APPROACH TO DISTAL FEMUR BY OSTEOTOMY OF THE PATELLAR DISTAL POLE AND INTERNAL FIXATION WITH BASKET PLATE IN COMPLEX ARTICULAR FRACTURE: REPORT OF FIVE CASES

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SUMMARY – According to AO classification, 33-C3 (complete articular multifragmentary) fracture of distal femur is characterized by complex articular involvement, along with short distal femoral block with multiple small fragments and usually with severe soft tissue abruption. In such cases of complex articular fracture of distal femur with extensive comminution of the femur condyle that is often seen in these fractures, anatomical reduction is quite difficult. Minimal fixation strategies sometimes do not provide an optimal degree of reduction and stability of the distal femoral block osteosynthesis. We describe 5 cases of treatment of the 33-C3 distal femoral fractures using arthrotomy of the knee joint by osteotomy of the distal pole of the patella and internal fixation with basket plate as an alternative approach for anatomical reduction of the comminuted articular surface.

Key words: *Distal femoral fractures; Basket plate; Arthrotomy; Knee; Reduction*

Introduction

From February 2007 to December 2012, five patients, three male and two female, aged 58-68, presented to our hospital with complete articular multifragmentary fracture of distal femur. All patients were at a high risk of systemic or local soft tissue complications associated with surgical procedure, i.e. two with heart failure and three with damaged soft tissue envelope.

All patients received perioperative medications and consultations with different specialists and underwent late surgical treatment 14-19 days after injury.

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They were preliminarily treated with bridging external fixator. When soft tissue healed, all patients were treated with stable fixation employing arthrotomy of the knee joint by osteotomy of the distal pole of the patella and basket plate osteosynthesis as an approach for optimal visualization/reduction of the comminuted articular surface. There were no patients with fixation failure, varus collapse, or malunion.

We present the patient clinical data, radiographs, technique and review of the current literature describing approaches and surgical management of mechanically unstable fractures of distal femur.

Case 1

In February 2007, a 78-year-old woman presented with a history of heart failure, left knee pain and swelling due to high-energy fall from a high level onto the flexed knee. The patient was treated preliminarily

with bridging Ex-Fix until swelling resolved. Radiographs showed complete articular multifragmentary fracture of the distal femur, which was managed with open reduction and internal fixation with condylar plate using distal pole of the patella osteotomy as an approach to the articular surface for reduction and subsequent basket plate osteosynthesis of the patella.

Case 2

In October 2008, a 68-year-old man presented with right sided distal femoral fracture with severe soft tissue swelling as the result of high-energy trauma. The patient was treated with bridging Ex-Fix until swelling resolved, which took 11 days.

Radiographs revealed complex articular involvement with comminution of both condyles. Definitive reduction and internal fixation with condylar plate was performed through the presented approach.

Case 3

In March 2009, a 60-year-old man presented with fragmentation of the metaphyseal component and intra-articular involvement of the right distal femur as the result of motor vehicle collision. The patient had severely damaged soft tissue envelope and was preliminarily treated with bridging Ex-Fix. It took 19 days for soft tissue healing; after that, the patient underwent definitive treatment. The fracture site was

Fig. 1. Distal femoral fracture, anteriror view.

Fig. 2. Distal femoral fracture, lateral view.

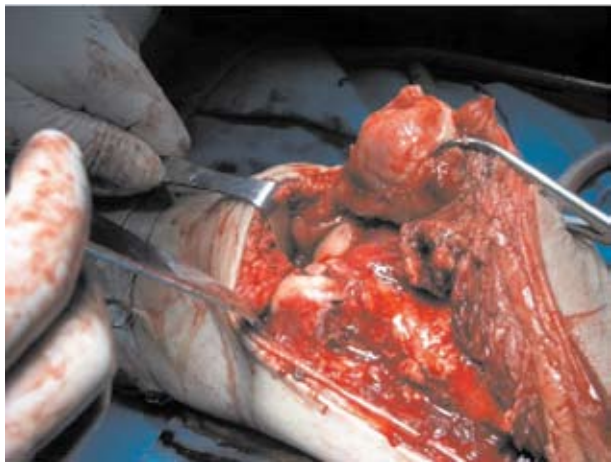

Fig. 3. Approach to distal femur by osteotomy of the patella apex.

Fig. 4. Internal fixation with condylar plate.

opened trough a distal pole of the patella osteotomy to reduce fragmentation.

Case 4

In June 2010, a 76-year-old man presented with heart failure and pain with swelling over his left knee, after a recent high-level fall. Physical examination revealed tenderness over the left distal femur. Radiographs showed distal femoral fracture associated with high levels of intra-articular involvement. The patient had traumatized soft tissue envelope and was preliminarily treated with bridging Ex-Fix. Anatomical reduction was achieved *via* knee arthrotomy performing osteotomy of the distal pole of the patella after 11 days.

Fig. 5. Lateral fixation of the osteotomized patellar apex.

Case 5

In December 2012, a 58-year-old woman presented to our emergency department following high-energy trauma. On physical examination, her left lower limb was shorter as compared to the right. Her left distal thigh and knee were swollen with multiple

Fig. 6. Postoperative x-ray, lateral view.

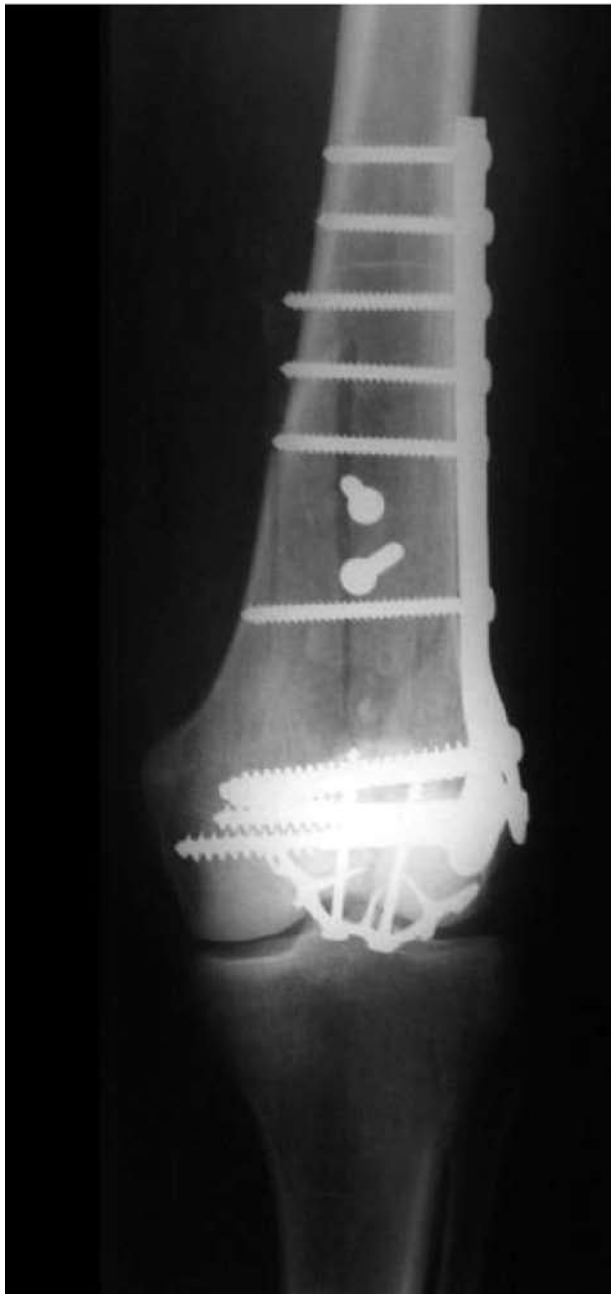

Fig. 7. Postoperative x-ray, anterior view.

abrasions and blisters. Anteroposterior and lateral radiographs of her left distal femur revealed a displaced intra-articular fracture (Figs. 1 and 2). The patient was preliminarily treated with bridging Ex-Fix until soft tissue healing and underwent definitive treatment 18 days later after swelling and blisters had resolved.

A decision was made to treat the fracture by internal fixation with condylar plate and osteotomy of the distal pole of the patella was used as an approach for anatomical reduction of the comminuted articular surface and stable basket plate osteosynthesis of the previously osteomized distal patellar pole (Figs. 3 and 4). Postoperative radiographs are shown in Figures 5 and 6.

Discussion

Distal femur fractures can occur as the result of high-energy trauma, or a simple fall from a standing height. The quantity of comminution depends on the energy striking the femur and on the patient's bone quality.

Distal femur fractures occurring as the result of high-energy trauma may lead to severe comminution of the articular surface, thus reduction methods must be meticulously implemented. Complete articular multifragmentary fracture, also classified as 33-C3, may be most difficult of the femur fractures to treat. A part of the frustration derives from the fact that reduction of multiple fragments can be very demanding. The vast majority of orthopedic surgeons would agree that fractures with complex articular involvement (C3) require direct visualization during reduction.

The goals of treatment in these fractures are well known; they include anatomic reconstruction of the articular surface with stable fixation, restoration of the femur length, and rotation and angulations in the metaphyseal and diaphyseal extension of the fracture[1].

In most difficult cases of complex fracture of distal femur (AO classification 33-C3), a knee arthrotomy is mandatory.

The usually employed approaches are standard anterolateral approach to the distal femur, anterolateral approach to the distal femur with tibial tubercle osteotomy, and medial and lateral parapatellar arthrotomy with patellar luxation[1]. Some surgeons also apply Y incision of the quadriceps tendon or Z incision of the patellar ligament. All of these approaches have certain disadvantages.

Standard approaches in some cases do not provide satisfactory degree of the visualization/reduction of the multiple articular fragments; on the other hand, incision of the tendon requires postoperative immobilization, thus delaying early unrestricted joint motion after operative treatment and its beneficial effects on cartilage healing[2].

A minimally invasive technique (LISS) has been better recognized during the last few years as an alternative procedure with good preliminary results[3-5].

However, the anatomically designed plate does not facilitate articular reduction and this method must be carefully evaluated under strict protocols, so that meaningful data can be obtained.

We propose a new alternative approach for successful and fast reduction of the complex distal femur fracture employing osteotomy of the distal pole of the patella and mechanically stable osteosynthesis of the patella with basket plate. The basket plate is principally used for surgical treatment of comminuted fractures of the distal pole of the patella[6].

The technique underwent a biomechanical cadaver study. Biomechanical model was submitted to the extension force, and the basket plate resisted the force over 1000 N without any deformation. Based on these results, we found the basket plate to allow osseous consolidation of the fracture and permit loading the leg with full body weight early in the postoperative period. We analyzed 100 cases with comminuted distal patellar pole fractures that had been treated with basket plate osteosynthesis using a modified Cincinnati knee rating system, and found no poor results[7].

We believe that osteotomy of the distal pole of the patella can be the most useful approach for reduction of complex distal femoral fractures with extensive condylar abruption, particularly in cases of severe comorbidities or traumatized periarticular soft tissue that significantly delay surgery, and in that way preclude satisfactory anatomical reduction *via* standard approaches. It allows complete and comprehensive view of both femoral condyles assisting in the anatomical reduction of the comminuted articular surface. In all five patients, we performed standard plating using condylar plate. On the first postoperative day, isometric exercises started with unrestricted passive motion. Patients were allowed partial weight bearing with crutches. No immobilization was used. Rehabilitation continued for 3 weeks in a rehabilitation center. There were no patients with fixation failure, varus collapse, or malunion. Four cases had flexion more than 120 degrees and one had flexion between 90 and 120 degrees. There was no extension deficit.

In conclusion, although it is an extensive approach, it provides fast and meticulous reduction and by virtue of mechanically stable basket plate osteosynthesis it also enables early rehabilitation without restriction of the knee-joint movements.

It should also be noted that this report cannot provide a definitive conclusion regarding the approach proposed without careful evaluation under strict protocol.

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Sažetak

PRISTUP NA DISTALNI FEMUR OSTEOTOMIJOM DISTALNOG POLA PATELE I UNUTARNJA FIKSACIJA KOŠARASTOM PLOČICOM KOD SLOŽENIH ZGLOBNIH PRIJELOMA: PRIKAZ PET SLUČAJEVA

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Prema AO klasifikaciji, 33-C3 (zglobni multifragmentarni) prijelomi distalnog femura obilježeni su složenim zahvaćanjem zgloba, zajedno s kratkim distalnim fragmentom femura, višestrukim malim fragmentima i često s teškim nagnječenjem mekog tkiva. U takvim slučajevima složenog zglobnog prijeloma distalnog femura s teškom kominucijom femoralnih kondila koja se često susreće kod ovih prijeloma, anatomska redukcija dosta je otežana. Strategije minimalne fiksacije često ne pružaju dovoljan stupanj redukcije i stabilnosti osteosinteze distalnog femoralnog fragmenta. Ovdje opisujemo 5 slučajeva liječenja 33-C3 distalnog prijeloma femura koristeći artrotomiju koljenskog zgloba osteotomijom distalnog pola patele i unutarnju fiksaciju košarastom pločicom kao alternativni pristup za anatomsku redukciju kominutivne zglobne površine.

Ključne riječi: *Prijelomi distalnog femura; Košarasta pločica; Artrotomija; Koljeno; Redukcija*