISTAL FEMORAL PHYSEAL ARREST SUCCESSFULLY TREATED WITH PHYSEAL BAR EXCISION AND GUIDED GROWTH: A CASE REPORT

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ABSTRACT

Background: Distal femoral physeal injuries are associated with a high risk of growth disturbance because of the significant contribution of the distal femoral physis to lower limb growth. Partial physeal arrest may result in progressive angular deformities that often become clinically evident several years after the initial injury. **Case Presentation:** An 8-year-old girl presented with progressive valgus deformity of the right knee three years after a road traffic accident that had resulted in extensive soft-tissue injury around the knee. Clinical and radiological evaluation demonstrated partial distal femoral physeal arrest with formation of a lateral physeal bar and preservation of the medial physis.
Intervention and Outcome: The patient underwent excision of the lateral physeal bar followed by medial temporary hemiepiphysiodesis using an eight-plate tension-band construct. Serial follow-up demonstrated progressive correction of valgus alignment, restoration of mechanical axis orientation, preservation of knee range of motion, and absence of implant-related complications. Satisfactory deformity correction was achieved through guided growth without the need for corrective osteotomy.
Conclusion: Delayed post-traumatic genu valgum resulting from partial distal femoral physeal arrest can be effectively managed using a combination of physeal bar excision and guided growth. Early recognition of growth disturbances and timely intervention are critical for achieving favorable outcomes while preserving remaining growth potential in skeletally immature patients.
Keywords: Distal femoral physeal arrest; Genu valgum; Guided growth; Hemiepiphysiodesis; Pediatric trauma.

INTRODUCTION

Physeal injuries represent a substantial subset of pediatric skeletal trauma and are clinically significant due to their potential to disrupt normal longitudinal growth. The distal femoral physis is particularly susceptible to growth disturbance because of its high growth contribution and biomechanical exposure, making injuries at this site more likely to result in partial or complete growth arrest compared with other physes. [1,2]

Following trauma, formation of an osseous bridge across the physis may occur, leading to asymmetric growth when the arrest is incomplete. Such partial physeal arrest often manifests as progressive angular deformity rather than isolated limb-length discrepancy. The onset of deformity is frequently delayed, becoming clinically apparent only after continued growth accentuates the imbalance between the affected and unaffected portions of the physis. [3,4] Management strategies for partial physeal arrest are guided by patient age, extent and location of physeal involvement, and remaining growth potential. While

corrective osteotomy can provide immediate realignment, it is associated with increased surgical morbidity and risk of recurrence in skeletally immature patients.[5] In contrast, biological approaches such as physeal bar excision combined with temporary hemiepiphysiodesis aim to restore growth symmetry and achieve gradual correction by modulating remaining physeal activity. [6]

This report describes a child presenting with delayed post-traumatic genu valgum secondary to asymmetrical distal femoral physeal arrest, successfully managed using a combined approach of lateral physeal bar excision and medial guided growth. The case emphasizes principles of assessment and intervention in pediatric trauma sequelae.

MATERIALS AND METHODS

Case Presentation

Patient Information

An 8-year-old female child presented with progressive deformity of the right knee and difficulty in ambulation. There was no history of pain or instability.

History of Present Illness

The child had sustained a road traffic accident at the age of 5 years, resulting in injury to the right knee with composite loss of skin, subcutaneous tissue, and quadriceps muscle. The initial injury was managed surgically with split-skin grafting. No bony procedure was performed at that time. The child remained asymptomatic for approximately two years, after which gradual valgus deformity of the right knee became apparent.

Clinical Findings

On examination, the patient had:

- Visible valgus deformity of the right knee
- Asymmetrical alignment compared to the contralateral limb
- No limb length discrepancy clinically
- Full range of motion at the knee joint
- No neurovascular deficits

Diagnostic Assessment

Radiological evaluation using standing long-leg radiographs demonstrated genu valgum of the right lower limb with asymmetrical distal femoral physeal arrest involving the lateral physis, while the medial distal femoral physis remained preserved.

Diagnosis

Post-traumatic genu valgum secondary to partial distal femoral physeal arrest with lateral femoral physeal bar.

Therapeutic Intervention

Surgical management was planned with the objective of correcting angular deformity while preserving remaining growth potential.

Under general anesthesia, the lateral distal femoral physeal bar was identified and excised. Care was taken to remove all bony bridges contributing to asymmetric growth arrest. Subsequently, medial temporary hemiepiphysiodesis was performed using a two-hole eight-shaped tension band plate, fixed with cortical screws across the medial distal femoral physis.

The procedure aimed to allow continued growth on the lateral side while temporarily restraining medial physeal growth, facilitating gradual correction of the valgus deformity.

Follow-Up and Outcomes

Postoperatively, the patient was mobilized as per standard protocol. Serial clinical and radiological follow-up demonstrated:

- Progressive correction of valgus alignment
- Improvement in mechanical axis alignment
- Maintenance of knee range of motion
- No implant-related complications

At final follow-up of 6 months, satisfactory correction of deformity was achieved, indicating effective growth modulation.

Ethical Considerations

The case report was approved by the Institutional Ethics Committee. Written informed consent was obtained from the patient for publication of clinical information and accompanying images. All efforts have been made to protect patient confidentiality and anonymity.

DISCUSSION

Growth disturbance following distal femoral physeal injury remains a well-recognized complication, with partial arrest frequently leading to angular deformities due to asymmetric physeal function. Compared with other growth plates, the distal femoral physis carries a higher likelihood of clinically significant deformity because of its rapid growth rate and central role in lower limb alignment.[2,7]

Reports describing post-traumatic genu valgum secondary to distal femoral physeal bar formation consistently highlight the challenge of delayed diagnosis. Naseer et al. emphasized that isolated excision of a physeal bar may be insufficient once angular deformity is established, advocating the use of adjunctive growth modulation to achieve sustained correction in skeletally immature patients.[8] This observation aligns with the management strategy employed in the present case.

Temporary hemiepiphysiodesis has become an integral component of deformity correction in children with remaining growth potential. Comparative work by Martínez et al. demonstrated that tension band plate constructs offer controlled and predictable correction of genu valgum with a favorable complication profile when compared with transphyseal screw techniques.[9] The reversibility and gradual corrective mechanism of the eight-plate system were particularly advantageous in the present patient.

A recurring observation in the literature is the delayed clinical recognition of post-traumatic physeal arrest, with deformity often emerging years

after the initial injury as growth progresses.[4,10] In such cases, combined surgical strategies are frequently required. Physeal bar excision addresses the structural growth constraint, while guided growth corrects the resultant angular deformity by redistributing physeal activity, as supported by previous clinical reports.[6,11]

Delayed recognition of post-traumatic physeal arrest remains a significant challenge because angular deformity may not become apparent until several years after the initial injury. Continuous follow-up of children sustaining injuries around the distal femoral physis is therefore essential, even when immediate radiographs do not demonstrate obvious physeal disruption. Early identification of growth disturbance allows intervention before severe deformity develops and may reduce the need for more invasive corrective procedures.

In the present case, a combined strategy of lateral physeal bar excision and medial temporary hemiepiphysiodesis resulted in progressive correction of genu valgum while preserving the remaining growth potential of the distal femoral physis. The successful outcome supports previous reports advocating growth modulation techniques as an effective alternative to corrective osteotomy in skeletally immature patients. Furthermore, the case demonstrates that satisfactory correction can still be achieved despite delayed presentation and a history of severe soft-tissue injury. These findings reinforce the importance of individualized treatment planning based on the extent of physeal involvement, remaining growth potential, and degree of deformity.

The present case possesses several noteworthy features. First, the valgus deformity became clinically evident approximately three years after the initial trauma, highlighting the delayed nature of growth disturbances following physeal injury. Second, the patient had sustained substantial soft-tissue loss requiring split-skin grafting, which increased the complexity of subsequent management. Third, rather than performing a corrective osteotomy, which is commonly considered for established angular deformities, a growth-preserving strategy comprising physeal bar excision and temporary hemiepiphysiodesis was employed. This combined approach allowed gradual correction of alignment while preserving residual growth potential. The favorable outcome observed in this patient supports the role of early recognition and growth modulation techniques in appropriately selected skeletally immature children with partial distal femoral physeal arrest.

CONCLUSION

Post-traumatic asymmetrical distal femoral physeal arrest can present years after the initial injury as progressive genu valgum. A combined approach of physeal bar excision and guided growth using temporary hemiepiphysiodesis is an effective method for correcting deformity while preserving growth potential. This case underscores the importance of long-term surveillance following pediatric knee trauma.

Declarations

Ethics Approval and Consent to Participate: The case report was reviewed and approved by the Institutional Ethics Committee, PES Institute of Medical Sciences and Research, Kuppam.

Consent for Publication: Written informed consent for publication of clinical details was obtained from the patient.

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Conflict of Interest: The authors declare that they have no conflict of interest.

Availability of Data and Materials: All relevant data supporting the findings of this case report are included within the article. Additional information is available from the corresponding author upon reasonable request.

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