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ORIGINAL ARTICLE

Analysis of the failures of a cemented constrained liner model in patients with a high dislocation risk☆

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KEYWORDS
Hip arthroplasty;
Dislocation;
Constrained cup;
Survival;
Revision surgery

Abstract
Objective: To evaluate the short-term results of an ultra high molecular weight polyethylene retentive cup in patients at high risk of dislocation, either primary or revision surgery.
Materials and methods: Retrospective review of 38 cases in order to determine the rate of survival and failure analysis of a constrained cemented cup, with a mean follow-up of 27 months. We studied demographic data, complications, especially re-dislocations of the prosthesis and, also the likely causes of system failure analyzed.
Results: In 21.05% (8 cases) were primary surgery and 78.95% were revision surgery (30 cases). The overall survival rate by Kaplan–Meier method was 70.7 months. During follow-up 3 patients died due to causes unrelated to surgery and 2 infections occurred. 12 hips had at least two previous surgeries done. It was not any case of aseptic loosening. Four patients presented dislocation, all with a 22 mm head ($P = .008$). Our statistical analysis did not found relationship between the abduction cup angle and implant failure ($P = .22$).
Conclusions: The ultra high molecular weight polyethylene retentive cup evaluated in this series has provided satisfactory short-term results in hip arthroplasty patients at high risk of dislocation.

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PALABRAS CLAVE
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Análisis de los fracasos de un modelo de cotilo constreñido cementado en pacientes de alto riesgo de luxación

Resumen
Objetivo: Evaluar los resultados a corto plazo de un cotilo retentivo de polietileno, en pacientes con alto riesgo de luxación, ya sea en cirugía primaria o de revisión.
Material y método: Revisión retrospectiva de 38 casos, con el objetivo de determinar la tasa de supervivencia y el análisis de los fallos de un cotilo constreñido cementado, con un seguimiento promedio de 27 meses. Se estudiaron los datos demográficos, las complicaciones, en especial las reluxaciones de las prótesis y así mismo se analizan las probables causas de fracaso.
Resultados: En un 21,05% se implantó en cirugía primaria (8 casos) y en un 78,95% en cirugía de revisión (30 casos). El estudio de supervivencia global del implante mediante el método de Kaplan–Meier ha sido del 70,7 meses. Durante el seguimiento, ocurrieron 3 casos de defunción no relacionado con la cirugía y 2 casos de infección. En 12 de las caderas se habían realizado previamente, como mínimo, 2 cirugías. No hubo ningún caso de aflojamiento del implante al hueso. Cuatro pacientes presentaron luxación, todos con cabeza de 22 mm ($p = 0,008$). Nuestro análisis estadístico no encontró relación entre el ángulo de inclinación acetabular y el fracaso del implante ($p = 0,22$).
Conclusiones: El cotilo retentivo de polietileno de ultra alto peso molecular cementado evaluado en la presente serie ha proporcionado resultados satisfactorios a corto plazo, en pacientes con artroplastia de cadera con alto riesgo de luxación.

Introduction

Prosthetic hip dislocation is a complication which appears in between 2% and 7% of primary arthroplasties, and may even reach 25% after revision surgery.[1,2] Therefore, recurrent instability of a total hip prosthesis is the most common indication in revision surgery.[3,4] Its etiology is usually multifactorial, but it has been related to risk factors inherent to the patient, such as age, neuromuscular disorders and gluteal deficiency. It is also attributed to surgical factors, such as the type of access route, number of prior interventions, imbalance of soft tissues, malposition of prosthetic components, nonunion of the trochanter and collision between the prosthetic neck and the edge of the cup.[5,6]

All these risk factors can appear in patients undergoing either primary surgery or revision surgery. These patients often have complex medical histories, with varied indications. Published works have generally focused on analyzing the type of implant used, rather than the type of patient.[7] For this reason, in many published series the authors analyze the problem in a joint manner despite the fact that, as already mentioned, the incidence in revision surgery is higher. Most dislocations take place in the immediate postoperative period, and are occasionally treated successfully in a conservative manner. However, in other cases, joint instability is difficult to resolve, with an incidence of subsequent dislocations after the first one between 8.2% and 51%, according to the various published series.[1–4] Several surgical techniques for the treatment of unstable hips have been described, including the correction of wrongly oriented components.[8–12] the use of inserts with an anti-dislocation tab, increasing the diameter of the femoral head, placing a bipolar or tripolar joint,[13,14] actions on soft tissues[15–17] and/or the use of implants with double mobility.[18,19] Nevertheless, in some patients, none of these measures are able to provide and maintain stability. For this reason, constrained or self retentive cups are normally used when other methods fail.

The constrained cup is designed to retain the femoral head within the acetabular component. The forces which usually cause a dislocation are absorbed and transferred to a blocking mechanism, to the metal cup or to the bone-prosthesis interface. Its use is simple and provides immediate stability, as reflected by multiple series which report a prevention of dislocation in 80–95% of cases.[7,20–23]

Nevertheless, these implants have also been associated to certain risks and problems, such as insert dissociation, progressive loosening of the metal dome, increase in volumetric wear of the polyethylene component and reduction of the range of movement.[7,20] For this reason, the use of a constrained acetabular component should be reserved for those patients whose risk of recurrent dislocation or additional surgery exceeds the risks associated to the use of a constrained component; situations such as severe abductor insufficiency secondary to neurological disorders, tumor reconstruction surgery and complex revision surgery, among others.[23]

The objective of the present study is to assess the results obtained in a retrospective series of patients in whom a cemented constrained cup was used as a method to obtain a stable prosthetic hip, both in primary surgery with a high risk of dislocation and in complex revision surgery.

Figure 1 Image of the implant used for the study. The semitransparent detail shows the constrictor ring (CCC cup, Socinser®, Gijón, Spain).

Materials and methods

We conducted a radiological, clinical and retrospective analysis of a series of 38 constrained cups implanted between February 2006 and August 2013 at the Hip Unit of a third level hospital.

In all cases, the cup used was a cemented polyethylene implant of ultra-high molecular weight (CCC cup, Socinser®, Gijón, Spain) (Fig. 1), characterized by a non-closed or retentive ring (constrictor), made of the same polyethylene material, designed to prevent dislocation of the femoral head and placed in the interior of the cup. This ring included a metal ring, also open, which acted as a spring or clamp. The design of the ring allowed the prosthetic head to be introduced, as it opened under the simple pressure it exerted on the system, but its design and the mentioned clamp also prevented the implant from coming out or dislocating. In order to obtain the maximum resistance, the interior diameter of the cup varied according to the size. Cups equal to or smaller than 46 mm only accepted femoral heads of 22 mm. Cups with sizes greater than 48 mm only accepted heads of 28 mm.

The main inclusion criterion was defined as ''prosthetic hip surgery with high risk of dislocation''. Therefore, both patients who underwent primary surgery and revision surgery were included. In primary surgery, the indication to use this kind of implant was established for patients with neurological diseases, failure of the osteosynthesis, tumors and joint rigidity in extreme positions. In revision surgery, the main indication was recurrent dislocation or associated to infection, abductor insufficiency or the use of allograft-prosthesis compounds.

Patients in whom another model of constrained cup was used were excluded from the study, as were patients with a follow-up period shorter than 6 months. We considered that, after this exclusive postoperative follow-up period, the joint had to be stable over time.

We used the Hardinge lateral approach[24] in all cases except for 4: 3 patients who underwent revision surgery of the rod through extended trochanteric osteotomy and 1 case of primary tumoral surgery in which the Letournel[25] ileal-inguinal approach was used.

We categorized the acetabular bone defects according to the classification by Paprosky et al.[26] In 34 cases, the cup was cemented directly on the acetabular bed. In the other 4, an acetabular support metal ring was added to obtain better stability in relation to the bone defect (1 case 2A; 1 case 2B; 1 case 2C; 1 case 3A). In these patients, the cup was cemented in the interior of the ring. In 1 case of tumoral primary prosthesis we used a structural coxal allograft for the reconstruction following resection of a malignant fibrous histiocytoma, giant cell variant with type 2 coxal involvement according to the classification by Enneking and Dunham.[27]

For the preoperative and postoperative clinical and functional assessments we used the scale by Merle D' Aubigné as modified by Postel.[28]

The radiological assessment was based on an anteroposterior projection of the pelvis centered on the pubic symphysis which was conducted in the immediate postoperative and at the end of the follow-up period. We analyzed the radiological positioning of the acetabular component to identify the inclination and anteversion angles. These radiological measurements were carried out through the software package Traumacad® (Voyant Health Ltd., Feld-Kirchen, Germany). The anteversion angle was measured using the length of the major and minor diameters of the ellipse formed by the opening of the cup, applying the following formula (angle = sin − 1 [minor diameter/major diameter]).

Loosening of the acetabular component was defined as the presence of migration and/or a continuous radiolucent line (thickness over 3 mm) in 2 out of 3 periacetabular regions defined by DeLee and Charnley.[29] We defined as migration a mobilization over 4 mm in relation to the tab or if the acetabular inclination increased or decreased by 4° or more. We defined as implant failure the observation of femoral head dislocation, which indicated a failure of the constrictor mechanism (ring), and also the loosening of the acetabular component. According to the classification described by Guyen et al.[30] for failures of tripolar cups (a type of constrained cup with a double constrained joint surface), and adapting it to the monopolar design of our cup, failure of the constrictor ring corresponded to type 3 and failure due to uncementing would be type 1; if the cement was separated from the cup, it would be type 2; if the metal head was separated from the morse cone, it would be a type 5 failure. Type 4 failure could not be applied to our cases, as we did not use a tripolar cup.

Measurement of polyethylene wear was carried out using the Roman software package v1.70 (Robert Jones & Agnes Hunt Orthopedic Hospital, Oswestry, United Kingdom).

We assessed the possible relation of cup failure with respect to its size, the length of the neck, patient obesity, the type of bone defect, the presence of a supporting ring and the orientation of the component.

Statistical study

The results were expressed as mean ± standard deviation (SD) or as median and 25 and 75 percentiles (P25; P75) for

quantitative variables. Qualitative variables were described as absolute frequency and percentage (%). We assessed prognostic factors for dislocation, loosening and the need for replacement for any of the 2 reasons.

For qualitative variables we used Fischer's exact test, and for ordinal or quantitative variables we used the Mann–Whitney *U* test. In the specific case of postoperative and preoperative differences in the Merle D'Augibné scale, we conducted 2 approximations, one through the Mann–Whitney *U* test and the other through an ANOVA model adjusted by the base value, with non-parametric approximation through transformation to ranges of the dependent variable.

Additionally, we calculated survival curves using the Kaplan Meier method, both overall and according to the diameter of the head (size of the cup). We also assessed the level of satisfaction of patients in order to describe the evolution of the series more accurately. When necessary, we used the log-rank test to assess a possible effect.

All the analyses were conducted with the statistical package SPSS® version 20 (IBM, Rochester, US) using a type I error of 5% in all statistical tests. Given the observational nature of the search for possibly differential factors for prosthesis failure, we did not make any adjustments for multiplicity.

Results

We obtained data from 38 patients who were intervened between the mentioned dates. The follow-up period was less than 6 months in 2 cases, 1 with a primary prosthesis and 1 with revision surgery, so both patients were excluded from the study. The median follow-up period of the 36 remaining cases was 27 months (range: 10–42 months). All patients were intervened in a single hip, with 20 cases (55.6%) on the right side. We intervened 11 (30.6%) males and 25 (69.4%) females, with a median age at the time of surgery of 79 years (66; 83). The median body mass index (BMI) was of 27 kg/m^2 (25–30), with 11 obese patients (BMI $\geq$30 kg/m^2).

The main indication (30 cases, 78.95%) was in revision surgery. Only in 8 cases (21.05%) was the indication established in primary surgery with a high risk of dislocation.

At the end of the follow-up period, none of the cases studied presented a loosening of the cup at the level of fixation to the bone or cement. There was 1 case of septic loosening of the rod, which is mentioned in detail in the section on complications.

A total of 32 patients (88.88%) presented a satisfactory evolution; with a fixed cup, with no images of loosening and with no dislocations due to failure of the constriction mechanism. In total, 4 of the 36 implanted cups (11.11%) required revision due to failure of the retentive ring of the prosthetic head (type 3 according to the classification by Guyen et al.[30]), all in cases of revision surgery. We did not register any cases of dislocation of constrained cups among patients with primary prostheses.

In order to obtain an adequate center of rotation and correct reconstruction, we used ground and compacted graft in 2 of the revision cases (type 2C and 3A defects), as well as a structural coxal allograft for the reconstruction with primary prosthesis, following the resection of a malignant fibrous histiocytoma, giant cell variant with type 2 coxal involvement according to the classification by Enneking and Dunham.[27]

Out of the 4 cases with failure by dislocation, 1 case was $\leq$2B in the classification by Paprosky and in the remaining 3 cases the defect was $\geq$2C (75%). The defect was $\leq$2B in 9.7% of cases which were not dislocated. This figure was statistically significant, with a value of $P = .011$.

In total, 12 patients (33.33%) had undergone at least 2 previous interventions. The 4 cases of dislocation presented this feature, although this figure was not statistically significant ($P = .290$) (Table 1).

In 4 cases (11.1%), the patients had acetabular support rings. Of these, 3 cases presented dislocation, but no statistically significant relationship was found between dislocation and the presence of these fixation accessories ($P = .390$).

Heads with a diameter of 28 mm were implanted in 24 cases (66.7%). None of them were dislocated. The 4 cases of dislocation had heads of 22 mm. Up to 25% of patients without dislocation also had heads with that diameter. The differences were statistically significant ($P = .008$) (Table 2). The most common length of the neck was the medium (18 cases, 50%), with no differences being observed between the dislocated prosthesis compared to the rest ($P = .277$).

The overall median acetabular inclination was 38° (35–41). The median of the inclination angle of dislocated hips was 45° (29–49), whereas in the rest it was 39° (35–41), with these differences not being statistically significant ($P = .631$). Regarding the anteversion angle, we found 6 (18.8%) patients with levels >15°, but none of them suffered dislocation.

In 7 of the 32 cases without dislocation (21.87%), the acetabular component was out of the safety margins established by Lewinnek et al.[31] (40° ± 10° inclination and 15° anteversion), whilst this was true in 2 of the cases of dislocation (50%). These figures were not statistically significant ($P = .2$).

We found 1 case of usury of the polyethylene component by 1 mm/year due to excessive verticalization of the cup, with an inclination angle of 50°.

Prior to the intervention, the median score in the Merle D'Aubigné scale, regardless of the presence of dislocation, was 9 (6–12). The differences following the intervention were statistically significant ($P = .008$), improving in median and interquartile range of 6 (4–10) points evolution in cases without dislocation, and 4 points (2–5) in cases with dislocation. The score in the scale corresponding to joint mobility showed no significant differences with respect to the preoperative situation.

At the end of the follow-up period, we did not observe a higher level of satisfaction among patients without dislocation compared to those with dislocation ($P = .280$) (Table 1).

As surgical complications, we diagnosed 2 cases of infection. One of them, the tumoral case, was an acute infection which was treated by surgical cleaning and antibiotic therapy, maintaining the implant. The other case presented septic loosening of the rod 2 years after the intervention. For this reason, we carried out a total replacement in a single stage, replacing the cup by one with double mobility. There

Table 1 Patients analyzed in the series: demographic characteristics and detailed results.

		Failure by dislocation		
	Total	Dis. No	Dis. Yes	Value of *P*
Gender				
Female	25 (69.4%)	21 (65.6%)	4 (100%)	0.290[a]
Male	11 (30.6%)	11 (34.4%)	0 (0%)	
Age (years)	79 (66; 83)	79 (67; 83)	66 (50; 83)	0.534[b]
Obesity				
<30 kg/m^2	25 (69.4%)	21 (65.6%)	4 (100%)	0.290[a]
≥30 kg/m^2	11 (30.6%)	11 (34.4%)	0 (0%)	
Follow-up period (months)	27 (10; 42)	25 (9; 42)	36 (30; 56)	0.185[b]
Death				
No	30 (83.3%)	27 (84.4%)	3 (75%)	0.535[a]
Yes	6 (16.7%)	5 (15.6%)	1 (25%)	
Type of intervention				
Primary	6 (16.7%)	6 (18.8%)	0 (0%)	1.000[a]
Replacement	30 (83.3%)	26 (81.2%)	4 (100%)	
Side				
Right	20 (55.6%)	19 (59.4%)	1 (25%)	0.303[a]
Left	16 (44.4%)	13 (40.6%)	3 (75%)	
Paprosky				
≤2B	29 (82.9%)	28 (90.3%)	1 (25%)	0.011[a]
≥2C	6 (17.1%)	3 (9.7%)	3 (75%)	
Satisfaction				
Poor	3 (8.33%)	2 (6.2%)	1 (25%)	0.280[b]
Average	5 (13.88%)	4 (12.5%)	1 (25%)	
Good	18 (50%)	16 (50%)	2 (50%)	
Excellent	10 (2.77%)	10 (31.2%)	0 (0%)	

The data are shown as medians (25 percentile; 75 percentile) for the results of quantitative variables and as absolute frequencies (%) for the results of qualitative variables.

[a] Fisher exact test.

[b] Mann–Whitney *U* test.

were 3 deaths not related to the surgery. One of them was the tumoral case, deceased after 36 months due to recurrence of the original tumor with metastasis. Another patient died 7 months after the surgery due to a prostate neoplasm, diagnosed prior to the intervention. The third patient was 88 years old and died 8 months after the surgery due to unrelated causes.

The study of overall survival of implants through the Kaplan–Meier method showed a result of 63.9% at the end of the follow-up period. Mean survival in the series was 70.7 months, with a 95% confidence interval (60.8–80.6) (Fig. 2). When considering the diameter of the head (Fig. 3), we observed a lower survival among those cups which used a head with a smaller diameter (22 mm) (log-rank, value of $P < .001$).

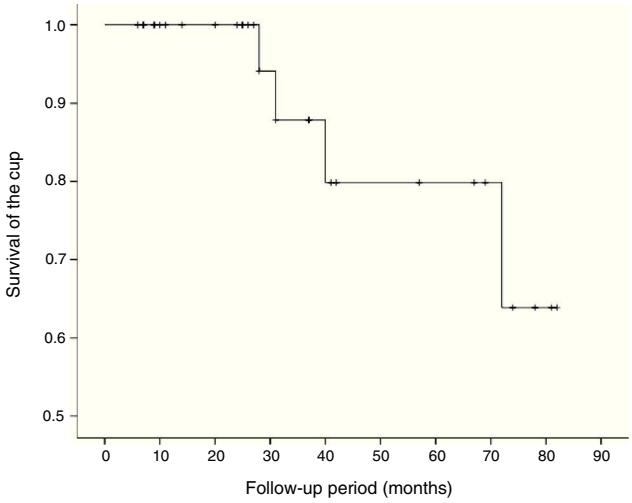

Figure 2 Overall survival of the constrained cup in the present series, based on the Kaplan–Meier analysis (with a 95% confidence interval).

Discussion

The results obtained with constrained cups in total hip arthroplasty are controversial. In the present series, the study of overall implant survival using the Kaplan–Meier

Table 2 Detailed description of the results.

		Failure by dislocation		
	Total	Dis. No	Dis. Yes	Value of *P*
Presence of screw or accessory				
No	32 (88.9%)	29 (90.6%)	3 (75%)	0.390[a]
Yes	4 (11.1%)	3 (9.4%)	1 (25%)	
Size of the neck				
Short	3 (8.3%)	3 (9.4%)	0 (0%)	0.277[b]
Medium	18 (50%)	17 (53.1%)	1 (25%)	
Long	14 (38.9%)	11 (34.4%)	3 (75%)	
Extra long	1 (2.8%)	1 (3.1%)	0 (0%)	
Diameter of the head (mm)				
22	12 (33.3%)	8 (25%)	4 (100%)	0.008[a]
28	24 (66.7%)	24 (75%)	0 (0%)	
Inclination of the cup (degrees)				
<35	2 (5.6%)	2 (6.2%)	0 (0%)	0.631[b]
35–40	12 (33.3%)	11 (34.4%)	1 (25%)	
40–45	15 (41.7%)	13 (40.6%)	2 (50%)	
45–50	2 (5.6%)	2 (6.2%)	0 (0%)	
50–55	5 (13.9%)	4 (12.5%)	1 (25%)	
55–60	0 (0%)	0 (0%)	0 (0%)	
60–65	0 (0%)	0 (0%)	0 (0%)	
>65°	0 (0%)	0 (0%)	0 (0%)	
Degrees of anteversion of the cup				
<10	19 (52.8%)	17 (53.1%)	2 (50%)	1.000[b]
10–15	11 (30.6%)	9 (28.1%)	2 (50%)	
>15	6 (16.7%)	6 (18.8%)	0 (0%)	
Retroversion	0 (0%)	0 (0%)	0 (0%)	

The data are shown as absolute frequencies (%) for the results of qualitative variables.
[a] Fisher exact test.
[b] Mann–Whitney *U* test.

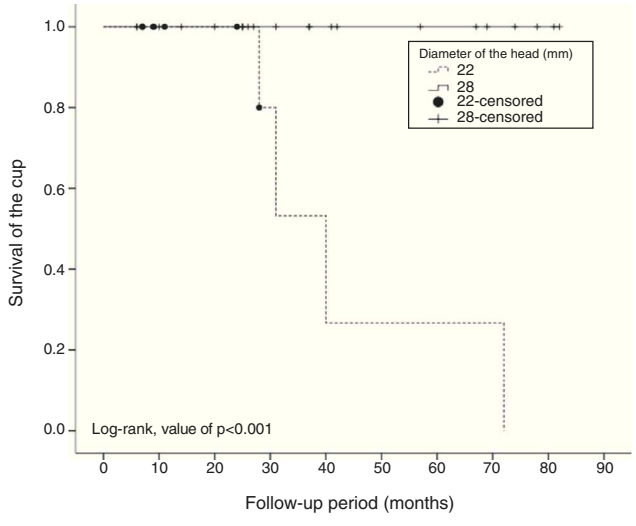

Figure 3 Comparison of the survival of the cup according to the diameter of the head. A head size of 22 mm was associated with a worse prognosis of survival of the cup (log-rank, value of $P < .001$).

method was of 63.9%, after a median follow-up period of 27 months. This result was lower than those obtained in studies conducted by other authors, who have published survival results between 74% and 96% with medium-term follow-up.[8,21–23] Nevertheless, more recent studies have reported similar results to ours, indicating that none of the current designs provide sufficient guarantee for revision arthroplasty[32] and even reporting rates of revision of up to 34.8% at 127 months.[33]

It is worth noting that the series are heterogeneous regarding the indication for the use of this type of cup and also regarding the technical options, which include: cementing the constrained cup directly on the bone, placing a compatible constrained insert within a stable metal cup, placing the insert in a new, uncemented metal cup, cementing the constrained cup in the interior of a non-compatible metal cup and cementing on a reconstruction liner or ring.

The 4 failures in the present series were secondary to failure of the constrictor mechanism (type 3 failure), resulting in dislocation of the prosthetic head. It is striking that in our series there were no cases of type I failure (loss of fixation to the bone). The work by Guyen et al.,[30]

analyzed an uncemented tripolar prosthesis. As mentioned previously, this constriction mechanism is very different to the one employed in our work, as it involves a double constrained joint. These authors presented a total of 389 cases, a single failure of fixation to the bone in 11 hips, 6 failures of the retention mechanism of the insert, 10 failures of the constrictor mechanism and 3 dislocations of the prosthetic head, with 12 cases of infection. Parra and Vaquero,[34] who presented a series of 41 cases using a constrained cup in which the constrictor ring was placed after reduction of the head, observed 10 redislocations and related them to a wrong positioning of the blocking ring. Nevertheless, they recognize that the use of self retentive cups is an alternative to be considered for the treatment of recurrent dislocation. We did not observe this complication in the type of cup analyzed in the present study, as the ring positions itself following reduction of the head.

Bakker-Dyos and Moran[35] published a series in which the cup was cemented directly on the bone in 89 cases and on a reconstruction liner in 11 cases. They only reported 4 failures, out of a total of 100 cases, with a mean follow-up period of 2.9 years. Failures occurred due to loosening of the cup: the authors explain that, in 1 case, the cup had been cemented excessively laterally and, in another case, there was a previous, undiagnosed pelvic disjunction. In our series, we did not have any case of pelvic dissociation or wrong positioning of the implant.

A work published by Hernigou et al.[36] assessed the results of the use of constrained vs non-constrained cups in patients with neurological disorders (e.g. poliomyelitis, Down syndrome and myelomeningocele) and cognitive alterations (dementia, confusion or psychiatric diseases with poorly controlled behavioral alterations). In the group of constrained cups, there were 3 failures out of a total 164 hips: in 2 cases the head was dissociated from the neck and in another case the constrictor mechanism was broken. Nevertheless, the authors demonstrated a lower risk of dislocation in this group of patients when comparing the results with non-constrained cups (in this group, 25% was dislocated at least once).

Other series show scarcely favorable results and recommend limiting the indication as much as possible. Pattyn et al.[1] published a failure rate of 26% among a heterogeneous sample in which different implant designs were used in 46 hips (38 patients) and, as an alternative, indicated the use of heads with a large diameter. Another series with one of the worst results published[32] describe the analysis of cups which were explanted due to failure; failure of the constrictor mechanism took place in 51% of cases, whilst 28% presented loosening of the cup and 22% presented infection. This series analyzed the results of 4 types of constrained cup implants not cemented on the bone. All of these were cups with a polyethylene cover over 180° and semispherical shape, and this predisposes toward an impact between neck and cup, and toward transmission of forces which could cause a disanchoring of the cup, damage to the constrictor mechanism, excessive wear and the disassembly of the head. Retentive cups with notches have been designed to avoid this excessive coverage, although the long-term results have still not been determined.[37]

Malposition has been proposed as a risk factor for failure of the retentive cup. Anderson et al.[38] identified the presence of an elevated acetabular abduction angle (with a mean value of 70°, $P < .05$) as the only predictive factor of failure. In our series, the median value for the inclination angles of dislocated hips was 30° (29–49), whilst in the rest it was 39° (35–41). These differences were not statistically significant ($P = 1.000$).

The study of the size of the head and its relationship with the risk of dislocation in constrained cups has not attracted special interest in previous publications. In this series, we have observed more dislocations in heads of 22 mm compared to heads of 28 mm, with this difference being statistically significant ($P = .008$). We believe that smaller head sizes should correspond to smaller constrictor ring sizes and, therefore, less resistance to deformation, always in relation to the weight of the leg.

The main limitation of the present study is its retrospective nature and its short mean follow-up period (27 months). On the other hand, it includes a relatively low number of cases ($n = 36$) and the indication varies from primary surgery to revision surgery. Nevertheless, it deals with a cohort of complex cases with a high risk of dislocation, all treated with the same implant and with results which we consider very favorable, given the intrinsic difficulty of these cases. For each case, the surgeon must solve the specific case of anchoring these implants to the bone. For this reason, the treatments applied may seem heterogeneous, but all seek the same objective: fixation.

In our opinion, a prosthesis which has already suffered a first dislocation or which has already dislocated on several occasions can be categorized in a context of risk. The use of a constrained cup is one of the techniques employed for the treatment of these patients, especially when other techniques have failed previously. In conclusion, in the present series we have estimated a survival of cemented constrained cups of 70.7 months. The use of heads with a diameter of 22 mm in small-sized implants has been shown to be a significant risk factor. Given the complexity of these cases and their high risk of dislocation, we consider this result to be satisfactory. Although more studies and a longer follow-up period with this implant are necessary, we consider it to be a good rescue option for unstable total hip prostheses and in patients with a high risk of dislocation in primary hip arthroplasty.

Level of evidence

Level of evidence IV.

Ethical responsibilities

Protection of people and animals. The authors declare that this investigation did not require experiments on humans or animals.

Confidentiality of data. The authors declare that they have followed the protocols of their workplace on the publication of patient data and that all patients included in the

study received sufficient information and gave their written informed consent to participate in the study.

Right to privacy and informed consent. The authors declare having obtained written informed consent from patients and/or subjects referred to in the work. This document is held by the corresponding author.

Conflict of interests

The authors have no conflict of interests to declare.

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