Isolated Acetabular Revision with Use of the Harris-Galante Cementless Component

Study with Intermediate-Term Follow-up

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Background: Isolated revision of an acetabular total hip component is associated with special problems related to the retention of the femoral component. We reviewed the intermediate-term results of a series of such operations with use of the Harris-Galante Porous acetabular component.

Methods: We retrospectively studied the results of ninety-five isolated acetabular revisions, specifically focusing on sixty-three that had been followed for a minimum of sixty months (average, 130 months). Evaluation measures included the Harris hip score, radiographic analysis, complications, and prosthetic survival. Follow-up information was obtained with self-administered questionnaires, telephone contact, and/or clinical examination. The effects of a femoral component with a modular neck-head junction and of trochanteric osteotomy on the dislocation rate were evaluated.

Results: Nine shells were rerevised: four because of recurrent dislocation, four because of aseptic loosening, and one because of dissociation of the liner. The survival rate with rerevision of the shell as the end point was 90.5% at 120 months. Pelvic osteolysis occurred in 4% of the cases. The dislocation rate for the sixty-three hips was 8%. When femoral component modularity was accounted for, the analysis of the dislocations revealed a significantly higher dislocation rate for the hips without a trochanteric osteotomy ($p = 0.04$). Eight arthroplasties were complicated by nerve palsies, seven of which resolved fully or nearly so.

Conclusions: Isolated acetabular revision with use of the Harris-Galante Porous acetabular component was associated with a low rate of loosening, lysis, and rerevision of the shell at the time of intermediate-term follow-up. However, there was a high rate of complications, including trochanteric nonunion, dislocation, and nerve palsy. The performance of a trochanteric osteotomy was associated with a decreased rate of dislocation.

Level of Evidence: Therapeutic study, Level IV (case series [no, or historical, control group]). See Instructions to Authors for a complete description of levels of evidence.

Isolated revision of an acetabular component with retention of the femoral component can lead to specific technical challenges. In addition to the usual complexities of acetabular revision surgery, the presence of the retained femoral component can dictate differences in exposure, alter the choices of head size, and limit the options available for restoration of limb length, offset, and soft-tissue tension.

Several authors have noted a high rate of dislocation after isolated acetabular revisions. Jones and Lachiewicz reported a dislocation rate of 18% (twelve of sixty-eight) after isolated acetabular revisions compared with 8% (eleven of 142) after revisions of both components ($p = 0.03$)[1]. They found no difference between these groups with regard to survival of the acetabular implant if a dislocation occurred. Similarly, Paprosky and Weeden reported a 19% dislocation rate (thirteen of sixty-eight) after isolated acetabular revisions, despite the use of a constrained liner in 15% of the hips[2]. Seven of the thirteen hips that dislocated required a reoperation because of recurrent dislocation. It should be noted that a high percentage (18%) of the index acetabular revisions in their series were performed because of recurrent dislocation.

We evaluated the clinical and radiographic results of

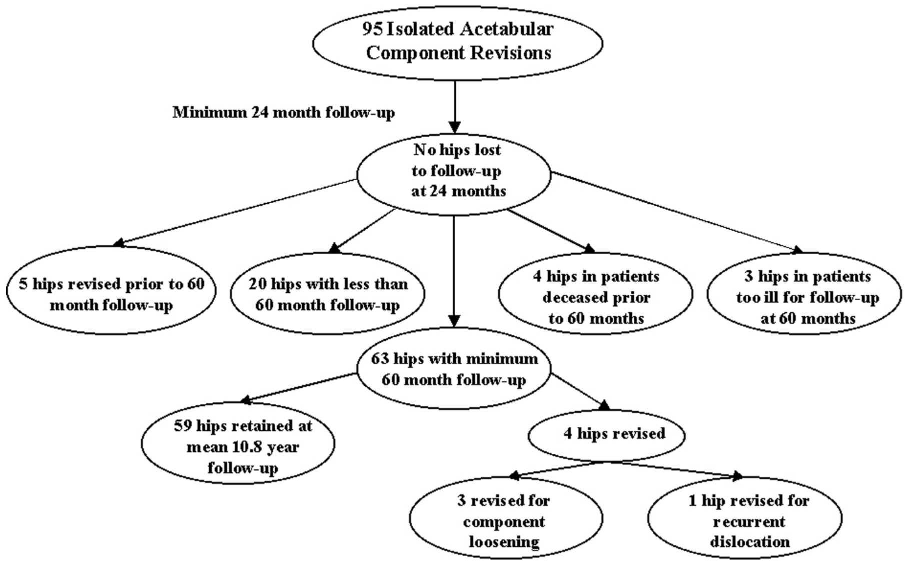

Fig. 1

Summary of the ninety-five isolated acetabular revisions followed clinically for a minimum of twenty-four months.

a consecutive series of isolated revisions of the acetabular component with use of the Harris-Galante Porous acetabular component (Zimmer, Warsaw, Indiana). Our purpose was to report the results of these revisions and to ascertain the complication rate, particularly the dislocation rate. Furthermore, we sought to determine if the use of a trochanteric osteotomy was related to the dislocation rate.

Materials and Methods

Between July 1984 and November 1996, the senior author (W.H.H.) performed ninety-five isolated acetabular revisions in ninety-three patients using the Harris-Galante Porous I or II acetabular component. All ninety-five hips were followed for a minimum of twenty-four months. A subset of sixty-three acetabular revisions in sixty-one patients who had been followed for at least sixty months was the central focus of this report. The other thirty-two hips were excluded from the detailed analysis but were included in the survivorship analysis (Fig. 1).

Twenty Harris-Galante Porous I and forty-three Harris-Galante Porous II components were used in the series of sixty-three hips. The Harris-Galante Porous I component differs from the Harris-Galante Porous II component in that it has a thinner shell and smaller-diameter cancellous bone screws are used (5.1 mm compared with 6.5 mm for the Harris-Galante Porous II component).

The average duration of follow-up of the sixty-three hips was 130 months (range, sixty to 208 months). The group consisted of thirty-nine women and twenty-two men with an average weight of 65.8 kg (range, 42 to 105 kg), an average height of 1.67 m (range, 1.37 to 1.90 m), and an average age of 56.5 years (range, twenty-five to eighty-four years). Twenty-six hips were classified as Charnley class A; thirty-one, as Charnley class B; and six, as Charnley class C[3]. Fifty-nine of the sixty-one patients were alive at the time of the last follow-up for this study.

Prior to the index operation, the sixty-one patients had undergone a total of 100 hip operations, including sixty-three primary arthroplasties (fifty-eight with cement, three without cement, and two hybrid procedures) (Figs. 2-A and 2-B) and nine revision arthroplasties. The index acetabular revision was the first revision in fifty-five hips, the second acetabular revision in seven hips, and the third acetabular revision in one hip. The average interval between the index acetabular revision and the previous arthroplasty was 121 months (range, two to 214 months).

A trochanteric osteotomy was performed in fifty-seven hips (fifty-five patients). Thirty of these procedures were performed after a previous osteotomy of the greater trochanter. Thirty-five of the trochanteric osteotomies were conventional osteotomies, and twenty-two were vertical in orientation[4]. The conventional osteotomy was performed from approximately 1 cm distal to the vastus tubercle and was angled proximally and medially toward the interval between the tendon of the gluteus minimus and the superior hip capsule. A vertical trochanteric osteotomy was required in cases in which the anatomy had been altered by a previous trochanteric advancement and the greater trochanter was attached to the lateral femoral cortex. Sixteen (73%) of the vertical osteotomies and fourteen (40%) of the conventional osteotomies were repeat osteotomies. Of the fifty-seven trochanteric osteotomies, nine were repaired with chromium-cobalt wires alone and forty-eight were repaired with chromium-cobalt wires as well as chromium-cobalt mesh[5]. Acetabular screws were used in all of the acetabular revisions, with the number of screws averaging 3.4 (range, two to seven). Thirty-five hips were reconstructed with a so-called high hip

TABLE I Preoperative Acetabular Deficiency

Classification	No. of Hips
Paprosky et al.[7]	
Grade 1	6
Grade 2A	14
Grade 2B	20
Grade 2C	9
Grade 3A	12
Grade 3B	2
AAOS[8]	
None	2
Segmental	1
Cavitary	35
Combined	25
Pelvic discontinuity	0
Tanzer et al.[9]	
Type I	7
Type II	18
Type IIIA	21
Type IIIB	17
Type IV	0

center—i.e., the center of the head was at least 3.5 cm proximal to the interteardrop line[6]. A so-called jumbo cup, defined as a cup with an outer diameter of ≥65 mm, was placed in four hips.

All sixty-three hips were evaluated with use of anteroposterior hip and pelvic, frog-leg lateral, true lateral, and two oblique pelvic radiographs (Judet views) at each time-period. Acetabular deficiencies were graded, on the basis of the operative notes and the preoperative radiographs, with use of three different systems: that described by Paprosky et al.[7], the AAOS (American Academy of Orthopaedic Surgeons) classification[8], and the classification described by Tanzer et al.[9]. The grading of the bone deficiencies at the time of the index operation revealed extensive acetabular bone loss (Table I). Thirty-three hips had preoperative osteolysis in zone I (twenty-eight linear and five balloon lesions); thirty, in zone II (twenty-seven linear and three balloon lesions); and twenty-four, in zone III (twenty-one linear and three balloon lesions).

Penetration of the femoral head into the polyethylene was measured with use of the technique of Livermore et al.[10]. Only hips for which comparable radiographs were available according to the criteria of Russotti and Harris[6] and that had had no additional revisions of the shell, femoral head, or acetabular liner were included in this analysis.

The chi-square test was used to compare dichotomous data. The Fisher exact test was used when indicated. Dichotomous data were stratified with use of the Mantel-Haenszel test[11]. The significance level was set at $p = 0.05$. Survival analysis was performed with the method of Kaplan and Meier[12].

Results

Nine (9%) of the ninety-five hips with an isolated acetabular revision required a rerevision of the shell. Five of those hips failed less than sixty months postoperatively. Of the five hips, three underwent a repeat isolated revision of the index acetabular component—two because of recurrent dislocation and the third because the shell had migrated into the pelvis—within the first three months after the operation, one

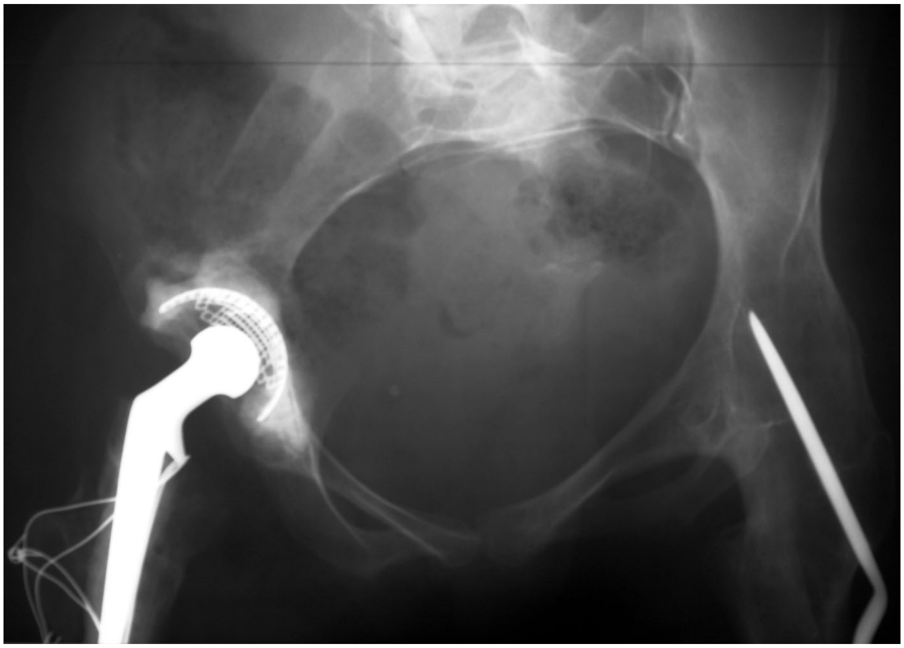

Fig. 2-A

Figs. 2-A and 2-B Anteroposterior pelvic radiographs of woman treated with the index acetabular revision at the age of thirty-nine years. The patient had a history of poliomyelitis, a previous arthrodesis of the left hip, and a right subtrochanteric femoral osteotomy. **Fig. 2-A** Seven years after a primary hip arthroplasty on the right, the acetabular component loosened.

TABLE II Pain Ratings at Preoperative and Latest Follow-up Examinations (N = 49)

	Pain Rating*			
	None or Slight	Mild	Moderate	Severe
Preoperative	4	6	21	18
Latest follow-up	40	8	0	1

*The values are given as the number of hips.

hip had recurrent subluxations and ultimately required revision of both components, and the fifth hip presented with a dislodged polyethylene liner one year after the index revision. Overall, of the nine shell rerevisions in the ninety-five hips, four were due to recurrent dislocations; four, to aseptic loosening; and one, to dissociation of the liner.

At an average of 130 months postoperatively, fifty-nine (94%) of the sixty-three acetabular shells had been retained. Of the four rerevised shells in this group, three had loosened and were revised at 9.3, 11.3, and 12.1 years postoperatively (Figs. 3-A through 3-D). The fourth hip had a well-fixed shell that was revised because of late recurrent dislocation at 9.5 years. There was no difference, with the numbers available, in the rerevision rate between the Harris-Galante Porous I and II shells ($p = 0.59$, Fisher exact test). In addition to the four hips with a rerevision of the shell, eight hips underwent exchange of the polyethylene liner at the time of an operation on the femoral component. Thus, twelve (19%) of the sixty-three hips that had been followed for a minimum of sixty months underwent some form of additional surgery on the acetabular reconstruction after the index operation.

With revision of the shell for any reason as the end point, Kaplan-Meier analysis demonstrated a survival rate of 90.5% (95% confidence interval, 83.5% to 97.6%) at 120 months for the entire series of ninety-five isolated acetabular revisions. With rerevision of the shell because of aseptic loosening as the end point, the 120-month survival rate was 96.8% (95% confidence interval, 92.3% to 100%).

Of the fifty-one intact index acetabular components (shells in place without a liner exchange), two were associated with balloon osteolysis at the time of the latest follow-up, one was associated with a circumferential radiolucency that was seen on the immediate postoperative radiographs but not on the latest radiographs, and six were associated with a circumferential radiolucency at the time of the latest follow-up. Comparable radiographs suitable for assessment of shell migration and femoral head penetration were available for thirty-three of the fifty-one hips. No component had migrated, and the average rate of linear femoral head penetration was 0.098 mm/yr (range, 0 to 0.29 mm/yr).

The Harris hip score[13,14] was available for forty-nine of the fifty-one hips that had not had additional acetabular surgery. The average Harris hip score improved from 55 points (range, 22 to 93 points) preoperatively to 81 points (range, 31 to 100 points) at the time of the latest follow-up; this mean improvement of 26 points was significant ($p < 0.0001$). Pain ratings

Fig. 2-B
The patient underwent an isolated acetabular revision with a Harris-Galante Porous I shell through a repeat transtrochanteric approach in addition to a subtotal ischiectomy and allograft augmentation of the calcar of the femur. She had a high-hip-center reconstruction, which had to function opposite the fused left hip. Seventeen years later, the right hip continued to function well.

TABLE III Use of Walking Supports at Preoperative and Latest Follow-up Examinations (N = 49)

	Support Used*					
	None	Cane	Cane for Long Distance	Crutch	Two Canes	Two Crutches
Preoperative	17	9	6	4	1	12
Latest follow-up	26	9	8	0	1	5†

*The values are given as the number of hips. †All five hips were in patients with major comorbidities.

and use of walking supports are shown in Tables II and III.

Thirty-seven of the fifty-seven trochanteric osteotomy sites united and nine had fibrous union without displacement, a combined rate of 81%. There was a fibrous union with migration of <1 cm in three additional hips. Eight trochanteric osteotomy sites (14%) failed because of either migration or resorption. The rate of union was 74% (twenty-six of thirty-five hips) after the conventional trochanteric osteotomies and 50% (eleven of twenty-two hips) after the vertical osteotomies. This difference was not significant.

Of the sixty-three hips, five (8%) dislocated postoperatively. The average interval between the index operation and the first dislocation was ninety-three days (range, twelve to 227 days). Four of the five hips were successfully treated with closed reduction and a brace. The fifth hip, which had undergone the index revision because of recurrent dislocation, continued to dislocate postoperatively. The patient underwent an exchange of the femoral head to a larger size and an exchange of the liner to an extended-lip liner. Although this procedure was successful for eleven years, the dislocations recurred, ulti-

Fig. 3-A

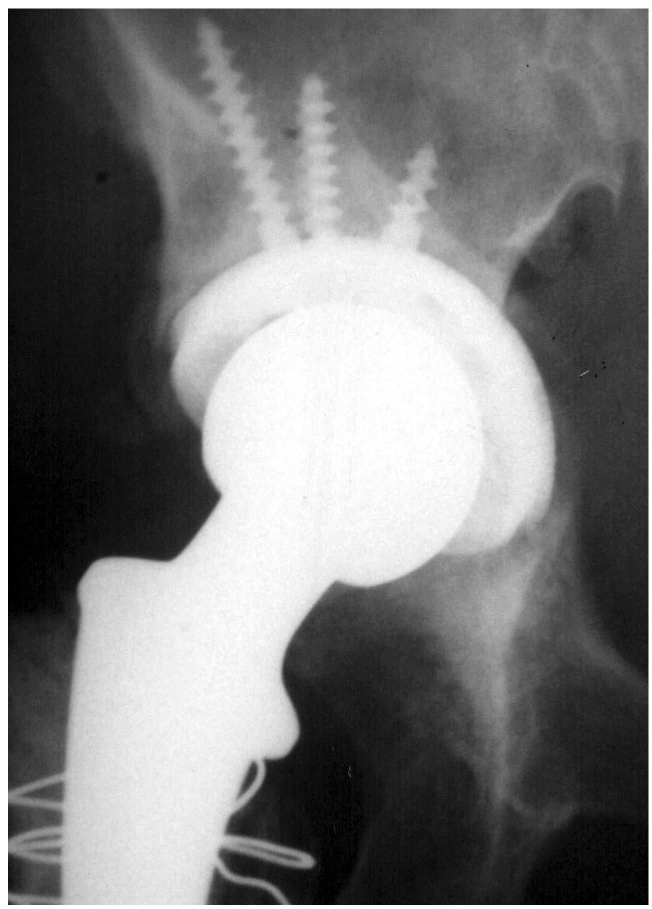

Fig. 3-B

Figs. 3-A through 3-D Anteroposterior radiographs of the right hip of a woman with developmental dysplasia of that hip who had the index acetabular revision at the age of forty-seven years. **Fig. 3-A** Radiograph made eleven years after a total hip arthroplasty with cement, showing a loose acetabular component. **Fig. 3-B** The index isolated acetabular revision was accomplished with a Harris-Galante Porous I component, with line-to-line reaming and fixation with three acetabular screws.

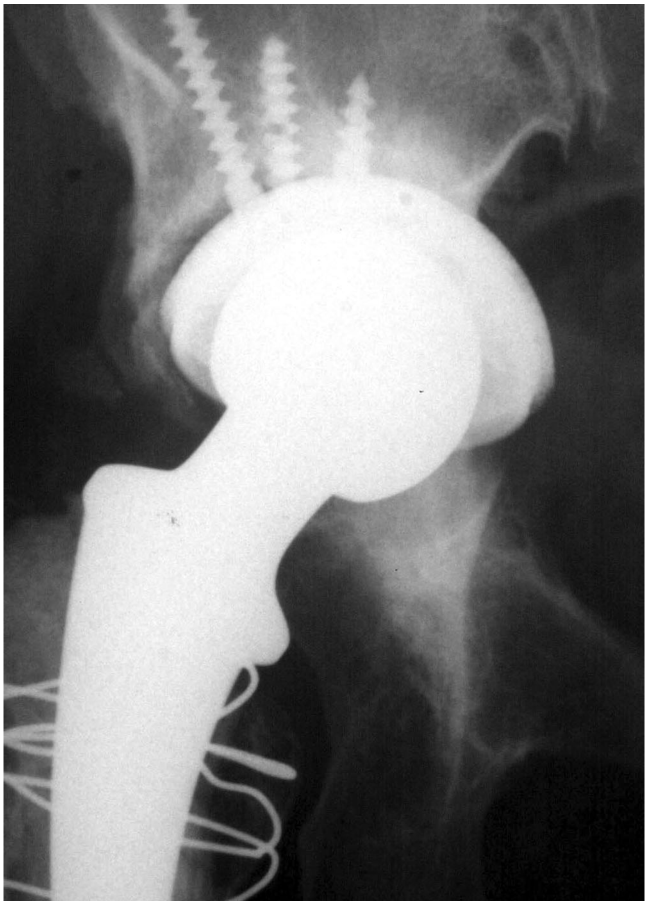

Fig. 3-C

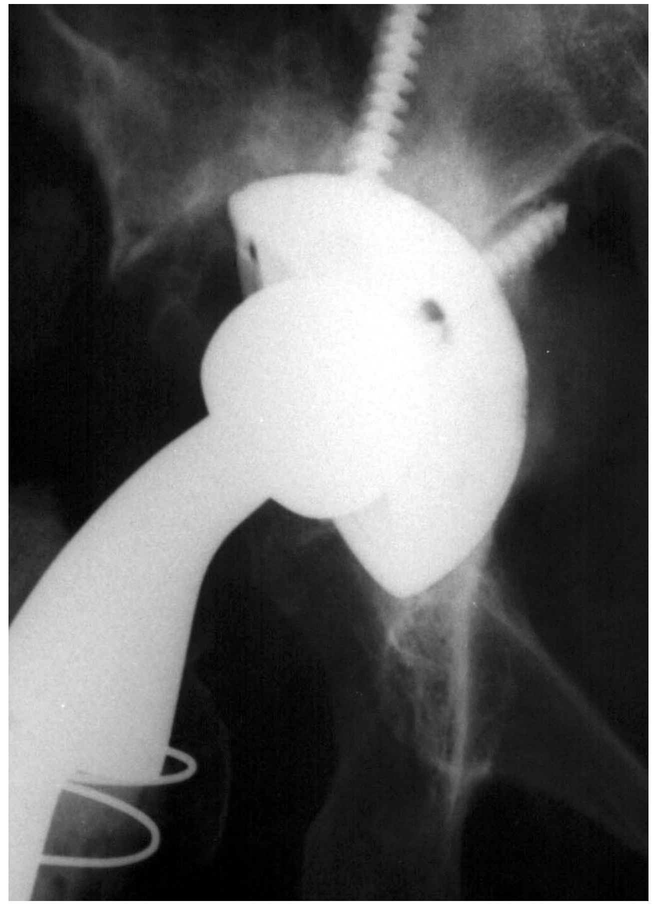

Fig. 3-D

Fig. 3-C By ten years postoperatively, progressive medial migration of the shell had occurred. **Fig. 3-D** Both components were rerevised eleven years after the index acetabular revision. The hip was functioning well five years later.

mately requiring a constrained liner. One other hip had repeated episodes of subluxation; the shell eventually loosened and was rerevised at nine years.

The rate of dislocation was 5% (three of fifty-seven) in the hips with a trochanteric osteotomy compared with two of six in those without an osteotomy. This difference was not significant ($p = 0.07$). There were no dislocations in the seven hips with a modular femoral head-neck junction, whereas 9% (five) of the fifty-six hips without such modularity had dislocated; again, the difference was not significant. When the dislocation rates of the hips with and without a trochanteric osteotomy were analyzed with the modularity of the femoral component accounted for, a significantly higher dislocation rate was found in the hips without a trochanteric osteotomy ($p = 0.04$, Mantel-Haenszel test). Of the eight hips with either resorption or >1 cm of proximal migration of the trochanter, one dislocated.

Other complications associated with the index operation, in addition to the trochanteric issues and dislocations discussed above, occurred in 49% (thirty-one) of the sixty-three hips, with a total of thirty-seven complications (Table IV). Eight (13%) of the sixty-three hips had a nerve palsy, with six of the palsies resolving fully or nearly so. With the numbers available, there was no association between the development of a nerve palsy and trochanteric osteotomy ($p = 0.57$).

Discussion

A central issue common to all acetabular revisions is obtaining stable fixation of the acetabular shell. In our overall series of ninety-five isolated revisions of the acetabular component, the rate of shell rerevision for any reason was 10% (nine rerevisions) and the 120-month survival rate with rerevision of the shell for any reason as the end point was 90.5%.

The dislocation rate in this series was 8% (eight) of the ninety-five hips and 8% (five) of the sixty-three hips followed for a minimum of sixty months. This rate of dislocation is lower than that in the series of isolated acetabular component revisions reported by Jones and Lachiewicz[1] and by Paprosky and Weeden[2] (18% and 19%, respectively). The use of a trochanteric osteotomy in our series was associated with a decreased rate of dislocation, although this difference was not significant. However, when the effect of trochanteric osteotomy on the dislocation rate was analyzed with the modularity of the femoral head-neck junction accounted for, there was a signifi-

TABLE IV Complications in the Sixty-three Hips Followed for a Minimum of Sixty Months

	No.
Trochanteric nonunion without displacement	9
Trochanteric nonunion with migration of <1 cm	3
Trochanteric nonunion with migration of >1 cm or resorption	8
Dislocation	5
Femoral nerve palsy*	4
Palsy of peroneal branch of sciatic nerve†	3
Palsy of femoral nerve and peroneal branch of sciatic nerve‡	1
Hematoma	3
Ileus	3
Hematuria	3
Contact dermatitis	2
Transfusion reaction	2
Urinary retention	2
Myocardial infarction	2
Deep vein thrombosis	1
Superficial thrombophlebitis	1
Pulmonary embolism	1
Pulmonary edema	1
Cardiac arrhythmia	1
Ischemic electrocardiographic changes	1
Foot ulceration	1
Urinary tract infection	1
Hypotension	1
Abduction contracture	1
Fever of unknown origin	1
Superficial infection (responsive to antibiotics)	1
Deep infection	0
Total number of complications	62

*Two resolved fully or nearly so. †Three resolved fully. ‡The complete femoral palsy resolved, with a mild residual peroneal palsy.

cantly higher dislocation rate in hips without an osteotomy.

The 13% rate of nerve injury in this series was higher than the rates reported after revision total hip arthroplasty[15,16]. Possible reasons for this high rate are the increased dissection required for exposure in isolated acetabular revisions, increased tension on the sciatic nerve during femoral exposure, retractor positioning, or impingement on the sciatic nerve by a monoblock femoral head.

Limitations of this study include the retrospective acquisition of data from our patient database as well as the availability of only sixty-three of the ninety-five hips at sixty months. The remaining hips were excluded from the detailed analysis because of a duration of follow-up of less than sixty months, revision at less than sixty months, or death of the patient or severe illness.

Although isolated acetabular revision continues to pose challenges related to bone stock, dislocation, and increased risks of neurovascular and other complications, the findings in this series confirm the utility of the Harris-Galante Porous acetabular component. In the group of sixty-three hips that had been followed for a minimum of sixty months, the rate of aseptic loosening was 5% at an average of 130 months. There were no deep infections, and the rate of osteolysis was 4%. The dislocation rate of 8% suggests a need for the use of additional techniques such as repair of the posterior capsule and short external rotators, postoperative bracing, use of larger head diameters, and use of a constrained socket in selected cases. The rate of nerve palsies in this series was high despite the common use of a trochanteric osteotomy. The rate of dislocation, the requirement for walking aids by some of the patients, and the prevalence of other complications (49%) emphasize the difficulties encountered with isolated revisions of the acetabular component of a total hip arthroplasty. ■

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