

## Distal femoral fracture Muller Type B1 associated with Segond fracture

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**Section:** Musculoskeletal system

**Area of Interest:** Bones

**Procedure:** eLearning

**Special Focus:** Trauma Case Type: Clinical Cases

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**Patient:** 24 years, male

### Clinical History:

A 24-year-old male patient presented to us with severe right knee joint pain and restricted movements. He had had a road traffic accident four months before after which he refused any surgical intervention. He eventually came back to us in severe pain.

### Imaging Findings:

Plain radiographs show intra-articular oblique fracture traversing the lateral femoral condyle with its marked upward displacement. Distal end of femur is medially displaced with reduced joint space at lateral compartment. (Fig. 1, 2, 3) Initial AP radiograph shows possible avulsion of lateral tibial plateau. Slightly angulated radiograph demonstrates classical Segond fracture. (Fig. 2)

MRI performed on 1.5 Tesla Philips scanner shows displaced oblique fracture of lateral femoral condyle extending from metaphysis up to the articular surface. According to Muller classification, it represents Type B1 fracture (sagittal, lateral condyle). (Fig. 4, 8)

Classical chipped off curvilinear bone fragment seen parallel to lateral tibial plateau representing Segond fracture. (Fig. 5).

Non-visualization of anterior cruciate ligament (ACL) noticed along with buckling of posterior cruciate ligament representing complete tear of ACL. (Fig. 6)

Complex tear of anterior horn and body of lateral meniscus is seen. (Fig. 7, 8)

STIR shows bone bruise at the fractured lateral femoral condyle. (Fig. 9).

### Discussion:

Distal femoral fracture involving condyle of femur results from high and low energy injuries in young and elder patients respectively. A wide spectrum of associated soft tissue injuries are a common finding. [1]

### Clinical perspective

Patients usually present with sudden, immense and sharp pain with weight bearing immediately after the injury followed by restricted movement. Later on swelling and bruising occur around the injury site. On examination, one can look for deformities, swelling, contusion or protruding bone through the skin. These fractures may be complicated by osteomyelitis, neurovascular damage, delayed consolidation / nonunion, compartment syndrome and septic arthritis. [2]

### Imaging perspective

Conventional radiographs are the first line of investigation. CT is utilized in high grade injuries to assess intra-

articular involvement and fracture fragments. [3] MRI is essential in all cases of intra-articular fractures to identify internal joint derangement. [4] There is a selective role of arteriography in some cases based on the history or clinical findings of ischaemia to map vascular injury, which has an incidence of around 37% in injuries involving the knee joint. [7]

Muller AO classification is the most widely used system for classifying distal femoral fractures. It was first published in 1987 by the AO Foundation as a method of categorizing injuries according to their localization and severity. Muller classification divides distal femoral fractures into 3 types, according to the localization of the fracture. [6]

Type A fractures : Extra-articular

Type B fractures : Partial articular

Type C fractures : Complete articular fractures with detachment of both condyles from the diaphysis.

These fracture types are further subdivided describing the degree of fragmentation and other, more detailed characteristics.

Fracture Type B is divided into:

B1 (sagittal, lateral condyle)

B2 (sagittal, medial condyle)

B3 (frontal, Hoffa type).

Fracture Type C is divided into:

C1 (articular simple, metaphyseal simple)

C2 (articular simple, metaphyseal multifragmentary)

C3 (multifragmentary). [5]

## Outcome

Distal femoral fractures especially involving the condyles require surgery and a post-op brace to limit the range of motion. Surgical intervention includes open reduction and internal fixation using hardware to stabilize the fractured bone. A majority of fractures heal within the following 4 to 6 months, depending on the severity of the injury. When properly treated and rehabilitated most of the patients regain their full strength and range of motion in the injured leg. [4]. Our patient was also treated surgically with good outcome and minimum postoperative morbidity.

## Take home message

Distal femoral fractures need comprehensive radiological imaging to search for associated soft tissue injuries in addition to bone trauma. This provides a comprehensive road map to the orthopaedic surgeon.

**Differential Diagnosis List:** Muller Type B1 (sagittal, lateral condyle) distal femoral fracture with associated Second fracture, Tibial plateau fracture, Complete intraarticular fracture of femoral condyle

**Final Diagnosis:** Muller Type B1 (sagittal, lateral condyle) distal femoral fracture with associated Second fracture

## References:

Wong MK, et al (2005) Treatment of distal femoral fractures in the elderly using a less-invasive plating technique. Int. Orthop 29(2):117–120 (PMID: [15703938](#))

Tsukada S, et al (2016) Three-Dimensional Computed Tomographic Analysis for Comminution of Pertrochanteric Femoral Fracture: Comminuted Anterior Cortex as a Predictor of Cutting Out. *Open Orthop J* 10:62-70 (PMID: [27347234](#))

Garnavos C, et al (2012) New classification system for long-bone fractures supplementing the AO/OTA classification. *Orthopedics* 35(5):e709-19 (PMID: [22588414](#))

Kolmert L, et al (1982) Epidemiology and treatment of distal femoral fractures in adults. *Acta Orthopaedica Scandinavica* 53(6), 957-962 (PMID: [7180408](#))

Stover M, et al (2001) Distal femoral fractures: current treatment, results and problems. *Injury* 32 (2001): 3-13 (PMID: [11888192](#))

Müller ME, et al (2012) The comprehensive classification of fractures of long bones. *Femur*, Springer Science & Business Media 116-147

Kendall RW, et al (1993) The role of arteriography in assessing vascular injuries associated with dislocations of the knee. *J Trauma* 35(6):875-8 (PMID: [8263986](#))

**Figure 1**

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**Description:** Superior displacement of fractured lateral femoral condyle (white arrow). **Origin:** Hamid. S, Department of Radiology, Jinnah Postgraduate Medical Center, Karachi, Pakistan.

**Figure 2**

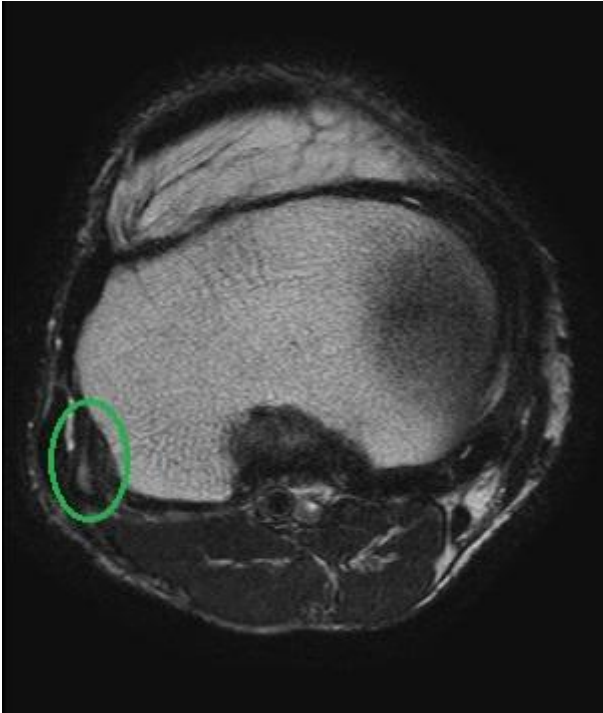
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**Description:** Intra-articular fracture involving lateral femoral condyle (yellow arrow). Mild effusion is also noted. **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.

**Figure 3**

**a**



**Description:** Chipped off bone fragment along the lateral tibial plateau representing Second fracture (yellow circle) **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.

**Figure 4**

**a**



**Description:** Non-visualization of anterior cruciate ligament along with buckling of posterior cruciate ligament suggesting complete tear of anterior cruciate ligament (white arrow). **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.

**Figure 5**

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**Description:** Complex tear of anterior horn and body of lateral meniscus (blue circle). **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.



**Figure 6**

a



**Description:** Oblique displaced intraarticular fracture of lateral femoral condyle extending from metaphysis up to the articular surface (green arrow). Hyperintense signals within anterior horn of lateral meniscus representing its complex tear (yellow arrow). **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.

**Figure 7**

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**Description:** Slightly angulated radiograph nicely depicts classical tiny elliptic bone fragment parallel to the lateral aspect of the tibial plateau representing Segond fracture (white square) and Muller Type B1 distal femoral fracture. **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.

**Figure 8**

**a**



**Description:** Marrow signal abnormality seen involving fractured lateral femoral condyle (white circle) and intercondylar ridge of tibia representing bone bruise . **Origin:** Hamid, S, Department of Radiology, Jinnah Postgraduate Medical center, Karachi, Pakistan.

**Figure 9**

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**Description:** Partial intra-articular fracture (black arrows) of lateral femoral condyle with its marked superior displacement (single white arrow) - Muller Type B1 fracture. Suspected avulsion of lateral tibial plateau (white circle). **Origin:** Hamid. S, Department of Radiology, Jinnah Postgraduate Medical Center, Karachi, Pakistan.