Hip Arthroplasty after Previous Arthrodesis

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Received: 10 October 2008 / Accepted: 24 July 2009 / Published online: 19 August 2009
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Abstract Total hip arthroplasty after previous arthrodesis has been associated with increased complications and decreased survivorship of the prosthesis. We evaluated pain, function, and the factors influencing survivorship of total hip arthroplasties after previous arthrodesis between 1985 and 2000 and compared these results with those obtained in prior years with the same procedure and in the same institution. We retrospectively reviewed 30 patients who had previous spontaneous or surgical arthrodesis. The minimum followup was 2 years (mean, 10.4 years; range 2–20.5 years). Seven failures were identified (23%). The overall survival free of failure was 86% at 5 years and 75% at 10 years. At last followup, 27 of the 30 patients (91%) had no or slight pain, 26 (87%) had a limp, and 18 (61%) needed a gait aid. Surgical arthrodesis, age younger than

50 years at the time of arthroplasty, and length of arthrodesis less than 30 years independently predicted failure. Conversion of arthrodesis to hip arthroplasty reliably decreases pain and improves function, but many patients will limp and require a gait aid. Our outcomes were similar to those after revision rather than after primary hip arthroplasty.

Level of Evidence: Level IV, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Hip arthrodesis is no longer commonly used for treatment of end-stage hip disease. Long-term studies suggest although patients with fused hips functioned relatively well [4, 13], they frequently had severe low back or ipsilateral knee pain that increased with the passage of time. In many, conversion of the arthrodesis to a THA often is contemplated [1]. Numerous reports document improved range of motion, level of pain, functional outcome, and survival of arthroplasty with takedown of the arthrodesis and conversion to THA [1, 3, 6, 7, 10, 11, 15–17]. However, the altered hip anatomy, atrophied musculature, and prior hardware all present a challenge to the reconstructive surgeon [10, 11]. In 1988, Strathy and Fitzgerald [14] reported on 80 cemented Charnley THAs performed at the Mayo Clinic after previous arthrodesis and followed for 10.4 years. They encountered a high rate of complications (33%) and a 22% rate of revision surgery at a mean followup of 10.4 years. Others have reported fewer complications (ie, 11%–12%) and better prosthetic survival (ie, 90% and 97%) after conversion of arthrodesis to cemented joint arthroplasty [7, 8].

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

Each author certifies that his or her institution has approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained. This study was performed at Mayo Clinic College of Medicine.

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In the last 20 years, there have been substantial changes in surgical technique and fixation technology in hip arthroplasty. Approaches that do not involve trochanteric osteotomy have become the rule and uncemented fixation has matured to the point of routine use.

We reviewed the patients treated at the Mayo Clinic with conversion of an arthrodesis to hip arthroplasty in the last 20 years to answer the following questions: (1) Is the back and/or knee pain that prompted the procedure improved by the arthrodesis and conversion to hip arthroplasty? (2) What are the Mayo hip scores and prosthetic survival in patients during the last 20 years? (3) Have the type of arthrodesis, age at the time of arthrodesis, duration of arthrodesis, number of surgeries necessary to achieve arthrodesis, or original diagnosis influenced the outcome? (4) Have scores and prosthetic survival with modern fixation techniques improved compared with those reported in a previous study [14]?

Materials and Methods

We retrospectively reviewed all 30 patients with prior hip arthrodesis who had a THA performed between 1985 and 2000. The indication for conversion was low back pain, knee pain, or both for all patients. The mean age of the patients at the time of arthrodesis was 19.9 years (range, 2–42 years). The mean age of patients at the time of arthroplasty was 52.5 years (range, 27–70 years) and the mean time from arthrodesis to conversion to THA was 32.6 years (range, 1–42 years). There were 12 male and 18 female patients. The left hip was converted in 19 patients and the right in 11. The underlying diagnoses for arthrodesis were septic arthritis (10 patients), tuberculous arthritis (five patients), posttraumatic arthritis (eight patients), developmental dysplasia (three patients), slipped capital femoral epiphysis (two patients), and failed arthroplasty (two patients). Five patients had a spontaneous arthrodesis and in 25 patients, the arthrodesis was obtained surgically, requiring an average of three procedures (range, 0–31) to obtain a solid arthrodesis. There were 15 patients in whom the arthrodesis had been in place more than 30 years at the time of conversion to arthroplasty and in 15, the interval was less than 30 years. There were 19 patients who were older than 50 years at the time of conversion and 11 in whom the conversion occurred before the age of 50 years. The diagnoses before arthrodesis were infection in 17 instances, dysplasia or slipped capital epiphysis in five, and posttraumatic arthritis in eight. All arthrodeses were clinically and radiographically solid. At the time of review, six patients had died, all with functioning prostheses, and none of the six required a subsequent operation or revision surgery. The minimum

followup was 2 years (mean, 10.4 years; range, 2–20.5 years). All patients were followed until the time of last clinical followup or until time of revision, component removal, or death. Six of the 30 patients had died of reasons unrelated to the surgery.

The arthroplasties were performed using the transtrochanteric approach in 15, an anterior approach in 10, and a posterior approach in five. The components used also varied and included cemented fixation in two patients, hybrid fixation in 10, uncemented fixation in 17, and an uncemented bipolar in one. All but three of the acetabular components were uncemented. Uncemented fixation was achieved by press-fitting of a hemispheric porous-coated acetabular component and the fixation always was augmented with ancillary screws. There were two cemented all-polyethylene acetabular components and one bipolar component. In the case of cemented fixation of the femur, the cement technique used included pressure lavage of the canal, vacuum mixing of the cement, and retrograde injection of the cement. The uncemented femoral components were proximally coated components in 17 of the 18 cases and there was one patient who received a fully coated AML component. In all instances, tight press-fitting of the femoral component was attempted. The review of the operative records did not allow us to reliably ascertain the quality of the press-fitting achieved.

All patients received antibiotic prophylaxis with second-generation cephalosporin at the time of surgery. However, the patients who had a history of tuberculous arthritis were considered cured of their tuberculosis and were not given specific antituberculous therapy.

Patients were followed prospectively and were asked to return at 1 year, 2 years, 5 years, and every 5 years thereafter for an interview and clinical examination. In eight patients, this was not possible and patients were asked to answer a standardized letter questionnaire and to send radiographs. Eight of the 30 patients did not have radiographs at the time of last followup; however, all were evaluated clinically with an examination or through a questionnaire.

We determined the Mayo Clinic hip score (Table 1) [9], which is a composite of clinical and radiographic data. In this score, we rely on the patient assessment of their pain with four possible responses to the pain question: none, slight, moderate, or severe.

All radiographs were reviewed by the senior author (MEC). Acetabular loosening was defined by the presence of a complete radiolucent line thicker than 1 mm in two radiographs or by migration of the prosthesis. Cemented femoral components were assessed following the criteria of O'Neill and Harris [12]. The criteria used for loosening of the uncemented femoral component were established by Engh et al. [5].

For the survival analysis, we defined failure as removal or revision of the prosthesis for any reason. Survivorship of the different variables was calculated following the Kaplan-Meier method. Reoperation for infection that included débridement with component retention was not considered a failure. Kaplan-Meier survivorship curves were calculated using failure as an end point and were used to estimate long-term survival free of major revision for infection, instability, or mechanical failure. Survivorship curves were calculated for the entire cohort (Table 2). Ninety-five percent confidence intervals were calculated

for the survivorship estimates and the curves were compared using log rank tests. We explored the influence of the following variables on survival: nature of arthrodesis whether spontaneous or surgical, age at the time of arthrodesis (younger or older than 50 years), interval between arthrodesis and arthroplasty (less than or greater than 30 years), number of operations required to achieve arthrodesis (greater than two or less than two), and the diagnosis before arthrodesis (Table 2); we compared differences between these groups using Wilcoxon rank sum tests.

Results

At the time of the last followup, 23 of the 30 patients had functioning implants; six of these 23 had died with functioning implants. Of the remaining 17, 10 reported good relief of their preoperative back or knee pain and four reported partial relief of their preoperative pain. Thus, we considered that in 20 of the 30 patients (67%), the pain that led to the conversion of arthrodesis to arthroplasty was helped. Of the 10 unsuccessful results, seven had failure of the arthroplasty; in three patients, the back or knee pain was no better or worse. Of the seven patients with failed results, five underwent revision of the arthroplasty for loosening of the acetabular component, the femoral component, or both. Another patient had a femoral reconstruction with an allograft-prosthetic composite, which failed again and required rerevision, and the third

Table 1. Overall assessment with Mayo hip score

Assessment	Points
Clinical	80
Pain	40
Function	20
Mobility	20
Radiographic	20
Acetabular component	10
Femoral component	10
Result	
Excellent	≥ 90
Good	80–89
Fair	70–79
Poor	< 70

Table 2. Mayo hip scores and survivorship

Factor potentially influencing survival or hip score	Number	Failure (%)	5-year survival (%) (95% CI)	10-year survival (%) (95% CI)	p Value	Mean hip score	p Value
Overall		23	86.1 (80–100)	75.4 (59–95)	N/A	81.5	N/A
Spontaneous surgical	5	0	100 (100–100)	100 (100–100)	0.5	82.8	0.8
Surgical	25	28	86.7 (70–100)	69.7 (51–95)		81.8	
Age > 50 years	19	5.3	100 (100–100)	90 (73–110)	0.007	78.1	0.01
Age ≤ 50 years	11	54	66.7 (45–99)	55.6 (14–97)		91.2	
Length > 30	15	6.7	93.3 (81–106)	93.3 (82–106)	0.03	78.1	0.02
Length ≤ 30	15	40	80 (61–100)	57.1 (15–99)		86.7	
Age > 50 + years							
Length > 30	0		100 (100–100)	100 (100–100)		78.8	
Age ≤ 50 + years							
Length ≤ 30	50		70 (47–105)	56 (31–101)	0.005	95.4	0.002
0–2 previous operations	19	16	89 (75–105)	81 (63–103)	0.19	81.8	0.8
> 2 previous operations	11	36	81 (60–109)	65 (38–110)		80.9	
Diagnosis							
Dysplasia, SCFE	5	20					0.33
Infection	17	17.6					
Posttraumatic arthritis	8	37.5					

CI = confidence interval; SCFE = slipped capital femoral epiphysis; N/A = not applicable.

Fig. 1 An anteroposterior radiograph of a 50-year-old patient 30 years after a spontaneous hip arthrodesis after septic arthritis is shown.

patient required resection arthroplasty for an early post-operative infection.

Twelve patients had a Mayo hip score greater than 80 points, eight from 70 to 79, and three with less than 70. The low scores in the three patients were related to two with loose femoral stems and to severe pain and limp in the patient with a bipolar prosthesis. Twenty-one of the 23 patients reported no or slight pain and two of the 23 had moderate pain. No patient with a functioning hip arthroplasty at final followup reported severe or disabling pain. Gait aids (cane, crutch, walker) were used by 14 patients and 20 had a substantial limp that either was reported by the patient or observed on physical examination. Two of the 30 patients (7%) experienced dislocation; one patient experienced three dislocations and the second patient reported recurrent subluxations without frank dislocation. The latter patient had a Mayo hip score of 59. Radiographically the 20 uncemented and two cemented acetabular components were well fixed. One of the 10 cemented femoral components and two of the 13 uncemented components were loose. However, only one of these three patients was symptomatic. Two of the three (one cemented and one uncemented) had Mayo hip scores of 66 and 50, respectively, but the other had a score of 90. Survivorship free of removal or revision at 5 years was 86% (95% confidence interval [CI], 80–100) and 75% at 10 years (95% CI, 59–95).

Patients older than 50 years and those whose arthrodesis had been present for more than 30 years at the time of arthroplasty had a greater chance of longer survivorship of the arthroplasty. The number of operations necessary to

Fig. 2A–B (A) Oblique and (B) anteroposterior radiographs of the same patient shown in Fig. 1 were obtained 18 years after surgery. The Mayo hip score was 95. The patient uses no support and walks with only a slight limp.

achieve arthrodesis did not seem to have an influence on the success of the outcome. However, when combining patients older than 50 years with length of arthrodesis greater than 30 years, it appears the survivorship at 10 years was 100% but the average Mayo hip score was only 79. Conversely, in patients 50 years or younger (Fig. 1) who had the arthrodesis in place 30 years or less, the survivorship was lower ($p = 0.005$), but in those whose hip was functioning at the time of final followup, the functional result and the Mayo hip score were higher ($p = 0.002$) (Fig. 2). The underlying diagnosis that caused the arthrodesis did not appear to have an influence on the outcome of the subsequent arthroplasty. Survival was similar whether the patient had a spontaneous or surgical arthrodesis conversion.

Discussion

Conversion of an old hip arthrodesis to a movable arthroplasty is tempting in patients with old hip fusions and substantial low back, ipsilateral knee pain, or both. This type of procedure is disappearing as the number of arthrodeses performed today rapidly dwindles. We asked if the conversion to arthroplasty alleviated the back and/or knee pain that initially brought the patients to surgery. We also wanted to assess the functional outcome and survival of the arthroplasty after a sufficiently long followup and in addition to see what variables might be important in producing the best long-term outcomes so that patients can be counseled regarding this procedure. Finally, we wanted to

compare the results of arthrodesis conversion with arthroplasty performed with more modern techniques and with those done at the beginning of the hip arthroplasty era.

We note several limitations to this retrospective study. Our patients were followed prospectively and we had accurate data for all the patients. However, we have little data regarding whether the arthroplasty was successful in relieving the symptoms that caused patients to have surgery in the first place. Patients responded to questions related to pain relief at different times postoperatively. Their responses varied depending on when the question was asked during followup. When interviewed postoperatively, patients stated they experienced relief of back or knee pain; however, it was not uncommon for patients to have back pain develop again as seen with later followup.

Previous reports suggest cautious optimism must be used when considering conversion of an arthrodesis to an arthroplasty, because the outcomes are clearly inferior to those of primary THA and resemble more those of revision hip arthroplasty. The results reported here are similar to those reported by others [1–3, 7, 8, 10, 14]. Hamadouche et al. [7] reported excellent results in 45 patients on whom this operation was performed by one surgeon. The age of the patients, duration of arthrodesis, and followup are similar to those in our study, but the number of spontaneous arthrodeses is very large and this may have biased their results toward better survivorship and better quality. Similar to our study, the state of the gluteal muscles was unpredictable preoperatively before conversion and might diminish the quality of the clinical result.

One of the objectives of our study was to compare our results with those reported from our institution by Strathy and Fitzgerald [14] with the same operation at an earlier time. Reporting on a much larger number of patients, their 10-year followup results showed a failure rate of 26% and a large number of unsatisfactory results of 38%. They also concluded the nature of the arthrodesis, whether spontaneous or surgical, influenced the result with the spontaneous arthrodesis having a better prognosis for longevity of arthroplasty and higher hip scores. They also found an inverse relationship between failure rate and duration of arthrodesis. The age of the patients at the time of arthrodesis was another factor that influenced the result of conversion to arthroplasty. Patients older than 50 years had a lesser failure rate and a better survivorship of the arthroplasty. Thus, their findings were at least partly corroborated in our study. However, when analyzing the patients with retained implants at the conclusion of the study, we found a high Mayo hip score did not correspond with highest survivorship. The patients who were 50 years or younger, the patients whose arthrodesis had been in place less than 30 years and the group that included those younger than 50 years with an arthrodesis duration equal or

less than 30 years had substantially better hip scores than those whose arthrodeses had been in place more than 30 years and were older than 50 years. Thus, it would appear the lower age and lower interval between arthrodesis and arthroplasty have a substantially negative impact on the long-term implant survival, but if the implant does not fail, the quality of the result appears better (Figs. 1, 2). It is interesting that these are the youngest and most active individuals in our study.

The difference between the report by Strathy and Fitzgerald [14] and our report is important. In the original report, all patients received cemented monoblock stems with cemented all-polyethylene acetabular components. In our study, there were only two cemented prostheses, the rest being either hybrid or uncemented arthroplasties. In addition, modern implants offer variable femoral component offset, use of modular heads, and of course the ingrowth modular acetabular components with various liner options. Cemented techniques also have improved. Despite all this, we did not observe a major improvement in implant survival, hip scores, or percentages of excellent and good results. This is partly the result of the relatively high pain scores that the patients reported late after arthroplasty, perhaps reflecting the fact that although back pain initially is relieved, with longer followup, back pain returns.

Our data emphasize conversion of arthrodesis to THA remains a procedure resulting in inferior function and implant survival compared with primary hip arthroplasty, and the quality of the results approaches that of revision arthroplasty. Nevertheless, it remains a satisfying procedure although patients' expectations should be tempered in view of our current results.

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