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Intermediate to long-term results of periacetabular osteotomy in patients younger and older than forty years of age

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INTERMEDIATE TO LONG-TERM RESULTS AFTER HYBRID TOTAL HIP ARTHROPLASTY FOR PATIENTS WITH RHEUMATOID ARTHRITIS

Abstract

There have been few reports describing intermediate to long-term results after hybrid total hip arthroplasty in patients with rheumatoid arthritis. We followed 52 hips in 44 patients, 5 men and 39 women, for a mean of 11.5 years (range, 5–23.5 years). Revisions had been performed in 6 hips in 6 patients: 1 both acetabular and femoral components for infection, 1 acetabular component for aseptic loosening, 3 acetabular components for recurrent dislocation, and 1 acetabular component for dislodgement of the polyethylene liner from the metal shell. None of other acetabular or femoral components were revised or found to be loose at the final follow-up. Although postoperative dislocation remains a concern, hybrid total hip arthroplasty had an acceptable result in patients with rheumatoid arthritis.

Key words: hybrid total hip arthroplasty, rheumatoid arthritis, cementless acetabular component, cemented femoral component, clinical results

Introduction

Rheumatoid arthritis (RA) is a systemic disease characterized by multiple joint involvement. Total hip arthroplasty (THA) has been one of the successful options for patients with RA in terms of pain relief and functional improvement with patient satisfaction. Good results have been reported with use of cemented and uncemented THAs [1-4], however, there have been few reports describing intermediate to long-term results after hybrid THA [5, 6].

The hybrid THA combines insertion of an acetabular component without cement and a femoral component with cement. We now assess retrospectively whether a hybrid THA is a viable option for the treatment of patients with RA. We reviewed the intermediate to long-term clinical and radiological results of hybrid THA for non-selected, consecutive patients with RA.

Patients and methods

Between December 1987 and October 2006, 73 hybrid THAs were performed in 61 patients with either juvenile or adult-onset RA. Nine patients (11 hips) died before a minimum 5-year follow-up. We were unable to trace 8 patients (10 hips) as a result of refusal to participate, deterioration of health precluding return for assessment, or loss to follow-up. At last follow-up all 21 THAs were radiographically well-fixed at an average of 27 months (range, 6–54 months) postoperatively. We were able to follow-up 44 patients (52 hips, 71%, 36 unilateral, 8 bilateral) for more than 5 years. The average duration of follow-up was 11.5 years (range, 5–23.5 years). The average age at the time of the index operation was 52.2

years (range, 17–74 years). The average weight was 48 kg (range, 35–65 kg) and the average height was 148 cm (range, 130–180 cm). Five patients were men and 39 were women. There were 25 right hips and 27 left hips. According to the functional classification of the American Rheumatism Association, 19 patients had class-II, 23 patients had class-III, and 2 patients had class-IV capacity [7].

All of the procedures were performed through the posterolateral approach without trochanteric osteotomy. One of 2 different hybrid THA systems was used. A Harris Precoat, Precoat Plus, or CDH Precoat stem with a titanium hemispherical Harris-Galante porous-coated 1 or 2 acetabular component (Zimmer, Warsaw, Ind) was used in 40 hips, and a 4-U Hip System (Nakashima Medical, Japan) was used in 12 hips. The acetabular component was inserted with a line to line fit. An average of 3.4 screws (range, 2–5 screws) was used for fixation. The diameter of the prosthetic femoral head was 22 mm in 40 hips and 26 mm in 12 hips. Standard polyethylene liner was used in 41 and elevated liner was used in 11. The average surface roughness was 2.0 μm in the Harris Precoat stem, 2.2 μm in the Harris Precoat Plus or CDH Precoat stem, and 2.0 μm in the proximal half and 1.0 μm in the distal half in the 4-U stem. The surface of the 4-U stem is equivalent to the matte finish. We asked the manufacturers to provide femoral rasps for each final component, which over-rasped by 0.5 mm. All final femoral rasps used in this study for canal preparation over-rasped by 0.5 mm. A so-called second-generation cementing technique was used with Simplex cement (Stryker-Howmedica-Osteonics, Mahwah, NJ) and a cement gun for the retrograde introduction of cement. A methylmethacrylate plug was used in all hips. We did not use vacuum-mixing, centrifugation, proximal cement pressurizers, or stem centralizers. We did not repair of the external rotators and the posterior aspect of the capsule.

Clinical evaluations were made using hip scoring system [8]. Hips with the score of 90 to 100 points were defined as showing excellent results, 80 to 89 points as good results, 70 to 79 points as fair results and less than 70 points as poor results. An anteroposterior radiograph and a true lateral radiograph were made preoperatively and at each follow-up examination. Anteversion of the acetabular component was measured [9]. The acetabular interface on the anteroposterior radiograph was divided into three zones [10]. The acetabular component was classified as migrated if there was a change of at least 4 mm in the horizontal or vertical position of the center of the component [11]. Linear head penetration into the polyethylene liner was measured [12]. Anteversion of the femoral component was calculated by the anteversion angle measured on true lateral radiographs and the neck-shaft angle of each femoral component [13].

Cementing of the femoral stem was classified as Grade A, B, C-1, C-2, and D [14]. The dimensions and location of radiolucent lines at the bone-cement interface of the femoral component and osteolytic lesions were recorded [15]. The canal filling ratio of the femoral component was defined as the percentage of component width to intramedullary width at the midpoint of the component on an anteroposterior radiograph taken within one month after surgery [16]. Loosening of the femoral component was defined using the criteria described by Harris et al. [17].

The study design was approved by the Ethics Committee of Asahikawa Medical

University.

Statistical analyses were performed using SPSS software (SPSS Inc., Chicago, Ill). Clinical, radiographic, and surgical factors were evaluated with use of chi-square tests or Mann-Whitney U test where appropriate. Preoperative and postoperative Harris hip scores were compared with use of the Wilcoxon signed-rank test. Probability values less than 0.05 were considered significant. Kaplan-Meier survival curves with end points defined as revision for any reason and aseptic loosening of the acetabular and femoral component were calculated. All survivorship data were reported with 95% confidence interval.

Results

At the time of the most recent follow-up, revisions had been performed in 6 hips in 6 patients. Both acetabular and femoral components of 1 hip with postoperative infection were simultaneously removed 3 months after index surgery. One acetabular component was revised for aseptic loosening 4 years postoperatively. Three acetabular components were revised for recurrent dislocation 2 months, 7 months and 3 years postoperatively, respectively. One acetabular component was revised for dislodgement of the polyethylene liner from the metal shell 9 years postoperatively. None of other acetabular or femoral components were revised or found to be definitely loose at the final follow-up (Fig. 1). Kaplan-Meier analysis revealed that a 10-year survival rate was 98.1% (95% confidence interval: 96.2%–100%) with revision for aseptic loosening of the acetabular or femoral component as the end point and 89.5% (95% confidence interval: 85.0%–94.0%) with revision for any reason as the end point, and a 20-year survival rate was 98.1% (95% confidence interval: 96.2%–100%) with revision for aseptic loosening of the acetabular or femoral component as the end point and 85.4% (95% confidence interval: 79.5%–91.3%) with revision for any reason as the end point.

The Harris hip score increased from a preoperative average of 37 points (range, 22–62 points), to 75 points (range, 46–96 points) at the most recent follow-up for patients who did not have a subsequent revision ($p < 0.001$). The result was excellent in 5 (10%) hips, good in 11 (21%) hips, fair in 23 (44%) hips, and poor in 13 (25%) hips.

The average angle of abduction of acetabular components at the latest follow-up was 43.8° (range, 38–60°). The average anteversion of the acetabular components was 13.2° (range, 2–30°) and the average combined anteversion of the acetabular and femoral components was 48.2° (range, 22–80°). None of the acetabular components showed radiographic migration, rotation, or a continuous radiolucent line other than one component which underwent subsequent revision for aseptic loosening. Radiolucent lines were observed around 7 (14%) acetabular components. These lines were all 1 mm wide or less and no sockets showed a continuous radiolucent line. Small pelvic osteolytic lesions were observed adjacent to the acetabular component in 12 (23%) hips. The average rate of head penetration into the polyethylene liner was 0.08 mm (range, 0.01–0.38 mm) per year.

None of the femoral components showed definite or probable loosening at the most recent follow-up. The position of inserted femoral components was neutral in 45, varus in 4 and valgus in 3. The cementing of the femoral component was grade A in 16, grade B in 24, grade C-1 in 8, and grade C-2 in 4. Grade C-1 was given mainly due to the presence of small voids and grade C-2 due to the presence of a thin mantle of cement. Radiolucent lines were observed around 4 (8%) femoral components. All radiolucent lines were seen at the bone-cement interface located in the zone 1. No radiolucent line was observed at the implant-cement interface. No hips showed femoral osteolysis other than 1 hip with postoperative infection. The average canal filling ratio was 77% (range, 61%–92%).

Eight hips (15%) dislocated posteriorly. Three hips had undergone revision of the acetabular component for recurrent dislocation as described. The remaining dislocations were successfully treated without reoperation. The average anteversion angle of the acetabular component in 8 hips with dislocation and 44 hips without dislocation was 11.6° (range, 2–24°) and 13.4° (range, 2–30°), the average anteversion angle of the femoral component was 25.6° (range, 15–35°) and 36.7° (range, 20–65°), and the average combined anteversion angle of the acetabular and femoral components was 37.2° (range, 22–50°) and 50.2° (range, 22–80°), respectively. There was a significant relationship between dislocation and anteversion angle of the femoral component ($p = 0.025$), and combined anteversion angle of the acetabular and femoral components ($p = 0.020$). There was no significant relationship between dislocation and patient age ($p = 0.509$), gender ($p = 0.653$), height ($p = 0.257$), body weight ($p = 0.775$), diameter of the femoral head ($p = 0.07$), use of elevated liner ($p = 0.216$), and abduction angle ($p = 0.267$) and anteversion angle ($p = 0.493$) of the acetabular component.

There was no intraoperative periprosthetic fracture, nerve palsy, or clinically evident pulmonary embolisms.

Discussion

We previously reported good intermediate-term results of the primary hybrid THA for patients with osteoarthritis secondary to developmental dysplasia [18, 19]. Other authors also reported similar good results of hybrid THAs for patients with developmental dysplasia [20, 21]. There have been few reports which described clinical results of hybrid THAs for patients with RA. Lachiewicz and Messick reported average 10-year good clinical results of hybrid THAs, in which operative diagnosis was RA in 15 of 75 hips [5]. Only 1 of 15 cups had radiographic loosening, while all stems had no possible, probable or definite loosening. On the contrary, Bilsel et al reported an average 12-year results of 14 hybrid THAs in patients with juvenile RA, in which 3 of 14 (21%) hips required revision due to cup breakage or aseptic loosening [6]. These results were conflicting, however, a 20-year survival rate of 85.4% with revision for any reason as the end point and only 1 acetabular component had aseptic loosening at an average follow-up of 11.5 years in our study, indicating that hybrid THA remains an option for patients with RA.

Whether the results of THAs for patients with RA tend to inferior to those with osteoarthritis (OA) remains controversial. Several studies reported a higher rate of radiologically loose acetabular components in RA with the Charnley prosthesis [22, 23]. Rud-Sørensen et al reported that the overall survival of primary THAs in RA patients is similar to that in OA patients from the Danish Hip Arthroplasty Registry at an average follow-up of 5.9 years [4]. They described that clinical implication of their findings was unclear since the absolute difference in cumulative revision rate estimates between RA and OA patients was small. Furnes et al found no difference in the 10-year survival rate of total implants between RA patients and OA patients [2]. Johnsen et al reported similar results from the Danish Hip Arthroplasty Registry [24]. Our results support these previous studies.

Which concept of uncemented, cemented or hybrid THA is better for patients with RA also remains controversial. In several studies, aseptic loosening of cemented cups has been found to be disturbingly high [1, 22, 23, 25-27]. Rud-Sørensen et al did not find such poor results regarding the cemented cups, either due to aseptic loosening or for any cause of revision [4]. Other 2 large registry studies also described good results of the cemented cups [2, 3]. Eskelinen et al reported that there was a trend for better results with the cemented THA concept when all revisions were taken into account, which can be attributed partially to the increased number of liner revisions in the uncemented cup [3]. They found promising results for cemented polyethylene cups, with a 10-year survival of more than 90% and recommended this type of prosthesis as an alternative in younger patients. Furnes et al did not find any significantly worse results of the cemented cups either [2]. These recent good results with cemented cups may have related to several substantial improvements in modern cementing techniques during the past 10–20 years.

Eskelinen et al indicated that although uncemented cups do not have any better resistance to aseptic loosening than cemented cups in young patients with RA, press-fit porous-coated uncemented cups were the only concept to show a positive cohort effect, the survival rate for cups implanted during 1992–2003 being higher than that for cups implanted in 1980–1991 [3]. Highly cross-linked polyethylene and optional surface bearings such as ceramic and metal-on-metal articulations may reduce wear and improve the results for uncemented cups. Long-term results will be required, however, to conclude whether or not they provide a solution for patients with RA.

Several authors have reported good results concerning the survival of stems in RA patients [2-4, 28-30]. Modern, second-generation uncemented stems with proximal circumferential porous coating have been reported to be a good choice for young patients with RA [3]. Rud-Sørensen et al reported that the good survival of cemented and uncemented stems in RA patients, supposing that it might be due to a lower level of physical activity in RA patients [4]. On the contrary, although the results of cemented stem fixation with a modern, third-generation cementing technique have been reported markedly better than those with first-generation techniques [31, 32], Eskelinen et al reported that the results of cemented stems did not improve significantly from the 1980s to the 1990s in young patients with RA [3]. The reason for this somewhat conflicting finding remains unclear. There was no aseptic loosening of the cemented stems in our study. Our consistent surgical techniques including “tight-fit technique”, in which all final femoral rasps used for canal preparation over-rasped only by 0.5 mm, seem to have contributed to the good clinical results [18, 19].

Several studies have reported increased rates of dislocations in patients with RA. Hedlundh et al described an increased risk ratio of 1.8 for patients with RA compared to those with osteoarthrosis in more than 3000 Charnley hip arthroplasties [33]. Creighton et al reported an 11% dislocation rate in 103 cemented THAs in patients with RA, in which all operations were performed by 1 surgeon through an anterior approach [26]. They used 2 types of prosthesis: either a Charnley stem with a 22.25-mm diameter head or an Iowa stem with a 28-mm diameter head. Berry et al performed a retrospective study on more than 6000 Charnley THAs operated in the Mayo clinic between 1969 and 1984 [34]. They reported long-term risk of dislocation after THA, in which the 445 patients (622 hips) with inflammatory arthritis had a mildly elevated risk of dislocation compared with the 3498 patients (4279 hips) with OA using multivariate analysis. Zwartelé et al carried out a prospective study assessing the incidence of dislocation within 2 years after surgery for patients with inflammatory arthritis and OA [35]. They reported that a dislocation rate in patients with inflammatory arthritis was significantly higher than that in patients with OA: 10% (7 of 70hips) in the inflammatory arthritis group and 3% (10 of 340 hips) in the OA group, and emphasized that inflammatory arthritis must be considered to be an independent risk factor for dislocation after primary THA. Our results support these previous studies. The 15% dislocation rate for RA patients found in our study is unacceptably high. Zwartelé et al discussed that the inferior quality of the soft tissues due to RA probably leads to inadequate soft tissue tension, and that the concomitant impairments in RA patients including the upper extremity, ipsilateral knee and ankle or contralateral hip can lead to hyperflexion of the operated hip while rising from a chair, or during other activities of daily living [35]. To reduce the risk of dislocation in patients with RA, they suggested careful intraoperative soft tissue handling to preserve the stabilizing structures, consideration to use an acetabular component with an elevated rim, special attention during the postoperative rehabilitation program to prevent hyperflexion of the operated hip. Our high dislocation rate seems to be related to the use of femoral heads with a relatively small diameter of 22 mm in 40 hips and 26 mm in 12 hips. Although the use of elevated liner did not reduce dislocation rate in this study, it might be associated with our small cohort of patients. Our use of the posterior approach without repair of the external rotators and the posterior aspect of the capsule also might have been a factor leading to the high dislocation rate. We agree with the measures proposed by Zwartelé et al to reduce the risk of dislocation in patients with RA.

Dislodgement of the polyethylene liner from the metal shell has been reported as a complication of the HGP-I or II component [36, 37]. The locking mechanism for the modular polyethylene liner was greatly improved in the same titanium fiber-coated Trilogy component, which has been commercially available in Japan since 1995.

Several clinical studies have shown a high failure rate of the precoated femoral component [38-40]. Ong et al [39] reported that the failure rate of roughened, precoated, cemented femoral components was considerably higher and occurred earlier than that of femoral components that were neither textured nor precoated with methylmethacrylate. These studies suggested that an enhanced cement-prosthesis bond may be deleterious rather than helpful because rougher surfaces generated more cement debris than smooth surfaces when loosening occurred. Use of a precoated or so-called matt finish femoral component in hybrid THAs was not detrimental in intermediate-term results of hybrid THAs in this study with an average follow-up of 11.5 years, however, careful observation over a longer-term follow-up period is indispensable for these components.

We conclude that hybrid THAs provides acceptable intermittent to long-term results for patients with RA. Postoperative dislocation remains a concern. Although we do not have any data to reduce the dislocation rate, it might be possible that the use of a larger diameter of the femoral head, acetabular component with an elevated rim, and careful intraoperative soft tissue handling could reduce dislocations. We believe that use of a tight fit technique is important to achieve good clinical results for the cemented femoral component. On the basis of our results, we continue to use the hybrid THA for patients with RA.

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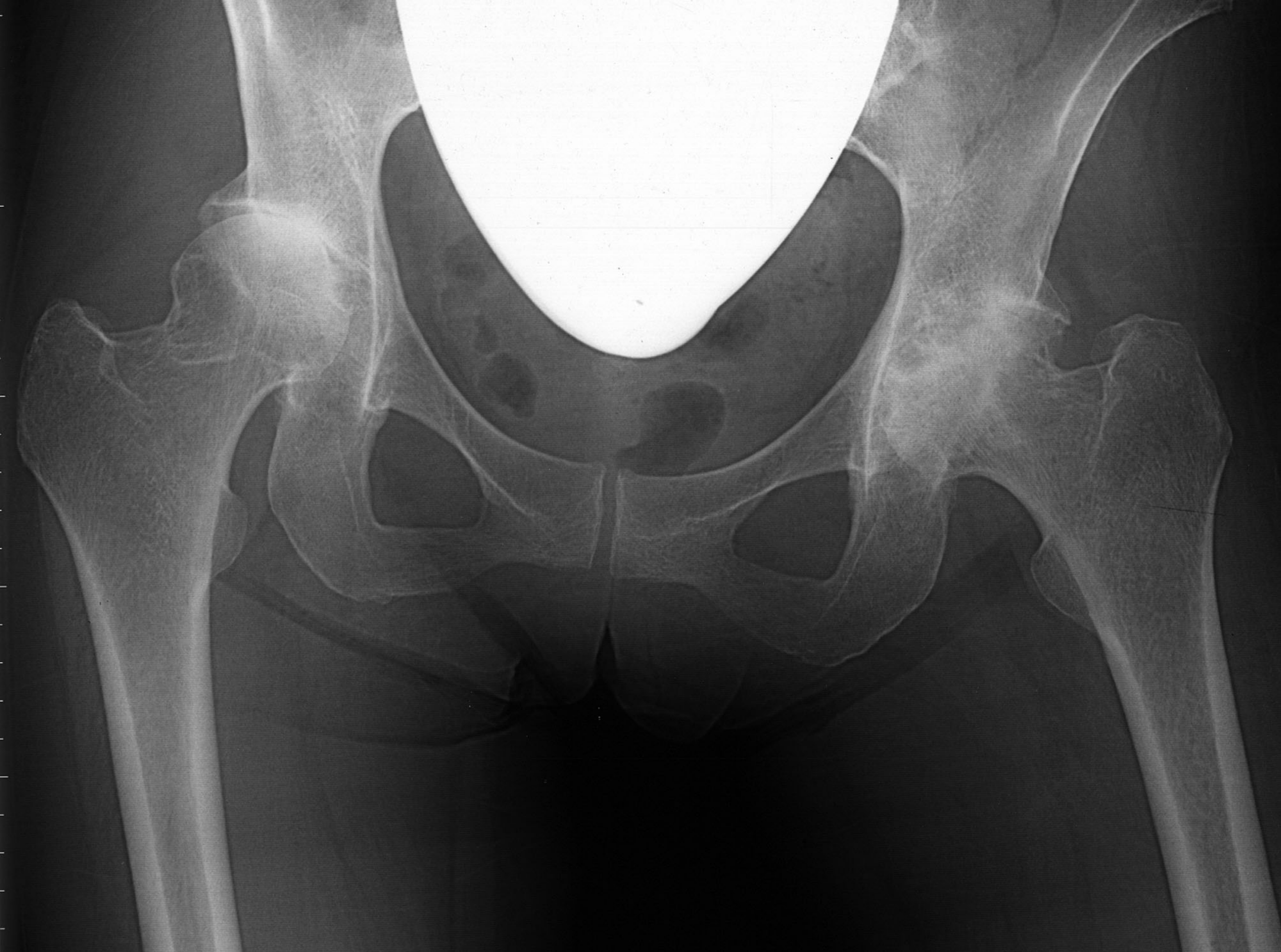


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