

Potpourri – Recent and Relevant Literature in Distal Femur Fractures

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Abstract

Distal femur fractures include fractures of the supracondylar and intercondylar region and are relatively common injuries. The goals of treatment follow AO principles of anatomic reduction of the articular surface, restoration of limb alignment, length, and rotation. Despite improvements in implant design, management of distal femur fractures remains a challenge; fractures are often comminuted, intra-articular, and involve osteoporotic bone, making fixation challenging to achieve. In the geriatric trauma population, the incidence of co-morbidities is high and may impact the therapeutic options. We have aimed to bring together all the recent advances and literature in the management of distal femur fractures through this article.

Keywords: Distal femur, Plating, Nailing, Prosthesis

Role of Dual Plating in Distal Femur Fractures (DFFs)

Supracondylar femur fractures are commonly associated with severe comminution and significant soft-tissue injury. Distal femoral fractures are mostly caused by high-energy injuries, such as falling injury and traffic accidents, and fractures are often severely comminuted. Despite the recent advances in techniques and implants, the treatment of intra-articular multi-fragmentary distal femoral fractures remains a challenge. Long-term disability can occur in patients with extensive articular cartilage damage and marked comminution. DFFs in the elderly are complicated by poor bone quality (severe osteoporosis), a distal segment that is too short for adequate fixation, blood loss, malunion and non-union, and increased mortality [1,2].

Sain et al. [3] in their study concluded that dual plating of DFFs offers a reliable

stable fixation in cases with medial supracondylar bone loss, low transcondylar bicondylar fractures, medial Hoffa fracture, periprosthetic DFFs, non-union after failed fixation with single lateral plate, poor bone quality, and comminuted DFFs (AO type C3). Single-incision or dual-incision approach may be used depending on the surgeon. Orthogonal plate configuration with locked plates provides stable fixation and allows for early rehabilitation which is necessary to prevent joint stiffness.

Lodde et al. [4] in their study about the role of dual plating in fractures and non-unions of distal femur reached the endpoint that double plating of femoral shaft fractures, distal femoral fractures, periprosthetic femoral fractures, pathological fractures of the proximal femur, and femoral non-unions achieve high union rates with moderate complication rates.

Knee Mega-prosthesis for the Management of Distal Femoral Fractures

DFFs are unusual and difficult to deal, especially in elderly patients. A consensus about a gold standard treatment has not been reached yet. Available options include both conservative and surgical management. In elderly patients, a prosthetic replacement could be a valid treatment option.

Meluzio et al. [5] in their review study showed that the use of knee mega-prosthetic implants could represent a valid treatment option aiming to reduce patient's immobilization and hospital stay. Good clinical outcomes with low rate of complications were reported by Charles et al. [6] and Sukhonthamarn et al. [7].

Mancino et al. [8] concluded that mega-prosthesis represents a viable treatment option in patients affected by distal femoral fractures (either acute, periprosthetic, or non-union) because they allow immediate weight-bearing, shorter hospital stay, a fast recovery of knee function, and activities of daily

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living.

The Treatment of Periprosthetic Distal Femoral Fractures after Total Knee Replacement

Periprosthetic distal femoral fracture after total knee arthroplasty carries substantial morbidity and mortality regardless of fixation technique. Surgical treatment is favored in most patients compared with conservative therapy because of high rates of nonunion, malunion, and reoperation after casting or bracing.

Periprosthetic distal femoral fractures carry substantial morbidity and mortality regardless of fixation technique. Quinzi et al. [9] in their study gave that the recommendations for care are of periprosthetic DFFs, as concluded in Table 1. Surgical treatment is favored in most patients compared with non-operative therapy because of high rates of non-union, malunion, and reoperation after casting or bracing. Internal fixation techniques including retrograde intramedullary nails and locked plating are favored for the surgical treatment of

most fractures when the bone stock in the distal fragment allows for appropriate fixation.

In the setting of deficient distal femoral bone stock or implant loosening, revision arthroplasty with distal femoral replacement is the favored technique. Studies have been conducted with regards to the use of retrograde intramedullary nails, locked plating, or distal femoral replacement or the use of combinations of these fixation techniques in periprosthetic fractures and these were found to have good outcomes [10,11].

According to Wright [12], Grade A indicates good evidence (Level-I studies with consistent findings) for or against recommending intervention; Grade B, fair evidence (Level-II or III studies with consistent findings) for or against recommending intervention; Grade C, poor-quality evidence (Level-IV or V studies with consistent findings) for or against recommending intervention; and Grade I, insufficient or conflicting evidence not allowing a recommendation for or against

intervention.

Intramedullary Nailing for DFFs

Retrograde nailing represents an excellent option for the treatment of extra-articular and intra-articular fractures of the distal femur. Intramedullary nailing offers substantial benefits including minimally invasive insertion, biomechanical strength, early weight-bearing, and the potential to improve union rates and decrease complications. In more complex and more distal fractures, retrograde nailing can be technically demanding, and advanced techniques to both obtain and maintain reduction are often required.

Neradi et al. [13], in their recent meta-analysis comparison between plating and nailing in DFFs, came to a conclusion that surgical duration and blood loss favored plating group and the difference is significant. However, while analyzing parameters such as implant failure, infection, and non-union, their analysis favored nailing group, but the difference is not significant.

Henry et al. [14] in their study about the use of intramedullary nailing in elderly patients with DFFs concluded that their study showed satisfactory results using a retrograde femoral nail in the management of elderly patients with a distal femoral fracture. Early and unrestricted mobilization is possible with a very low risk of fracture healing complications.

Nino et al. [15] conducted a study to report union rate, complications, and secondary procedures after open reduction and retrograde intramedullary nailing of comminuted, intra-articular, and DFFs. They concluded that comminuted intra-articular DFFs that can be successfully treated with retrograde intramedullary nailing fixation will reliably go on to union with a complication rate that is favorable to that reported for plate fixation.

Current Concepts in the Management

Table 1: Recommendations for the management of periprosthetic distal femoral fractures after total knee arthroplasty type of treatment recommendation [9]

Type of treatment	Recommendation	Grade of recommendation
Conservative treatment (bracing or casting)	No ambulatory patient with minimally displaced fracture	C
	Patient medical comorbidities preclude surgical intervention	C
Conventional plating	Simple fracture pattern in patients with good bone stock proximal and distal to fracture (Su Types I and II; Rorabeck and Taylor types I and II)	C
Locked plating	Displaced and non-displaced fractures in patients with appropriate surgical risk, supportive distal fragment bone stock (Su Types I and II), and stable implant (Rorabeck and Taylor types I and II)	B
Retrograde intramedullary nail	Displaced and non-displaced fractures in patients with appropriate surgical risk, supportive distal fragment bone stock (Su Types I and II), open-box femoral component, and stable implant (Rorabeck and Taylor types I and II)	B
Combination intramedullary and locked plate fixation	Displaced and non-displaced fractures in patients with appropriate surgical risk, supportive distal fragment bone stock (Su Types I and II), open-box femoral component, and stable implant (Rorabeck and Taylor types I and II)	C
Distal femoral replacement	Displaced fractures in patients with appropriate surgical risk, deficient distal fragment bone stock (Su Type III, substantial osteolysis of the femoral component), loose femoral component (Rorabeck and Taylor type III), and previous distal femoral replacement or revision femoral component precluding appropriate distal fixation	B

of Bisphosphonate-associated Distal Femoral Fractures

Bisphosphonates are a class of drugs used as the mainstay of treatment for osteoporosis. Bisphosphonates function by binding to hydroxyapatite and subsequently targeting osteoclasts by altering their ability to resorb and remodel bone. While aiming to reduce the risk of fragility fractures, bisphosphonates have been associated with atypical insufficiency fractures, specifically in the femur. Atypical femoral fractures occur distal to the lesser trochanter, until the supracondylar flare. There are a number of the differing clinical and radiological features between atypical femoral fractures and

osteoporotic femoral fractures, indicating that there is a distinct difference in the respective underlying pathophysiology.

Recent literature suggests that operative management of atypical fractures is more challenging than that of typical femoral fractures, necessitating a greater level of surgical expertise and technique [16]. Atypical femoral fracture repair has also been found to have an increased incidence of iatrogenic intraoperative fractures, as well as a higher implant failure rate [17].

Rudran et al. [18] in their study stated that prophylactic nailing is an option in clinically symptomatic patients and visible transverse fracture lines on plain

radiographs extending >50% of the lateral cortex. This has been shown to be a cost-effective means of reducing the burden of complete fractures on hospitals. However, surgical fixation in this population does not come without risk and meaningful dialogue with the patients is suggested to individualize treatment decisions in each case.

Al Qarooni et al. [19] in their study concluded that bisphosphonate-induced femoral fractures should be treated with nailing rather than plating as this reduced the incidence of periprosthetic fractures with plate in situ due to increase stress riser.

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

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