ADVANTAGES OF TRABECULAR METAL IN REVISION HIP ARTHROPLASTY

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Abstract

Total hip arthroplasty is a surgical procedure that address to people with severe hip disorder. The number of total hip replacement is growing year by year due to the good functional results obtained after this procedure, which include pain relief, improvement of walking and quality of life. With improvements in the techniques, materials and prostheses, hip arthroplasties are performed in the younger age patients, which leads to the demand for revision procedures. This procedure almost always come across with acetabular bone defect. The main challenge for the surgeon during the revision hip arthroplasty is to achieve good implant stability. The purpose of this study is to assess the early clinical and radiological results after revision acetabular components using trabecular metal shells and augments. It was performed on 26 patients classified as Paprosky IIC and IIIA. The functional evaluation was performed perioperatively, at three and then at six months after the surgery using radiographic evaluation and Harris Hip Score. No evidence of cup migration or periacetabular osteolysis was noted. With low rate of complications and with overall good level of satisfaction, we assume that modular TM acetabular components may provide good long-term solutions for reconstruction of acetabulum in revision hip arthroplasty.

Keywords: revision hip arthroplasty, trabecular metal, clinical/radiographic evaluation, acetabular components

Introduction

Total hip arthroplasty is a worldwide spread surgical procedure addressed for patients with hip disorders, used to reduce pain and to increase mobility. Once the number of hip replacements has increased, it also increased the number of hip revision. Hip instability and mechanical loosening are the most common indications for revision total hip arthroplasty. The number of total hip revisions is expected to grow substantially over the next several decades.

The 46,000 hip revisions performed in 2004 in the United States are expected to be more than double by 2030[1].

The most common causes of total hip revision are mechanical loosening, instability/dislocation and infection, and there were demonstrated in 2009 by Bozic et al [2] in a study evaluating the main causes that lead to
hip arthroplasty revision. The most common indication reported was instability/dislocation. Preoperative planning is vital for all patients that are proposed for surgery. Also, surgeons must be aware of all reconstruction options for acetabulum.

With improvements in the techniques and materials, the results obtained after hip replacement have been satisfactory. However, some patients will need a revision surgery due to different complications, such as aseptic loosening, instability, infection or osteolysis. Osteolysis is an important complication that can lead to acetabular defects, therefore to a higher risk of instability during revision [3,4].

A new technique to address massive acetabular defects is trabecular metal acetabular revision system [5].

Before choosing a surgical procedure, there are some factors that must be evaluated such as remnant bone stock and the nature of acetabular defect.

The purpose of this review is to assess the results of using trabecular metal acetabular components after hip arthroplasty revision.

Materials and methods

We performed 26 total hip arthroplasties revision in the Orthopedic-Traumatology Clinic of SUUB using trabecular metal augments to reconstruct acetabular bone defect between 2013 to 2017. Among 26 patients, 16 were males, 10 females. Mean age of patients was 62 years. We used Paprosky classification for acetabular bone defects (Table 1). 16 cases were classified as grade 2c and 10 cases as grade 3a.

Preoperative planning

All patients had blood tests, with special attention for the inflammatory markers. They all had negative samples, so systemic or infectious etiologies could be eliminated and all of them underwent one stage revision.

Functional status, difference between the lengths of legs, hip deformity, pain level, neurologic deficits were also evaluated. Preoperative antibiotic prophylaxis was administrated to help prevent surgical infections.

Anteroposterior pelvis radiographs were made to all patients to determine the extent of bone loss. Three-dimensional computed tomography was used for the patients classified as Paprosky III to obtain a better view of osteolytic lesions.

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Table 1 - Paprosky Classification of Acetabular Bone Loss

All patients were operated using a standard posterolateral approach occasionally ex-tended with a greater trochanter osteotomy to expose the femur. Acetabular implant and remaining cement from the primary arthroplasty were removed. Debridation and acetabular assessment for size and type of defect was performed. Future hip center was established. The acetabulum was prepared using graduated reamers until bleeding bone appeared.

Trial components were used to evaluate the defects size and the need for additional support. The trabecular metal shell was introduced into the prepared acetabulum. Screws were drilled into the posterosuperior side of the cup to held it in position. Based on the defects encountered, augments were assembled, and the cup was inserted. We used both cemented and uncemented cups. The wounds were closed in layers.

In the first 5 postoperative days was administrated intravenous antibiotic Cefuroxime (1,5 g every 12 h), then switched to oral Cefuroxime for another 10 days.

Patients went home 14 days after the procedure. Patients were not allowed to put their leg on the ground for the first 6 weeks and then partial weight bearing was permitted for another 2 months. Physiotherapy and kinetotherapy for
hip muscle strengthening were started after 8 weeks.

Follow-up radiographs were made after the surgery, 3 and 6 months and then yearly. Clinical evaluation after the surgery was performed using Harris hip score (HHS).

Postoperative radiographies were evaluated based on the 3 acetabular zones of DeLee-Charnley. Migration of the cup more than 5 mm in either horizontal or vertical directions, radiolucent lines of 2 mm or more in all DeLee-Charnley zones, variation of the cup angle greater than 5° and breakage of screws were considered criteria of radiographic failure of the cup.

Results

The radiographic analysis showed that all cups were found to be fully incorporated, and no evidence of cup migration or periacetabular osteolysis was noted (Figure 1).

No radiolucency, osteolysis, or loosening found during follow-up radiographic examination (Figures 2-4).

The results were excellent for 14 hips, good for 8, fair for 3, and poor for 1. Among all 26 patients, 20 of them were very satisfied and 6 were satisfied, comparing with their previous condition.

The mean Harris hip score increased from 30 (range, 10–49) before surgery to 68 (range, 50–80) at 3 months follow-up examination and to 85 (range, 78–95) at six months follow-up examination (Figure 5).
In 3 cases we also made the femoral component revision with Revitan Hip System (Figure 5).

We had one case of infection (complication rate 3.84). The implant had to be extracted. The patient is still waiting for a two-stage revision.

Discussions

The goal of revision acetabular reconstruction is to restore hip center and to ensure a stable fixation.

Trabecular metal is an important new biomaterial that has been introduced to enhance the potential of biological ingrowth as well as provide a structural scaffold in cases of severe bone deficit [6].

We can say that the most common indication for revision is aseptic loosening which results from inadequate initial fixations, mechanical loss of fixation, biological loss of fixation or osteolysis [7].

Revision hip arthroplasty is much more difficult than primary one and require excellent preoperative planning with good choice of implant.

Trabecular metal material provides structural support for bone ingrowth and remodeling in acetabular revision and reconstruction [8,9]. The bone-like properties of trabecular metal material help facilitate joint reconstruction and restoration of normal weight bearing. The high coefficient of friction created by the strut configuration helps ensure a stable scratch fit for revising an acetabular component [9,10].

Trabecular metal is the only material that closely resembles in function and structure with trabecular bone. Trabecular Metal Technology ensures important advantages over other
materials, such as greater stability between the implant and the bone [11,12] and flexibility, which means that the implant can move and flex with the bone [11-13].

Trabecular metal has fluid-flow characteristics and an open-pore structure which ease bone integration, remodeling and vascularization [11] (Figure 7).

Figure 7 - Bone ingrowth into porous trabecular metal

We have recorded similar functional results with those published in the literature by Lingaraj et al, Weeden and Schmidt or Del Gaizo et al, with no loss of fixation, high rate of success and survival and good osteointegration [14].

About the treatment of moderate to severe bone losses, Van Kleunen et al made a study in 2009 with 90 patients classified Paprosky 2 or more. Revision shell and metal augment were used for the hip reconstruction. Out of the 90 patients reported in this study, there were 8 cases of infection and one revision for hip dislocation. With the results obtained, the authors concluded that moderate and severe bone losses can be treated with revision shells associated with metal augment.

In a review comparing titanium and tantalum cup for revision hip arthroplasty, Jafari et al. concluded that tantalum cups have a better fixation and a lower failure rate.

In current literature there are many studies that evaluate the outcome after hip revision with trabecular metal, with similar results: high patient satisfaction after surgery, good fixation of the implant, few or no aseptic loosening [15].

Conclusions

Revision hip replacement using tantalum ensure a better integration and fixation potential, due to the intrinsic characteristics. Providing a good substitute of bone, tantalum has proved to be an important material in revision surgery.

We think we need a long-term period of follow up to be able to define the true benefits of trabecular metal even if this technique was highly satisfactory results in medium term.

References


