

THE CEMENTED DOUBLE MOBILITY CUP IN HIP REVISION: DIFFERENT POSSIBILITIES OF USE

ACETÁBULO CIMENTADO DE DUPLA MOBILIDADE EM REVISÃO DE QUADRIL: DISTINTAS POSSIBILIDADES DE USO

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ABSTRACT

Introduction: The aim of our work is to review those patients who underwent prosthetic hip revision surgery in our hospital considered to be patients at high risk of dislocation or recurrent dislocation, and who underwent a double mobility cemented cup (CMD). Analyzing the different ways to place these cups and the clinical results and relaxations. **Material and methods:** The 69 cases comprised 34 men and 35 women with a mean age of 77,39 years. The mean follow-up was 4.7536 years. The type of intervention performed varied according to the cause of the intervention, the acetabular bone stock and the state of the primary cup. In the cases in which there was a good fixation of the primary metalback, we opted to carry out a cementation of the cemented DMC into the existing well-fixed metal acetabular shell, this occurred in 23 cases. In the cases where there was loosening of the primary cup but there was a good bone stock, a CMD was cemented into the bone (21 cases). In the cases where there was a Paprosky type III we cemented a DMC to a Bursch-Schneider reinforcement ring together with the placement of a cancellous bone graft (25 cases). **Results:** The clinical evaluation at the end of the follow-up, according to the MD Scale, showed the mean value was 16.454 (SD 0.79472), with a survival at the end of the follow-up of 100% of the placed DMC. **Conclusion:** The use of cemented DMC is a good solution in the replacement of THA, especially in cases of relaxation or risk of dislocation due to personal or technical predisposing factors. The use of these DMC cemented can be directly to the bone, into the existing well-fixed metal Shell, or cemented to a reinforcing ring, depending on the acetabular defect. **Evidence Level III; Comparative Case Series.**

Keywords: Reoperation, Procedures, Operative Surgical, Hip Replacement, Total, Follow-Up Studies.

RESUMO

Introdução: Revisar os pacientes que foram submetidos à cirurgia de revisão protética de quadril neste hospital, considerados como pacientes com alto risco de luxação ou luxação recorrente, submetidos a cirurgia por acetábulo cimentado de dupla mobilidade (CMD). Analisando as diferentes formas de posicionamento desses copos, seus resultados clínicos e relaxações. **Material e métodos:** Os 69 casos correspondiam a 34 homens e 35 mulheres com uma idade média de 77,39 anos. O tempo médio de acompanhamento foi de 4,7536 anos. O tipo de intervenção realizada variou de acordo com a causa da intervenção, o estoque ósseo acetabular e o estado do copo primário. Nos casos em que houve uma boa fixação do metal primário, optou-se por realizar uma cimentação do DMC cimentado na cúpula acetabular metálica firme existente, o que ocorreu em 23 casos. Nos casos em que houve um afrouxamento acetabular primário com um bom estoque ósseo disponível, cimentou-se um CMD (21 caixas). Nos casos em que havia um Paprosky tipo III, cimentou-se um DMC a um anel de reforço Bursch-Schneider juntamente com a colocação de um enxerto ósseo esponjoso (25 caixas). **Resultados:** A avaliação clínica realizada no final do acompanhamento, de acordo com a Escala MD, mostrou que o valor médio foi de 16,454 (DP 0,79472), com uma sobrevivência ao final do acompanhamento de 100% do DMC inserido. **Conclusão:** O uso do DMC cimentado pode ser uma boa solução para substituição do THA, especialmente em casos de relaxação ou risco de deslocamento devido a fatores de predisposição pessoais ou técnicos. O uso destes DMC cimentados pode ser realizado diretamente ao osso, dentro da cúpula metálica fixa existente, ou cimentados a um anel de reforço, dependendo do defeito acetabular. **Nível de Evidência III; Série de Casos Comparativos.**

Descritores: Reoperação, Procedimentos Cirúrgicos Operatórios, Artroplastia Total do Quadril, Seguimentos.

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INTRODUCTION

One of the most important complications in prosthetic hip surgery is dislocation. According to Woolson,¹ the incidence found in their series reaches 3.5% of the 10,500 cases of primary total hip replacement (THA) that they collect. But this incidence is much higher in revision surgery. Grigoris finds up to 25% of dislocations in the review.² According to the 2019 US THA registry, in 2017 the main reason for revision was due to prosthetic instability and in 2018 it was the second after infection.³

Rowan recently conducted a literary search to assess historical perspectives and current strategies to prevent dislocation after primary THA. This study included 3,458 articles and included 154 in its analysis.⁴ There are two groups of causes that can favor prosthetic instability and therefore dislocation: patient-specific causes and technical causes. Among the patient's own causes, it has been shown that age, body mass index above 30Kg / m², lumbosacral pathology, rheumatoid arthritis, muscle atrophy, history of interventions on the same hip, can be factors favoring instability. Among the technical causes, the approach route, the size of the femoral heads, the anteversion of the cotyloid component, the inclination of the acetabular component, the relaxation of the soft tissues, the femoral retroversion. Taking into account all the favorable effects of prosthetic instability, preoperative planning is very important in a primary THA, but much more in revision surgery. It is also important to be able to do a dynamic test with the trial prosthetic components during surgery, such as the push-pull test, to assess the soft tissue tension and the stability of the prosthesis. But not all approaches facilitate it in the same way.^{4, 5}

In these circumstances, any technical help that can improve the stability of the surgery and especially in revision surgery, is welcome. In revision surgery, patients already have a history of surgeries with poorer quality soft tissue and many times with bone defects that are difficult to resolve. There is no doubt that double mobility cups (DMC) have become an aid to improve stability. Good results have been reported in the use of DMC in primary surgery,^{6,7} also in patients with neuromuscular problems⁸⁻¹³ and even in revision surgery,¹⁴⁻¹⁶ but there are still no conclusive data on the use of DMC in revision surgery. in patients with a neurological history, or older patients. The aim of our work is to review those patients who underwent prosthetic hip revision surgery in our hospital considered to be patients at high risk of dislocation or recurrent dislocation, and who underwent a cemented CMD. Analyzing the different ways to place these cups and the clinical results and relaxations.

MATERIAL AND METHODS

In total, 69 patients underwent was operated between January 2010 and December 2001, placing an Avantage® DM cemented Shell (Zimmer Biomet, Warsaw, USA), the study was conducted in line with the established ethical guidelines of the hospital: each patient at the hospital was asked to sign an informed consent whether to let his or her data public or private for future access, and only open access medical records were reviewed by the authors of the study. Since this is an observational retrospective study, it does not describe experimental studies on either humans or animals and so it does not need any ethical approval.

The external surface of the cemented Avantage Reload metal shell has a bright polish (Ra max 0.4 μm), and the inner articulate surface is highly polished. In all cases, a cobalt-chrome femoral head was used. The diameter of the heads depended on the size of DMC used. Highly cross-linked polyethylene liner infused with vitamin E (GUR 1050) was used on all cups.

All patients were operated on by 2 highly experienced orthopedic hip surgeons. Cefazolin 2gr was administered intravenously before

surgery and twice after the operation with an interval of 8 hours. The patients underwent antero-external or posterolateral surgery and received the same rehabilitation program, which allowed full loading immediately after surgery. Thromboembolic prophylaxis with low molecular weight heparin was performed, and blood saving protocol with tranexamic acid. In the postoperative period, surgical bleeding and days of hospital admission were analyzed. The indications for these implants in particular were: patients without age limits who require revision surgery due to implant instability, or revision surgery with their own or technical risk factors for prosthetic instability. All cases were submitted to preoperative planning.

The 69 cases comprised 34 men and 35 women with a mean age of 77,39 years (range between 46 and 89 years) at the time of surgery. The mean follow-up was 4.7536 years (SD 2.075) between 3-16 years. The mean time elapsed between primary surgery and revision was 12.79 years (SD 6.7814) between 1-28 years. The mean body mass index was 27.40 kg / m² (range 17.38 to 43.40). The distribution of patients according to diagnosis was: in 23 cases a recurrent prosthetic instability, in 35 cases a prosthetic loosening with risk of instability, in 7 cases they were due to prosthetic replacement caused by a Vancouver type B or C periprosthetic fracture, and in 4 cases septic exchange with risk of dislocation. (Table 1) The type of intervention performed varied according to the cause of the intervention, the acetabular bone stock and the state of the primary cup. In the cases in which there was a good fixation of the primary metalback, we opted to carry out a cementation of the cemented DMC into the existing well-fixed metal Shell (Figure 1), this occurred in 23 cases. In the cases where there was loosening of the primary cup but there was a good bone stock, a DMC was cemented into the bone, this happened in 21 cases. (Figure 2) And in cases where there was a Paprosky type III A or B bone defect, we cemented a DMC to a Bursch-Schneider reinforcement ring together with placement of a cancellous bone graft in 25 cases. (Figure 3) Patients were clinically assessed using the Merle d'Aubigné (MD) score preoperatively and at the end of follow-up. The mean pre-operative assessment was 6.9276 (SD 2.068669). The radiological evaluation was carried out by means of a standard anteroposterior radiography of the pelvis and lateral hip, verifying the migration,

Table 1. Description of the re-revised study population.

		Statistical significance
Age, years, mean (range)	77, 39 (46-89) SD 9.4217	
Sex	Female 35, male 34	P>0.005
Side,Right/Left	R 42, L 27	
Body mass index, kg/m ² ,mean (range)	27,40 kg / m ² (range de 17,38 a 43,40)	
Operations Previous	2,3 (1-4) SD 6,7814	
Years since the first Operation	12,79 (1-28)	
Preoperative MD	6.9276 (SD 2.068669)	
Cause Surgery	-Loosening 35 cases -Dislocation recurrent 23 cases -Fractura periprotetica 7 cases -Infection 4 cases	P>0.005
Type Surgery	-Anillo Bursch-Schneider + ingerto + Cemented DMC 25 cases -Cemented DMC in metalback 23 cases -Cemented DMC in boone 21cases	P>0.005
Follow-up	4,7536 years (SD 2.075)	
MD postop	16.454 (SD 0,79472)	

osteolysis and signs of radiolucency, as well as the position of the cup and the position of the femoral stem.

Descriptive data are presented as median and range or by mean and standard deviation. The level of significance for all the analyzes performed was established at $p \leq 0.05$. Statistical analyzes were performed using SPSS 26.0 (SPP Inc., Chicago, IL, USA).



Figure 1. The case of an 86-year-old woman operated on for right PTC infection, with replacement of both prosthetic components. Placement of cemented DMC to the bone.

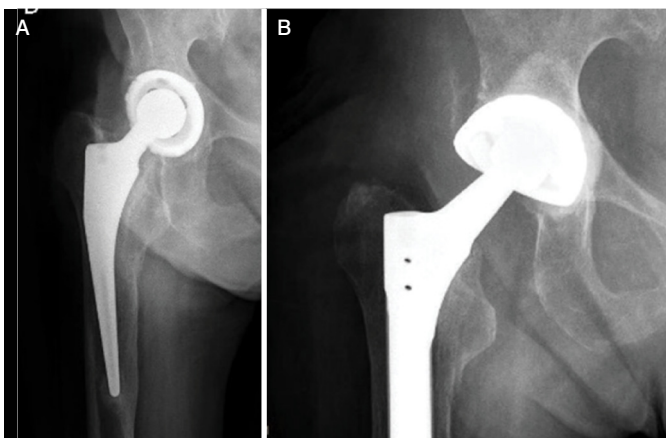


Figure 2. The case of a 79-year-old man with septic loosening of total hip arthroplasty (A). Placement of cemented DMC into DMC into the existing well-fixed metal shell (B).



Figure 3. The case of an 82-year-old woman with aseptic acetabular loosening. Placement of cemented DMC into the Bursch-Schneider ring.

RESULTS

We had no intraoperative complications. In the postoperative period, a mean bleeding in the drainage of 275cc (between 225-700cc) was registered. Only 6 cases (8.69%) required transfusion. The mean hospital stay was 6.5 days (range 5-7 days). The patients began sitting 24 hours after the intervention and walking with partial load between 24-48 hours after the intervention. In the moment of hospital discharge, according to our hospital protocol, 51 patients followed the Home Hospitalization protocol with the assistance of a physiotherapist at home for the first week, 17 patients were transferred to a social health center for recovery.

As postoperative complications, we had an early infection that required debridement surgery and it resolved. We also had a case of femoral nerve paresis that resolved in 6 months. We did not have any case of venous thrombosis and we did not have any case of dislocation until the end of the follow-up.

The clinical evaluation at the end of the follow-up, according to the MD Scale, showed the mean value was 16.454 (SD 0.79472), with a survival at the end of the follow-up of 100% of the placed DMC. The radiographic evaluation at the end of the follow-up showed no subsidence of the femoral stems, there was no osteolysis, no periprosthetic ossification or radiolucency. The average acetabular inclination was 44° (range $42^\circ - 50^\circ$).

DISCUSSION

Above all, we are aware of the limitations of our work due to the number of cases we present and the follow-up time of these patients. Nevertheless, we believe that it is important to analyze the results of the use of cemented DMC in prosthetic revision surgery with its possible applications.

Recurrent instability remains a difficult problem after THA revision with a recent study reporting a 35% relaxation rate after THA revision due to instability at 15 years.^{1,2} These patients are usually elderly people who have undergone hip surgery several times and who usually have multiple underlying pathologies associated with it.^{4,5} All this means that they can be considered high-risk patients in revision surgery. In our series, the mean age of revision surgery was 77.39 years (range 46 to 89 years). As a medical history, we have: hip reoperation patients, diabetes mellitus, hypertension, obesity, neuromuscular diseases, heart disease.

The objective of primary hip surgery is to restore the original anatomy and biomechanics of the hip by placing a THA.¹⁷ For this reason, good preoperative planning is always advised through the use of templates. However, in revision surgery, preoperative planning must be more careful, it must include the evaluation of the soft tissues, especially the abductor muscles, the bone stock and its condition, knowing well the technical possibilities that we have, and above all it is very surgeon's experience is important.¹⁷

Today we have different resources in revision surgery. Hailer conducted a study of the Swedish Registry of Hip Arthroplasty between 2005 and 2010 and reported 399 revision procedures for THA due to dislocation, being more frequent in the posterior approach than the lateral or anterior approaches.¹⁸ Another important factor, which we have already mentioned, is the tension of the abductor muscles.¹⁹ We know that we can modify it by lateralizing the femur with the lateralized offset stems or with the larger diameter heads.¹⁸ For this reason, it is advisable to change both prosthetic components at the time of THA revision surgery. But on many occasions it is difficult for the surgeon to change a component that is not loose due to the danger of associated bone fractures. In acetabular bone defects, the placement of jumbo-type acetabular components has been proposed, successfully reported in some studies,¹⁹ the use of support rings associated with allograft placement,^{20,21} the use of

large diameter has helped a lot in revision surgery.²² But we know that these heads increase torsional forces at the junction of the trunion and the heads and can cause adverse local alterations, in addition to being an important cause of postoperative pain.^{22,23} Despite all these technical aids, we need something more in revision surgery in elderly patients at risk of dislocation. We agree with Chalmers that surgical options are limited and the use of restricted liners is indicated in THA revision surgery.¹⁶ Increased polyethylenes were initially used in one area of the rim, but have proven to be insufficient. Constrained polyethylenes later appeared, but they have also caused problems.²⁴ We currently have the DMC. They began to be used in the 1970s in primary THA surgery with great success.⁸ Currently we have cemented DMC that allow us different possibilities of use. We can cement them directly to the bone in those cases where there is a good bone stock. We can also cement the DMC into the existing well-fixed metal shell in order to shorten the operative time, and reduce blood loss, bone damage, and overall perioperative morbidity.²⁵ And finally, we can cement them to a ring in cases of significant Paprosky type III A and B bone defects, associated if necessary with bone allograft for regeneration of bone defects. In our series, 25 cases were placed with a cemented DMC with a Bursch-Sneider ring associated with allograft placement; in 23 cases a DMC was cemented into the existing well-fixed metal Shell; and in 21 cases it was decided to cement the DMC directly to the bone.

One of the objectives of our work is to assess the clinical situation of the patients after the THA revision intervention with the DMC. There are many studies that recognize a good result in the assessment scales in the follow-up of these patients. Philippot recognizes a clinical improvement from 7.1 preoperatively to 15.8 10 years after the intervention according to the MD scale.²⁶ More recently, Lamo-espinoza et al. Report a mean preoperative MD score of 10.31 that goes to 15.61 postoperatively in patients undergoing THA revision using the DMC.¹⁰ In a series of 36 patients considered high risk and submitted to THA revision, Plummer²⁷ reported an improved Harris Hip Score by a mean of 45 points with a final mean of 90. In our series we have gone from a preoperative assessment of 8.34, according to the MD scale, to a result at the end of the follow-up of 15.55 (Table 1). With these results we can affirm that the DMC used in the THA review can reliably improve pain and gait in these patients.

Another objective of our study is to assess re-dislocations in patients with DMC after THA revision surgery. Simian²⁸ reported a dislocation

rate of 1.4% in patients undergoing THA revision, mainly for aseptic loosening and no history of hip instability, with DMC constructions. In a 994 review THA study for all indications, Wegryzn reported a total dislocation rate of 1.5% and the intraprostatic dislocation rate was 0.2%.²⁹ Several reports indicate up to a 30% dislocation rate of acetabular constrainer liner in operated patients at high risk of recurrent dislocation.^{30,31} DMC constructions and restrained liners have different mechanisms for imparting hip stability. In theory, restricted liners restrict the hip to fit prosthetic design in an attempt to compensate for poor soft tissue. In our series we did not have any case of dislocation after review with the CMD in any of the operated groups.

Another of the possible advantages of the DMC is the possibility of the reduction under closed sky when there is a dislocation of the same. We have already commented previously that in many cases there is a concurrence of several instability factors that facilitate recurrent dislocation. Some of these factors can be unpredictable. This is what happens when the existence of neuromuscular diseases and abductor insufficiency of the hip are associated. Sonohata reported a case of dislocation of a line acetabular constrainer cup that was conservatively resolved without the need for surgical intervention,³² but most constrainer liners have a broken mechanism and make conservative reduction impossible. However, DMC can be carried out on many occasions a conservative reduction.¹⁶ But this is not always possible, as reported by Plummer, who reported two DMC dislocations in a series of 36 patients that required surgical intervention at two years of follow-up.²⁷

In patients at high risk of dislocation despite multiple unsuccessful surgical attempts to obtain a stable hip replacement, DMC constructions not only allow greater stability, but also allow the option of treating repeated dislocations with closed reduction and braces instead of needing urgent surgical intervention as usual. the case in most dislocated constricted liners.

CONCLUSION

As a conclusion to our work, we can affirm that the use of cemented DMC is a good solution in the replacement of THA, especially in cases of relaxation or risk of dislocation due to personal or technical predisposing factors. The use of these cemented DMC can be directly to the bone, into the existing well-fixed metal Shell, or cemented to a reinforcing ring, depending on the acetabular defect. In any case, we need more casuistry and a longer follow-up time.

AUTHORS' CONTRIBUTION: JJMC: Formal analysis; Investigation; Methodology; Project administration; review & editing. ET: Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Visualization; Roles/Writing – original draft; Writing.

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