Management of Tibial Bony Defect with Metal Block in Primary Total Knee Replacement Arthroplasty

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Purpose: To analyze minimum 2-year clinical and radiological follow-up results of primary total knee replacement arthroplasty (TKRA) with metal block augmentation for tibial bony defect.

Materials and Methods: We analyzed 67 cases (52 patients) of primary TKRA with metal block augmentation for tibial bony defects from March 1999 and March 2008. Clinical results were evaluated using the Knee Society clinical rating system and the Western Ontario and McMaster University (WOMAC) score. Radiologic results were evaluated using the Knee Society roentgenographic evaluation system.

Results: The mean knee score and function score improved from 42.0 and 45.6 preoperatively to 94.5 and 85.4 postoperatively. At last follow-up, the mean WOMAC score was 16.8. The incidence of radiolucent lines was 10% (7 cases) during the follow-up period, but there was no case of progression. There were no statistically significant differences between the groups divided according to the block size (below 5 mm and over 8 mm) and between the stem and no-stem groups for all parameters.

Conclusions: Primary TKRA with a metal block produced satisfactory results for the minimum 2-year follow-up and can be considered as a simple and effective method for the treatment of tibial bony defect in primary TKRA.

Keywords: Total knee replacement arthroplasty, Bony defect, Metal block

Introduction

Tibial bony defect is commonly encountered during total knee replacement arthroplasty (TKRA) for osteoarthritis. It has been associated with angular position and stability of the implants after TKRA. Therefore, augmentation of bony defects is crucial to the maintenance of implant stability and alignment and longevity of TKRA. Tibial bony defect has been managed with bone cementing, insertion of a thick polyethylene implant after bone resection down to bone defect, or bone grafting. Some recent studies have introduced metal wedge or block augmentation methods. However, there are still controversies over the advantages and disadvantages of these methods. In particular, there is a paucity in the literature on the results of primary TKRA with metal block augmentation.

In the current study, we analyzed clinical and radiographic results of primary TKRA with metal block augmentation for tibial bony defect with a minimum 2-year follow-up. In addition, the influence of the block thickness and the use of a stem on the results was also investigated.

Materials and Methods

A total of 910 primary TKRAs were performed on 593 patients at our institution between March 1999 and March 2008 and metal block augmentation for tibial bony defect was carried out in 92 cases (72 patients) during TKRA. Of these 92 cases, the results in 67 cases (52 patients) available for ≥2 years of follow-up were analyzed in this study. The mean age of the patients ranged from 45 to 82 years with a mean age of 64.8 years. There were 47 females and 5 males. The mean follow-up period was 5.3 years.
(range, 2 to 10.7 years). The cause of surgery was osteoarthritis in 54 cases and rheumatoid arthritis in 13 cases. The prosthesis used was Scorpio (Stryker, Mahway, NJ, USA) in 59 cases and Nexgen LPS (Zimmer, Warsaw, IN, USA) in 8 cases. In all cases, a posterior cruciate ligament substituting type of prosthesis was fixed with bone cement.

After tibial bone resection at a site 10 mm distal to the lateral plateau, metal block augmentation was performed for a non-contained defect in the medial cut surface, if it was ≥3 mm deep from the inferior surface of the tibial component and involved ≥1/3 of the medial compartment. The deficient and sclerotic areas in the medial compartment were prepared in rectangular shape to approximate the metal block size and thickness (4, 5, 8, or 10 mm). In the 67 cases, a 4 or 5 mm metal block was used in 29 cases, a 8 or 10 mm block in 35 cases, and double blocks in 3 cases.

A stem was used in all cases with an 8 or 10 mm metal block or double blocks, and in some cases with a 4 or 5 mm block if implant construct stability was considered insufficient during the varus-valgus stress test and flexion-extension test for soft-tissue balancing with use of a trial prosthesis and a metal block or due to poor bone quality of the proximal tibia that could result in implant subsidence. Therefore, a stem was used in 42 cases (63%): 33 cases with an 8 or 10 mm metal block, 3 cases with double blocks, and 6 of the 29 cases with a 5 mm metal block. The length of the stem was ≥80 mm in 33 cases (79%) and ≤70 mm in 9 cases (21%).

Clinical assessments were done by an independent orthopedic surgeon based on the pre- and postoperative range of motion (ROM), the Knee Society clinical score, and the Western Ontario and McMaster University (WOMAC) score at the last follow-up.

On the radiographic evaluation, femorotibial alignment was assessed on the pre- and postoperative and last follow-up standing radiographs, and the presence of periprosthetic radiolucency and component loosening was evaluated on the anteroposterior (AP) radiographs taken using fluoroscopy, lateral views focused on the femoral component and tibial component each, and axial views. The Knee Society roentgenographic evaluation system was used for the assessment of the periprosthetic radiolucency and loosening. Radiographic measurements were performed twice by each of two knee surgeons. Inter- and intraobserver reliability was evaluated by kappa values. Statistical analysis of the results was done using SPSS ver. 17.0 (SPSS Inc., Chicago, IL, USA). Statistical significance of the influence of the block thickness and the use of a stem on the clinical results was assessed using the independent t-test and on the radiographic results using the Fisher’s exact test with a significance level set at 0.05.

Results

1. Clinical Evaluation

Regarding the ROM, the mean flexion contracture was corrected from 12.0° (range, 0° to 40°) preoperatively to 1.1° (range, 0° to 10°) at the last follow-up, and the mean maximum flexion was 122.7° (range, 75° to 150°) preoperatively and 123.7° (range, 100° to 140°) at the last follow-up.

The mean knee score improved from 42.0 points (range, 3 to 75 points) preoperatively to 94.5 points (range, 79 to 100 points) at the last follow-up. The mean function score increased from 45.6 points (range, 5 to 75 points) preoperatively to 85.4 points (range, 60 to 100 points) at the last follow-up. The mean knee score and function score in the ≤8 mm metal block group were 95.8 points (range, 87 to 100 points) and 87.1 points (range, 60 to 100 points), respectively, and in the ≥8 mm metal block group were 92.8 points (range, 79 to 100 points) and 82.8 points (range, 60 to 100 points), respectively, showing no statistically significant intergroup difference (p=0.323, p=0.274). The mean knee score and function in the no-stem group were 94.6 points (range, 87 to 100 points) and 86.9 points (range, 60 to 100 points), respectively, and in the stem group were 94.2 points (range, 79 to 100 points) and 84.5 points (range, 60 to 100 points), respectively, indicating no significant intergroup difference (p=0.850, p=0.362).

At the last follow-up, the mean WOMAC score was 16.8 points (range, 4 to 39 points) with the mean pain score 3.0 points (range, 0 to 6 points), mean symptom score 0.7 points (range, 0 to 2 points), and mean physical function score 13 points (range, 4 to 31 points). The mean WOMAC score was lower in the ≤8 mm metal block group (15.8 points; range, 9 to 36 points) than in the ≥8 mm metal block group (17.5; range, 4 to 39 points), but the difference was not statistically significant (p=0.282). The mean WOMAC score was not notably different between the no-stem group (15.3 points; range, 9 to 27 points) and the stem group (17.7 points; range, 4 to 39 points; p=0.115).

2. Radiographic Evaluation

Preoperative radiographs showed varus deformity in 66 cases and valgus deformity in 1 case. The mean femorotibial alignment was corrected from a varus of 10.8° (range, -25.5° to 4.5°) preoperatively to a valgus of 5.0° (range, 1.3° to 12.2°) postoperatively in the medial metal block augmentation group and from a valgus of 18.3° preoperatively to a valgus of 4.1° postoperatively in the lateral metal block augmentation group.