Outcome of the Contralateral Hip in Rapidly Destructive Arthrosis After Total Hip Arthroplasty

A Preliminary Report

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Abstract: We investigated the outcome of the contralateral hip in patients with rapidly destructive arthrosis of the hip after total hip arthroplasty. Twenty-four patients were included, and the mean duration of radiographic follow-up was 7.0 years (range, 3.8-17.8 years). To assess the capable parameters for predicting the development of osteoarthritis, we evaluated the receiver operating characteristic curves. Three (12.5%) of 24 patients developed osteoarthritis and underwent total hip arthroplasty within 3.8 to 6.5 years. In these 3 patients, both the acetabular-head index and the center-edge angle were significantly lower than those in patients without osteoarthritis ($P < .005$). Based on the receiver operating characteristic curves, both an acetabular-head index of less than 72% and a center-edge angle of less than 16° were considered to be associated with the development of osteoarthritis. **Key words:** rapidly destructive arthrosis of the hip, contralateral hip, total hip arthroplasty, osteoarthritis, acetabular dysplasia.

Rapidly destructive arthrosis (RDA) of the hip generally occurs in the elderly and causes painful disabilities of the hip joint. Most of the RDA cases are unilateral involvement, and the rates have been reported to be around 89% [1]. Because of the rapid destruction of the hip joint and severe pain, the majority of patients with RDA are treated by total hip arthroplasty (THA) [2].

Many previous studies have focused on the affected hip joint for the purpose of investigating the etiology of RDA [2-4]; however, to the best of our knowledge, no study has yet shown the outcome of the contralateral hip after THA.

The purpose of this study was to investigate the outcome of the contralateral hip in patients with RDA after THA.

Patients and Methods

Patients

Between January 1986 and December 1999, 27 patients underwent THA in our institution based on the previously reported criteria of RDA [1-3,5]: a clinical history of hip pain of 1 to 6 months' duration, a radiographic appearance of rapid joint space narrowing (>2 mm in 1 year or 50% joint space narrowing in 1 year) and progression of bone destruction involving the femoral head and the acetabulum with minimal osteophyte formation, and the absence of clinical or laboratory evidence

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of sepsis and neurological disease. None of the 27 patients had ever had contralateral hip pain and radiographic evidence of contralateral hip osteoarthritis, which was defined based on minimum joint spaces of 2.5 mm or less and the absence of osteophytes and subchondral cysts [6]. Patients with rheumatoid arthritis, osteonecrosis, or chondrocarcinosis were excluded.

For each subject, the sex, age at the initial THA for RDA, height, weight, body mass index (calculated as weight [kg] divided by height [m] squared), side of contralateral hip, and a previous history of TKA were recorded.

Study Protocol

A supine anteroposterior radiograph of the hips was obtained at 1 month after the initial THA and at every 1-year follow-up visit. Radiographs were taken using the same technique throughout this study period, on which the standardized position of the beam and radiographic penetration were adopted.

Every follow-up radiograph on the contralateral hip was evaluated for joint space width and the presence of osteoarthritis. The development of osteoarthritis was evaluated based on the clinical symptoms and radiographic evidence of joint space narrowing [7]. Total hip arthroplasty in the contralateral hip was used as the end point of the radiographic follow-up. In addition, each initial radiograph (taken 1 month after the initial THA) was evaluated quantitatively for radiographic parameters, including the center-edge (CE) angle, acetabular-head index (AHI), pelvic tilt, and joint space width (initial joint space width). All radiographs were evaluated by 2 observers, and all demarcations and reference points were decided by consensus. The radiographs were masked for clinically identifying information and were arranged in random order.

Measurement Methods

Center-Edge Angle. The CE angle (Fig. 1A) is formed by (1) a vertical line drawn from the center of the femoral head at right angles to the teardrop line and (2) a line from the center of the femoral head to the lateral edge of the acetabular roof [8]. The center of the femoral head was determined with concentric circles engraved on a transparent device.

Acetabular-Head Index. The AHI (Fig. 1B) is the percentage that is calculated by dividing the horizontal distance of part of the femoral head (a), which is from the innermost surface of the head to the edge of the acetabulum, by the total horizontal width of the femoral head (b) and multiplying by 100: $(a/b) \times 100$ [9].

Joint Space Width. The joint space width (Fig. 1C) is determined by a vertical line going through the femoral head center at right angles to the teardrop line [10]. The joint space width was measured using a transparent ruler with a 0.5-mm graduation.

Pelvic Tilt. We measured the angle of pelvic tilt on the anteroposterior radiograph using the method of Konishi and Mieno [11]. The formula for the estimation of the angle of pelvic tilt (backward tilt from neutral position [15°]) from the height of the obturator foramen and teardrop distance is as follows: angle of pelvic tilt (in degrees) = height of obturator foramen/(teardrop distance $\times A - B$), where $A = 207.0$ and $B = 32.0$ in a female subject and $A = 137.4$ and $B = 23.1$ in a male subject.

Statistical Analysis

Patients were divided into 2 groups based on the development of contralateral hip osteoarthritis. Univariate analyses between the prevalence of osteoarthritis and the nonprevalence of osteoarthritis groups were performed by means of Fisher exact probability test in proportion of sex and Student t test for numerical data of age, height, weight, body mass index, CE angle, AHI, pelvic tilt, and initial joint space width.

To further assess the capable parameters for predicting the development of contralateral hip osteoarthritis, we used the receiver operating characteristic (ROC) curves [12]. In these ROC curves, the circumscribed areas (the area under the curve) give an estimate of the parameter's diagnostic efficiency (in our study, the diagnostic efficiency of the development of contralateral hip osteoarthritis). This analysis involves plotting the true-positive rate (sensitivity) against the false-positive rate (1 − specificity) for possible cutoff scores. Each point on the ROC plot represents a sensitivity/specificity pair corresponding to a particular decision threshold. The higher the ROC curve is skewed toward the upper-left corner, the better the discriminatory capacity of the parameters. The areas under the curve were compared using the Mann-Whitney U test [13].

A Kaplan-Meier curve was produced with a threshold level, which was defined as the highest sensitivity/specificity combination based on the ROC curve for the most capable parameter for predicting the development of contralateral hip