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Original article

Small femoral offset is a risk factor for lateral femoral cutaneous nerve injury during total hip arthroplasty using a direct anterior approach

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ABSTRACT

Introduction: Lateral femoral cutaneous nerve (LFCN) injury is a risk specific to the direct anterior approach (DAA) for total hip arthroplasty (THA). However, prevention strategies have not been established. This study aimed to identify the predisposing factors determining LFCN injury during THA via a DAA.

Hypothesis: Patients with LFCN injury after THA via DAA would demonstrate predisposing factors.

Material and methods: LFCN injury was identified using a patient questionnaire. Potential factors predisposing to LFCN injury were identified in four categories in patient records: patient factors (age, sex, BMI, diagnosis and range of hip motion), surgical factors (surgical time and surgeon's experience of the DAA), preoperative radiographic factors (neck-shaft angle, femoral offset, acetabular offset, total offset and length of muscle on computed tomography axial image) and radiographic changes (differences between each offset pre- and post-surgery). Multivariate analysis was performed to identify risk factors for LFCN injury during this surgery.

Results: After application of inclusion and exclusion criteria, 102 hips (28 with LFCN injury; 74 without) in 102 patients (17 males, 85 females; mean age 66.0 years [range, 26–88 years]) were included. Univariate analysis of patients with and without LFCN injury revealed that small preoperative femoral offset and short preoperative long axis of the *tensor fascia lata* were statistically significant risk factors for LFCN injury ($P=0.004$, and $P=0.01$, respectively). Multivariate analysis showed that small preoperative femoral offset was the only independent risk factor for LFCN injury (odds ratio, 0.895; 95% Confidence Interval, 0.817–0.981; $P=0.0018$).

Discussion: Smaller femoral offset was a significant risk factor for LFCN injury following THA via a DAA. Our recommendations are that careful attention should be paid to the skin-fascia incision and subcutaneous exposure, and that excessive retraction of the *sartorius* muscle and *tensor fascia lata* should be avoided, to reduce the risk of LFCN injury in patients with a small femoral offset.

Level of evidence: IV, retrospective historical cohort study.

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1. Introduction

The direct anterior approach (DAA) for total hip arthroplasty (THA) has gained in popularity because of its advantages of early recovery, less postoperative pain and lower dislocation rate [1,2]. However, the DAA is considered to be technically demanding and to increase the risks of intraoperative fracture and lateral femoral cutaneous nerve (LFCN) injury [3–6].

Although LFCN injury does not cause major neurological complications, such as sciatic and femoral nerve palsies, patients with LFCN injury often complain of numbness or paresthesia of the lateral thigh, or in severe cases, painful neuroma analogous to meralgia paresthesia. Bhargava et al. showed that the presence of impaired sensation did not appear to affect the patient's functional outcomes [7]. In our previous analysis of 122 hips that underwent THA via a DAA, an incidence of LFCN injury of 31.9% was observed [8]. This study demonstrated that LFCN injury resulted in decreased quality of life (QOL), although hip function was not affected [8].

Prevention and treatment strategies of LFCN injury have not been established, because risk factors remain unclear. We therefore hypothesized that patients with LFCN injury after THA via

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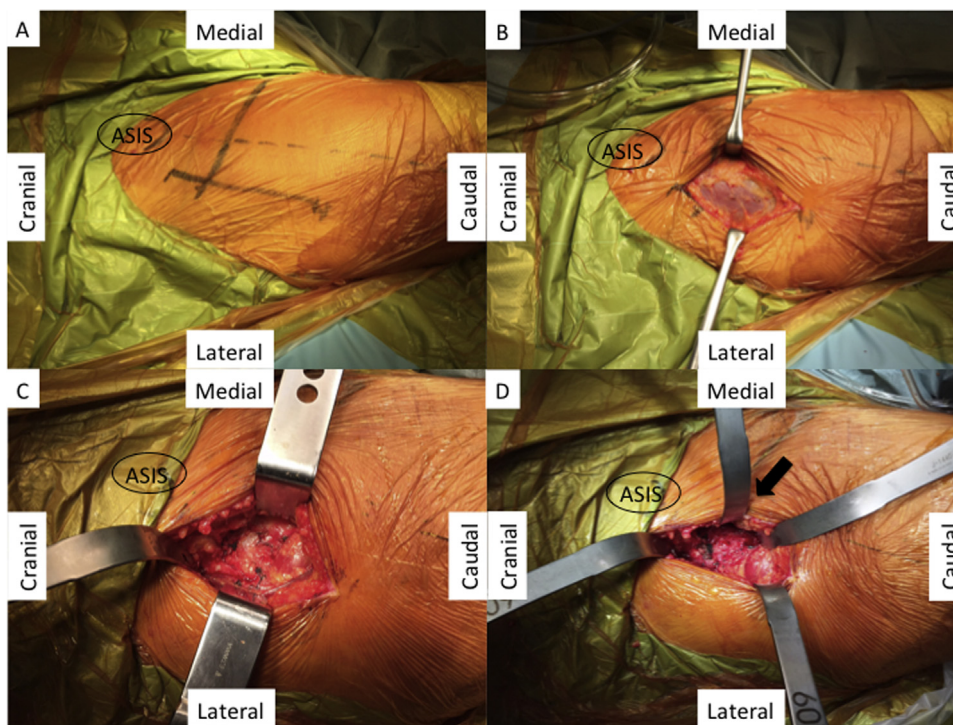


Fig. 1. A. A 10-cm oblique skin incision was made, beginning 2 cm lateral and 2 cm distal to the anterior superior iliac spine. B. The *tensor fascia lata* muscle was incised about 2 cm lateral to the skin incision. C. The *sartorius* and *tensor fascia lata* were retracted using several retractors to access the hip joint. D. For exposure of the acetabulum, a narrow retractor was placed under the *iliopsoas* muscle at the anterior aspect of the acetabular wall (black arrow).

a DAA would demonstrate predisposing factors. The aim of this study was to identify these risk factors. We asked first whether predisposing factors were related to the patient's anatomy or to the surgical technique, and second whether predisposing factors could be recognized on the preoperative radiographs.

2. Material and methods

As previously reported [8], between 2011 and 2014, we performed 132 primary THAs using the DAA. Four of these cases were excluded because of major postoperative complication or dementia, but all of the remaining patients were surveyed by letter, using a questionnaire to elicit reporting of symptoms of LFCN injury. Patients who had undergone a total of 122 hip surgeries replied and were initially included in the study. Of these 122 hips, with average follow up of 12.8 months, 39 hips were identified with LFCN injury using the questionnaire [8]. LFCN injury was identified by symptoms of numbness, dull sensation, tingling or jolt-like sensation, pain, and/or a strange feeling over the lateral aspect of the thigh, excluding the surgical scar. Patients with only temporary symptoms of LFCN injury (less than 6 months' duration) were excluded from the study. In addition, patients were excluded if their files contained incomplete data concerning personal characteristics, physical examination or radiographic follow-up. Ultimately, 102 hips (28 with LFCN injury; 74 without LFCN injury) in 102 patients (17 males, 85 females; mean age at surgery 66.0 years [range, 26–88 years]) were included in the analysis. Osteoarthritis was diagnosed in 77 hips (75.5%), osteonecrosis in 21 hips (20.6%) and femoral neck fracture in four hips (3.9%). The right hip was the subject of 52 procedures (50.9%). Mean BMI was 23.1 kg/m² (range, 18–44 kg/m²). Mean postoperative follow-up was 13.3 ± 6.9 months.

The DAA was performed with the patient supine on a standard surgical table [9,10]. General anesthesia was used in all cases. Briefly, an oblique skin incision was made, beginning 2 cm

lateral and 2 cm distal to the anterior superior iliac spine (ASIS) and extending 10 cm posterolaterally (Fig. 1A). The *tensor fascia lata* was incised about 2 cm lateral to the skin incision (Fig. 1B). The intermuscular space between the *tensor fascia lata* and *sartorius* muscles was bluntly entered, then the *sartorius* and *tensor fascia lata* were retracted, using several retractors, to access the hip joint (Fig. 1C). To expose the acetabulum, a narrow retractor was placed under the *iliopsoas* muscle at the anterior part of the acetabular wall (Fig. 1D, black arrow).

Ethical approval for the study was obtained from our institutional review board. Factors potentially predisposing patients to LFCN injury were identified in their medical records and investigated in four categories, as follows.

2.1. Patient factors

Age, sex, height, body weight, body mass index (BMI), diagnosis, and preoperative passive range of motion of hip flexion, abduction, adduction, internal rotation and external rotation.

2.2. Surgical factors

Duration of surgery and experience of the surgeon in performing the DAA (inexperience was defined as having performed fewer than 40 surgeries using the DAA [6], because De Geest et al. mentioned that the surgeon's level of experience seems to correlate with complication rate until a plateau is reached after 40–100 cases [6]).

2.3. Preoperative radiographic factors (Fig. 2A)

On a preoperative anteroposterior (AP) radiograph of hips in a supine position using the standardized technique, the native neck-shaft angle and the length of the vertical between the center of the femoral head and the top of the lesser trochanter were measured in

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