



## Constrained acetabular liners in hip revision surgery. A low-cost solution for senile patients

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The objective of this study was to analyze the results of a cemented polyethylene model that captures the hip prosthetic head. In a retrospective study we reviewed 36 cemented constrained acetabular liners implanted in patients older than 75 years (mean 83, SD : 4.4), of which 30 patients were aged 80-90 years and 26 were women. The average period of follow-up of our patients was 25.4 months (12-39 months, SD : 7.3). In 26 patients this model was implanted due to recurrent dislocation or instability, in 8 other cases this model was implanted during revision surgery for periprosthetic fractures, aseptic loosening of the acetabular component, wear of the polyethylene or replacement of the implant because of infection. There was a single case of recurrent dislocation (2.8%). Cemented acetabular constrained liners are a good option in revision surgery in senile patients in which the femoral stem is firmly fixed to the bone.

**Keywords :** total hip arthroplasty ; instability ; dislocation ; recurrent dislocation ; senile patients ; constrained cup.

### INTRODUCTION

An increasingly aged population with higher survival rates and failing total hip arthroplasties (THA) has made hip revision surgery increasingly more frequent in these patients.

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Of all the complications that dramatically affect the evolution of these patients, instability and in its extreme degree, dislocation, represents the most serious (8). In elderly patients, the presence of instability introduces a certain severity factor, since these patients require a definitive and fast treatment option, one that must provide early ambulation with support, thus allowing imminent reinsertion in their social and family environments.

In these cases, the primary objective should be the reduction of the dislocated hip followed by the

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prevention of future instability, thereby avoiding the need for subsequent procedures. There are various conservative options after reduction, consisting of immobilizing braces which are exceptionally used due to their poor tolerance and need for permanent use. There are a number of surgical alternatives that use different types of commercial prosthetic components including retentive, restrictive, bipolar, double mobility, etc. (1). These models aim to prevent new dislocations, however sometimes require a complex, aggressive technique or replacement of the femoral stem and are not exempt from recurrent dislocation.

A simple, fast, and low-cost alternative is the utilization of a cemented acetabular component, allowing the femoral stem to be retained, in conjunction with a restrictive system so as to avoid new episodes of dislocation.

The objective of this study was to analyze the results obtained in revision surgery of senile patients with a cemented constrained polyethylene liner, designed to reduce the risk of hip dislocation by capturing the prosthetic femoral head.

## MATERIAL AND METHODS

We performed an analytical and retrospective observational study and review of the medical records and x-rays of 36 patients older than 75 years, in which a cemented retentive polyethylene cup had been implanted between 2010 and 2013. We excluded 21 patients (under 75 years, deceased within the twelve month period after surgery, or lost in follow-up). A questionnaire was designed for this purpose, including only patients with a preoperative and postoperative clinical and radiological evaluation, including epidemiological data such as age, sex, and side of surgery. This study was approved by the Institutional Board Review (Research Committee, Hospital St Agustin, Spain).

This technique has been used in revision surgery in the elderly after replacement of the femoral and acetabular component, or the acetabular dome alone where the femoral component was firm.

Data was collected regarding the type of arthroplasty originally used, initial surgical approach, cause of dislocation, cause of instability and the type and mechanism of dislocation. Intraoperative surgical data was also collected, including the time of surgery, approach used, cup and prosthetic femoral head size, and the type of femoral

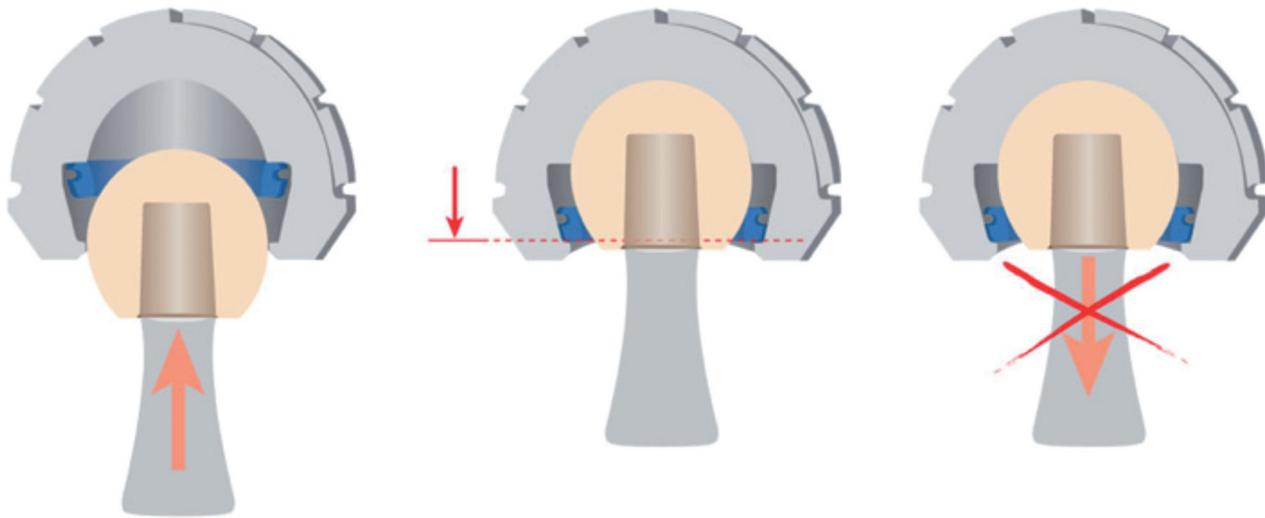
stem used (cemented or non-cemented) in cases where the original was not retained. The minimum follow-up period was 12 months after surgery, collecting data at 3 and 6 months and then annually, including clinical situation, rate of revisions and recurrent dislocation, and the causes of failure of the antiluxant component. Preoperative anteroposterior and axial hip radiographs were reviewed, in the immediate postoperative period, at 6 months and annually post surgery. With regard to preoperative radiographs, we measured the acetabular inclination angle of the first arthroplasty with respect to the bischium line, head coverage angle and the presence of radiolucent acetabular lines and/or wear of polyethylene. Radiographic measurements were carried out based on calibration offered by software included in the IMPAX radiographic imaging system (Agfa Healthcare®, Mortsel, Belgium).

The same type of retentive cup was used in all cases (Lepine-Lefevre, Groupe Lepine, Genay, France), implanted with cementation, and composed of a high molecular weight polyethylene in accordance with the requirements of standard ISO 5834-2, with metal marks for radiological control in equatorial and polar planes. The implant is characterized by a cup with external grooves to optimize cementation, and an internal mobile ring which prevents dislocation. A 10 mm cover closes the entire peripheral equatorial zone (Fig. 1). The available inside diameters are 22.2 and 28 mm and external cup sizes range from 46 to 60 mm in diameter.

## RESULTS

26 cases were female and 10 were male. The average age was 83 years (75-98 years); 4 patients were aged 75-79 years, 30 patients were aged 80-90 years and 2 were older than 90 years. Initial surgical approach was anterior in 17 cases, lateral in 13 and posterior in 6.

In 26 patients this model was implanted as treatment for recurrent dislocation or instability in patients whose risk factors could not be identified and in which the femoral stem was firmly attached to the bone (Table I). The average preoperative acetabular inclination angle was 46.5°, with limits of 28.2° and 64.1°. No relationship was found between the extent of this angle and the presence of dislocation. In 11 patients there had been more than three previous episodes of dislocation, more than two episodes in 3 patients, and 12 patients had



**Fig. 1.** — Restraint system : introduction of head in the retentive device, embraced by the socket. Impossible dislocation head

Table I. — Cause of the surgery

	Number of cases
Recurrent dislocation	14
Instability	12
Aseptic acetabular loosening	5
Polyethylene wear	2
Infection	1
Periprosthetic fractures	2
Total	36

referred to certain instability with manoeuvres, and in some cases with auto-reduction.

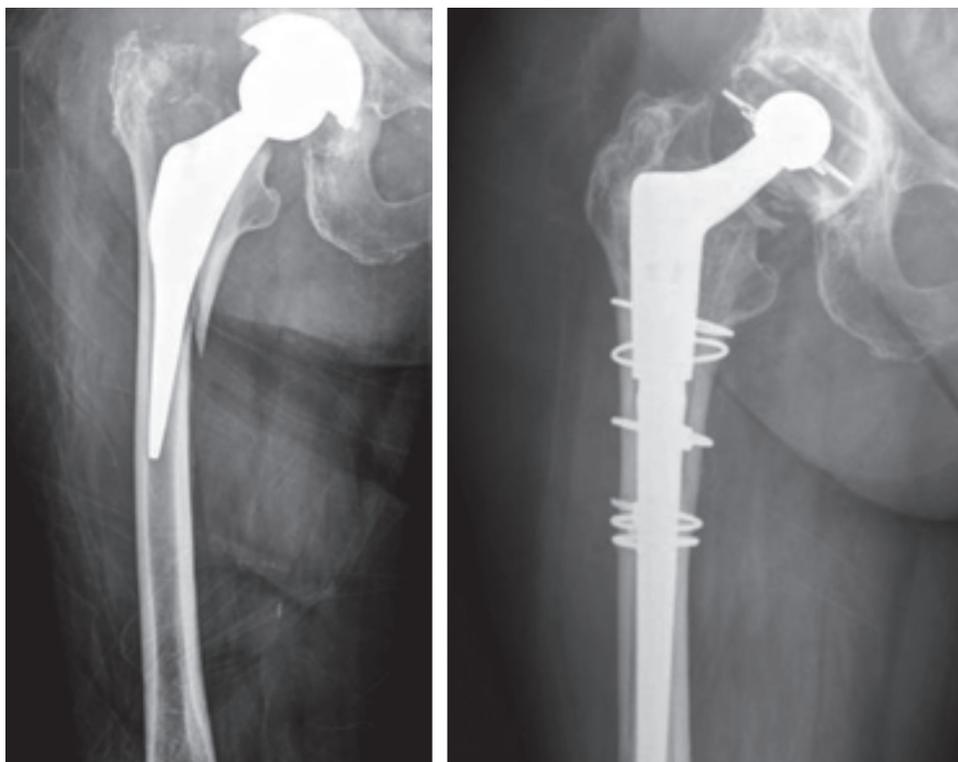
In 10 other cases this model was implanted during revision surgery for periprosthetic fractures (Fig. 2), aseptic loosening of the acetabular component, after revision surgery for wear of the polyethylene (Fig. 3) or replacement of the implant because of infection. The average surgical time was 87 minutes, with a maximum of 120 minutes and a minimum of 65 minutes. The posterior approach was used in 24 patients, and the lateral or anterior in the remainder of cases. In 23 patients a cup with an inner diameter of 22 mm was implanted, since the original implant was monobloc and low friction, and in the other 13 patients it was 28 mm. In cases

where femoral revision was necessary, modular uncemented femoral stems were always used.

The average period of follow-up of our patients was 25.4 months (12-39 months, SD : 7.3). One single case of dislocation was found (2.8%), solved by replacement of the component with another of the same model. The cause of the failure was not found in the constriction mechanism, and probably emerged after a trivial traumatism. In 4 cases a superficial infection appeared but did not require replacement of components. One patient presented paralysis of the external popliteal sciatic nerve which recovered spontaneously. At the time of data collection, 5 patients had died due to causes unrelated to this procedure such as old age.

## DISCUSSION

Instability and in its maximum degree, dislocation, is among the most frequent cause of failure in THA, and can occur at any time. Within the early postoperative period (< 90 days post surgery), it tends to be associated with a defect in the position of the components or insufficient muscle coverage, whilst in the long-term, other factors become more important such as wear of the polyethylene or mobilization of components. In previous studies involving primary surgery, the incidence of



**Fig. 2.** — Periprosthetic femoral fracture. Treatment with femoral stem revision and retentive cemented cup.

instability is described as between 3 to 7%, however in revision surgery it can reach up to 10%. Other studies observe a certain degree of instability, as high as 20%, which in most cases is well tolerated by the patient and in others develops into dislocation (11).

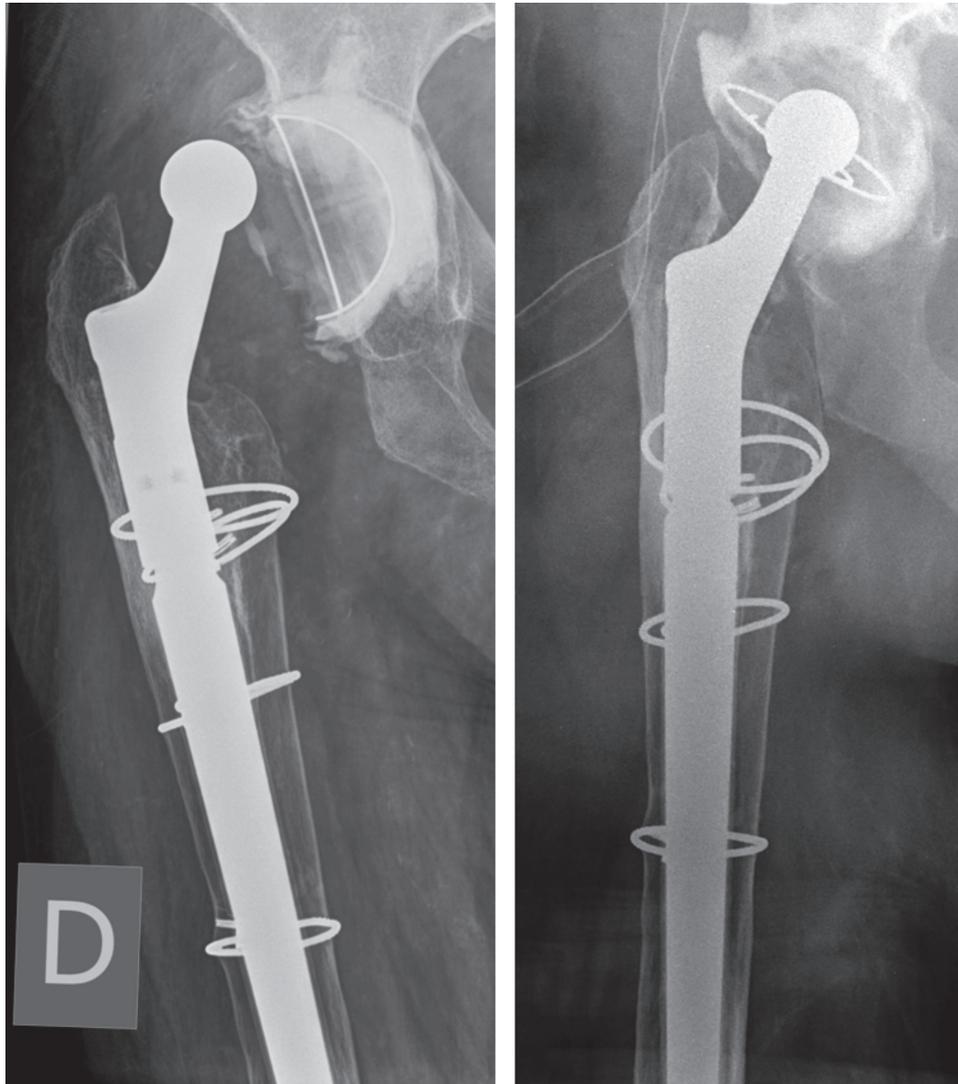
The recurrence of dislocation has been referred to by various authors (6). Berend *et al* (2) describe a recurrence of 17.5% in a 2 year follow-up, whilst in other more long-term studies (3,10), recurrence of dislocation in primary THA nears 60%, and even rises as high as 70% following revision surgery.

Different risk factors for dislocation have been identified, but it is assumed that a combination of several is necessary to trigger dislocation (Table II). These risk factors include previous episodes of instability, surgical review, malposition of components, type of surgical approach used, inadequate tension of the soft tissue, abnormal contact with the bone plane or between components, inexperience of

the surgeon, and extreme postures that exceed the normal coverage of the acetabular cup.

Despite the fact that this complication can appear at any age, a THA dislocation in senile patients and with multiple morbidity becomes a severity factor and produces uncertainty in the surgeon. In this group of patients in particular, muscle hypotrophy, cognitive impairment, lack of neuromuscular control, frequent falls, and polyethylene wear favor the presence of instability if not dislocation. In our study, the average age was 83 years, and 32 of the 36 patients were aged over 80 years. However there are no studies concerning dislocations in THA in other such elderly patients, so we were unable to compare our results with those of other authors.

Approximately 65% of dislocations are resolved with closed reduction, and around one-third of unstable hip prostheses will require surgery, especially if the first episode occurs more than three months post intervention and/or is recurrent. In



*Fig. 3.* — Dislocation after revision surgery. Treatment with cemented retentive dome

these cases it is common to act on the etiological factors of instability or dislocation, however it is not uncommon for the underlying cause to be difficult to determine. In these cases, certain arthroplasty models such as dual-mobility cups or tripolar implants are recommended, permitting a greater range of motion without the disassembly of components. Another alternative is a constrained or constrictive model, such as those used by us.

There are numerous constrained models, more or less ingenious, designed to reduce the risk of new

dislocations. Some systems allow fixation to the bone plane using metallic casings supported with screws or cement. Williams *et al* (12) conducted a review of these models, analyzing 8 studies that included the results of 1200 cases ; 10% of patients had new episodes of dislocation with great variation (from 0 to 29%) amongst the models analyzed. Various causes of failure were listed, such as disassembly of the device, dissociation between polyethylene and metal cup, ring fracture, etc. Although it is possible that modern models offer

Table II. — Indications for the use of constrictive models in THA

Multidirectional intraoperative instability
Intraoperative instability unrelated to defective positioning of components
Abductors deficiency
Episodes of recurrent instability
Episodes of recurrent dislocation
Failure of stabilizing procedures
Pseudoarthrosis or unresolved greater trochanter fracture
Revision surgery after periprosthetic fracture
Revision surgery after arthrodesis
Revision surgery after resection arthroplasty
Senile dementia
Disability or neuromuscular diseases

better results, this technique is not exempt from complications and as yet there are no long-term studies, so their use should be restricted to certain types of local situation and certain types of patient (4,9). These models are recommended in patients with deteriorated neuromuscular function or senile patients for whom other procedures are deemed more aggressive, with high risk of recurrence of dislocation, and are sometimes impossible to perform due to prior general status. The advantages of the model that we used in this study include easy installation, versatility, and few failures.

Only a small number of results have been published concerning cemented constrained models (5). The most extensive study is that published by Hernigou *et al* (7), who have used this model in primary surgery for patients with cognitive or neurological impairment, and compared the presence of new dislocations with a minimum follow-up of 5 years. They performed a retrospective study comparing 164 cases with this type of constrained model and 132 cases with a standard polyethylene cup. In the second group, they found 25% of dislocations with 21 recurrent dislocations, whilst in the first group there were only 2% of dislocations with a single recurrence. They concluded that this retention system was as effective as the dual mobility systems in the treatment of prosthetic instability, with the advantage of its simplicity and cost

savings. In our study only one patient presented a dislocation, and although we were not able to identify the cause of the failure, there were no signs of disassembly nor component malposition, thus inferring that it could be related to an untimely and uncontrolled movement which surpassed the consistency of the constriction system.

This technique allows for the femoral stem to be retained and even the prosthetic head, implanting only a cup which is fixed with bone cement. In our practice, the model has an average cost of between 300-500 euros, very similar to conventional polyethylene models, representing a significant cost reduction compared to other constrained systems.

Limitations of this study include the fact that it is not a prospective study, and we have not compared this treatment with others featured in related literature. Another is the relatively short follow-up period which can be explained by the elderly age of our patients. We do not know the long-term results in relation to the potential deterioration of the constriction system, or the incidence of new dislocations. Accepting these limitations, our overall experience with this model is positive, and has helped elderly patients resume ambulation and their daily living activities.

In senile patients with muscle weakness and/or neurological impairment, a cemented constrained liner is a good choice in revision surgery. It is a

simple, fast, versatile and low-cost technique. The choice of different sizes of prosthetic heads facilitates their use and avoids unnecessary stem revision.

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