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Original Article

A 2- to 7-Year Follow-Up of a Modular Iliac Screw Cup in Major Acetabular Defects
Clinical, Radiographic and Survivorship Analysis With Comparison to the Literature

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ABSTRACT

Background: Inadequate acetabular bone stock is a major issue in total hip arthroplasty, and several treatment options are available. Stemmed cups have been used in this scenario with variable results. A novel modular polyaxial uncemented iliac screw cup (HERM-BS—Sansone cup—Citieffe s.r.l., Calderara di Reno, Bologna, Italy) has been recently introduced to overcome the drawbacks of stemmed cups. In this retrospective study, we report the results of this cup in patients with large acetabular bone defects at 2- to 7-year follow-up.
Methods: We evaluated a consecutive series of 121 hips (118 revisions and 3 complex primary arthroplasties) treated with this novel cup at a mean follow-up of 46 months. Kaplan—Meier survival analysis was performed with implant revision for any reason as a primary end point. Further survival analysis was performed excluding septic failures. Clinical outcome was assessed with the Harris Hip Score.
Results: There had been 7 reoperations: 1 for aseptic loosening, 5 for deep infection, and 1 for recurrent dislocation. In 5 cases, the cup was removed; estimated survival rate at 5-year follow-up with implant removal for any reason was 95.6% (95% confidence interval = 91-99), and 98.3% (95% CI = 96-100) excluding those failed for infection. Mean Harris Hip Score at latest follow-up was 77 points (range, 44-95; standard deviation = 11.9).
Conclusion: The present findings show the short-term efficacy of the iliac screw cup with respect to implant survival. A longer follow-up and a larger number of patients are necessary to confirm the encouraging preliminary results.

Major acetabular bone deficiency constitutes a challenging problem in hip arthroplasty (HA) and may arise from different conditions such as developmental dysplasia of the hip, previous trauma, aseptic loosening, or infection [1-3]. The usual fixation sites are missing or severely damaged, making it a technically demanding procedure and potentially compromising its results. As a reflection of such adverse scenario, different techniques have been proposed for the management of these large defects, including placement of an uncemented cup at a high hip center [4], jumbo cups [5-7], antiprotrusio cages [8-11], highly porous metal cups [12-17], oblong cups [18-23], custom triflange cups [24-26], cup-cage constructs [27-29], and stemmed cups [30-40].

The rationale for the use of stemmed cups is the fact that the iliac isthmus, also called iliopubic bar, often remains supportive even in the severely deficient acetabulum [33,34,39,40]. This concept has been used in revision and complex primary HA with variable results [30-40]. However, all these previous reports derive either from monoblock implants in which the iliac stem is fixed to the cup [30-37,39] or from an implant with an iliac screw that can

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vary in length, but not in angular position respect to the cup [38,40]. In both cases, the position of the stem or iliac screw inside the iliac isthmus determines the final orientation of the cup. This lack of versatility makes positioning of the implant technically demanding, leading to errors such as inadequate version/inclination of the cup [39] or perforation and placement of the stem outside the iliac isthmus [34,37].

To overcome these drawbacks and combine the advantages of stemmed cups (greater stability due to the iliac isthmus bone stock) and modularity (better orientation of the cup), a modular polyaxial uncemented iliac screw cup (ISC) (HERM-BS—Sansone cup—Citieffe s.r.l., Calderara di Reno, Bologna, Italy) was recently introduced. This implant provides individual patient solutions, since the iliac screw and the cup can be positioned independently and then assembled together.

We present the clinical and radiographic results of this novel acetabular component in patients with large acetabular bone defects, with a minimum follow-up of 2 years.

Patients and Methods

Patients

This study was approved by the local Institution research ethics committee.

Between July 2008 and September 2013, 2 experienced hip surgeons (GP and DD) from 1 institution performed a series of primary and revision HA with the ISC in 118 patients (121 hips).

Mean age at the time of surgery was 66.9 years (range, 30-91; standard deviation [SD] = 12.8). There were 94 women and 24 men. The diagnosis for the primary HA was post-traumatic osteoarthritis with chronic pelvic discontinuity secondary to acetabular fracture (3 hips, 2.5%); for the 118 revision HA, the diagnoses included aseptic loosening (85 hips, 70.3%), septic loosening (19 hips, 15.7%), recurrent dislocation (10 hips, 8.3%), polyethylene wear and osteolysis (2 hips, 1.6%), metallosis (1 hip, 0.8%), and painful hemiarthroplasty due to extensive acetabular erosion (1 hip, 0.8%). Distribution of the revision cases according to the extent of acetabular defect on preoperative radiographs using the Paprosky classification [41] and the number of previous acetabular revisions are presented in Table 1. The bearing couples used were ceramic-on-ceramic in 90 hips (74.4%), metal-on-polyethylene in 17 hips (14%), and ceramic-on-polyethylene in 14 hips (11.6%).

An uncemented femoral stem was used in all 3 primary arthroplasties. In 52 of 118 revision arthroplasties, the femoral component was also revised during the same procedure: uncemented stems were used in all these cases as well.

Impacted morselized allograft was used to address the acetabular bone defect in one of the 3 primary arthroplasties and in 103 of the 118 revision arthroplasties.

One patient with bilateral ISC was excluded from final evaluation due to death of unrelated causes before the minimum follow-up period, and another patient with unilateral ISC was excluded due to lack of complete clinical and radiographic documentation.

One hundred and sixteen patients (118 hips) were clinically and radiologically evaluated at the longest available follow-up; mean follow-up period was 46 months (24-84 months).

Table 1
Distribution of the Revision Cases According to the Extent of Acetabular Defect Using the Paprosky Classification and the Number of Previous Acetabular Revisions.

Type of Acetabular Defect	Number of Cases	Number of Previous Acetabular Revisions			
		None	1	2	3
2a	14	11	3	0	0
2b	18	8	10	0	0
2c	11	6	3	1	1
3a	42	24	14	4	0
3b	33	18	11	2	2

Implants

ISC is an uncemented, titanium-made, hemispherical cup with grit-blasted surface and a truncated conical design adjacent to its pole. It has a hole for the so-called iliac or isthmic screw at the tip of the cone, with an inclination of 10° respect to the polar axis. Four additional holes are present for peripheral fixation with conventional screws (diameter 6 mm, lengths from 20 to 60 mm; Fig. 1). The cup comes in 6 sizes (46, 50, 55, 60, 65, and 70 mm) with ceramic (internal diameters 32 and 36 mm) or highly cross-linked polyethylene (internal diameters 28, 32 and 36 mm) modular liners available.

The isthmic purchase is provided by a hydroxyapatite-coated titanium screw with 50° of polyaxial freedom respect to its cup hole. This characteristic makes the device innovative. Differently from the stemmed cups, ISC is a novel cup where the primary stability is provided by a modular “threaded stem,” that is, the isthmic screw. Isthmic screw comes in 3 diameters (10, 12, and 14 mm) and multiple lengths (from 40 to 100 mm). The isthmic screw is protected from backing out by a locking washer, which also prevents micromotion between the screw and the cup.

Surgical Technique

The lateral approach in supine position was used in all cases. After assessing the acetabular bone defect, reaming was performed with dedicated hemispherical and conical reamers to achieve a bleeding surface. The isthmic screw entry point is a critical step of the procedure: it must be prepared in the posterosuperior quadrant of acetabulum [42] and approximately 1.5 cm anterior to the greater sciatic notch. A hole was made with the starter awl at this entry point, and the integrity of the iliac isthmus was carefully assessed with a thin metallic probe and by digital palpation around the sciatic notch. Progressive reaming of the iliac isthmus was performed using handheld reamers, until initial resistance is met. When indicated, impacted morselized allograft was placed over the acetabular defect. The ISC was placed in adequate orientation, matching the entry point in the acetabulum with the cup hole for the isthmic screw. Finally, the isthmic screw was inserted through the cup into the iliac isthmus and fixed by the locking washer; 1 or 2 additional peripheral screws were used to improve rotational stability. As a routine, 32-mm femoral heads were used with the 46-mm ISC and 36-mm femoral heads with the 50 mm or larger ISC.

Most of the time, it was impossible to obtain adequate press fit of the cup due to the severity of bone defect, and in such cases, the isthmic and peripheral screws provided the initial mechanical stability. The isthmic screw does not necessarily need contact with the cortices; good purchase is obtained during screw insertion, as it compresses the cancellous bone inside the iliac isthmus. A secondary stability resulting from osseointegration of the hydroxyapatite-coated screw, and the cup is expected to take place over time.

Failure to obtain adequate purchase of the isthmic screw has never been experienced by the authors, but as a last resort, it could be cemented inside the iliac isthmus; in this case, obviously, osseointegration of the screw is not expected.

Wound lavage and closure were done in standard manner. Two suction drains were used in all cases: one deep in joint and another in subcutaneous plane.