Eur Orthop Traumatol (2013) 4:15–20
DOI 10.1007/s12570-012-0149-z

ORIGINAL ARTICLE

Cementless total hip arthroplasty for osteonecrosis of the femoral head in systemic lupus erythematosus: a study with 10–16 years of follow-up

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Received: 21 February 2012 / Accepted: 28 November 2012 / Published online: 8 December 2012

Abstract
Objectives The purpose of the present study was to describe the long-term results of total hip arthroplasty (THA) for osteonecrosis of the femoral head (ONFH) in patients with systemic lupus erythematosus (SLE).
Methods From 1994 to 2001, 18 cementless THAs (14 SLE patients) were included in the present study. Four hips (three patients) were lost to follow-up. The remaining 14 hips (11 patients) were available for evaluation. The mean follow-up period was 13.1 (range, 10.0–16.4) years. The follow-up rate was 77.8 %. The mean age at the time of surgery was 35.2 (range, 27.4–51.0) years.
Results Mean preoperative Harris Hip Score was 37.4 (range, 17.1–63.1) points, which improved to 94.5 (range, 73.9–100) points at final follow-up. Two hips had dislocation and were treated successfully with closed reduction. No patient in this study group had deep venous thrombosis or pulmonary embolism. One hip had peroneal nerve palsy. No superficial or deep wound infection was observed. Two hips of two patients required reoperation due to dislodgement of a polyethylene insert. With revision of the acetabular component for any reason considered to be a failure, the 10-year survival rate was 93 % (95 % CI, 0.79–1).
Conclusion We have reported the long-term results of THA for ONFH with SLE. Although several reports have noted that the results of THA for ONFH are less favorable than those for osteoarthritis, the long-term results of THA for ONFH with SLE were acceptable. THA is an acceptable option for patients with advanced-stage or an extended region of ONFH.

Keywords Osteonecrosis of the femoral head · Total hip Arthroplasty · Systemic lupus erythematosus

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Introduction

Systemic lupus erythematosus (SLE) is a serious autoimmune disease that most commonly occurs in young women and has a large spectrum of clinical manifestations. The prognosis of SLE has improved remarkably from a <5 % 5-year survival rate in 1955 [1] to a >90 % 10-year survival rate in recent years [2–4]. An improvement in quality of life (QOL) has necessarily accompanied this prognostic improvement. Osteonecrosis of the femoral head (ONFH) is a serious problem that decreases the QOL of SLE patients. The incidence of ONFH in SLE patients is relatively high: Oinuma et al. reported that 23 of 72 SLE patients (31.9 %) had ONFH [5].

Joint-preserving surgery such as curved intertrochanteric varus osteotomy [6–9], transtrochanteric rotational osteotomy (TRO) [10–17], and bone grafting [18–23] are preferred for ONFH after articular collapse. However, total hip arthroplasty (THA) is often required when these procedures fail.

Several studies have reported short- to medium-term results of THA for ONFH in SLE patients [24–27]. However, to the best of our knowledge, no long-term results of THA for ONFH in SLE patients have yet been reported. Because the prognosis of SLE has improved, long-term outcomes of THA are becoming increasingly important. The purpose of the present study was to describe the long-term results of THA for ONFH in patients with SLE.

Material and methods

Patient characteristics

From 1994 to 2001, 49 cementless THAs were performed for collapsed ONFH in 41 patients with various diseases. Of these, 18 cementless THAs (14 SLE patients) were included in the present study. Four hips (three patients) were lost to follow-up, because they were transferred to other hospitals in accordance with their primary physicians' moves. The remaining 14 hips (11 patients) were available for evaluation. The mean follow-up period was 13.1 (range, 10.0–16.4) years. The follow-up rate was 77.8 %. The study population included two men (2 hips) and nine women (12 hips). The mean age at the time of surgery was 35.2 (range, 27.4–51.0) years. Mean weight was 54.2 (range, 42.0–70.4) kg, mean height was 157.5 (range 144.0–173.0) cm, and mean body mass index was 21.9 (range, 16.4–28.2) kg/m^2. Three hips had undergone joint-preserving surgery; two TROs and one bone graft. All hips with ONFH were stage 4 according to the 2001 Revised Criteria for Staging of Idiopathic Osteonecrosis of the Femoral Head from the Japanese Ministry of Health, Labor and Welfare [28].

Surgical procedure

Surgery was performed in a clean-air operating room. The operations were performed by a senior surgeon (H.Y.) under general anesthesia through a direct lateral approach [29] for 13 hips and a modified anterolateral approach for 1 hip [30].

Four types of uncemented acetabular components were used: Seven HGP2 cups (Zimmer, Warsaw, IN, USA), five Trillogy (Zimmer), One DURALOC (DePuy, Warsaw, IN, USA), and one ZTT (DePuy). The acetabular component was fixed with a press-fit technique; the diameter of the implant was 2 mm larger than the diameter of the last reamer used to prepare the acetabulum. Additional screw fixation was used in all cups. Twelve femoral components were an anatomically designed uncemented Anatomic (Zimmer) and two were a modular cylindrical uncemented S-ROM stem (DePuy). Two S-ROM stems were used for two hips after TRO. The implanted femoral components corresponded to the size of the largest rasp or reamer used. The modular femoral head is a cobalt–chromium alloy fitted in the femur with a conical tape.

Clinical evaluation

Clinical follow-up was performed at 1, 3, and 6 months, 1 year, and yearly thereafter. Harris Hip Scores (HHS) were determined before surgery and at each follow-up examination [31]. Points were assigned as follows: pain (0–44 points), function (0–47 points), deformity (0–4 points), and range of motion (0–5 points). The result was considered excellent when the Harris Hip Score was 90–100 points, good when it was 80–89 points, fair when it was 70–79 points, and poor when it was <70 points.

Statistical analysis

Survivorship analysis was performed using the Kaplan–Meier method, with revision for any reason as an end point. We determined differences in continuous variances between preoperative and postoperative results using Mann–Whitney's U test. p values less than 0.05 were considered to be significant.

Results

Clinical outcome

Mean preoperative HHS was 37.4 (range, 17.1–63.1) points, which improved to 94.5 (range, 73.9–100) points at final follow-up. Overall, 10 hips were excellent, three hips were good, one hip was fair, and none were poor. Thus, satisfactory results (excellent and good) were obtained in 92.9 % of the series.

Complications

Two hips had dislocation and were treated successfully with closed reduction. No further dislocation was observed in these hips, except for one, at final follow-up. This hip had recurrent dislocation (three times); however, further dislocation did not occur due to patient education by a physical therapist. No patient in this study group had deep venous thrombosis or pulmonary embolism (PE). One hip had peroneal nerve palsy; however, the patient experienced full return of nerve function. No superficial or deep wound infection was observed.

Revisions and survivorship

Two hips of two patients required reoperation due to dislodgement of a polyethylene insert. One hip had massive

osteolysis in the acetabulum and was revised. For the other hip, only polyethylene exchange was revised. No femoral revision was performed during the follow-up period. With revision of the acetabular component for any reason considered to be a failure, the 10-year survival rate was 93 % (95 % CI, 0.79–1) (Fig. 1). With revision of the femoral component for any reason considered to be a failure, the 10-year survival rate was 100 %.

Discussion

Several studies have described the results of THA for SLE. Zangger et al. reported the results of 24 THAs and 2 hemiarthroplasties in 19 patients at an average follow-up of 5 years, in which only 1 patient required revision of both components due to loosening [26]. Prupas et al. reported good short-term results of six THAs without complication at 23–76 months of follow-up [24]. Hanssen et al. reported short- to medium-term results of 14 bipolar hemiarthroplasties and 29 THAs in 31 patients with an average follow-up of 57 months, and concluded that THA uniformly provided a good or excellent result in patients of all ages who had SLE, at a mean follow-up of 66 months [25]. Ito et al. reported the medium- to long-term results of 18 bipolar hemiarthroplasties in 12 patients and 25 THAs in 20 patients, which indicated that hip arthroplasty contributed to improved health-related QOL in SLE patients [27]. Chong et al. reported the results of 26 THAs for patients with autoimmune diseases (including SLE, rheumatoid arthritis, and ankylosing spondylitis), which indicated that THA contributed to improve HHS from 41.3 to 86.53 ($p<0.05$), with no occurrences of implant loosening, infective arthritis, dislocations, or neurovascular injuries [32]. Furthermore, in a recent systematic literature review, Johannson et al. showed that revision rates for those patients with a diagnosis of SLE were significantly lower than those of the overall group (4 vs. 13 %, $p=0.002$) [33]. The present study is the first study to report the long-term results of THA for ONFH in SLE patients. In agreement with previous studies, the present study has demonstrated good long-term results of THA for ONFH.

In contrast, several reports have noted that the results of THA for ONFH are less favorable than those for osteoarthritis (OA). The high activity level of ONFH patients and poor bone quality due to chronic steroid use are generally believed to be responsible for these results. Radl et al. reported that survival rate with stem revision as an endpoint for failure was significantly lower in ONFH patients (74 %) than in OA patients (98 %) [34]. Saito et al. compared 29 THAs performed for ONFH, with 63 performed during the same period for OA. At 7-year follow-up, these researchers observed that 48 % of hips in the ONFH group and 33 % of hips in the OA group were in unsatisfactory condition. Furthermore, femoral component loosening occurred more frequently in the ONFH group (28 %) than in the OA group (5 %) [35]. Ortiguera et al. reported that patients with ONFH who are <50 years old have a significantly higher rate of mechanical failure than those with OA who are <50 years old [36]. Cornell et al. reported that the failure rate of THA for patients with ONFH was four times greater than that of patients with OA. Radl et al. also reported that patients with THA after ONFH associated with a systemic disease (steroid medication, alcohol abuse, or sickle cell disease) are at a higher risk of complications compared to patients with idiopathic or post-traumatic ONFH [37]. Based on the observation that the present results of THA for ONFH with SLE were not poor, we speculate that the activity of SLE

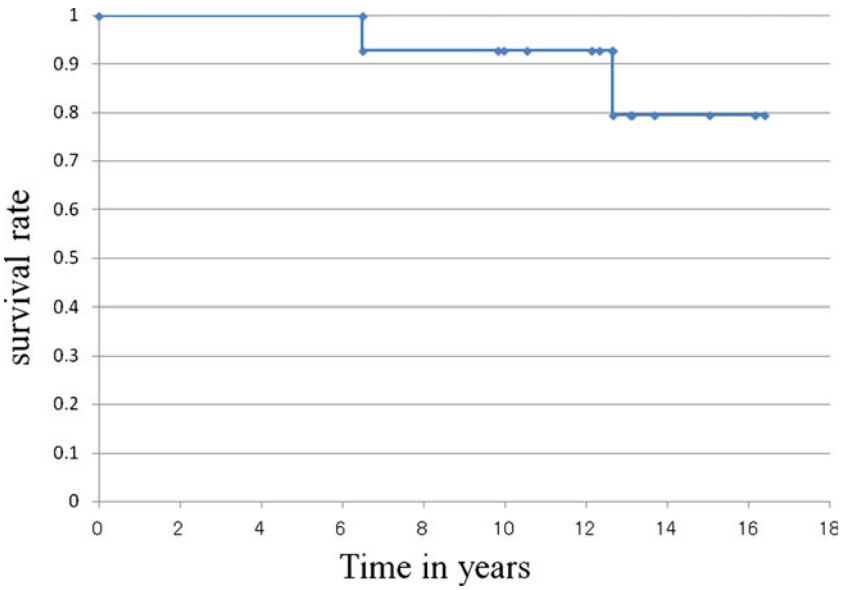

Fig. 1 Survival rate with revision of the acetabular component for any reason as the endpoint

patients was not higher than that of patients with idiopathic or post-traumatic ONFH.

Deep surgical site infection (SSI) is a major complication of THA. A nationwide study from the USA reported a 0.2 % incidence of deep SSI after THA [38], and a study from the UK reported a 1.1 % incidence [39]. However, in the present cases, the rate of deep SSI was 0 %. Mahomed et al. reported that the primary diagnosis, including OA, rheumatoid arthritis, and ONFH, was not found to be an independent risk factor for deep SSI [40].

Dislocation remains the major leading cause of revision. Dislocation rates reported in the literature have ranged from <1 to >9 % [41–46]. Ortiguera et al. showed that the incidence of dislocation was higher in ONFH patients compared to OA patients, and suggested that this might be related to the fact that patients with ONFH have much less soft tissue constraints than patients with OA, and therefore might potentially reach a higher range of motion that would, in turn, make them more susceptible to dislocation [36]. In agreement with previous reports, the present study showed high incidence rates of dislocation (14.3 %).

The overall complication rate was not low; however, serious complications, such as PE or infection, were not observed. Although the dislocation rate was high, precise placement of the implants [47, 48] and several methods, such as using a larger femoral head [49–52] or meticulous repair of the posterior capsule via the posterior approach [49], may decrease the dislocation rate.

The correct indication is important to the success of joint-preserving surgery. Sugioka et al. reported that the success rate of TRO performed for late-stage ONFH was 70 %, while that for early-stage disease was 89 %. Furthermore, Sugioka et al. reported the importance of the area of necrosis to the success of TRO: these investigators reported a 29 % success rates in patients with a ratio of intact area of the femoral head to the acetabular weight-bearing area of <20 %, while patients with a ratio >36 % experienced a >93 % success rate [13]. These results suggest that joint-preserving surgery for ONFH is preferable to THA; however, the success rates were not good for patients with advanced-stage or an extended area of ONFH. In addition, several studies have reported the difficulty of THA after femoral osteotomies. Kawasaki et al. reported that the operating time for THA after TRO was significantly longer and perioperative blood loss was significantly larger than that in primary THA [53]. Lee et al. also reported that the risk of stem or cup malposition was increased in THA after TRO compared to primary THA [54]. These researchers concluded that careful preoperative evaluation of anatomy and preoperative planning are required for THA after TRO.

We used uncemented THA for ONFH. Selection of implant for ONFH remains controversial. Orban et al. recommend cemented implants because long-term corticosteroid therapy may induce severe osteopenia, which can create an unsatisfactory bony tissue quality for uncemented fixation [55]. However, Smiłowicz and Kowalczewski reported the results of 122 THAs (70 uncemented and 52 cemented) for 80 rheumatic patients, which showed that uncemented and cemented prostheses were similar in terms of Merle d'Aubigne hip score and revisions due to aseptic loosening [56]. Furthermore, Johannson et al. conducted a systematic literature review and showed that 89 % of 458 THAs performed for ONFH in 1990 or later used uncemented fixation and that the survival rate of 458 THAs at a mean follow-up time of 6 years was 97 % [33]. Based on these results, we believe our selection of uncemented THA was satisfactory.

A limitation of our study was the small population. Although further study is required in a larger number of patients, the present results suggest that THA is superior to other types of joint-preserving surgery for end-staged ONFH.

In conclusion, we have reported herein the long-term results of THA for ONFH with SLE. Although several reports have noted that the results of THA for ONFH are less favorable than those for osteoarthritis, the long-term results of THA for ONFH with SLE were acceptable. Joint-preserving surgery should be performed for ONFH only when indicated; the success rates were not good in patients not suitable for the indication. THA is an acceptable option for patients with advanced-stage or an extended region of ONFH.

Conflict of interest The authors declare that they have no conflicts of interest.

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