

A Rare Case of Left Femoral Neck Fracture in a 6-Year-Old Boy with Osteopetrosis

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Learning Point of the Article:

In pediatric osteopetrosis related femoral neck fractures, physal sparing fixation may achieve union but risks late capital femoral epiphysis slippage, suggesting that crossing the physis may be necessary for long term stability.

Abstract

Introduction: Pathological femoral neck fractures are rare but significant injuries in children with osteopetrosis and pose unique management challenges. Optimal treatment strategies remain controversial, particularly in skeletally immature patients with open physes.

Case Report: We report a rare case of a 6-year-old boy with osteopetrosis who sustained a pathological fracture of the left femoral neck following trivial trauma. The child was managed with closed reduction and physal-sparing internal fixation using cannulated cancellous screws, followed by hip spica immobilization. Although fracture union was achieved, the patient subsequently developed slippage of the capital femoral epiphysis, resulting in a painless limp and limb length discrepancy.

Conclusion: This case highlights the importance of fixation strategy in pathological pediatric femoral neck fractures and suggests that crossing the physis may be necessary to prevent late epiphyseal slippage.

Keywords: Osteopetrosis, pediatric femoral neck fracture, pathological fracture, cannulated cancellous screws.

Introduction

Osteopetrosis is a rare hereditary metabolic bone disorder characterized by increased bone density due to defective osteoclastic bone resorption. Based on the age of onset, it is classified into infantile (malignant), intermediate, and adult-onset (benign) forms. Adult-onset osteopetrosis is further subdivided into two types. Many patients remain asymptomatic and are diagnosed only after sustaining fractures, most commonly involving the proximal femur [1, 2].

Management of pathological femoral neck fractures in children with osteopetrosis is particularly challenging due to abnormal bone architecture, increased bone brittleness, technical

difficulties during surgery, and risks of complications such as avascular necrosis, non-union, and growth plate injury. Owing to the rarity of this condition, standardized treatment guidelines are lacking [3,4,5,6].

Case Report

A 6-year-old boy presented to the emergency department with pain and inability to bear weight on the left lower limb following a trivial slip and fall. Clinical examination revealed restricted and painful movements of the left hip. Radiographs of the pelvis demonstrated a fracture of the left femoral neck with marked sclerosis of the pelvic bones and proximal femur, raising

Author's Photo Gallery



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Figure 1: Anteroposterior radiograph of pelvis with both hips at presentation showing left femoral neck fracture with diffuse bony sclerosis.

suspicion of a pathological fracture (Fig. 1).

The child was the firstborn of two siblings, delivered at term following an uncomplicated pregnancy and normal vaginal delivery. There was no history of neonatal intensive care admission or prior fractures. Magnetic resonance imaging of the pelvis showed features suggestive of osteopetrosis.

The patient underwent closed reduction on a fracture table using traction and internal rotation, followed by internal fixation with two 4-mm cannulated cancellous screws, deliberately stopping short of the physis (Fig. 2). Intraoperatively, significant technical difficulty was encountered due to dense sclerotic bone, including breakage of a drill bit, which required removal by burring the surrounding bone.

Postoperatively, a hip spica cast was applied for 7 weeks. After removal of the hip spica cast, gradual physiotherapy and progressive weight-bearing were initiated under clinical supervision. Follow-up radiographs after cast removal showed



Figure 2: Immediate post-operative radiograph showing fixation with two cannulated cancellous screws (May 07, 2024).

satisfactory fracture healing (Fig. 3). At 3 months, the fracture had united without evidence of avascular necrosis or non-union (Fig. 4), and the child had a painless full range of hip movements. Full weight-bearing ambulation was initiated.

Seven months postoperatively, the child presented with a painless limp and apparent limb shortening. Radiographs revealed slippage of the capital femoral epiphysis despite fracture union (Fig. 5). The likely cause was stress concentration at the screw tips adjacent to the physis. Revision fixation was deferred due to the small size of the epiphysis and anticipated poor screw purchase. At 1-year follow-up, radiographs demonstrated progression of epiphyseal slippage with significant limb length discrepancy (Fig. 6), although the child remained painless and ambulatory. The patient was advised to continue observation with a plan for future deformity correction.



Figure 3: Radiograph at 7-Weeks follow-up after Hip Spica Cast removal showing progressing fracture union without evidence of avascular necrosis.



Figure 4: Radiograph at 3-month follow-up showing progressing fracture union without evidence of avascular necrosis.



Figure 5: Radiograph at 7-month follow-up demonstrating slippage of the capital femoral epiphysis.

Discussion

Osteopetrosis results in dense but brittle bone due to defective osteoclastic resorption, making fracture fixation technically demanding. Femoral neck fractures are particularly problematic because of high biomechanical stress and the risk of growth-related complications in children [1,2].

Various fixation strategies have been described for pediatric femoral neck fractures, including cannulated screws crossing the physis, pediatric dynamic hip screws, and locking plate constructs. However, the optimal fixation method in patients with osteopetrosis remains uncertain due to altered bone biology, increased bone brittleness, and technical challenges during drilling and implant placement.

Although conservative treatment has been described, it is associated with complications such as non-union and coxa vara [5,6]. Surgical fixation is generally favored; however, drilling and implant insertion are difficult due to bone hardness, with reported complications including drill bit bending or breakage [3,7,8]. Similar intraoperative challenges were encountered in our case.

Our case demonstrates that physeal-sparing fixation, while initially successful for fracture union, may predispose to subsequent capital femoral epiphyseal slippage. We believe that screw tips may act as stress risers near the growth plate. The hypothesis that screw tips near the physis may act as stress risers remains speculative and would require biomechanical validation in future studies. Similar fixation challenges and complications have been described in previous reports of osteopetrotic fractures, emphasizing the need for careful surgical planning and consideration of alternative fixation strategies in this unique patient population. Crossing the physis during fixation may provide better long-term stability in



Figure 6: One-year post-operative radiograph showing progression of epiphyseal slip with limb length discrepancy.

pathological femoral neck fractures, despite traditional concerns regarding physeal injury [3,4,9]. Advanced imaging modalities such as computed tomography may provide better evaluation of fracture morphology and implant positioning in osteopetrotic bone.

Alternative fixation options, including physeal-crossing screws, pediatric dynamic hip screw constructs, or supplementary fixation, may be considered to improve stability in pathological femoral neck fractures associated with osteopetrosis. Post-operative magnetic resonance imaging evaluation of the physis could potentially help assess growth plate viability and detect early complications. Management of osteopetrosis often requires a multidisciplinary approach involving orthopedic surgeons, endocrinologists, and metabolic specialists to address both skeletal and systemic manifestations.

Orthopedic surgeons should anticipate intraoperative challenges and carefully select fixation strategies in osteopetrotic fractures. Meticulous technique and close post-operative surveillance are essential [10].

Limitations

This report has several limitations. First, it represents a single case observation, which limits the ability to generalize the findings to the broader pediatric population with osteopetrosis. Because the study involves only one patient, conclusions regarding the optimal fixation strategy remain speculative and should be interpreted with caution. Although the patient was followed for 1-year, longer follow-up would be required to assess late complications such as avascular necrosis, progressive deformity, or degenerative changes of the hip joint. Genetic confirmation of the specific subtype of osteopetrosis was not performed in this case, which may influence fracture behavior

and healing potential. Objective quantification of bone quality using bone mineral density testing or advanced imaging techniques was not performed.

Standardized pediatric functional outcome scores or gait analysis were not utilized, and clinical recovery was assessed primarily through physical examination and radiographic follow-up. Case reports may also be subject to publication bias, as unusual or complicated cases are more likely to be reported.

Conclusion

Surgical fixation is an effective treatment option for pathological femoral neck fractures in children with

osteopetrosis, despite significant technical challenges. Although fracture union can be achieved with physal-sparing techniques, this case illustrates the risk of late capital femoral epiphyseal slippage. This case suggests that physal-crossing fixation may provide improved stability in pathological femoral neck fractures associated with osteopetrosis; however, further clinical studies are required to validate this observation.

Clinical Message

Pathological femoral neck fractures in children with osteopetrosis should be managed surgically. Internal fixation that crosses the physis may be necessary to prevent subsequent capital femoral epiphyseal slippage and achieve optimal outcomes.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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