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Total hip arthroplasty via an anterolateral supine approach for obese patients increases the risk of greater trochanteric fracture

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ABSTRACT

Purpose: The aim of this study was to evaluate the outcomes and early complications of obese patients who underwent total hip arthroplasty for osteoarthritis via an anterolateral approach in the supine position (ALS-THA) and compare these outcome with of a matched control group of non-obese patients.

Patients and methods: Thirty-one hips in 28 patients with obesity (BMI $\geqq 30\,kg/m^2$) were included in this study. As a control group, 31 hips of 31 patients with a normal weight (BMI between 20 and $25\,kg/m^2$) were matched based on age, sex, and laterality. Clinical evaluations using the Merle d'Aubigne and Postel hip score, radiological evaluations and perioperative complications were compared in two groups.

Results: There were no significant differences between the groups in the operative time, period of hospitalization, clinical hip score, or cup positioning, although the position of the cup tended to deviate from the optimal safe zone in the obese compared with non-obese group (32.3 and 16.1%, respectively). There was no infection, dislocation, nerve palsy, or life-threatening event in either group. The rate of avulsion fractures of the greater trochanter in the obese group was 3 times higher compared to that in the non-obese group.

Conclusions: As the clinical outcome of ALS-THA for the obese group is not inferior to that for the non-obese group, obesity is not considered to be a contraindication for ALS-THA. However, obesity increases the risk of intraoperative greater trochanteric fracture. Thus, surgeons should be particularly careful when manipulating the femur in this class of patients, who should be informed of this risk.

1. Introduction

Total hip arthroplasty (THA) via an anterolateral mini-incision approach has been reported to successfully reduce the rate of posterior dislocation and improve recovery and rehabilitation by preserving muscle insertions.[1,2]

However, minimally invasive operative techniques demand that surgeons have experience and skill. Moreover, obesity further complicates the operation.

Obesity has been defined as a body mass index (BMI) $\geqq 30\,kg/m^2$ by the World Health Organization.[3] BMI is calculated by dividing the weight in kilograms by the height in meters squared. Several studies have reported a relationship between obesity and poor outcomes after THA, including component malpositioning, infection, an increased operative time, longer hospitalization, and lower clinical scores.[4–7] Liu reported that obesity negatively influenced the dislocation rate, functional outcomes and operative time of primary THA.[4] However, some studies have reported controversial results.[8]

Even in minimally invasive THA (MIS-THA), surgical indications for obese patients are controversial. For example, while Sculco stated that patients with BMI $< 28\,kg/m^2$ were the most suitable for minimally invasive THA,[9] other studies have reported that obesity is not a contraindication for the mini-incision approach.[10,11]

As the population ages, the demand for THA to treat obese patients has been increasing in Japan. To the best of our knowledge, however, there are only a few reports on the early complications of THA performed via an anterolateral approach in the supine position (ALS-THA) in obese patients.

Therefore, the aim of this study was to evaluate the clinical and radiological results and complications during the intra- and early postoperative period of obese patients who underwent ALS-THA for osteoarthritis and compare them with those in a matched control group of non-obese patients.

2. Patients and methods

Between January 2010 and February 2015, a total of 756 primary cementless THAs were performed at our hospital. The data from all

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operations and clinical and radiological examinations were routinely collected and stored in our institutional database. From the original cohort, we included only patients with a diagnosis of osteoarthritis with no prior hip surgery. Patients with markedly dislocated hips were excluded because of the need for additional femoral shortening osteotomy. Other exclusion criteria included the following: a history of acute intracranial disease or hemorrhagic stroke, uncontrolled hypertension, myocardial infarction during the past 3 months, severe liver or renal disease, and pulmonary embolism. Patients who underwent simultaneous bilateral THA, which was performed depending on cases in our hospital, were also excluded, leaving a remainder of 491 hips.

Of these 491 hips, 31 hips in 28 obese patients (BMI $\geqq$ 30 kg/m^2) were included in this retrospective, case-matched study.

The average age of the patients at the time of the operation was 62.6 years (range: 35–85 years). Seventeen hip replacements were performed on the right side, and 14 were performed on the left side. This study group included 6 men and 22 women.

As a control group, 31 hips (31 patients) of patients with a normal weight (BMI between 20 and 25 kg/m^2) were selected from the 491 hips, after being matched based on age, sex, and laterality. The average BMI was 32.2 (range: 30.1–39.0) in the obese group and 22.0 (range: 20.0–24.6) in the matched non-obese group. The demographic data of the case-matched series are shown in Table 1. All patients were followed up for at least 6 months and had complete records, including radiographic and clinical examinations.

Institutional review board approval was obtained for this study and all patients provided written informed consent.

2.1. Operation

All operations were performed under general anesthesia utilizing an anterolateral approach in the supine position; the interval between the tensor fasciae latae and gluteus medius muscles was opened using minimally invasive instruments, and the operations were conducted by or under the supervision of the senior author in a single institution.[2,12]

Regarding the femoral component, a cementless, collarless, tapered, titanium fiber metal proximally coated stem (Versys Fiber Metal Taper/Zimmer, Warsaw, IN, USA) was used in all cases. The acetabular cup used in this study was the HA/TCP Trilogy Acetabular cup (Zimmer) in all cases. The optimal windows of abduction and anteversion angles of the acetabular cup were 30–50° and 5–25°, respectively. Bearing combinations included ceramic-on-polyethylene and cobalt chrome-on-polyethylene, and femoral heads were either 28 or 32 mm in size.

To reduce the need for allogeneic blood transfusion, preoperative autologous blood donation was used in all cases. Within 1 month of the operation, patients deposited one unit (400 mL) of blood and received it after the operation. In addition, all patients received 1000 mg of intravenous tranexamic acid just before surgical incision and just prior to wound closure.

Postoperatively, the patients underwent a standard rehabilitation protocol. They were mobilized with the assistance of physical therapy, and full weight-bearing was allowed with the use of a walker on the first postoperative day.

Table 1
Preoperative patient date.

	Obese	Non-Obese	P-Value
Side (Right: Left)	17:14	17:14	1*
Sex (Male: Female)	6:25	6:25	1*
Age (years old)	62.6 (35–85)	62.7 (46–81)	0.76**
Height (cm)	154.1 (130.0–183.0)	157.0 (145.0–174.0)	0.17**
Weight (kg)	76.6 (53.0–104.0)	54.6 (44.0–67.9)	< 0.0001**
BMI (kg/m2)	32.2 (30.1–39.0)	22.0 (20.0–24.6)	< 0.0001**

Data analysis.
* Chi-squared test.
** Mann-Whitney's *U* test.

2.2. Evaluation items

As evaluation items, the operation time, estimated blood loss, requirement of allogenic transfusion, period of hospitalization and number of days to achieve gait with a cane were reviewed. Hemoglobin (Hb) concentrations (g/dL) within 1 month before the operation, within 1 h after the operation, and on postoperative day 1 were also recorded.

As clinical evaluation, pre- and post-operative pain and function were assessed using the Merle d'Aubigne and Postel hip score, which assigns up to 6 points for each category of pain, mobility, and the ability to walk, with a total of 18 points being given to a normal hip.[13] The postoperative hip score was determined at the time of the latest follow-up.

Radiographic analysis was performed by digitizing anteroposterior (AP) pelvic and lateral radiographs. The images were evaluated by the same observer who was blinded to the patient group.

The preoperative femoral morphology was assessed by quantifying the Canal Flare Index (the ratio of the canal width of the femur at a point 20 mm proximal to the lesser trochanter to that at the isthmus) and classified into three general shapes: normal, stovepipe, and champagne-flute, according to Noble et al. in both groups.[14]

Postoperative radiographs were taken at each follow-up examination using a standardized technique. The immediate postoperative AP and lateral images were examined for cup abduction, anteversion, and stem orientation. Cup anteversion was measured on AP radiographs according to Widmer's method.[15] The numbers of cups within the so-called safe zone described by Lewinnek et al. were used as the anticipated target value of abduction at 40 ± 10° and anteversion at 15 ± 10° were measured in both groups.[16]

The incidence of implant loosening, the presence of a radiolucent line and stress shielding upon imaging were evaluated at the time of the most recent follow-up. The presence of radiolucent lines around the femoral stem was evaluated using the seven zones described by Gruen et al.[17] Stress shielding was graded according to the classification of Engh et al.[18]

Peri- and post-operative complications including infection, dislocation, nerve palsy, life-threatening events, and re-operation, were recorded in both groups. Life-threatening events included venous thromboembolism, myocardial infarction, and cerebrovascular incidents.

2.3. Statistical analysis

Data were statistically analyzed in both groups and compared using the Mann-Whitney *U* test for quantitative parameters and the Chi-squared test for dichotomous parameters. The statistical software package StatView-J 5.0 (SAS Institute Inc., Cary, NC, USA) was used for all calculations. Differences were considered significant when the *p*-value was less than 0.05.

3. Results

There was no significant difference in the mean age at the operation or height between the two groups (Table 1). The mean BMI was 32.2 and 22.0 in the obese and non-obese groups, respectively ($P < 0.0001$).

The mean operative time was slightly longer in the obese group compared with the non-obese group (70.8 and 64.8 min, respectively), but this difference was not significant ($P = 0.25$). The mean total blood loss was significantly greater in the obese group compared with the non-obese group (385.4 and 267.7 mL, respectively, $P = 0.01$), but no patient required allogenic transfusion after the operation in either group (Table 2). The Hb concentration was significantly higher in the obese group at all points of measurement except for postoperative day