



Abductor Reconstruction with Gluteus Maximus Transfer in Primary Abductor Deficiency during Total Hip Arthroplasty

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Abductor deficiency in native hip joint may cause severe limping and pain. It is more serious situation in case of arthroplasty due to instability and recurrent dislocation. Well-known causes of abductor deficiency are repeated surgery, chronic trochanteric bursitis, superior gluteal nerve injury, failure of repair of abductor tendon insertion to the greater trochanter. Author had experienced primary abductor deficiency during total hip replacement and treated successfully with the transfer of gluteus maximus. We'd like to introduce the operation technique with the review of literature.

Key Words: Hip, Abductor deficiency, Reconstruction, Gluteus maximus

The tensor fascia latae and gluteus medius and minimus are known as primary hip abductor muscles. Main functions of these muscles are hip abduction and balancing the weight of the body and the non-weight-bearing leg during walking¹⁾. Abductor deficiency or dysfunction is clinically uncommon. Spontaneous rupture at the greater trochanter is caused by repeated trauma such as runners or complication of trochanteric bursitis^{2,3)}. Other well-known causes are failure of repair of abductor during the total hip replacement and injury of superior gluteal nerve which innervates hip abductors⁴⁾.

Regardless of causes, abductor dysfunction may cause limping, positive Trendelenburg sign and pain in native hip joint. In case of artificial joint, additional important issue is a joint stability. It may lead to joint instability, recurrent dislocation, finally unsatisfactory results⁵⁾.

Several treatments were introduced in the literature⁶⁻⁹⁾. In this report, we'd like to introduce easy and reproducible operative technique with the use of anterior fiber of gluteus maximus during the total hip arthroplasty accompanied with primary abductor deficiency.

CASE REPORT

Sixty four-year-old female presented to our hospital with a history of left hip pain with limping gait. Her hip pain and limping gait were started about 2 years ago and 5 months ago, respectively. She had no special trauma history and discomfort on her hip joint until two years ago. She had no prior operation history on left hip joint. Body mass index was 23.8 kg/m² and bone mineral density was -0.59.

Plain radiographs on pelvis including anteroposterior and frog leg lateral view were taken initially (Fig. 1). Lateral center edge angle, acetabular inclination, and femoral head

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extrusion index were 5°, 30°, 41.6% respectively. It also demonstrated the joint space narrowing compare to the right side. She was diagnosed with a secondary osteoarthritis as a consequence of hip dysplasia.

Since the use of pain killer for several months was not helpful for her pain, the patient wanted a surgical treatment, so was elected to undergo total hip arthroplasty. During the operation, the patient was placed in right lateral decubitus position and the surgical approach was posterolateral. After skin incision, gluteus maximus was split as a usual manner. After cutting the short external

rotator and the joint capsule, the joint was dislocated and neck was cut. There was no muscle attached at the tip of the greater trochanter (Fig. 2). Fatty change of gluteus medius and minimus and tensor fascia latae were detected on preoperative computed tomography scan (Fig. 3). During the posterolateral approach, one can see the bulk gluteus medius at the tip of the greater trochanter. The operation was carried out and all trial implants were inserted in the acetabulum and femur. However the stability was disappointing because the dislocation was happen at the 70° flexion and neutral rotation. We decided to transfer of anterior fiber of gluteus maximus to reconstruct the abductor deficiency at the hip joint. We harvested the gluteus maximus with a length of 12 cm from the 4 cm distal at the tip of the



Fig. 1. Preoperative anteroposterior pelvis radiographs shows osteoarthritis of left hip joint following dysplasia.

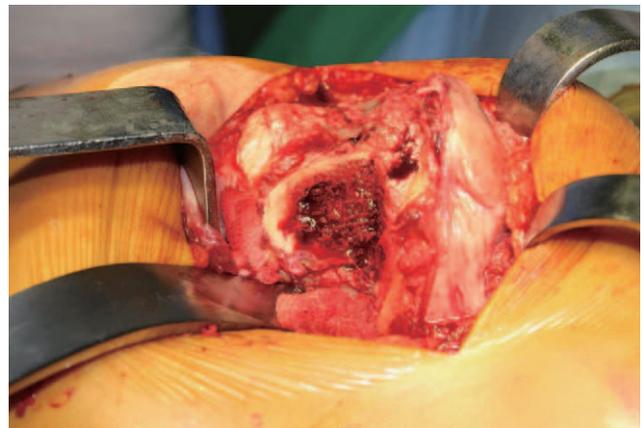


Fig. 2. No muscle attachment but only fascia attachment at the tip of the greater trochanter is shown.

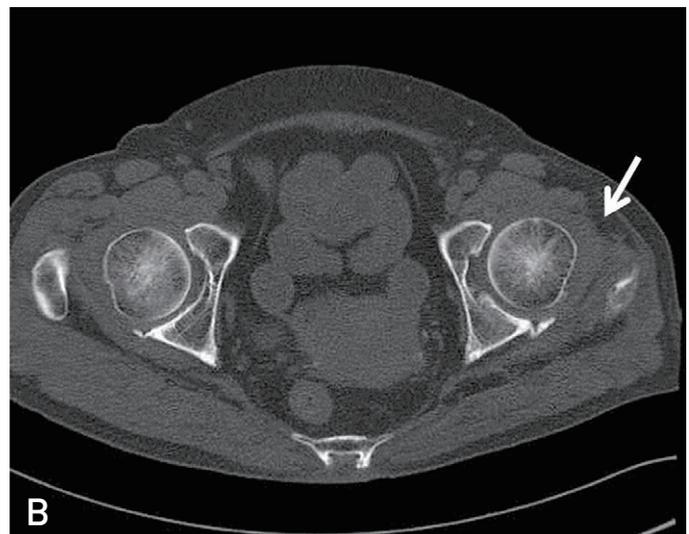
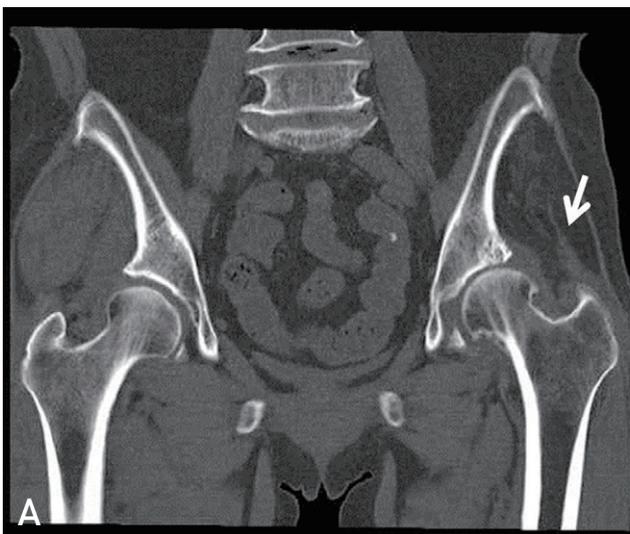


Fig. 3. White arrow indicates (A) fatty change of glumeus medius and minimus and (B) tensor fascia latae in preoperative computed tomography scan.

greater trochanter. The width of the harvested muscle was 3 cm at the distal end but the width was gradually increased as going to the proximal portion like fan. Non-absorbable suture material was applied with Krackow suture technique on the distal end of the harvested muscle. We made a hole with the size of 1 × 3 cm to pass through the muscle at the 2 cm distal to the tip of the greater trochanter (Fig. 4). The harvested muscle was

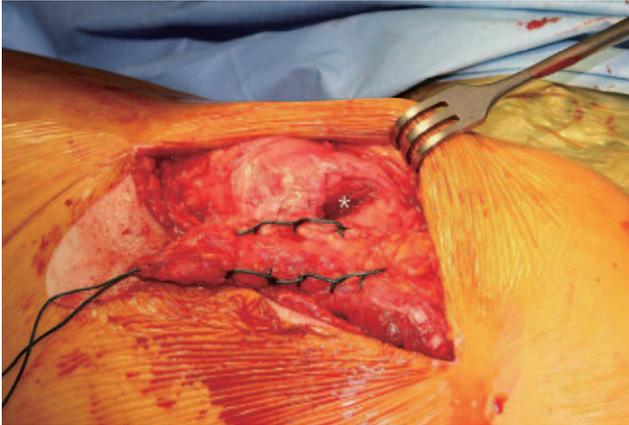


Fig. 4. It shows harvested muscle of anterior fiber of gluteus maximus and bone tunnel (asterisk) at the greater trochanter.

passed through the hole from medial to lateral and securely sutured through the bone tunnel which is located 3 cm distal to the hole in 20° abduction (Fig. 5). The joint stability was satisfactory at this point. The superior gluteal neuropathy was confirmed in electromyography, postoperatively. However, we couldn't find the exact cause of the neuropathy.

During the rehabilitation period, active abduction was prohibited until 3 weeks. After then gradual strengthening exercise and weight bearing was permitted. At two years of follow up, the patient showed a slightly positive Trendelenburg sign with mild limp.

DISCUSSION

Abductor deficiency in the hip causes lateral hip pain and limping in native joint. More serious problem in artificial joint is joint instability. Well known causes of this unique condition include rupture of the abductor tendon at its insertion, failure of repair of abductor during the total hip replacement, multiple revision total hip replacement and injury of superior gluteal nerve which innervates hip abductors²⁻⁴). In current study, there was no readily identifiable cause for superior gluteal nerve injury such as

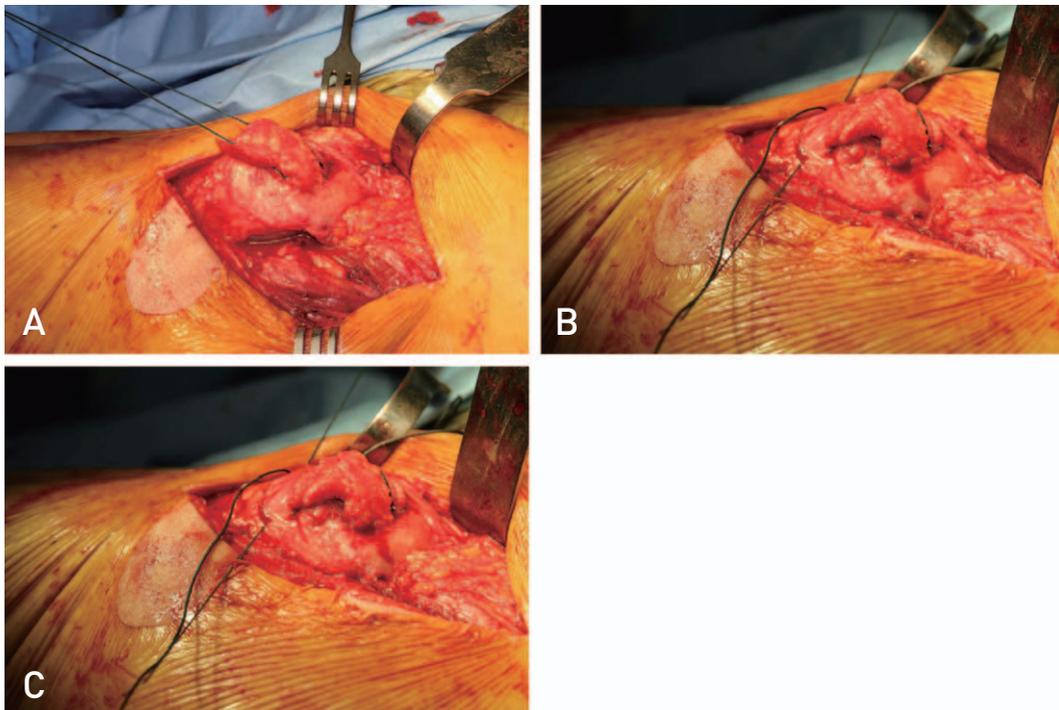


Fig. 5. Intraoperative photographs. (A) The harvested muscle was passed through the bone tunnel from medial to lateral aspect. (B) Non-absorbable suture material was passed through the hole made by Kirschner wire crossing the proximal femur. (C) The harvested muscle passed through the bone tunnel is securely sutured.

trauma, injection around hip joint, prior surgical history.

Several techniques were introduced in the literatures⁶⁻⁹⁾. Fehm et al.⁶⁾ reported the results of repair of a deficient abductor mechanism with achilles tendon allograft. However this technique was used in irreparable abductor tendon at their insertion site. Kohl et al.⁷⁾ introduced vastus lateralis muscle shift technique and had showed the satisfactory result. As they mentioned in the article, however, their technique is complex, demanding, relatively high complication rate and not easily applicable by many surgeons.

An anatomic study¹⁾ showed the gluteus medius is composed of three distinct parts making up the fan shape. The posterior part of this muscle and gluteus minimus run almost parallel to the neck of the femur. The fibers of middle and anterior part run vertically. Distal attachments of these two muscles are the anterosuperior margin of the greater trochanter not the lateral aspect. In this study, also, the authors postulated that the gluteus medius and minimus function primarily as hip stabilizers and pelvic rotators, rather than hip abductors. In other words, the horizontal fibers work as hip stabilizer and the vertical fiber is pelvic rotator. The primary function of hip abduction would then be achieved via the tensor fasciae latae muscle. According to this study, the joint stability can be achieved by transfer of the anterior fiber of gluteus maximus which have a running route similar to horizontal fibers of gluteus medius and gluteus minimus. If the function of the tensor fascia latae is normal, transfer of this muscle isn't necessary.

Whiteside^{8,9)} introduced two techniques for the reconstruction of deficient abductor of the hip. One is transfer of anterior fiber of gluteus maximus and the other is combined transfer of gluteus maximus and tensor fascia latae. The concept of Whiteside's techniques is similar with our technique; however, the differences are as follow. The first one is distal fixation method. We made a hole to pass the harvested muscle from inside to outside. We thought this method would reconstruct the gluteus medius and minimus simultaneously and may stabilize the femoral head in the acetabulum more effectively due to its closer location from the joint. The second one is posterior capsule enforcement with posterior fiber of gluteus maximus. Theoretically, it would be better than no soft tissue envelop in terms of preventing dislocation. But we can't make sure the effectiveness in the artificial joint. Because many hip surgeons experiences that dislocation doesn't happen in

the artificial joint without posterior capsule. So, we thought this additional procedure make the operation difficult. The correct position of the implant, reconstruction of the deficient abductor and patient education are the cornerstone to prevent the dislocation. The third one is combined transfer of tensor fascia latae. However, it's impossible to transfer this muscle because combined deficiency with gluteus medius due to superior gluteal neuropathy.

There are several limitations in this study. First, we experienced only one case. Second, follow-up period is also short. Third, there is no comparative group.

Despite these several limitations, we think current technique is one of the useful treatment methods to gain joint stability and abductor function in the abductor deficient hip joint.

CONFLICT OF INTEREST

The authors declare that there is no potential conflict of interest relevant to this article.

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