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An alternative treatment for osteoporotic Su Type III periprosthetic supracondylar femur fractures: Double locking plate fixation

Hakan Çiçek [a, *], Ümit Tuhanioğlu [a], Hasan Ulaş Oğur [a], Fırat Seyfettinoğlu [a], Murat Bozkurt [b]

[a] Adana Numune Training and Research Hospital, Orthopedics and Traumatology Department, Adana, Turkey
[b] Yıldırım Beyazıt University, Department of Orthopedics and Traumatology, Turkey

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ABSTRACT

Introduction: Patients with Su Type III fractures based on total knee arthroplasty (TKA) constitute a patient group with problematic treatment and management. Although it has difficulties, open reduction and internal fixation is one of the treatment options.
Method: A retrospective evaluation was made of 22 patients surgically treated in our clinic with double locking, low contact titanium plate and screw for a Su Type III periprosthetic fracture based on TKA. The patients were evaluated with bone mineral densitometry, postoperative Knee Society Score (KSS), WOMAC and radiological evaluations.
Results: The mean follow-up period of the patients was 68.6 ± 15.5 months, with pain-free weight-bearing determined at 4.9 ± 1.1 months and mean radiological union at 18.5 ± 4.3 weeks. Revision was required because of non-union in 2 (9.09%) cases. The postoperative KSS value was 81.8 ± 7.8, the WOMAC value was 78.1 ± 5.3 and the T-score was −3.3 ± 0.3. At the final follow-up examination, a correction loss (4.9° ± 1.5°) was determined in the mean knee valgus angle according to the mechanical axis, which was statistically significant but remained within the physiological limits ($p = 0.21$).
Conclusion: In addition to providing the advantages of rigid fixation together with early and effective rehabilitation, satisfactory clinical and radiological results were obtained with the application of double locking plate and screw in the treatment of periprosthetic femoral fractures based on TKA, with osteoporosis.
Level of evidence: Level IV, Therapeutic study.

Introduction

In parallel with the increasing number of arthroplasty applications today, the prevalence of periprosthetic supracondylar femur fractures (PSFFs) following total knee arthroplasty (TKA) is also increasing.[1,2] The majority of patients are in the geriatric age group, and their fractures are generally the result of a minor trauma.[3] This patient group is usually exposed to an accompanying clinical table of problems, which constitute a risk of fracture, with osteoporosis being the most common one.[4,5]

The treatment is technically difficult and the complication rates are relatively high. Fixation failure in 4%, nonunion in 9%, revision surgery in 13% and infection in 3% of the cases have been reported.[6] In the application of locking plate with the potential adverse effects of underlying factors, high rates of reduction loss, nonunion and failure have been reported.[6–8] Therefore, the need for a stronger and long-lasting technique for these patients who are at particular risk of treatment failure is obvious.

In this study, we aimed to present the clinical and radiological results of the cases treated with double locking plates and screws for Su Type 3 PSFFs following TKA.

Patients and methods

All cases treated for distal femur periprosthetic fractures following TKA in our clinic between the year 2007 and 2012 were retrospectively examined. Patient data were retrieved from the

* Corresponding author. Adana Numune Training and Research Hospital. Orthopaedics and Traumatology Department, Serinevler Mah., EgeBagtur Bulvarı, Yüreğir, Adana, Turkey. Fax: +903223550155.
E-mail address: drcicekh@hotmail.com (H. Çiçek).
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hospital records. A total of 22 patients (4 males, 18 females; mean age: 72.7 ± 4.5 years, range: 68–82 years) were included in our study. Patients were monitored for duration of the track and they were able to participate in the final evaluation. The inclusion criteria were defined as having a Su Type 3 periprosthetic fracture following primary TKA, stable femoral and tibial components, a t-score of <−3.0 in one of the localizations of the femoral neck, L4 or L5, and osteosynthesis applied with the double locking plate and screw technique. Thirteen patients (59.1%) had a history of osteoporosis (eight patients had been treated with alendronate and five with etidronate), seven patients (31.8%) had a history of ipsilateral hip arthroplasty and six patients (27.3%) had a history of smoking. Basic demographic data of the patients and additional pathologies are presented in Table 1.

The Su classification was used in the evaluation of the periprosthetic fracture (Table 2). We preferred Su classification over Rorabeck classification, since in the first classification, the bone stock of the distal fragment is more indicative in the evaluation of the fracture line location and course, while in the latter, the fracture line displacement and the stability of the prosthesis are taken into consideration. Su Type 3 periprosthetic supracondylar fractures are fractures where the distal fragment is within the fracture line and the implant looks stable on anteroposterior (AP) and lateral knee radiographs.[9,10]

The fracture line and localization were evaluated in all patients on AP and lateral radiographs, and with tomography where necessary (Fig. 1). Following antibiotic prophylaxis with first-generation cephalosporin (cefazolin 1 g IV), spinal anesthesia was performed. Using a sterile tourniquet, an arthrotomy was made using the old TKA midline incision and a medial parapatellar approach (Fig. 2). Following reduction, iliac spongious autograft was used in 13 cases (59.1%) to fill the metaphyseal defects. In five cases (22.7%) within this group, additional cortical-spongious autograft was taken from the iliac wing and was applied as bridging graft across the fracture line (Fig. 3).

Then double locking plates were placed medially and laterally and stabilization was provided using locking cortical and spongious screws in the distal femur. For each plate, a maximum of three divergent screws were placed in the distal fragment. Following bleeding control, a negative pressure air drain was placed and the incision was closed. A plaster cast was applied with the knee in 30° of flexion (Fig. 4). The cast was removed three weeks later and range of motion (ROM) exercises were begun. Upon observation of radiological findings of union (cortical continuity in at least three of four cortices), active weight-bearing was permitted.

The patients were followed up and evaluated radiologically at two-week intervals for the first two months, then at four-week intervals until the sixth month and later every six months until the final follow-up. Pain-free weight-bearing, time to radiological union, presence of ipsilateral hip prosthesis, varus, valgus and recurvation angulation, limb length discrepancy, Knee Society Score (KSS), WOMAC score and ROM were evaluated in the follow-up period and at the final evaluation. Correlations between clinical results were assessed.

Table 1
Basal demographic data.

Variable	n (%) mean ± SD
Gender (M/F)	4/18 (18.2/81.8)
Age (years)	72.7 ± 4.5
Diabetes	6 (27.3)
Hypertension	9 (40.9)
Hyperlipidemia	8 (36.4)
Cigarette smoking	6 (27.3)
Body Mass Index kg/m^2	28.7 ± 3.9
Peripheral artery disease	5 (22.7)
Osteoporosis treatment	13 (59.1)
Affected side (right/left)	13/9 (59.1/40.9)
Hip prosthesis	7 (31.8)
T-score	−3.3 ± 0.3

Table 2
The Su Classification for periprosthetic fracture.

SU CLASSİFİCATİON OF SUPRACONDYLAR PERİPROSTHETİC FEMUR FRACTURE'S	
Type I	Fracture is proximal to the femoral component
Type II	Fracture originates at the proximal aspect of the femoral component and extends proximally
Type III	Fracture originates at the proximal aspect of the femoral component and extends proximally

All statistical analyses were performed using the SPSS 17.0 software (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as percentages. The difference between postoperative and final valgus angles was tested using the paired-samples t-test. The Pearson test was used in evaluating correlations. A p value of <0.05, computed with two-tailed test in all analyses, was accepted statistically significant.

Results

The mean period from primary TKA to fracture was 18.3 ± 9.5 (range: 5 to 36) months. The fracture was associated with a minor trauma in 19 patients (86.4%) and with a major trauma in three patients (13.6%) (Table 3).

Patients had a mean body mass index (BMI) of 28.7 ± 3.9 (range: 23 to 32). The mean surgery time was 107 ± 18 (range: 85 to 165) minutes, hospitalization period was 3.7 ± 0.7 (range: 3 to 5) days, and follow-up period was 68.6 ± 15.5 (range: 39 to 90) months.

Radiological union was observed in a mean of 18.5 ± 4.3 weeks in 20 patients (90.9%). The valgus angle of the knee in relation to the anatomical axis was 5.2°±1.6° in the early postoperative period and 4.9°±1.5° at the final follow-up. The loss of correction was statistically significant ($p = 0.021$), however, the final values seemed to be within physiological limits. No genu varum deformity was detected in any patient due to correction loss at the final follow-up. Recurvation was observed in one patient (4.5%) due to 10° of malpositioning of the distal femoral fragment. According to the Tayside classification, two patients (9.1%) had Type 2 and two patients (9%) had Type 3 notching (Table 3).

At the final follow-up, the mean KSS was 81.8 ± 7.8 (range: 56 to 90), the mean WOMAC score was 78.1 ± 5.3 (range: 62 to 88) and the mean t-score was −3.3 ± 0.3. At the final evaluation of the operated knee, the mean ROM was 98.1°± 8.2° (range: 70°–110°) and the mean time to pain-free weight-bearing was 4.9 ± 1.1 (range: 4 to 8) months (Table 3).

In the evaluation of the correlation between KSS and WOMAC and clinical and radiological variables, a statistically significant and negative correlation with a moderate strength was found between KSS and time to pain-free weight-bearing. A statistically insignificant and negative correlation with a weak strength was found between KSS and t-score (Table 4). A statistically significant and negative correlation with a weak strength was found between the WOMAC score and the time to pain-free weight-bearing. A statistically insignificant and negative correlation with a weak strength was detected between the WOMAC score and t-score (Table 5). In evaluation of the correlations between ROM and the other variables, only a statistically significant and negative correlation with a moderate strength was found with the time to pain-free weight-bearing (Table 6).

Out of the total 22 patients, revision with constrained TKA was applied to one patient due to nonunion and to another due to

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