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Unilateral Free Vascularized Fibula Shared for the Treatment of Bilateral Osteonecrosis of the Femoral Head

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ABSTRACT

Between June 2007 and May 2008, 21 patients with bilateral osteonecrosis of the femoral head were surgically treated with implantation of free vascularized fibula obtained from the unilateral donor site. All patients were followed up clinically and radiographically for an average of 3.5 years. The evaluation included operative duration, blood loss, Harris hip score, incidence of complications, and radiological examinations. The time for fibular harvesting was 20 min on average. Total operative duration was 100–240 min, with an average of 150 min. Blood loss averaged 300 ml. All transplanted fibula integrated well to the femoral head 3.5 years postoperatively with no severe complications observed. The results revealed that unilateral free vascularized fibula is effective for the treatment of bilateral osteonecrosis of the femoral head.

Implantation of free vascularized fibula (FVF) has been considered as a valid method for the treatment of osteonecrosis of the femoral head (ONFH). However, traditional surgical technique has restricted its wide application in the world, possibly due to complicate and high demand surgical technique. Moreover, patients with bilateral ONFH are usually unable to endure simultaneous operations for prolonged periods with iatrogenic trauma. Fortunately, Zhang and associates [1-3] have modified the method of fibular harvesting and hip surgery using a novel method with simplified procedures, decreased operative duration and blood loss, and which has achieved similar clinical outcomes when compared to other treatment centers [1,3].

With the traditional method, two separate surgical teams are needed to harvest respective fibula for bilateral ONFH, to decrease the operation and anesthesia time. According to our preliminary reports, simultaneous operations are safe and beneficial for reducing hospital stay and medical costs. Numerous studies have previously found that extremely long free vascularized fibula can be obtained for reconstructive surgery of massive bone defects by one surgical team, and with any corresponding complications being acceptable. Therefore, we investigate whether free vascularized fibula can be obtained from the unilateral side and shared for the treatment of bilateral ONFH, and whether any resultant complications and clinical results are acceptable.

Under the guidance of a senior surgeon, we employed free vascularized fibula from the unilateral side to treat bilateral ONFH. Comprehensive evaluations including operative duration, blood loss, Harris hip score (HHS), incidence of complications, and radiological examinations were adopted to analyze the effect and prognosis of the surgical technique. This study was approved by the ethics committee of the Shanghai Sixth People's Hospital, Jiao Tong University, China.

Materials and Methods

Patients

Between June 2007 and May 2008, 21 patients with bilateral ONFH had femoral head-salvage treatment with implantation of FVF from unilateral donor in our department of orthopedic surgery. There were 18 males (36 hips) and 3 females (6 hips), with an average age of 39.6 years (range, 17–57 years). The etiology of the disease was due to steroid medication in six cases, consumption of alcohol in eight, and idiopathic condition in seven. The diagnosis of bilateral ONFH was confirmed based on information obtained from plain radiographs and magnetic resonance imaging (MRI), as well as on positive physical examinations. Clinical symptoms included inguinal tenderness and restricted motion of the hip joint. The average history of the disease was 4.1 years (range, 2–6 years). According to the Steinberg system, 24 hips were classified as stage II, 15 as stage III and 3 as stage IV. Details of pre- and postoperative HHS are listed in Table.

Surgical Methods

Harvesting of Vascularized Fibular Strut

Using continuous epidural anesthesia or general anesthesia, the patients were placed supine. A sterile tourniquet was used for making

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Table
Comparison of Pre- and Post-Operative Harris Hip Scores (Mean ± SD)

	Stage II	Stage III	Stage IV
Preoperatively	74.10 ± 5.24	67.86 ± 4.77	59.50 ± 0.50
One year Postoperatively	92.50 ± 6.27	88.68 ± 9.32	78.00 ± 0.00
P value	.000	.000	.017

a 15–18 cm lateral incision, which started about 5 cm distal to the fibula head along the fibular shaft. Through the muscular interval between peroneus longus, peroneus brevis and triceps surae, the peroneus longus and brevis were separated from the fibula in order to expose the lateral aspect. Blunt dissection of medial aspect of the fibular periosteum was performed with two periosteal dissectors from anterior to posterior. The fibula was osteotomized with a wire saw under protection. Generally, the fibula was harvested to obtain a bony length of approximately 13 cm. The ends of fibular strut were controlled by two towel forceps. The attachment of the extensor digitorum longus, extensor hallucis longus, tibialis posterior and interosseous membrane was separated from the fibula, leaving a thin muscle cuff adjacent to the graft. The fibular vessel was then exposed and dissected from the distal to the proximal (Fig. 1), and care was taken to identify the tibial nerve. After the vascularized graft was freed from the fibula, the tourniquet was deflated to check for potential bleeding.

Preparation of Free Vascularized Fibula

The fibular vessels were dissected near the central graft. The graft was then osteotomized equally into two segments. The periosteum at both ends of the strut was peeled for better contact with the neighboring bone. The distal end of the fibular vessels, as well as the amputated vessels in the muscle cuff, was sutured carefully to reduce bleeding and restore effective circulation. The proximal end of the fibular vessel was perfused with heparinized saline and prepared for anastomosis (Fig. 2).

Hip Surgery

An 8–10 cm anterior incision was adopted for hip surgery. The start point of the incision was about 2 cm internal and inferior to the anterior superior iliac spine. The muscular interval was separated between the tensor fascia lata and the sartorius, and care was taken to identify the lateral femoral cutaneous nerve. The straight head of the rectus femoris was cut off at 1 cm distal to its origin, and mobilized distally to expose the ascending branch of the lateral circumflex femoral vessel. The vessels were separated to optimal length, ligated and cut off at the distal end. The hip capsule was opened along the axis of the femoral neck to expose the anterior aspect of the femoral neck. A bone groove was made along the axis of the neck which was deep into the subchondral area of the femoral head. A 2-cm lateral skin excision was made along the extension line of the femoral neck. Using a fluoroscopic monitor, the necrotic bone was thoroughly removed with a special reamer through the lateral excision and the groove. The necrotic tissue debris was washed away with normal saline. Cancellous bone chips from the femoral neck and the greater trochanter were packed into the femoral head, and compressed tightly by special instrument. The fibular graft was inserted into the groove and stabilized to the greater trochanter with an absorbable screw (Fig. 3). Subsequently, microvascular anastomosis was conducted between the fibular and lateral circumflex femoral vessels, followed by repair of the straight head of the rectus femoris.

Postoperative Management

Prophylactic antibiotics were administered intravenously for two days after surgery and anticoagulants and antivasospasm drugs were administered routinely. Mobilization of the ankle joint and toes was initiated on the second postoperative day. Passive mobilization of the

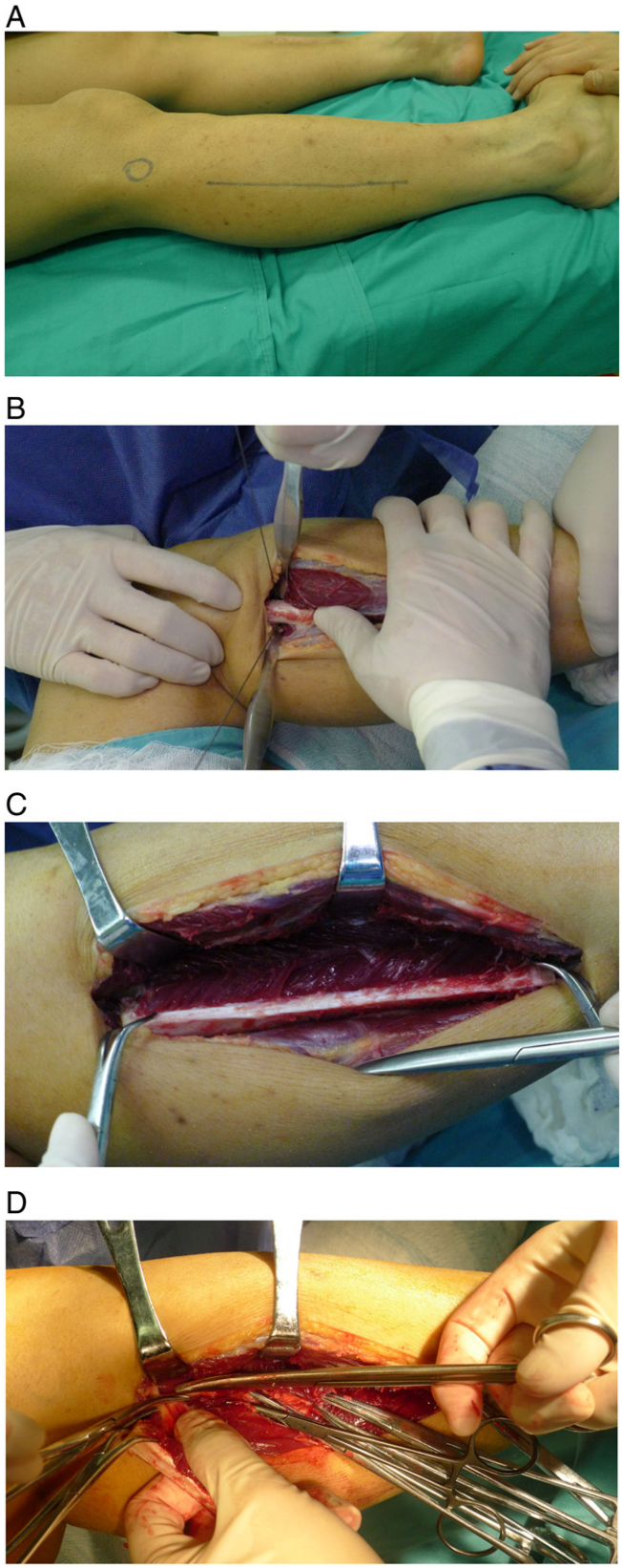

Fig. 1. Lateral approach to harvest free vascularized fibula. (A) The lateral approach was initiated to about 5 cm below the fibular head. (B) Proximal and distal end of the fibula was osteotomized by wire saw under protection. (C) The fibular strut was controlled by two towel forceps to expose medial neurovascular structure. (D) The vascularized fibula was freed from distal to proximal.