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Original article

Can cemented dual-mobility cups be used without a reinforcement device in cases of mild acetabular bone stock alteration in total hip arthroplasty?

T.X. Haen [a,*], G. Lonjon [b], E. Vandenbussche [b]

[a] Service de chirurgie orthopédique, hôpital Raymond-Poincaré, AP–HP, 104, boulevard Raymond-Poincaré, 92380 Garches, France
[b] Service de chirurgie orthopédique, hôpital européen George-Pompidou, AP–HP, 20, rue Leblanc, 75015 Paris, France

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ABSTRACT

Introduction: Cemented versions of dual-mobility cups (DMCs), helpful in cases of bone stock alteration, are usually used in association with a reinforcement device. To simplify the intervention in elderly subjects or those with a poor bone stock, the cups can be cemented directly into the bone, but the long-term result remains uncertain. We conducted a retrospective study in this population so as to: (1) assess whether cemented fixation of a DMC without a reinforcement device leads to a higher loosening rate, (2) confirm its efficacy in preventing dislocations in subjects at high risk of instability, and (3) measure the functional results.
Hypothesis: Cemented fixation of a DMC is reliable in cases of moderate alteration of bone stock.
Material and methods: Sixty-four patients (66 hips) undergoing implantation of a cemented DMC (Saturne™) without a reinforcement device were included in this single-center retrospective study. Their mean age was 79.8 years (range, 40–95 years). The indications varied: hip osteoarthritis (30.3%), prosthesis revision (44.0%), and trauma (25.8%). The patients were evaluated radiologically and clinically at follow-up. The main evaluation criterion was the revision rate for aseptic loosening. Dislocations, the infection rate, and the Postel Merle d'Aubigné (PMA) score were noted.
Results: At the mean follow-up of 4.2 years, three (4.6%) patients had been lost to follow-up and 22 (33.3%) had died. There was one case of aseptic loosening (1.5%). Cup survival was 98% at 5 years (95%CI [94–100]). There were no dislocations. There was one revision for infection. The mean PMA score was 15.5 (range, 9–18).
Discussion: The frequency of acetabular loosening was comparable to the frequency in cemented DMCs with a reinforcement device. A cemented DMC without a reinforcement device is possible and is a simple and viable option when there is moderate bone stock alteration.
Level of evidence: IV, retrospective cohort study.

1. Introduction

Dislocation following total hip arthroplasty (THA) has major functional, psychological, and economic consequences [1]. Dual mobility cups (DMCs), available since 1976 [2], have proven their efficacy in preventing dislocations [3], without an increase in the wear rate [2,4] or the loosening rate based on several recent studies on cementless DMCs [5,6].

The use of DMCs in a cemented version is sometimes necessary because of poor bone stock. For example, when there is insufficient primary fixation with a cementless cup, some authors recommend using a cemented implant rather than increasing the reaming diameter [7] (increased alteration of bone stock, risk of psoas-iliac muscle irritation). Cemented DMCs were initially used in association with cup reinforcement, but the implantation of reinforcement devices poses a neurovascular risk and lengthens the duration of surgery [3,8,9]. Implantation without an acetabular reinforcement device has been described more recently [10–13] (in case of THA revision with moderate alteration of bone stock or failure of impaction with a press-fit cup), but the medium-term results with a large cohort have not been described. Moreover, some authors currently advise against this procedure, fearing an increased risk of acetabular loosening [14–16]. Since the outcome of DMCs cemented directly in fragile bone or with moderate alteration

* Corresponding author. Tel.: +33 1 47 10 77 27; fax: +33 1 47 10 77 03.
E-mail address: tx_haen@outlook.com (T.X. Haen).

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Table 1
Preoperative epidemiological data.

Mean age	79.8 ± 11.1 years (range, 40–95 years)
Mean body mass index	24.3 kg/m^2
ASA score	Mean, 2.3 ± 0.7
	ASA 1: 4 (6.1%)
	ASA 2: 41 (62.1%)
	ASA 3: 19 (28.8%)
	ASA 4: 1 (1.5%)
	ASA 5: 1 (1.5%)
Gender	48 females (72.7%)
	18 males (27.3%)
Risk factors for dislocation (RF)	1.6 per patient on average ± 0.8
	0 RF: 6 (9.1%)
	1 RF: 21 (31.8%)
	2 RF: 31 (47.0%)
	3 RF: 8 (12.1%)

ASA: American Society of Anesthesiologists.

of the bone stock remains imprecise, we conducted a retrospective study to: (1) assess whether cemented fixation of a DMC without a reinforcement device leads to a higher loosening rate, (2) confirm its efficacy in preventing dislocations in subjects at high risk of instability, and (3) measure the functional results of a cemented DMC. We hypothesized that cemented fixation of a DMC is reliable in patients with moderate alteration of bone stock.

2. Material and methods

2.1. Patients

We conducted a single-center retrospective study on consecutive patients who had undergone a THA with a cemented DMC without a reinforcement device between January 2005 and May 2011. Only patients whose follow-up was longer than 1 year were included. Sixty-four patients (66 hips) were included. The epidemiological data are indicated in Table 1. The patients' mean age was 79.8 ± 11.1 years (range, 40–95 years). Sixty patients (90.9%) had at least one risk factor for dislocation: American Society of Anesthesiologists (ASA) score ≥ 3 [17], age ≥ 80 years [18], arthroplasty revision [17], a history of hip instability [3], and a prosthesis implanted after fracture of the upper extremity of the femur [19]. The surgical indications are listed in Table 2.

Surgery was performed by a senior surgeon in 37 cases (56.1%). The approach was posterolateral, with reinsertion of the piriformis tendon. A Saturne™ (Amplitude, Valence, France) (Fig. 1) DMC was used in its cemented version. The acetabulum was prepared using reams of increasing size up to 2 mm greater than the cup diameter. Three anchorage studs were made. The cement was high-viscosity Palacos Gentalline™® (Heraeus, Werheim, Germany). The femoral stem was an Exafit™ (Zimmer, Winterthur, Switzerland) stem, with a thin femoral neck designed to minimize the contacts with the polyethylene insert [3]. A 28-mm-diameter head was used except with small-diameter cups (44 or 46 mm), which required a

Table 2
Initial surgical indications.

Indication	*n*	%
Hip osteoarthritis with osteoporotic bone	20	30.3
Revision for dislocating prosthesis[a]	19	28.8
Fracture of femoral neck	12	18.2
Revision for acetabular loosening	10	15.2
Migration of osteosynthesis material after fixation of proximal femoral fracture	5	7.6
Total	66	100.0

[a] Including two cases of bipolar prothesis revision.

Fig. 1. Saturne™ cement implant: metal-back in stainless steel with grit-blasted coating; anterior notch (preventing impingement with psoas tendon).

22.2-mm head. The indications for ceramic heads were hip osteoarthritis before the age of 75 years. The surgical data are detailed in Table 3. In case of prosthesis revision, the possibility of using an isolated cemented DMC was confirmed intraoperatively, if bone substance loss did not exceed stage IIc in the Paprosky classification [20]. Fig. 2 shows an example of revision due to loosening.

2.2. Evaluation methods

The patients underwent radiological and clinical follow-up at 3 months, 1 year, and then every 2 years. They were asked to attend another visit if the last follow-up visit had been more than 3 months before. The main evaluation criterion was the revision rate for aseptic loosening. Occurrence of dislocation, the infection rate, the Postel Merle d'Aubigné (PMA) functional score [21], and pain (numeric evaluation [NE], between 0 and 10) were also noted.

Only patients who had radiological follow-up more than 1 year after surgery underwent the final radiographic analysis, i.e., 42 hips

Table 3
Surgical data.

	n	%
Side	Right: 38	57.60
	Left: 28	42.40
Cup size (mm)		
44	3	4.50
46	3	4.50
48	12	18.20
50	17	25.80
52	13	19.70
54	5	7.60
56	9	13.60
58	3	4.50
60	1	1.50
Prosthesis head size (mm)		
22.2	9	13.60
28	57	86.40
Prosthesis head material		
Chrome-cobalt	40	60.60
Alumina	26	39.40
Morselized bone graft	Autograft: 1	1.50
	Allograft: 2	3.00