## Case Report

**A Triplane Fracture of the Distal Femoral Epiphysis: A Case Report.**

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### Introduction

Since Hutchinson's 1894 report on the so-called "wagon-wheel injuries", fractures of the distal femoral epiphysis have been recognized as potentially serious injuries[1]. It is the largest physis in cross-sectional area, and its undulating contours make it more resistant to shear stress than other growth plates[2,3,4]. It contributes approximately 40% of the overall leg length[5,6,7].

Fractures involving the distal femoral growth plate represent between 1 to 5% of all physeal injuries, and approximately 7% of lower extremity physeal injuries[2,6,8,9]. Fusion occurs between 14 and 16 years of age for females, and 16 to 18 years of age for males [5,4,10,]. Because of the thicker periosteum and perichondral ring, it takes more energy to injure the growth plate of a child than that of an adolescent[5,10]. This, combined with the increased growth potential, puts the younger patient at an increased risk of complications: malunion, premature closure of part or all of the growth plate with corresponding angular and/or rotational deformities, or leg length discrepancies, and neuro-vascular injuries[2,10,11,12,13]. These physeal fractures have been classified either according to their anatomo-pathologic pattern, or the suspected mechanism of injury. The classic Salter-Harris (SH) classification is still the one favored by most[14].

Surgical treatment is usually recommended for displaced fractures, particularly those with an intra-articular component (SH III and SH IV)[2,4,3,9,]. Undisplaced or anatomically reduced fractures that are treated conservatively still require very careful observation, as Thompson has shown a 43% rate of redisplacement compared to 0% for those treated surgically[13].

Triplane fractures are by definition fractures that have a component involving all 3 planes:

saggital, coronal and transverse. In the Salter-Harris scheme, they would correspond to a hybrid between types II, III or IV. The classic triplane fracture was described for the distal tibial physis, and is presumed to result from a combination of shear and rotational stresses on the incompletely fused growth plate[15,16]. Triplane fractures have also been described for other epiphyses: proximal tibia[17], distal humerus[18], distal radius[19], and in the hand[20]. Unusual biplane fractures of the distal femoral physis have been reported[21], but, to our knowledge, a triplane fracture has never been reported as such. Our literature review has failed to describe or illustrate a case similar to ours, except possibly one of the examples in the 1962 article by Bassett, figures A to D, where the X-rays might be suspicious, but certainly not conclusive[12].

### Case Report

A 9-year-old male presented at the outpatient orthopedic clinic of the Mulago University Hospital in Kampala, Uganda, with a history of fall from a mango tree sustained 4 or 5 weeks earlier. His main complaint at the time was inability to extend the left knee. Initially there was sudden and severe pain in the knee area, with swelling and inability to bear weight, which was treated according to traditional healing practices with herbs and massages. There was no associated wound, and no other injuries. Eventually, pain and swelling subsided, but the patient remained unable to extend his knee or to ambulate, in spite of his parent's attempts at passive manipulation. The child had no history of prior injury to the left lower extremity or any history of musculo-skeletal pathology such as septic arthritis, TB, sickle cell disease or poliomyelitis.

On examination, the child was in good general condition, and only the left knee area showed

any abnormalities: it was held in approximately 85 degrees of flexion, without significant swelling, but with a visible and palpable non-tender prominence antero-laterally. There was no pain at rest, but only a few degrees of active range of motion. Passively, the knee could be flexed to 120 degrees and extended to around 60 degrees, with pain at both extremes. The distal neurovascular status was normal.

AP and lateral X-ray views were obtained (figures 1a and b) and, in spite of the amount of callous already present were highly suspicious of a triplane-type of fracture of the distal femur: except for the anterior half of the lateral femoral condyle, the entire epiphysis, and part of the medial metaphysis, were displaced mostly posteriorly, and to a lesser extent, proximally and medially.

In spite of the extremely poor prognosis in terms of bone growth or knee joint function, it was felt reasonable to attempt an open reduction, if only to improve the bony environment for an eventual knee fusion.

The intra-operative findings confirmed the radiologic suspicions: only the anterior half of the lateral femoral condyle was in anatomical relation with the proximal fragment (figure 2). The posterior half of the lateral condyle, the intercondylar part of the epiphysis and the entire

medial condyle with part of the medial metaphysis were displaced as anticipated. The remaining intact anterior lateral condyle impinged on its posterior half on attempts at extension.

The fragments were mobilized enough to lift the bony bloc, allowing passive extension to about 10 degrees from full. The remaining growth plate from the anterolateral condyle was curetted, in the hope of avoiding future angular deformity; a non-anatomical reduction was achieved and internally fixed with screws (figure 3). At the end of the procedure, the knee had a passive arc of approximately 10 to 90 degrees of motion.

We have no doubt that the residual growth potential is next to nil. In the best case scenario, the entire physis will fuse, creating a significant leg-shortening problem, but hopefully without associated angular or rotational deformities. Since many patients in this particular socio-cultural environment are lost to follow-up, it was felt that a knee ankylosis at 10 degrees of flexion was preferable to the alternative. If the patient does present for follow up, future problems such as pain, angular deformity and/or leg length discrepancy can be addressed by surgical arthrodesis, osteotomies, limb lengthening or contralateral epiphysiodesis, respectively.

a

b

b.



**Figure 1.a and b**. AP and lateral X-rays of the left knee on admission
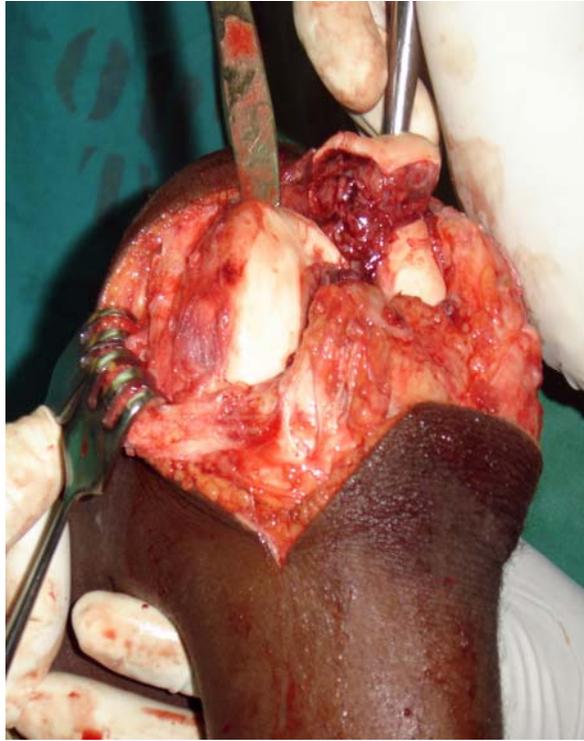
**Figure 2**. Intra-operative photo of left knee showing fracture fragment displaced   posteriorly and superiorly, leaving only anterior half of lateral femoral epiphysis in anatomical location
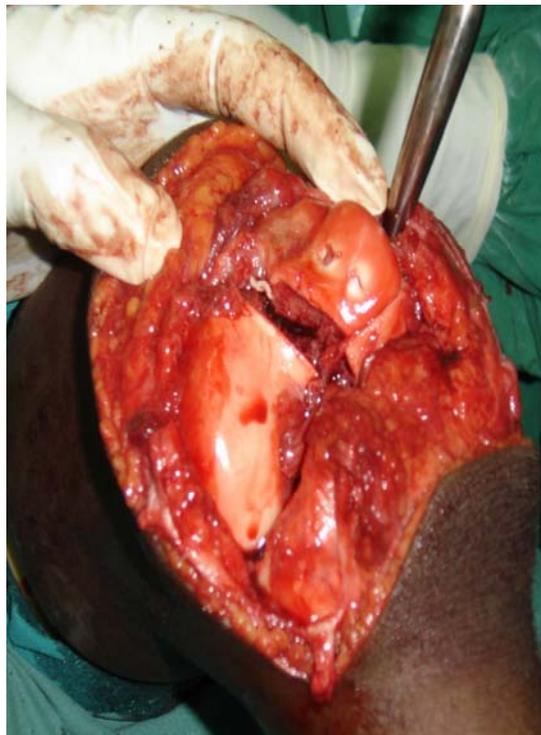


**Figure 3.** Intra-operative photo of left knee after partial reduction

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