

# SURGICAL INCISION TECHNIQUE APPROACH ON DISTAL FEMUR FRACTURE A LITERATURE REVIEW

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## Abstract

Fractures of the distal femur is described as a classic fragility fracture. Distal Femur fractures are rare, with a prevalence of 0.5% of all fractures. The incidence of distal femur fractures is 8.7/100,000/year. After the age of 60 years, a rapid increase in the incidence of distal femoral fractures was observed for both genders with a considerable female predominance. There are several surgical technique approaches on distal femur fracture. The surgical approach selection on distal femur fracture depends on classification of fracture type, the surgeon's capability, implant availability, facilities and infrastructure. For type c distal femur fracture that require lateral and medial exposure, mediana / medial parapatellar straight approach can be performed with a lateral parapatellar incision to dislocate the patella medially.

**Keywords:** Distal Femur Fracture, Surgical Approach, Surgical Incision, Mediana approach, Type c fracture

## INTRODUCTION

Distal Femur fractures are rare, with the literature reporting a prevalence of 0.5% of all fractures. Incidence rates of distal femur fractures have only been reported in a small number of studies. Fractures of the distal femur is described as a classic fragility fracture, with the mean age of patients reported as 67.3 years and the vast majority of fractures (83%) occurring in women.

A study shows an incidence of distal femur fractures is 8.7/100,000/year. After the age of 60 years, a rapid increase in the incidence of distal femoral fractures was observed for both genders with a considerable female predominance. Nowadays, the surgical management of distal femur fracture is evolving. This review will discuss about the incision approach on distal femur approaches.

## 1. Distal Femur Fracture Classification

According to Muller et al, distal femur fracture classified into 3 types, type A as extra-articular fracture which divided into 3 subtypes (A1 simple extra-articular fracture that include apophyseal, metaphyseal oblique or spiral and transverse type; A2 metaphyseal wedge extra-articular fracture that include intact, fragmented and lateral, fragmented and medial; A3 metaphyseal complex extra-articular fracture), type B as partial articular fracture which also divided into 3 subtypes (B1 partial articular fracture, lateral condyle, sagittal; B2 partial articular fracture, medial condyle, sagittal; B3 partial articular fracture, frontal), and type C as complete articular fracture divided into 3 subtypes (C1 complete articular fracture, anterior simple, metaphyseal simple; C2 complex articular fracture, articular simple, metaphyseal multifragmentary; C3 complete articular fracture, multifragmentary).

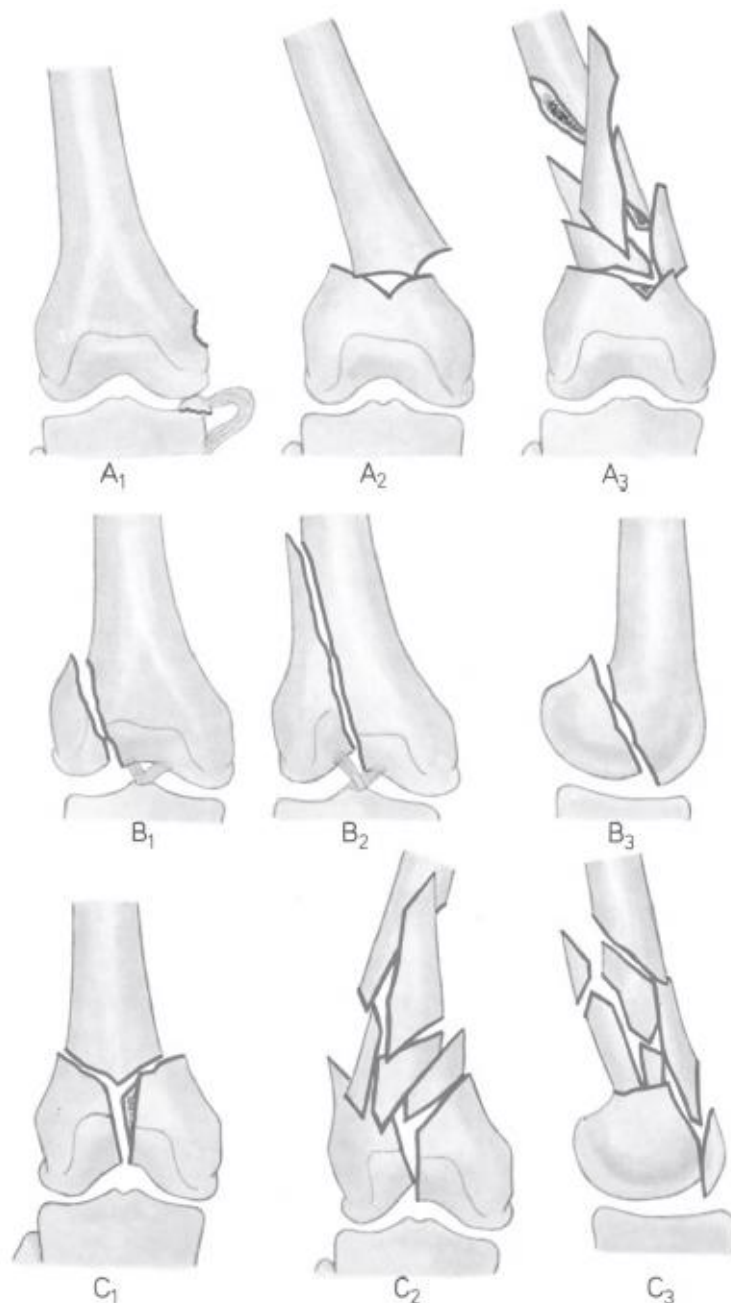


Figure 1. Classification of distal femur types<sup>6</sup>

## 2. Surgical Insision Technique Approach

Distal femur fractures can be operatively treated through minimally invasive submuscular techniques involving small lateral incisions or through conventional exposures performed anteriorly, laterally, or medially based on the fracture pattern and surgeon comfort<sup>7,8</sup>.

Based on those distal femur fracture classification, if an operation is indicated, requiring surgical technique approach which

according to Stanley Hoppenfeld is divided into :

- a. Lateral approach
- b. Posterolateral approach
- c. Anterolateral approach
- d. Anteromedial approach
- e. Posterior approach

The workhorse approach proven in fractures involving the articular surface is the lateral para-patellar arthrotomy with varying degrees of proximal extension<sup>9</sup>. The swashbuckler and mini swashbuckler

approaches have been described, enumerating techniques to extend the laterally based arthrotomy proximally between the IT band and vastus lateralis by following the lateral intermuscular septum to expose the distal femur<sup>10,11</sup>. However, mediana or medial parapatella incision for distal femur fracture type C is admissible to be done to attain exposure to the lateral and medial condyles of the distal femur both extra-articular and intra-articular, either T or Y comminuted fractures or severe comminutive.

### 3. Lateral Approach

The uses of the lateral approach include the following :

- Open reduction and internal fixation of intertrochanteric fractures (this is by far the most common use of the approach)
- Insertion of internal fixation in the treatment of subcapital fractures or slipped upper femoral epiphysis
- Subtrochanteric or intertrochanteric osteotomy

- Open reduction and internal fixation of femoral shaft fractures, subtrochanteric fractures, and supracondylar fractures of the femur
- Extra-articular arthrodesis of the hip joint
- Treatment of chronic osteomyelitis of the femur
- Biopsy and treatment of bone tumors

The minimally invasive approach to the distal femur utilizes two windows. The distal window is in effect a lateral parapatellar approach to the knee and allows visualization of the articular surface of the distal femur. The proximal window provides access to the femoral shaft and is a portion of the lateral approach to the femoral shaft. The minimally invasive approach is indicated for open reduction and internal fixation of distal femoral fractures, especially those that involve intra-articular fractures associated with complex metaphyseal injuries

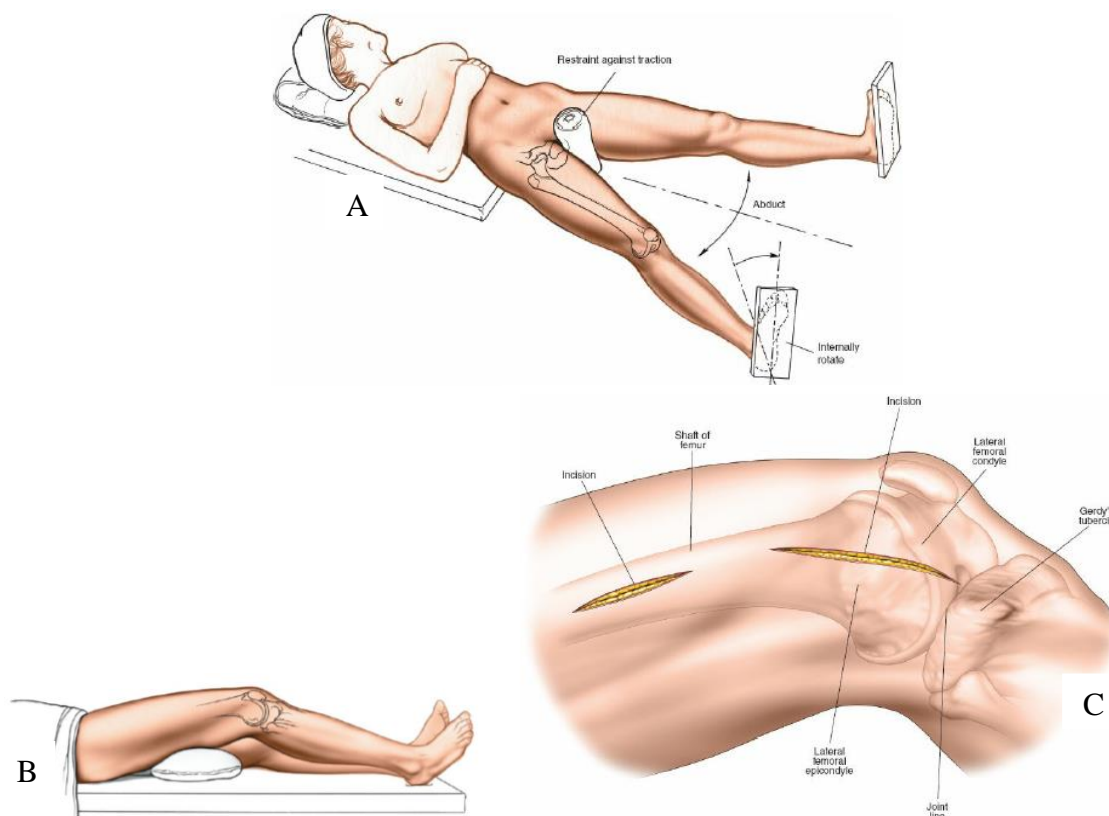


Figure 2. A. Position of patients on lateral approach. B.Position of patients on minimally invasive lateral approach. C.Incision of minimally invasive lateral approach.

#### 4. Posterolateral Approach

The uses of the posterolateral approach include the following :

- a. Open reduction and plating of femoral fractures, especially supracondylar fractures
- b. Open intramedullary nail placement for femoral shaft fractures if facilities for closed nailing do not exist
- c. Treatment of nonunion of femoral fractures

- d. Femoral osteotomy (which is performed rarely in the region of the femoral shaft)
- e. Treatment of chronic or acute osteomyelitis
- f. Biopsy and treatment of bone tumors

The extended of this approach allows accurate visualization of the entire distal end of the femur. This extension is used to allow reduction and fixation of intra-articular fractures of the distal femur.

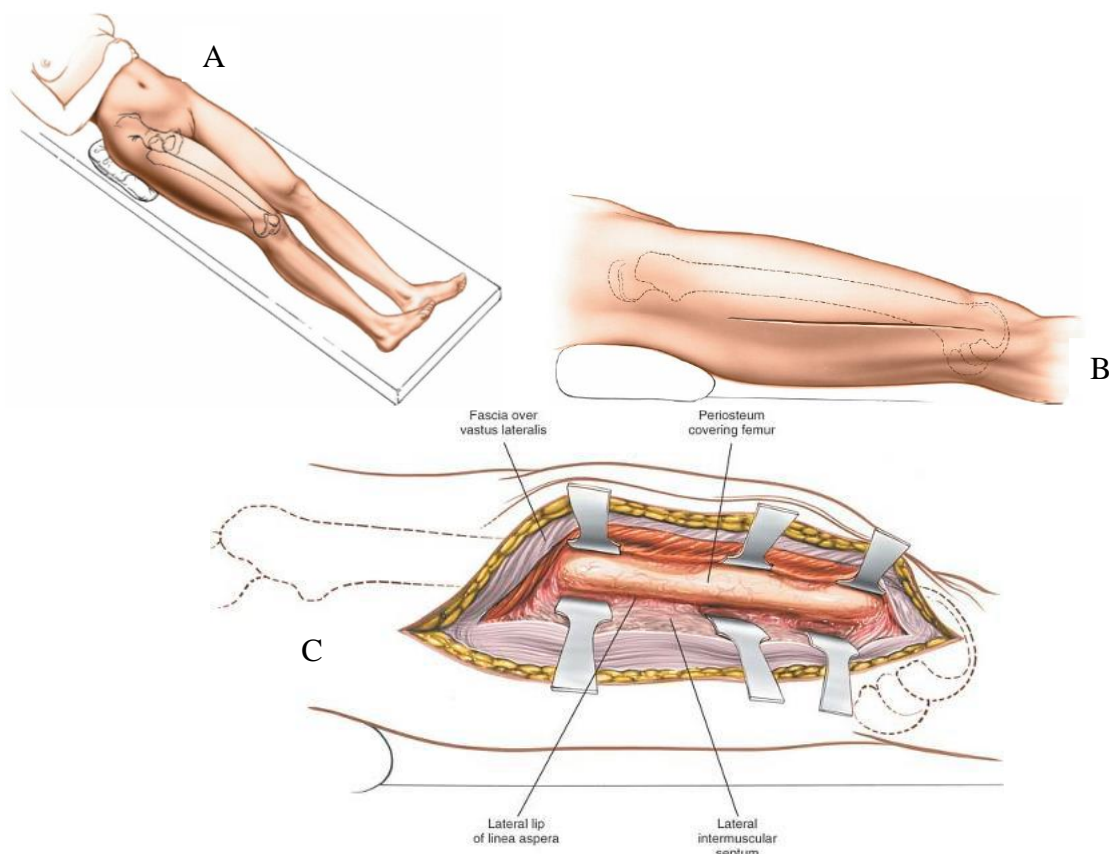


Figure 3. A. Position of patients. B. Incision of posterolateral approach. C.Exposure of extended approach

#### 5. Anterolateral Approach

The anterolateral approach can expose the entire femoral shaft. Its uses include the following<sup>8</sup>:

- a. Open reduction of femoral fractures and internal fixation with either plates or intramedullary rods
- b. Treatment of non-union of femoral fractures
- c. Femoral osteotomy (rarely performed in the region of the femoral shaft)
- d. Treatment of chronic osteomyelitis

- e. Biopsy and treatment of bone tumors
- f. Quadricepsplasty

#### 6. Anteromedial Approach

The anteromedial approach provides an excellent view of the lower two-thirds of the femur and the knee joint. Its uses include the following :

- a. Open reduction and internal fixation of fractures of the distal femur, particularly those that extend into the knee joint and

- require medial buttress plating (its major use)
- b. Open reduction and internal fixation of femoral shaft fractures
- c. Treatment of chronic osteomyelitis
- d. Biopsy and treatment of bone tumors
- e. Quadricepsplasty
- f. Distal femoral osteotomy

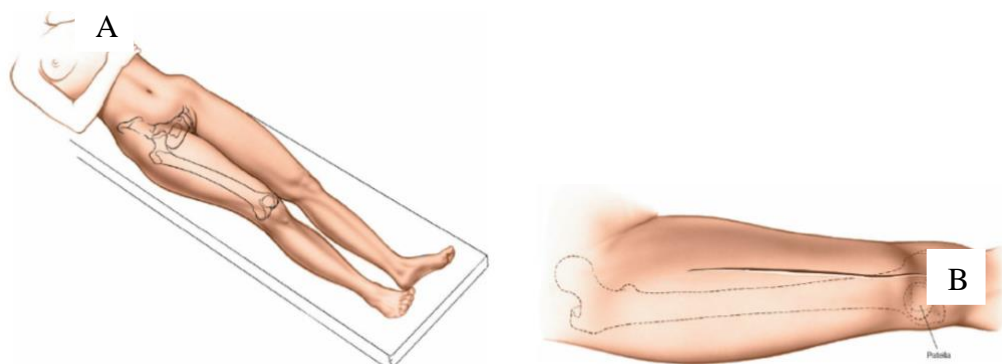


Figure 4. A. Position of patients. B. Incision of anteromedial approach<sup>8</sup>

### 7. Posterior Approach

The posterior approach is useful in patients who cannot undergo more anterior approaches because of local skin problems. It provides access to the middle three-fifths of the bone, as well as to the sciatic nerve. Although it is

performed rarely, its uses include the following:

- a. Treatment of infected cases of nonunion of the femur
- b. Treatment of chronic osteomyelitis
- c. Biopsy and treatment of bone tumors
- d. Exploration of the sciatic nerve

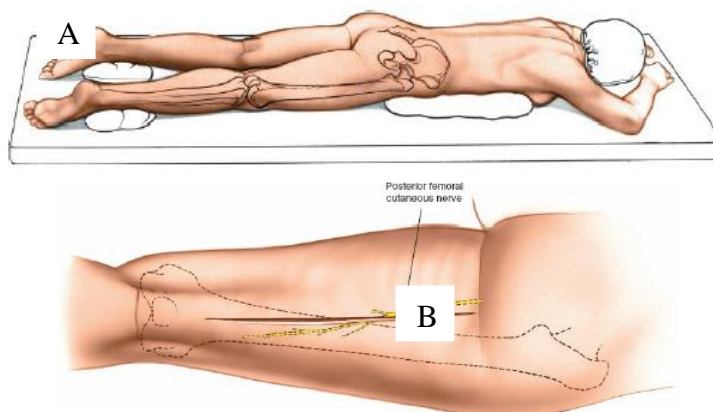


Figure 4. A. Position of patients. B. Incision of posterior approach.

### 8. Medial Parapatella Approach

The medial parapatellar approach is the workhorse approach to the knee. Extended to its full length, it allows excellent access to most structures. The uses of the medial parapatellar approach include the following:

- a. Total knee replacement
- b. Synovectomy
- c. Ligamentous reconstructions
- d. Patellectomy
- e. Drainage of the knee joint in cases of sepsis
- f. Open reduction and internal fixation of distal femoral fractures when a medial plate is to be used

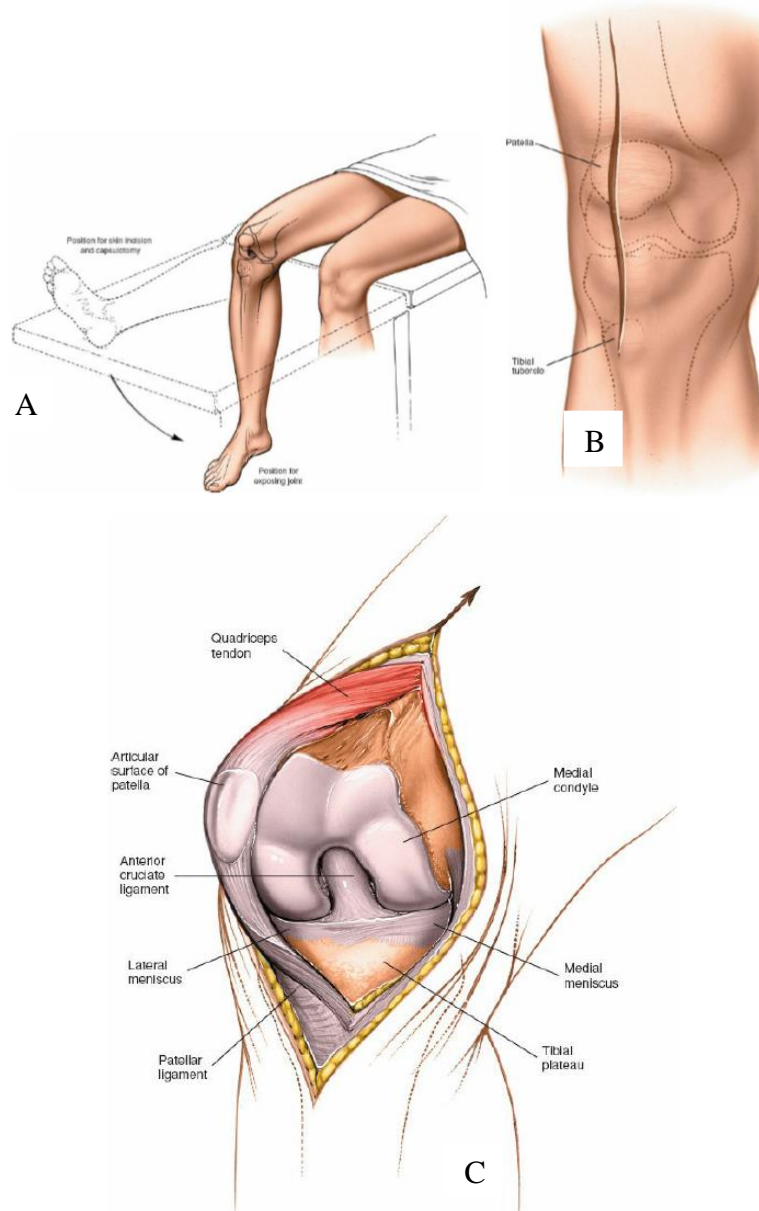


Figure 3. A. Position of patients. B. Incision of medial parapatella approach. C.Exposure of condyle

Table 1. Surgical Incision Technique Approach on Distal Femur Fracture

Approach	Commonly Used	Uses Include	Position of patient	Landmark	Incision	Internervous plane	Superficial Surgical Dissection	Deep Surgical Dissection	Dangers	Enlarge
Lateral	Upper third of femur	ORIF distal femur extended	Prox : supine Shaft : Lateral Distal : supine	Greater trochanter – shaft femur	Longitudinal begin midde greater trochanter	No	Fascia lata	-Vastus lateralis -Femoral shaft	A.perforantes	-Proximal -Distal
Posterolateral	Entire length of femur	ORIF suracondyler femur	Supine	Latera femoral epicondyle	Longitudinal posterolateral	Vastus lateral (femoral nerve) Lateral (Intermuscular) Septum (sciatic nerve)	Deep fascia (fascia lata)	-Vastus lateralis -Lateral intermuscular septum	A.perforantes	-Proximal -Distal
Anterolateral	Expose entrie femoral shaft	Expose knee joint intraarticular fracture extended	Supine	-Anterior Superior Iliac Spine -Lateral border patella	5 cm below ASIS to lateral border patella	No	Fascia lata-vastus lateral and rectus femoris	-Distal femur bone -Vastus intermedialis -Femoral shaft	-nerve to vastus lateralis -branch of a.circumflexa femoris -vastus intermedialis adhesion	-Proximal -Distal
Anteromedial	Lower two thirds of femur and knee	ORIF distal femur and knee	Supine	Vastus medialis	10-15 cm longitudinal	No	Fascia lata-vastus medialis and rectus femoris	-Capsule knee joint -Quadriceps tendon -Vastus intermedialis -Femoral distal bone	-Medial superior genicular artery -vastus medialis (Patella subluxation)	-Proximal -Distal → Patella subluxation -Lateral
Posterior	If cannot undergo more anterior approach because of local skin problem	-Osteomyelitis -Bone tumors -Exploration of the sciatic nerve	Prone	Gluteal folds	Longitudinal ± 20 cm long down the midline of the posterior aspect of the thigh	Lateral (intermuscular) Spetum (femur nerve) Biceps femoris (sciatic nerve)	-Deep fascia of thigh -Posterior femoral cutaneous nerve -Biceps femoris	-Long head biceps -Femoris medialis -Lateral intermuscular septum laterally -Short head biceps → detach from femur	-sciatic nerve and branches to biceps femoris	Cannot



Mediana (Medial Parapatellar Approach)	Workhouse approach to the knee	Distal femur (repair ACL)	Supine	Patella – tibial tubercle	3-5 cm above the superior pole of the patella run distally: 1.medial corner and around medial border patella running toward and just medial patella ligament (curve) 2.Straight midline to tibia tubercle	No	-Joint capsule -Patellar ligament -Quadriceps tendon -Synovillus -Medial meniscus	-Sciatic nerve -Posterior aspect femur -Bone patella -Distal femur -Proximal tibia	-Inferior paella nerve -Patellar ligament	-Proximal -Distal → Patella subluxation
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## 9. Surgical Incision Approach And Types Of Distal Femur Fracture

There are several types of surgical technique approaches on distal femur fracture. Opting

which technique to apply according to the abilities and habits of a surgeon, classification or type of fracture of the distal femur and the availability of the facilities and infrastructure<sup>13</sup>.

Based on surgical approach, distal femur fracture classification, and implant option of open reposition and internal fixation, then surgical approach on distal femur fracture is divided into<sup>13</sup>:

- a. If type A fracture (extra-articular)
  - Simple or non - avulsion comminutive can be done posterolateral approach
  - Avulsion or severe comminutive that needs lateral and medial side exposure for reposition, can be done mediana/medial parapatellar approach
  - If avulsion fracture of medial side can be done anteromedial approach
- b. If type B fracture (partial articular)
  - If it is a lateral or sagittal fracture, can be done posterolateral approach
  - If it is medial or sagittal fracture, can be done posteromedial approach
  - If it is posterior or frontal fracture, can be done posterior approach

- c. If type C fracture (complete articular fracture)

Bicondylar type C fracture requires a proper lateromedial exposure, and a stable internal fixation using plate and screw which commonly put on lateral side. Therefore, it needs a straight mediana/medial parapatellar surgical approach and the patella is dislocated medially for lateral and medial, proximal and distal repositioning along with a plate and screw fixation of lateral side of distal femur.

## CONCLUSION

- a. There are several surgical technique approaches on distal femur fracture
- b. The surgical approach selection on distal femur fracture depends on classification of fracture type, the surgeon's capability, implant availability, facilities and infrastructure.

- c. For type c distal femur fracture that require lateral and medial exposure, mediana / medial parapatellar straight approach can be performed with a lateral parapatellar incision to dislocate the patella medially.

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