Over-the-Top Cementing Technique in Cup-Cage Reconstructions

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Abstract: Cup-cage constructs have been used for acetabular reconstruction in the setting of severe defects as well as pelvic discontinuity. This construct consists of a porous tantalum shell augmented with screws with an ilio-ischial cage that is placed over it. The superior flange of the cage is then affixed into the ilium with screws while the inferior flange is impacted into the ischial bone. A polyethylene cup is then cemented into the cage to complete the construct. The over-the-top cementing technique extends the extruded cement mantle from the polyethylene cup impaction over the superior flange creating a buttress construct to prevent screw back-out. In the setting of these complex cases this buttress effect can possibly improve the strength of the cup-cage construct.

Keywords: Cup-cage, discontinuity, cement, screws.

1. INTRODUCTION

Cup-cage constructs have been used for acetabular reconstruction in the setting of severe defects as well as pelvic discontinuity. This construct consists of a porous tantalum shell augmented with screws with an ilio-ischial cage that is placed over it. The superior flange of the cage is then affixed into the ilium with screws while the inferior flange is impacted into the ischial bone. A polyethylene cup is then cemented into the cage to complete the construct [1]. This well described surgical technique was first presented in 2007 [2]. The ilio-ischial cage itself is made of titanium and its flanges are relatively thin in order to aid its contouring to the remaining bony anatomy. The bending necessary would preclude the option for potential use of locking screws [3]. Therefore, the titanium screws that are placed through the superior flange into the ilium are non-locking.

2. SURGICAL TECHNIQUE

The well described and well published surgical technique for cup-cage revision arthroplasty [1], has become a great addition for complex pelvic reconstruction in the setting of pelvic discontinuity to the arthroplasty surgeon. This small addition consists of allowing the extruded cement during the final polyethylene cup impaction to be molded over the top of the superior flange and into the screw hole/heads (Figure **1**). The cement therefore creates a buttress to screw back-out and can possibly increase the overall strength of the final reconstruction. This technique does not add any time to the case nor does it require any additional instruments or implants.

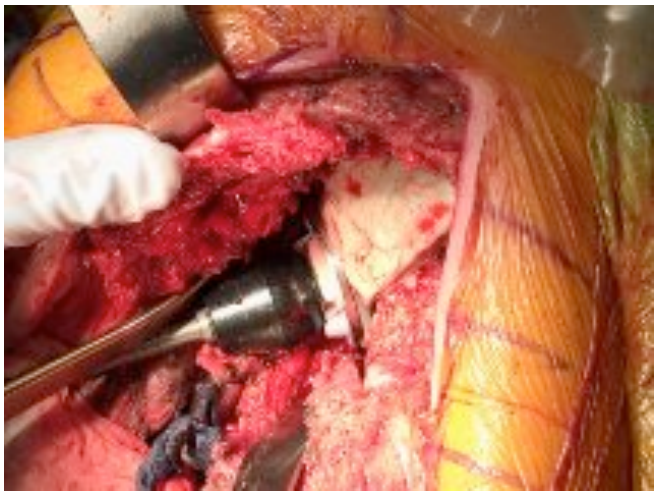

Figure 1: Extruded cement over the top of the superior flange.

The over-the-top cementing technique has been used in six cases from 2011 to 2015 (Figures **2** and **3**). All six cases involved pelvic discontinuity and multiple previous surgeries. Five female and one male patient ranged from 70 to 88 years old with a mean of 76.8. During their 1 year follow up one aseptic failure occurred that necessitated a revision. This was a case of an active 70-year-old female who was functioning well on her revision hip until she underwent a contralateral knee replacement approximately 8 months post-operatively. She subsequently began developing groin pain after several months and x-rays at her 12-month visit showed inferior instability of the tantalum cup and ischial flange of the cage. The screws in the ilium where seen to be broken just below the plate/screw junction due to cantilever stresses and the cement mantle over the superior flange was seen to be de-bonded and deep to the abductors. (Figures **4** and **5**).

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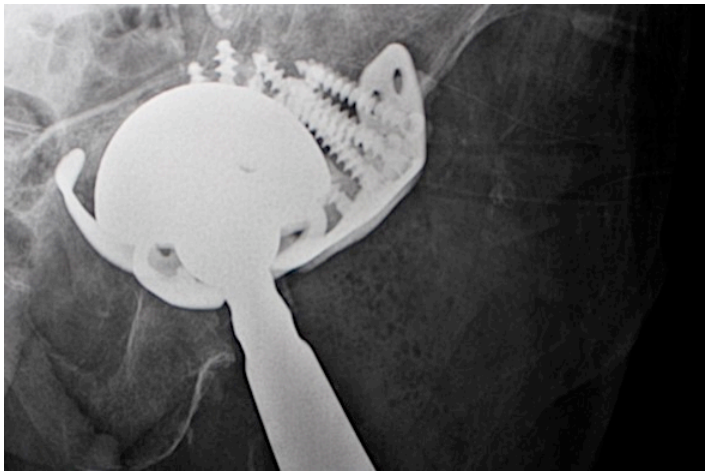

Figure 2: AP hip of the cup-cage construct with a thin layer of cement over the superior flange.

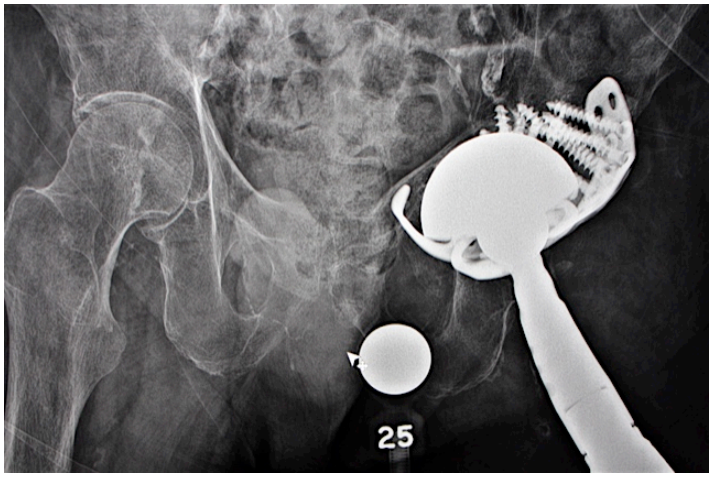

Figure 3: AP pelvis of the cup-cage construct.

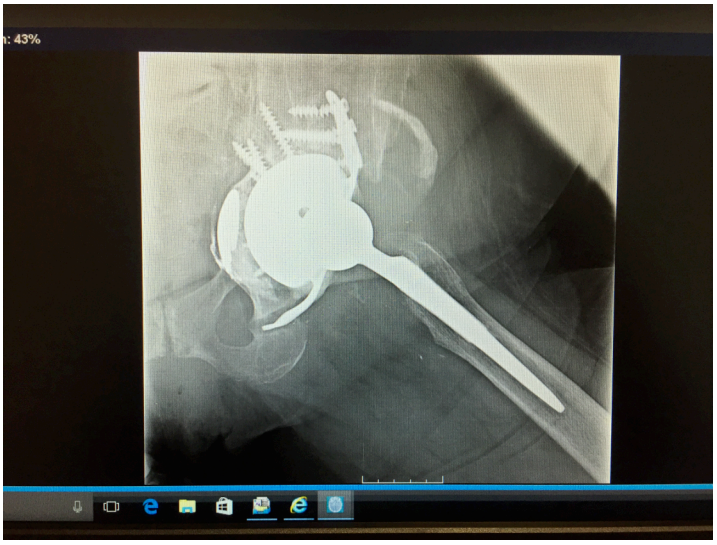

Figure 4: AP hip of lowered cup-cage showing inferior migration, superior screw breaking and cement mantle underneath the abductors.

3. DISCUSSION

Multiple studies have now been published with good short to mid-term results using the cup-cage technique in these very complex pelvic reconstructions. Kosashvili *et al*. published a paper in 2009 reviewing 26 cup-cage reconstructions with a 3.75-year follow-up

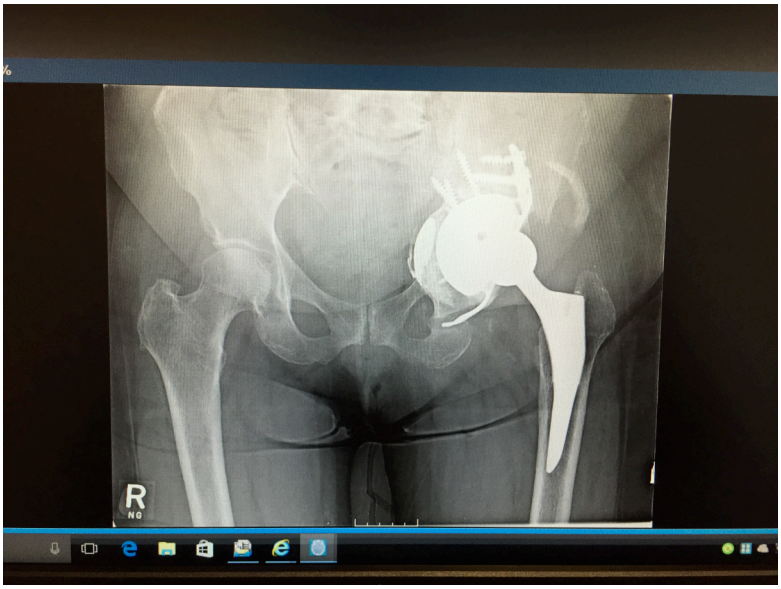

Figure 5: AP pelvis of migrated cup-cage construct.

showing a 11.5% failure rate [4]. Abolghasemian *et al*. reviewed 26 cases in 24 patients at a mean follow-up of 82 months (12-113 months) [5]. They reported a 15% failure rate for all causes with a mean survivorship rate of 87.2% at 7 years. One of the final conclusions of the paper was that early migration of the components does not necessarily result in failure as long as the continuity of the bone graft at the discontinuity site is not disrupted [5]. In the largest mid-term follow-up to date, Amenabar *et al*. showed a 5-year survival rate of 93% and a 10-year rate of 85% in 67 surgeries performed between 2003-2012 with an average follow-up of 74 months (24-135) [6]. They further defined loosening of the construct as any horizontal or vertical migration of greater than 5 mm. Lastly, a paper presented at the AAOS meeting in 2016 evaluated cup-cage construct stability using radiostereometric analysis. Solomon *et al*. reviewed 16 constructs and showed that 12/16 (75%) migrated within acceptable limits within the first year with mean proximal migration equaling 0.6 mm (range -0.5 to 4.4) [7].

The available literature in regards to cementing screw heads is sparse. Laflamme *et al*. inserted screws into Trabecular Metal revision shells and either countersunk the screws into the prefabricated holes or left the screw heads protruded within custom-drilled holes. After cementing in polyethylene liners, the screw shafts were loaded to failure. The protruded heads that were interdigitated with the overlying cement mantle had a 20-fold difference in stiffness upon load (1049.79 N *vs* 53.44 N) [8]. Le *et al*. studied locking plate humeral midshaft fixation in 24 synthetic bones. The hybrid screws which consisted of non-locking screws incorporating bone cement into the plate/screw bone construct were shown to have equivalent stiffness and yield strength from axial compression and torsion compared to locking unicortical screws [9].

4. SUMMARY

The over-the-top cementing technique during cup-cage reconstructions is a simple and quick addition to the well described cup-cage revision technique. Since it only involves spreading the extruded superior cement over the superior flange of the titanium cage it does not add any time to the case, involve any additional equipment, or call for increased dissection. The cement that is spread into the screw hole and screw heads theoretically increases the construct strength into the ilium. Although this technique has only been used in 6 surgeries, 5 surgeries were stable at 2-year follow-up and the one surgery that required revision showed proximal screw breakage indicative of a locking construct [10, 11]. The main disadvantage to this technique would be in accessing the screw heads for removal should infection occur. However, in the setting of these complex surgeries in which the race between bony healing and hardware failure frequently occurs, this additional technique might improve outcomes. Finally, a surgeon may also place a small amount of bone wax and/or gel foam within the screw head prior to cementation which keeps its recess patent should future removal become necessary [12]. Additional biomechanical and clinical studies would be necessary to fully evaluate the benefit of this technique.

REFERENCES

[1] Trousdale RT and Lewallen DG. Cup-cage construct provides options for large defect acetabular revisions. Orthopedics Today 2014.

[2] Noiseux M, Lewallen DG, Kellet C and Gross AE. Results of a porous coated cup-cage construct in complex revision surgery with severe bone loss. Paper presented at the AAOS Annual Meeting; 2007, San Diego, CA.

[3] Boulton CL, Kim H, Shah SB, Ryan SP, Metzger TA, *et al*. Do locking screws work in plates bent at holes? J Orthop Trauma 2014; 28(4): 189-94. https://doi.org/10.1097/BOT.0b013e3182a73a77

[4] Kosashvili Y, Backstein D, Safir O, Lackstein D and Gross AE. Acetabular revision using an anti-protrusion (ilio-ischial) cage and trabecular metal acetabular component for severe acetabular bone loss associated with pelvic discontinuity. J Bone Joint Surg Br 2009; 91(7): 870-876. https://doi.org/10.1302/0301-620X.91B7.22181

[5] Abolghasemian M, Tangsaraporn S, Drexler M, Barbuto R, Backstein D, *et al*. The challenge of pelvic discontinuity: cup-cage reconstruction does better than conventional cages in mid-term. Bone Joint J 2014; 96-B(2): 195-200. https://doi.org/10.1302/0301-620X.96B2.31907

[6] Amenabar T, Rahman WA, Hetaimish BM, Kuzyk PR, Safir OA, *et al*. Promising mid-term results with a cup-cage construct for large acetabular defects and pelvic discontinuity. Clin Orthop Relat Res 2016; 474: 408-414. https://doi.org/10.1007/s11999-015-4210-4

[7] Solomon LB, Abrahams JM, Callary SA and Howie D. Stability of cup-cage construct for treatment of pelvic dissociation measured by radiostereometric analysis. Paper presented at the AAOS Annual Meeting 2016, Orlando, FL.

[8] Laflamme GY, Alami GB and Zhim F. Cement as a locking mechanism for screw heads in acetabular revision shells – a biochemical analysis. Hip Int 2008; 18(1): 29-34.

[9] Le TT, Vo HV and Webb LX. Investigation of Kryptonite TM bone cement in hybrid screw configurations of locking plate humeral midshaft fixation: A study of surrogate bone model. J Orthop 2016; 13(3): 157-61. https://doi.org/10.1016/j.jor.2016.03.002

[10] Vallier HA, Hennessey TA and Sontich JK. Failure of LCP condylar plate fixation in the distal part of the femur. A report of six cases. J Bone Joint Surg Am 2006; 88: 846-853. https://doi.org/10.2106/JBJS.E.00543

[11] Strauss EJ, Schwarzkopf R, Kummer F and Egol KA. The current status of locked plating: The good, the bad, and the ugly. J Orthop Trauma 2008; 22(7): 479-86. https://doi.org/10.1097/BOT.0b013e31817996d6

[12] Ezzet KA. Cementing acetabular sockets into metal-backed acetabular components and antiprotrusio cages: a technical tip. J Arthroplasty 2007; 22(4): 609-11. https://doi.org/10.1016/j.arth.2006.12.053

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