

Acetabular de-escalation in hip revision

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Summary. *Background:* The idea of “de-escalation” (DE) indicates an arthroplasty revision performed by changing a revision component by a primary component. Aim of this study is to verify if this technique can represent an option in case of cage or ring failure. *Methods:* We observed five cases of revision hip cage loosening with complete allograft consolidation. This group of patients were revised with use of a primary cup and were specifically followed in ours institutions offices. Patients were clinically and radiologically followed every 6 months for the next two years and then annually *Results:* At final follow-up (15-2 years, mean 6 years) four patients (80%) showed a good recovery of their levels of activity. The mean Harris hip score improved from 20 points (range,7-38 points) preoperatively to 48 points (range, 16-88 points). At final radiological follow-up acetabular components were radiographically stable at the last follow-up. One patient (20%) at two years follow-up, was unable to walk without crutches due to hip pain. X-rays showed cup loosening in all three zones. Patient was dissatisfied. Primary cup was revised with a Burch Schneider cage. *Conclusions:* De-escalation technique is a surgical option to consider in case of young patients, limited number of previous revisions and more than three years survivorship of loosened acetabular cage. (www.actabiomedica.it)

Key words: hip revision, de-escalation technique, Burch Schneider cage

Introduction

The idea of “de-escalation” (DE) indicates an arthroplasty revision performed by changing a revision component by a primary component. This technique was introduced with use of distal locked stem as temporary femoral revision implant to be following by a standard primary component replacement (1,2). On the acetabular side, bone reconstruction after impaction grafting and ring or cage revision may allow a further revision by using a primary cup. In our experience DE technique was applied in five cases of acetabular ring loosening. Aim of this study is to verify if this technique can represent an option in case of cage or ring failure.

Materials and Methods

From January 2000 to December 2014, 116 failed total hip arthroplasty with complex acetabular deficiency reconstruction *via* antiprotrusio Burch Schneider cage and structural allografts were performed at our institutions. Twenty-four (20.6%) cages were revised. The causes of failed cages were infection in 4 hip, non-healing allograft with cage loosening in 10 cases, polyethylene loosening in 2 cases, recurrent dislocations in 3 cases and cage loosening with complete allograft consolidation in 5 hips. The sub group of failed Burch Schneider cage with complete allograft consolidation were revised with use of a primary cup. These patients were specifically followed in ours institutions offices. Patients were clinically and radiologically fol-

lowed every 6 months for the next two years and then annually. The Harris hip scores (3) were calculated preoperatively and on follow up and the patients expressed their subjective impression of the result as very satisfied, satisfied, or dissatisfied. At the same time, radiographic analysis was carried out to identify the presence of any radiolucent lines, osteolysis and sclerosis, according to the three zones defined by DeLee and Charnley (4). Radiographic examination included views, such as antero-posterior (AP) of the pelvis and lateral of the affected hip, according to a standard protocol for imaging reproducibility. A single observer made all measurements.

Results

From January 2006 to December 2014 we performed 5 revisions of acetabular ring by standard cup. 4 patients was female, 1 patient was male. Average age was 60,8 years (51-68). Survivorship of de-escalated acetabular ring was respectively 15,8,3,2,2 years. Number of previous revisions before DE surgery was: 3 in one case, 2 in two cases and 1 in two cases. During de-escalation surgery all hips were exposed using a postero-lateral approach (Table 1). Good quality of bone reconstruction after cage removal was intraoperatively evaluated. A primary press-fit cup with 2 or 3 screws were implanted in all cases. At final follow-up (15-2 years, mean 6 years) four patients showed a good recovery of their levels of activity. The mean Harris hip score improved from 20 points (range,7-38 points) preoperatively to 48 points (range, 16-88 points) at the time of the latest examination. Two patients were very satisfied and two patients were satisfied with their outcome. At final radiological follow-up acetabular components were radiographically stable at the last

follow-up, showing evident signs of bone remodelling and integration, without any radiolucent lines, sclerotic areas or periprosthetic osteolysis in all four cases.

One patient (20%) at two years follow-up, was unable to walk without crutches due to hip pain. X-rays showed cup loosening in all three zones. Patient was dissatisfied. Primary cup was revised with a Burch Schneider cage.

Discussion

The aim of the “reconstruction ring” approach is to replenish lost bone stock for future revisions, place the acetabulum at the correct anatomic position, and allow progressive weight bearing earlier, because the ring is attached directly to the pelvis, protecting the consolidating bone graft (5-7). Chance to revise a ring cup by using a primary cup depends on residual bone stock after ring removal. In turn, residual bone stock depends on previous graft incorporation. At time of ring implant, bone defects of the acetabulum can be treated by morcelized or massive bone grafting. Some authors considered the Burch Schneider cage to bridge the ilium and ischium and protect the bone grafts from resorption by excessive mechanical forces (6-8). Investigators have reported favorable results with both morselized autografts or allografts (9,10). Buma et al (11) studied morselized bone graft incorporation and showed the histological data concerning 9 biopsies taken from 8 grafted acetabula, 1-72 months after revision. During previous surgery femoral heads received from the local bone bank were morsellized with a into chips of about 1/2 cm³. The quantity of graft used varied from 1 to 3 femoral heads per patient. Histological study revealed different stages of graft incorporation. In the specimen 1 month post-revision, no signs of graft incorporation were found. At 8 and 9 months,

Table 1. Pre DE surgery and outcome data

Case N°	N° previous revisions	Acetabular defect at time of ring surgery (Paprosky class)	Ring implant survival (years)	Age at DE surgery (years)	Reason of DE revision	F.U
1	1	IIIa	8	67	Aseptic loosening	15 years
2	2	IIIb	6	68	Aseptic loosening	2 year
3	3	IIIa	3	51	Aseptic loosening	2 years loosening
4	2	IIIb	5	51	Aseptic loosening	8 years
5	1	IIIb	15	67	Aseptic loosening	3 years

various amounts of graft remnants were embedded in a new trabecular structure. The bone in the specimens, with a follow-up of 15 months or longer, closely resembled normal trabecular bone, with only very few remnants of graft. They concluded that impacted

morsellized chip graft completely incorporates into a new trabecular structure. A very similar original bone structure restoration can allow a primary cup implant.

The idea of DE tecnique indicates an arthroplasty revision performed by changing a revision component by a primary component. This technique was introduced and developed by Vives in 1987 (12) with use of distal locked stem, called "interlocking rod" as temporary femoral revision implant to be following by a standard primary component replacement before bone restoration. Use of interlocking stem has been widespread in France in the nineties but DE revision by primary stem was not routinely applied because locked



Figure 1. Case 4. Preoperative DE x-ray. Loosening of Burch Shneider revision cage

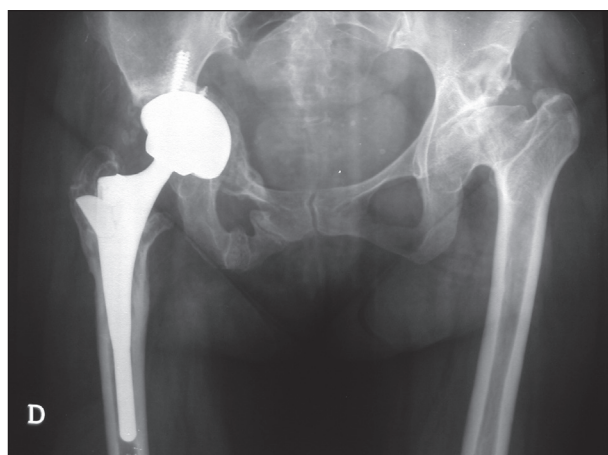


Figure 2. Case 4. Revision using a press-fit primary cup. No need for new bone graft or structural support. 8 years follow up

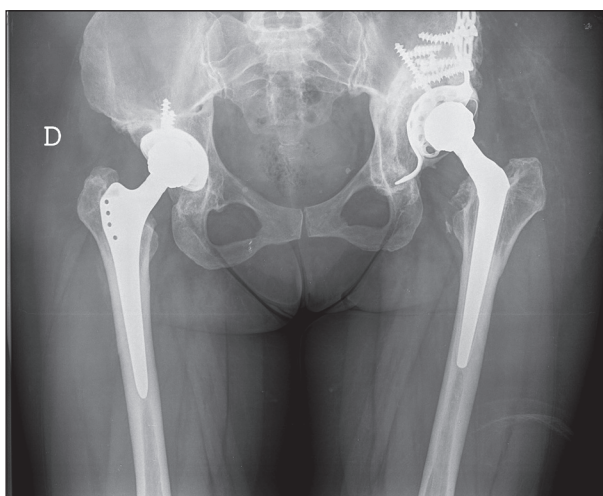


Figure 3. Case 3. Preoperative DE x-ray. Loosening of Burch Shneider revision cage three years before third hip revision

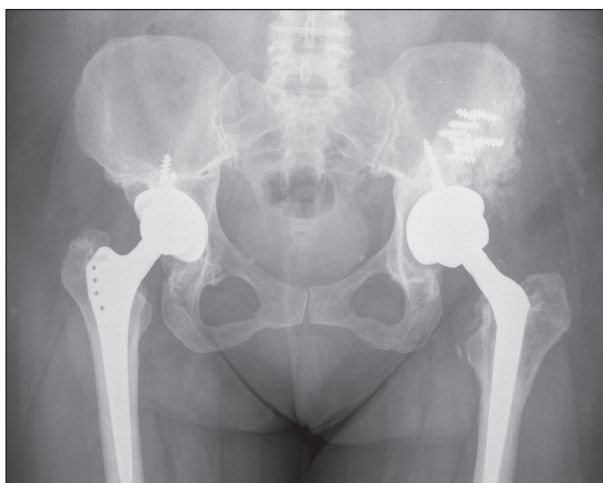


Figure 4. Case 3. Revision using a press-fit primary cup. 2 years follow up, loosening of the primary cup

stems have produced satisfactory and long lasting results (1,2).

Miletic et al.(1) reported good results of stem DE technique studying a group of 15 patients. In their experience DE technique was applied in case of loosened locked revision stem. There were no difficulties extracting the locked stem and a standard length primary stem was inserted with no associated procedures or bone complications in any of the cases.

Contrary to French experience, DE acetabular revision is not a two stage scheduled technique but it is allowed by graft incorporation and bone reconstruction protected by ring or cage implant.

Acetabular reinforcement rings or cages (Ganz rings and Burch-Schneider cages) are commonly used for reconstruction of severe bone defects in complex hip arthroplasty (13-16). They are widely implanted in revision hip arthroplasty with periprosthetic acetabular bone resorption but DE acetabular technique is rarely reported in literature.

Abolghasemian et Al (17) retrospectively reviewed 44 consecutive patients (50 hips) who underwent acetabular re-revision after a failed previous revision that had been performed using structural or morsellized allograft bone, with a cage or ring for uncontained defects. In 17 hips (34%), re-revision was possible using a cemented (n=2) or uncemented (n=15) primary acetabular component. No data concerning results of this sub group were available in the study. The mean follow-up of the entire group of study was 70.2 months (6 to 146) for 47 available patients. There were 18 (38.3%) radiological failures due to aseptic loosening, at a mean of 65 months (6 to 146) after the re-revision. In addition, four hips failed (8.5%) due to infection.

Hsu et al (16) retrospectively evaluated clinical outcomes and complications of using the Burch Schneider cage and structural allografts for complex acetabular reconstruction in 31 hips with a mean follow up of 5.5 years (range, 3.0e10.5 years). Using re-revision surgery as the endpoint, the cage had a survival rate of 76% at 5 years and 57% at 10 years. At the time of re-review, three hips had a failed reconstruction cage and small contained defect after partial consolidation of the previous structural allograft; they were treated with a noncemented primary acetabular com-

ponent and morselized allografts. Regarding to this sub group, at the follow up at 14 months, 16 months, and 28 months (average follow up of 19.3 months), the radiographs of the three hips confirmed that no hip had any measurable migration or displacement of the acetabular component

In our experience, in all five cases, we used morselized allograft bone from the tissue bank. In our opinion cadaver allografts offer advantages over autologous bone because they are available at any amount and thus enable us to avoid extensive damage to the iliac crest by autologous tissue harvesting. The size of 7 to 10 mm is optimal because it permits the grafts to maintain both structure and strength (18). The strict procedure of sample collection and examination minimizes the risk of infection transfer. As usual the progress of graft bone ingrowth was in our experience evaluated on radiographs that showed incorporation of allograft into the surrounding bone.

Only one patient out of five was revised due to de-escalation failure. Revised patient showed the highest number of previous revisions (n=3) and the lowest survivorship of de-escalation (3 years). Despite our results cannot considered statistically significant, age, functional requests, previous number of hip revisions should be data to be considered in case of DE technique planning. Quality of bone reconstruction after cage implant needs an intraoperatively evaluation.

Conclusions

Our little experience, according to clinical and histological reported studies confirms that impacted morsellized chip graft during revision by acetabular ring are completely incorporated into a new trabecular structure. This structure is able to integrate a standard cup in case of ring failure. De-escalation technique is a surgical option to consider in case of young patients, limited number of previous revisions and more than three years survivorship of loosened acetabular cage.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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