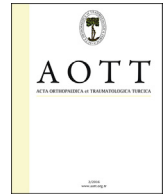


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Treatment of osteonecrosis of the femoral head with free vascularized fibular grafting: Results of 7.6-year follow-up

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ABSTRACT

Objectives: The aim of this study was to determine long term follow up of the patients who had femoral head osteonecrosis and had been treated with free vascularized fibular grafting.

Patients and methods: We retrospectively reviewed 28 hips of 21 patients who had undergone free vascularized fibular grafting for the treatment of osteonecrosis of femoral head. There were 16 male and 5 female patients. The mean age of the patients at the time of surgery was 30.7 years (between 15 and 53 years). The mean follow-up time was 7.6 years (between 5 years and 9.2 years).

Results: During follow-up, one patient died because of leukemia, and one patient was lost. The remaining 26 hips of 19 patients were evaluated. According to the Ficat classification, at the time of surgery, 17 hips were in grade 2 and 9 hips were in grade 3. The post-operative Harris hip scores in grade II disease were excellent in 12 patients, good in 3 patients, and fair in 1 patient. In grade III disease, 1 patient was excellent, 5 patients were good, and 1 patient was fair. There was a significant increase in HHS scores (61 ± 9.7 vs 84 ± 17.8 , $p < 0.001$).

Conclusion: Free vascularized fibular grafting yields extremely good results, particularly in pre-collapse stages of disease in young patients. The operation time does not mark increased if the surgical team is “familiar” with the procedure, and the residual fibular defect of the donor site does not impair the functions of daily living.

Level of Evidence: Level IV, Therapeutic study.

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Introduction

Osteonecrosis of the femoral head is a disabling disease that frequently affects adults aged 20–50 years.¹ Whatever the etiology, the disease often progresses to femoral head collapse and hip joint arthritis if left untreated.² Treatment options for the disease mainly depend upon the stage and age of the patient. According to many studies, the etiology of the disease is not a determinant for a particular technique.^{3,4} Older age, severely collapsed femoral head, and arthritic patients are accepted as candidates for arthroplasty. Treatment options before collapse of the femoral head aim for

regeneration of the subchondral necrotic bone to prevent collapse and preserve sphericity of the femoral head. Core decompression with or without cancellous bone grafting, non-vascularized strut grafts, tantalum rods, electrode insertions, different types of osteotomies, and free or muscle pedicled viable bone grafts have been presented for this purpose.^{5–7} Among these techniques, core decompression with vascularized fibular grafting technique removes all necrotic bone and fills the remaining cavity with vascularized bone graft and spongy graft that contain osteoinductive and osteoconductive properties together. The procedure is not new to our knowledge, but most reports in the literature are from a small number of pioneering clinics utilizing the free vascularized fibular grafting (FVFG) technique. In this study, we presented our experience in treatment with FVFG in pre- and post-collapse stages of disease. We report medium-term (mean: 7.6 years) follow-up results.

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Patients and methods

In this study, 28 hips of 21 patients (16 male, 5 female) who underwent FVFG for the treatment of osteonecrosis of femoral head in the years between 2005 and 2009 were retrospectively reviewed. Mean age of patients at the time of surgery was 30.7 years (range: 15–53 years). Seven patients who had bilateral hip involvement were operated in 5- to 8-month intervals. The etiologies were collum femoris fracture in 2 hips (7.1%), steroid use in 18 hips (64.3%), and idiopathic in 8 hips (28.5%). The osteonecrosis of patients was diagnosed and staged according to Ficat classification by evaluation of plain roentgenograms and magnetic resonance imaging findings. Mean follow-up duration of patients was 7.6 years (range: 5–9.2 years). Due to the follow-up period of less than 10 years, conversion to total hip arthroplasty (THA) was accepted as failure of the procedure. Radiologic progress of treatment was followed with plain roentgenograms taken in 3-month intervals for the first year, and then once yearly. The radiographs of patients were evaluated for trabecular bone appearance at the tip of the vascularized fibular graft, indicating new bone formation. Preservation of spherical femoral head and loss of subchondral cystic lesions and crescent sign were also accepted as part of the healing of the lesion. Loss of sphericity and decrease in the joint space indicated the progress of the disease. Functional outcomes of survived hips were evaluated using Harris Hip Score (HHS) system. Scores greater than 90 points were accepted as excellent, scores between 80 and 89 points were good, scores between 70 and 79 points were fair, and scores less than 70 points were poor.

The original technique described by Urbaniak and Aldridge et al was used in all cases.⁸ All patients were operated under general anesthesia in lateral decubitus position by the same surgical team, who were experienced in microsurgery. To reduce operation time, the preparation of hip and harvesting of fibular graft were performed concurrently by 2 teams (Fig. 1). Preoperatively, the extent and spatial localization of the lesion was studied on magnetic resonance images. Intraoperative C-arm fluoroscope was used for anteroposterior and frog leg lateral views (Fig. 2). Prior to placement of the fibular graft, bone graft mixture composed of cancellous autografts harvested from the greater trochanter and 5–10 cc demineralized bone matrix (DBM) allograft (Osteoplast Activagen Injectable Paste [OGS-ACI5], Biotech S.p.A., Arcugnano, Italy) was used in all patients. The ascending branch of the lateral femoral circumflex artery with accompanying veins was used as recipient vessels (Fig. 3).



Fig. 1. Completely scrubbed lower extremity, sterile tourniquet used.

Patients were treated with low-molecular-weight heparin (20 mg enoxaparin/day subcutaneously) for 3 weeks and intravenous antibiotic prophylaxis during hospitalization. All patients were maintained in absolute bed rest for 5 days and mobilized with crutches without weight-bearing on the affected side on the sixth postoperative day. Weight-bearing was prohibited until the third postoperative month. Then partial weight-bearing (20–25 kg) was initiated using a single Canadian-type crutch for the affected side for 45 days and gradually increased until full weight-bearing was achieved in the sixth postoperative month. Patients were informed about thumb flexion contractures and encouraged to stretch to extension.

Categorical variables were presented in a number of cases (percentage), with continuous variables as mean \pm standard deviation. Normal distribution was tested with skewness and kurtosis. Paired t-test was used to compare the changes in patients' pre- and post-operative HHS scores. A p-value of <0.05 was considered significant for all tests. SPSS software (version 11.0, SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

Results

During the follow-up period, 1 patient died because of leukemia, and 1 patient was lost. The remaining 26 hips of 19 patients were evaluated. According to Ficat classification, 17 hips were grade 2, and 9 hips were grade 3 at the time of surgery. At final follow-up, in 3 patients, the disease had progressed and eventually had been treated with THA. No complications related to the surgery—such as infection, deep venous thrombosis, femoral neck fracture, subtrochanteric fracture, peroneal nerve palsy, or severe flexion contracture of the great toe—were observed. Postoperative HHS in grade 2 disease was excellent in 12 patients, good in 3 patients, and fair in 1 patient. In grade 3 disease, 1 patient was excellent, 5 patients were good, and 1 patient was fair. There was a significant increase in HHS scores (61 ± 9.7 vs 84 ± 17.8 , $p < 0.001$). Radiographic trabecular bone formation at the tip of the fibular graft was detected in all patients with stage 2 and stage 3 disease. There was no sign of collapse or joint narrowing in patients with HHS greater than 80 points (Fig. 4). In 6 patients, the progress of collapse and joint narrowing was observed on plain X-rays (Fig. 5). The degree of collapse and joint narrowing were directly correlated with HHS.

Discussion

If the osteonecrotic lesion at the femoral head is large and involves the lateral pillar, the progress to collapse is inevitable; this usually occurs in less than 3 years, according to the study of Ohzono, which observed the natural progress of 115 untreated hips.⁹ Many treatment modalities have been proposed for the treatment of this disease. Osteotomies of the proximal femur, including femoral neck and intertrochanteric region, have been recommended to replace the osteonecrotic lesion area under the stress of body weight with an unaffected viable healthy portion of the femoral head. Rotation, varus, flexion, extension and medializing-type osteotomies have been proposed for this purpose.² The rotational osteotomy described by Sugioka is a very demanding procedure, with regards to both the planning required and the need to preserve the branches of a medial femoral circumflex artery during the procedure.⁵ Osteotomies also distort the anatomy and biomechanics of the hip joint. Analyzing the results of 115 osteotomies performed by Schneider et al, all osteotomies were associated with a high incidence of complications and low survival rate, and they provided only temporary benefits.¹⁰ Core decompression alone may be accepted, similar to the first generation of intralesional surgical interventions. Arlet and Ficat

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