The strength and function of hip abductors following anterolateral minimally invasive total hip arthroplasty

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【**Abstract**】**Objective:** To analyze the extent of postoperative hip abductor insufficiency in primary total hip arthroplasty (THA) patients undergoing anterolateral minimally invasive (ALMI) approach, and to investigate whether the clinical outcomes are more favorable in femoral neck fracture (FNF) patients than in non-femoral neck fracture (nFNF) patients.

Methods: A total of 48 patients were enrolled in this study. Each patient underwent a clinical examination preoperatively and 6, 12, 24 and 48 weeks postoperatively. The abductor torque, Trendelenburg's sign, gait velocity, Harris hip score, Oxford hip score, Westren Ontario and McMaster Universities (WOMAC) score and visual analog scale pain score were recorded. Statistical evaluation was performed with SPSS software version 18.0. The significance level was set at $P<0.05$.

Results: The abductor torque of the operated hip and the recovery ratio showed a gradual improving tendency from 6 weeks postoperatively until the last follow-up. Gait velocity, Harris hip score, Oxford hip score and WOMAC score improved significantly after the operation until 24 weeks postoperatively. In the FNF group, the abductor torque of the operated side and the recovery ratio were significantly higher than in nFNF group at 6 weeks postoperatively, however, as time passed, this trend tended to disappear.

Conclusion: This study demonstrates that patients can obtain good abductor strength and function in the early postoperative period and the hip abductor function of patients who suffer from hip osteoarthritis, rheumatoid arthritis, avascular necrosis of the femoral head could be significantly improved following ALMI THA.

Key words: ***Arthroplasty, replacement, hip; Surgical procedures, minimally invasive; Recovery of function***

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Total hip arthroplasty (THA) is a big achievement in orthopedic surgery and has been widely applied during the last several decades. When minimally invasive surgery (MIS) to the hip is used, the reduced soft tissue damage is supposed to provide the patient quicker mobilization and rehabilitation, especially in the early postoperative period. Indeed, many studies have demonstrated reduced blood loss, decreased pain, faster gait and walking ability improvement with the new techniques compared with standard approaches.[1-5]

The anterolateral minimally invasive (ALMI) approach was firstly described by Berger[6]. It is a modified version of the Hardinge approach,[7] with the expected advantages such as decreased incidence of dislocations,[8,9] good exposure of the acetabulum,[10] as well as avoidance of damage to the lateral femoral cutaneous nerve[11] and external rotators compared with other MIS approaches. However, this approach is also associated with possible postoperative hip abductor insufficiency due to detachment of the anterior one third of the gluteus medius and minimus tendons as well as potential injury to the inferior branch of the superior gluteal nerve.

Besides, before THA, patients who suffer from hip osteoarthritis (OA), rheumatoid arthritis (RA), avascular necrosis of the femoral head (ANFH)

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usually have hip dysfunction because of aseptic inflammation, disuse and/or change of the hip offset compared with femoral neck fracture (FNF) patients. So, theoretically, faster postoperative hip function recovery is expected in FNF patients. However, to the best of our knowledge, no previous literature has focused on this issue. The aim of the present study is to analyze the extent of postoperative hip abductor insufficiency in primary THA patients receiving ALMI approach, and to investigate whether the clinical outcomes are more favorable in FNF patients than in non-femoral neck fracture (nFNF) patients.

METHODS

Patients

This prospective study has been approved by the Ethics Committee of the First Affiliated Hospital of Chongqing Medical University. A total of 95 consecutive patients received primary unilateral THA in our department from May 2009 to February 2011. Patients with FNF, hip OA, ANFH, RA were included. Exclusion criteria consisted of previous hip surgery, ankylosis, severe hip dysplasia, intertrochanteric fracture, septic inflammatory polyarthritis, FNF patients combined with OA, ANFH or RA, body mass index (BMI) greater than 28, arthrosis of the contralateral hip and any physical or mental disability. Out of these patients, 48 met the inclusion criteria and were divided into FNF group (*n*=26) and nFNF group (*n*=22, including 11 OA, 8 ANFH and 3 RA). Each patient has signed the informed consent. Demographic data, surgical side, intraoperative blood loss as well as incision length are given in Table 1. There was no significant difference between FNF group and nFNF group. All participants underwent a clinical examination preoperatively and 6, 12, 24 and 48 weeks postoperatively.

Table 1. Demographic data on the patients' age, surgical side, intraoperative blood loss and incision length

Group	No. of hips	Age (yr)	Height (cm)	Weight (kg)	BMI (kg/m^2)	Surgical side (right/left)	Operative time (min)	Blood loss (ml)	Incision length (cm)
FNF	26	70.7±8.6	160.3±6.0	54.2±9.8	20.9±3.0	10/16	90.8±17.5	265.4±92.1	9.3±1.0
nFNF	22	64.6±8.6	162.8±9.9	60.8±11.2	22.8±2.2	12/10	99.1±14.3	327.3±105.7	10.0±1.2
P value	—	0.10	0.46	0.14	0.09	—	0.22	0.14	0.08
Total	48	67.9±8.9	161.5±8.0	57.3±10.8	21.8±2.8	22/26	94.6±16.4	293.8±101.4	9.6±1.1

P value=independent sample Student's *t*-test between FNF and nFNF groups. —: Data not analysed.

Surgical intervention

MIS THA was performed by the senior surgeon (Huang W) who has the experience of performing primary THA for more than 1 500 times. The surgery was performed under general anesthesia with the patient in lateral decubitus position. The skin incision was centered on a point 2 cm distal to the tip of the greater trochanter and the incision length was approximated 7-10 cm (Figure 1A). The gluteus medius was incised along the fiber course to a maximum length of 3 cm to protect the inferior branch of the superior gluteal nerve and the anterior one third of the abductors was detached from the greater trochanter (Figure 1B). Prolonged incision into the vastus lateralis was strictly avoided. Finally gluteal tendons were reattached with strong transperiosteal sutures (nonabsorbable suture X548H; DePuy, USA) to anatomically reconstruct the completeness of hip abductors in situ (Figure 1C). No drainage was placed at the end of operation. Patient-controlled intravenous analgesia as well as oral non-steroidal anti-inflammatory drugs (NSAIDs) was routinely administrated as postoperative pain control protocol. All the THA patients followed the same postoperative rehabilitation protocol under instructions of physical therapists: passive and active leg-raising training from the first day, partial weight bearing walking from the third day, going up and down stairs from seventh to tenth day. Postoperatively both physical (sequential compression of lower limbs) and chemical (low molecular weight heparin) treatment were given for all the THA patients to prevent deep vein thrombosis.

Clinical investigation

Each patient was examined before operation and at 6, 12, 24 and 48 weeks postoperatively. The abductor torque, Trendelenburg's sign, gait velocity,