Using Tantalum Augments for Major Acetabular Bone Defects in Revision Hip Surgery

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Abstract

Aim. The purpose of the study was to follow up the clinical and functional results of the patients with major acetabular bone defects in revision hip surgery.

Materials and methods. The study was retrospective, over a period of six years (from January 2014 to January 2019), and included all the patients with hip replacement, with major acetabular bone defects, who needed Tantalum blocks substitution.

11 patients were included in the study (8 men and 3 women). The average age was 71 years (between 64 and 78 years old). The average follow up period was 23 months (between 11 and 36 months). Paprosky radiological classification was used for the preoperative evaluation of the bone defects. In 9 cases, the bone defect was of type 2B Paprosky and in 2 cases, of type 3A. Harris score was determined preoperatively and postoperatively for the appreciation of functional results.

Results. 6 patients were underwent replacement for coxarthrosis secondary to dysplasia, 2 patients for coxarthrosis secondary to aseptic necrosis and 3 patients for primary coxarthrosis.

The average time elapsed from the moment of primary arthroplasty to the need of revision surgery was on average of 13 years (between 7 and 16 years). The postoperative radiological evaluation showed an improvement of the hip rotation center from an average postoperative vertical position of 3.1 cm (between 1.2 and 4.6 cm) at an average postoperative position of 1.1 cm (between 0.5 and 2.3). The average result of Harris score postoperatively was 36 (between 39 and 96). During the follow up period, no early loosening, infection or prosthesis dislocation was registered.

Conclusions. The Tantalum Augments used in major acetabular bone defects in revision surgery represent a good option, correcting the hip rotation center, thus considerably improving the functional score.

Keywords: Tantalum augments, hip revision, bone defects

Introduction

Using the Tantalum blocks with the aim of reconstructing the acetabular cavity has been used since 1997. The major advantage of this material is the substitution of the defects that are found especially at the level of posterosuperior acetabular region and the remarkable “bone in-growth” properties [1].
The clinical application of using this material is more and more important due to its properties, demonstrated by clinical studies:

- High porosity that offers the possibility to play an important role in locally delivering substances such as: antibiotics, bone growth factors and biophosphonates [2].
- Rough microtexture of the surface ensures a high coefficient of friction for the initial growth of the implant stability [3,4].
- The degree of elasticity creates the possibility of a more physiological transfer of the forces at the level of pelvis and reduces the acetabular stress [5,6].
- Tantalum bacterial adherence has been demonstrated as being equivalent or even inferior compared to the other structures [7].

Materials and methods

The study was retrospective, over a period of six years (from January 2014 to January 2019), and included all the patients with hip replacement, with major acetabular bone defects, who needed Tantalum blocks substitution.

The amount of surgeries in the medical history did not represent an exclusion criterion. 11 patients were included in the study (8 men and 3 women), the average age being 71 years (between 64 and 78 years old) at the moment the revision hip surgery was performed. Out of the total number of patients, 6 revisions implied the right hip, while 5 were performed at the level of left coxofemoral joint.

An X-ray of the pelvis and CT were performed for all the patients in order to preoperatively evaluate the bone defects by using Paprosky classification, as well as calculate the restoration of the prosthetic hip rotation center.

According to Paprosky classification, the bone defects in the study sample have been from moderate – 2B (defects below 3 cm), in 9 cases (Fig. 1) and in 2 cases, severe defects of type 3A (a defect greater than 3 cm) (Fig. 2).

Using the acetabular components was done with cemented acetabular cups. In two cases, cementless acetabular cups were used and their stability was achieved with screws.

The antibiotic prophylaxis was done with a second generation cephalosporin (in 8 cases) and a third generation cephalosporin (3 cases). No septic evolutions were registered during the follow up of these patients.

The follow up of the patients was done at 6 weeks, 3 months, 6 months and 1 year, the follow up criteria being clinical, by using the functional Harris score (both preoperatory and postoperatory), as well as imagistic.

Results

The highest incidence of the patients in the study sample, who needed revision by using the Tantalum block was the one of primary replacement for hip congenital dysplasia,
representing 54.5% (6 patients). This percent can be explained by the fact that the highest loosening of the cup in the first postoperative year, secondary to hip replacement, is found in patients with replacement for coxarthrosis secondary to congenital dysplasia [8].

18.1% (2 patients) was registered for coxarthrosis secondary to aseptic necrosis and 27.2% (3 cases) for primary coxarthrosis.

The average time from the moment primary arthroplasty was performed until the need of revision surgery was on average of 13 years (between 7 and 16 years).

The main symptoms for which the patient presented to hospital was the onset of pain and the relative functional impotence, with an interval between 3 months and a year and a half from the moment of its onset until the moment of presenting to the hospital.

The postoperative radiological evaluation (Fig. 3) showed an improvement of the hip rotation center from an average postoperative position of 3.1 cm (between 1.2 and 4.6 cm) to an average postoperative position of 1.1 cm (between 0.5 and 2.3).

The importance of restoring the rotation center represents a major advantage regarding the wear over time of the acetabular component as well as a significant improvement of the functional score of the patient.

Generally, in case of restorations that associate major acetabular defects (type III-A Paprosky), in order to realize a correct stability of the implant, cemented prosthetic components are used, these patients frequently associating a deficit of the bone density [9].

In the studied sample, in 18.1% (2 cases), cementless acetabular cups (Fig. 5) were used, but, in order to ensure a stability of the implant, additional screws were used at the level of the cup (3 screws in both cases). According to Paprosky classification, in both cases, one presented a type II-B cotyloid defect and the other presented a type III-A defect (Fig. 4).
Harris score was used for the functional evaluation. The follow up protocol of the patients to determine the improvement of the joint function, as well as the patient’s satisfaction, was determined preoperatory and at the 6 weeks postoperatory checkup.

An early substantial improvement of the Harris score could be observed in the study sample. The preoperative average result of the patients was of 36 points (between 11 and 56.7), and the postoperative average result was of 86 points (between 39 and 96) (Table 1).

### Table 1. Results of Harris score in the study sample

| Minimum Score | Preoperative result | Postoperative result | Maximum |
|---------------|---------------------|----------------------|---------|
| Score 11 points | 36 points | 86 points | 96 points |

Failure was defined as the need for revision of any component regardless the reason (septic or aseptic decementation), postoperative radiological aspect that included remaining osteolysis images, malpositioning of acetabular component, as well as failure of restoring the rotational center.

During the follow up period, no case of early decementation, infection or prosthesis luxation, was recorded.

### Conclusions

The Tantalum Augments used in major acetabular bone defects in revision represent a good solution, correcting the rotation center and considerably improving the functional score and the satisfaction of the patient.

It achieves a firm fixation of the acetabular component at the level of the pelvis with the aim of preventing the future early decementation of the acetabular component, the cementless acetabular components fixed with screws being used in certain cases. The recovery regime and the restriction period of postoperative loading depend on the intraoperatory fixation of the components, varying from early loading, immediately postoperatory, to loading restriction for a period of 6 weeks.

The limits of this study were the low number of patients included and the relatively short period of their follow up.

### Conflict of Interest statements

Authors state no conflict of interest.

### Informed Consent and Human and Animal Rights statements

Informed consent has been obtained from all individuals included in this study.
Authorization for the use of human subjects

Ethical approval: The research related to human use complies with all the relevant national regulations, institutional policies, is in accordance with the tenets of the Helsinki Declaration, and has been approved by the authors’ institutional review board or equivalent committee.

References

1. Issack PS. Use of porous tantalum for acetabular reconstruction in revision hip arthroplasty. J Bone Joint Surg Am. 2013 Nov 6; 95(21):1981–7. doi: 10.2106/JBJS.L.01313.
2. Tanzer M, Karabasz D, Krygier JJ, Cohen R, Bobyn JD. The Otto Aufranc Award: bone augmentation around and within porous implants by local bisphosphonate elution. Clin Orthop Relat Res. 2005 Dec; 441:30–9.
3. Zhang Y, Ahn PB, Fitzpatrick DC, Heiner AD, Poggie RA, Brown TD. Interfacial frictional behavior: cancellous bone, cortical bone, and a novel porous tantalum biomaterial. J. Musculoskelet. Res. 1999 Dec; (3):245–51.
4. Meneghini RM, Meyer C, Buckley CA, Hanssen AD, Lewallen DG. Mechanical stability of novel highly porous metal acetabular components revision total hip arthroplasty. J Arthroplasty. 2010 Apr; 25(3):337–41.
5. Gross AE, Goodman SB. Rebuilding the skeleton: the intraoperative use of trabecular metal in revision total hip arthroplasty. J Arthroplasty. 2005 Jun; 20(4 Suppl 2):91–3.
6. Gruen TA, Poggie RA, Lewallen DG, Hanssen AD, Lewis RJ, O’Keefe TJ, Stulberg SD, Sutherland CJ. Radiographic evaluation of a monoblock acetabular component: a multicenter study with 2- to 5-year results. J Arthroplasty. 2005 Apr; 20(3):369–78.
7. Meneghini RM, Ford KS, McCollough CH, Hanssen AD, Lewallen DG. Bone remodeling around porous metal cementless acetabular components. J Arthroplasty. 2010 Aug; 25(5):741–7.
8. Shinar AA, Harris WH. Bulk structural autogenous grafts and allografts for reconstruction of the acetabulum in total hip arthroplasty. Sixteen-year-average follow-up. J Bone Joint Surg Am. 1997; 79:159-68.
9. Amanatullah DF, Pallante GD, Floccari LV, Vasileiadis GI, Trousdale RT. Revision Total Hip Arthroplasty Using the Cement-in-Cement Technique. 2017 Mar 1; 40(2):e348-e351. doi: 10.3928/01477447-20161213-05.