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Case report

Unicompartmental knee arthroplasty for spontaneous osteonecrosis of the medial tibial plateau

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ABSTRACT

Background: There have been very few reports on isolated medial tibial plateau osteonecrosis, and the condition has not been clearly described. Unicompartmental knee arthroplasty (UKA) may be an appropriate treatment method for this condition. The aims of this study were to report our experience of using mobile-bearing knee implants for osteonecrosis of the medial tibial plateau and to discuss the etiology and treatment of this type of osteonecrosis.
Methods: This study included six consecutive patients with isolated medial tibial plateau osteonecrosis treated with an Oxford mobile-bearing knee implant. The average age was 71.0 years. We preoperatively graded the tibial necrosis lesion using radiographic findings. We also assessed the area and size of necrosis, extent of the surrounding high-density area, and the presence of any meniscal lesions by preoperative magnetic resonance imaging (MRI), and pre- and postoperative Oxford Knee Scores (OKS) were evaluated.
Results: MRI findings revealed that all patients had meniscal lesions in addition to a necrotic lesion. All patients significantly improved in their OKS. No knees required revision for either infection or loosening.
Conclusions: The etiology of these cases of necrosis is still unclear, but the current study suggested an association with medial meniscal lesions. The results of the study were promising, showing a good short-term clinical outcome of Oxford mobile-bearing UKA for this type of osteonecrosis.

1. Introduction

Spontaneous osteonecrosis of the knee (SONK) in the femoral condyle was first reported by Ahlback et al. in 1968 [1] as a typical unicompartmental disease. Although its etiology is still unclear, mechanical stress has been considered as one of the main causes of this condition. Conservative treatment can be applied during the early phase as long as the necrotic lesion is limited without collapse [2], while surgical treatment is used for patients experiencing prolonged pain with apparent collapse. High tibial osteotomy (HTO) and total knee arthroplasty (TKA) have been reported as reliable options for SONK in femoral condyle [3,4].

Abbreviations: SONK, spontaneous osteonecrosis of the knee; HTO, high tibial osteotomy; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty; ACL, anterior cruciate ligament; FTA, femoro-tibial angle; MRI, magnetic resonance imaging; HDA, high-density area; AP, anteroposterior; ML, mediolateral; MIE, medial intercondylar eminence; OKS, Oxford Knee Score; MFA, maximum flexion angle; RLL, radiolucent line.

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Unicompartmental knee arthroplasty (UKA) can be another reasonable option because it replaces only the affected condyle and preserves all major ligaments including the anterior cruciate ligament (ACL) with less invasion and good clinical outcomes [5,6].

Despite extensive knowledge on SONK in femoral condyle, SONK in tibial plateau has rarely been reported. It is rarer than SONK in femoral condyle and is estimated to comprise only two percent of SONK cases [7]. Although one report categorized SONK in tibial plateau into primary and secondary lesions [8], few further details have been provided. Despite the lack of information regarding this, UKA can be a reasonable choice, similar to SONK in femoral condyle, as long as it does not extend widely. The aims of this study were to report our experience on the use of mobile-bearing UKA for SONK in tibial plateau and to discuss the etiology and treatment of this type of osteonecrosis.

2. Materials and methods

2.1. Subjects, clinical data, and surgery

The subjects were six patients with SONK in the medial tibia plateau treated by UKA using an Oxford mobile-bearing knee implant (The Oxford Partial Knee, Zimmer Biomet Ltd.) in our hospital between 2012 and 2014 and followed up for at least two years after surgery. This study was approved by the ethics committee of our hospital. Patients provided informed consent for inclusion in this study. Only those patients with isolated tibial osteonecrosis were included and patients with both femoral and tibial osteonecrosis were excluded in this study.

Surgical treatment was performed if there is persistent pain and joint collapse was observed with failure of conservative treatment after at least three months. We selected UKA for these patients without multicompartment involvement of necrosis, soft tissue imbalance, ligament involvement, and coronal malalignment greater than 15°.

Surgeries were performed in the standard manner as described in the literature [9]. At the time of surgery, intact cruciate ligaments and healthy cartilage in the unaffected compartments were confirmed before performing UKA. In all cases, cemented implants were used in the tibial side and cementless implants in the femoral side.

We tried to completely remove the osteonecrotic lesion so that the normal bone can be used as a base for cement impregnation. However, we avoid deeper horizontal tibial cut to prioritize maintenance of soft tissue balance and joint line over complete removal of necrotic lesion. If there was a larger crater after horizontal tibial cut, we filled it with autologous bone graft harvested from the bone removed at surgery according to a previously reported method [6].

Clinical data of all patients are shown in Table 1. All six patients (two males and four females) were Japanese with an average age of 71.0 ± 6.5 years (range 61–78 years) and an average body mass index of 24.6 ± 3.6 kg/m^2 (range, 19.9–28.5 kg/m^2). The mean follow-up period was 32 months (range, 24–46 months).

2.2. Radiographic assessment

With reference to the previously reported radiographic staging system of femoral side necrosis by Carpintero [7], Lotke [10] and the Ficat and Arlet classification and its modification [8,11], we graded the tibial necrosis lesion as shown in Table 2.

We measured the femoro-tibial angle (FTA) as an indicator of lower limb alignment and compared the results pre- and postoperatively using the paired *t*-test ($P < 0.05$).

2.3. Magnetic resonance imaging study

We assessed the area and size of necrosis, the extent of the surrounding high-density area (HDA), and the presence of any meniscal lesions by preoperative magnetic resonance imaging (MRI). The size of the necrotic area was calculated as percentage of the anteroposterior (AP) and mediolateral (ML) widths of the medial compartment, where the ML width was defined as the distance between the medial intercondylar eminence (MIE) and the edge of the medial tibial plateau and the AP width was measured on the sagittal plane passing through the center of the ML width (Figure 1(A), (B)). The location of necrosis, visible as a low-density area in a T1-weighted image, was divided into four areas (anteromedial, anterolateral, posteromedial, and posterolateral) by bisecting the AP

Table 1
Clinical data of all patients.

No.	Sex (F/M)	Age (years)	Ethnicity	BMI (kg/m^2)	Stage	Interval symptom to ON (weeks)	Interval ON to UKA (weeks)	Follow-up (months)
1	M	78	Japanese	27.2	3	12	15	46
2	F	66	Japanese	20.8	3	18	21	35
3	M	77	Japanese	19.9	3	32	24	28
4	F	61	Japanese	27.2	3	23	19	27
5	F	72	Japanese	28.5	3	3	12	24
6	F	75	Japanese	23.9	4	38	14	22

BMI, body mass index; ON osteonecrosis; UKA, unicompartmental knee arthroplasty.