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The Use of Structural Distal Femoral Allograft for Acetabular Reconstruction of Paprosky Type IIIA Defects at a Mean 21 Years of Follow-Up

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ABSTRACT

Background: Revision total hip arthroplasty in patients with a nonsupportive superior acetabulum often requires secondary augmentation beyond a hemispherical cup to achieve reliable fixation. Treatment options include using a higher hip center, jumbo cup, custom triflange implant, cages, or filling the superior defect with a bilobed implant, structural allograft, or metal augments. We previously reported a cohort of 31 patients treated with porous-coated hemispherical cups and distal femoral allograft for Paprosky type IIIA acetabular defects.

Methods: The original cohort of 31 hips was retrospectively reviewed. Fourteen patients died with <15 years of follow-up, and 2 were lost to follow-up. This left 15 patients for evaluation including 5 males and 10 females, with an average age of 61 years (range: 37-74 years) at the time of surgery. Acetabular revision was performed with the use of a porous-coated hemispherical cup along with structural distal femoral allograft, cut to resemble the number 7, and secured with 6.5-mm cancellous screws with washers.

Results: Overall, 7 hips failed, resulting in a Kaplan-Meier survivorship of 72% at 25 years of follow-up. In surviving patients, radiographs demonstrated components to be well fixed, and average Merle d'Aubigné score increased from 5 to 10 points. There were a subset of patients that failed early (median: 6.2 years), but the remaining patients demonstrated excellent clinical and radiographic results.

Conclusions: The use of distal femoral allograft can be considered in young patients with type IIIA acetabular defects that could benefit from restoration of bone stock.

Revision total hip arthroplasty in the setting of a nonsupportive superior acetabular dome often requires secondary augmentation beyond a hemispherical cup to achieve reliable fixation. These Paprosky type IIIA defects have a variety of treatment options including inserting a cup with a higher hip center, using a jumbo cup, custom triflange implant, cages, or filling the superior defect with a bilobed implant, structural allograft, or metal augments. Short-term studies have demonstrated moderate success with the use of structural allograft; however, the outcomes were limited by complications including graft resorption and component loosening [1-5]. At present, these defects are most commonly treated with porous metal augments, as utilization of this technique has demonstrated excellent short-term results [6-10]. However, structural allograft provides the possibility of restoration of bone stock in younger patients, despite its inferior results as compared to porous metal augments.

We previously reported the results of a cohort of 31 hips in 31 patients treated with a porous-coated hemispherical cup and distal femoral allograft for a Paprosky type IIIA acetabular defect with an average follow-up of 10.3 years (range: 7-15 years) [11]. At that time, 5 acetabular components were rerevised for aseptic loosening and 1 was radiographically loose, giving an overall Kaplan-Meier survivorship for failure at 74% (95% CI: 70%-78%) All rerevised

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cups demonstrated incorporation of the allograft and were treated with repeat placement of a hemispherical cup. The purpose of the present study was to rereview this cohort of patients for clinical and radiographic outcomes.

Methods

The original cohort of 31 hips was retrospectively reviewed. Fourteen patients died with <15 years of follow-up, and 2 were lost to follow-up. The deceased patients, to our knowledge, did not require revision before death. This left 15 patients for evaluation including 5 males and 10 females, with an average age of 61 years (range: 37-74 years) at the time of surgery. All patients underwent surgery by the senior author of the article (WGP) between November 1987 and August 1995 at Central DuPage Hospital. Acetabular revision was performed with the use of a porous-coated hemispherical cup along with structural distal femoral allograft. The average postoperative follow-up was 21 years (range: 17-26 years).

Patients were evaluated clinically with Merle d'Aubigné scores and radiographically evaluated for significant graft resorption or component loosening. Merle d'Aubigné scores [12] are reported in the same manner as in the previous report by combining the pain component (none: 6, slight or intermittent: 5, after walking but resolves: 4, moderately severe but patient is able to walk: 3, severe, prevents walking: 2, severe, continuous: 1) and walking component (normal: 6, no cane but slight limp: 5, long distance with cane or crutch: 4, limited even with support: 3, very limited: 2, unable to walk: 1). Patients were considered failures if the acetabular component was revised or noted to be loose on radiographs.

The surgical technique was previously described [13]. Briefly, distal femoral allograft was cut to resemble a number 7. A posterior approach was used, and the graft was rigidly fixed to the acetabulum with 6.5-mm cancellous screws and washers. The graft was reamed until both anterior and posterior columns of the host bone were engaged. A porous-coated hemispherical cup was inserted and secured with screws. Postoperatively, patients were made touch-down weight-bearing for 3 months, then advanced as tolerated.

Results

In the interval since the publication of the previous report, 1 additional patient had required rerevision for deep periprosthetic sepsis at 12.9 years postoperatively. This resulted in an overall total of 6 hips that were rerevised and 1 hip was considered a failure for radiographic loosening. These failed at a median of 6.2 years postoperatively (range: 2.6-12.9 years). Kaplan-Meier analysis revealed a 72% survivorship at 25 years (95% CI, 53%-86%; Fig. 1). The average Merle d'Aubigné and Postel hip score increased from an average of 5 points preoperatively to 10 points at the time of the most recent follow-up. Complications within the first 3 months included 1 postoperative foot drop and 1 dislocation treated with closed reduction. Late complications included 1 greater trochanter fracture treated nonoperatively at 14 years postoperatively and 1 patient requiring head and liner exchange for polyethylene wear at 19 years postoperatively. At the time of most recent follow-up, there were overall 14 patients who were deceased, 7 failed hips, and 2 lost to follow-up. This left 8 remaining patients with well-functioning hips, 6 of which had updated radiographs (Table 1). All of these hips demonstrated the acetabular component to be well fixed (Fig. 2A-F). However, 1 hip had some moderate graft resorption but no signs of acetabular loosening or failure.

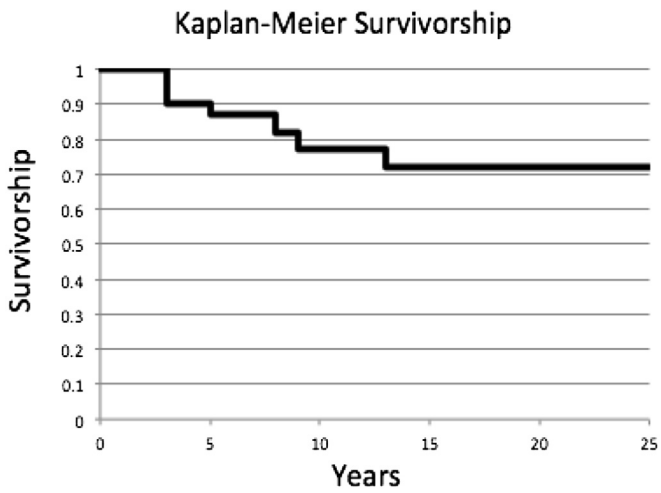

Fig. 1. Kaplan-Meier survivorship at 25 years postoperatively using cup revision or radiographic loosening as an end point.

Conclusions

The previous report of the use of distal femoral allograft for acetabular reconstruction demonstrated a relatively high early failure rate, and therefore, this technique was mostly abandoned. Although a large percentage of the patients in our cohort have died, there has been only 1 additional failure since the prior report, which was due to deep infection. This suggests that this technique may provide adequate long-term results in patients whose cups become well fixed and do not fail because of early loosening. Furthermore, the use of structural allograft has the potential to restore bone stock, functionally converting the acetabulum into a Paprosky type II defect and allowing acetabular rerevision via isolated placement of an uncemented hemispherical component. In our previous report, we reported that all rerevisions were amenable to treatment with a porous hemispherical shell alone. Other reports [2,4,5,14] have shown similar findings by demonstrating that despite the presence of relatively high failure rates with structural allograft, in 34%-57% of patients, there was no need to add additional structural support during rerevision.

Other reports on the use of structural allograft have demonstrated variable results, somewhat dependent on the type of allograft used, which can indirectly indicate the amount of host bone coverage. Woodgate et al [1] demonstrated an 80.4% survival rate at 10 years postoperatively using a shelf allograft. Lee et al [2] demonstrated a 20-year Kaplan-Meier estimated survivorship of 55% in patients treated with shelf allograft. Chandler et al [3] reported a 26% revision rate and 41% loosening rate at 12 years postoperatively using femoral head graft and recommended that

Table 1
Summary of the 8 Living Patients With Well-Functioning Acetabular Components.

Age at Surgery (y)	Gender	Cup Diameter (mm)	Cup Angle (°)	Cup Model
54	F	60	41	Depuy Arthropor
70	F	52	44	Depuy Duraloc
59	F	63	42	Depuy Arthropor
62	F	66	42	Depuy Solution
71	M	72	44	Depuy Solution
64	F	56	26	Depuy Solution
56	F	64	33	Stryker Osteonics
62	F	60	47	Depuy Solution
37	M	72	36	Depuy Arthropor

F, female; M, male.