

Inefficacy of the cementation of femoral head collapse in glucocorticoid-induced osteonecrosis

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Abstract The objective of this paper was to assess the efficacy of cementation of the femoral head in stage III glucocorticoid-induced osteonecrosis. Ten hips (nine patients) were treated by the injection of low-viscosity cement to reduce the collapse. The follow up included clinical and radiological assessments preoperatively and at 3, 6 and 12 months after surgery. The visual analogue scale (VAS) score, the Lequesne index and the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) score did not show any significant improvement. Eight of the ten hips showed a worsening of the collapse and required total hip arthroplasty during follow up. The mean time before total hip replacement was 8.6 ± 7 months. The other two hips did not show any relapse of collapse nor

functional worsening at the maximum follow up of 5 years. Our results suggest that cement injection is not a treatment that should be proposed for glucocorticoid-induced osteonecrosis.

Résumé Objectif: Evaluer l'efficacité de la cimentation des têtes fémorales dans les ostéonécroses de stade III post cortisoniques. Méthode : 10 hanches (9 patients) ont été traitées par une injection de ciment à basse viscosité de façon à réduire le collapsus de la tête. Le suivi de ces patients a été à la fois clinique, radiologique avec une évaluation pré-opératoire à 3, 6, 12 mois après l'intervention. Résultats: le VAS, l'index de Lequesne et le score de WOMAC n'ont pas montré d'améliorations significatives. Sur les 10 hanches 8 ont vu leur collapsus s'aggraver et ont nécessité une arthroplastie totale de hanche. Le temps moyen avant la mise en place de cette prothèse a été de sept mois, les deux autres hanches n'ont pas présenté de récurrence ni d'aggravation fonctionnelle sur un suivi de 5 ans. En conclusion, l'injection de ciment n'est pas un traitement que l'on peut proposer dans les ostéonécroses cortisoniques.

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Introduction

Osteonecrosis (ON) of the femoral head due to corticosteroids therapy is a bone disease which can affect young patients [12]. Its late stages are characterised by a collapse of the femoral head due to subchondral fracture. The collapsed hip usually progresses to secondary osteoarthritis and requires total hip replacement. However, in patients receiving corticosteroids, the risk of complications after hip arthroplasty, such as osteolysis and loosening, is increased [15]. Therefore, alternatives to total hip arthroplasty should

be promoted. Different treatments have been proposed, including core decompression, osteotomy and vascularised bone grafts. Nevertheless, none of these treatments seem to be totally efficient, especially in the later stages of ON when collapse has occurred. The use of cement injection to restore the sphericity of the femoral head was proposed in ON due to sickle-cell disease [7] and in other cases with different aetiological factors [17]. The results presented were good, allowing postponement of total hip arthroplasty and providing immediate pain relief.

The aim of this study was to assess the effectiveness of cement injection in stage III glucocorticoid-induced ON.

Subjects and methods

The study has been approved by the ethics committee and has, therefore, been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. All persons gave their informed consent prior to their inclusion in the study.

Ten hips (nine patients) suffering from stage III ON of the femoral head according to the ARCO staging (presence of a collapse on X-rays) due to corticosteroid therapy were included in this study (Table 1). Among the nine patients, there were six men and three women with a mean age of 45 ± 16 years. All patients except one suffered from bilateral ON of the femoral head, as confirmed by magnetic resonance imaging (MRI). The controlateral hip was Ficat stage 1 in one patient, stage 2 in four, stage 3 in three and stage 4 in one patient. The time between the onset of pain ranged from 4 to 24 months. All patients except one had stopped their corticosteroid therapy for at least 4 months.

Preoperatively and at 3, 6 and 12 months after surgery, the patients were assessed for pain using the visual

analogue scale (VAS) and for hip function with use of the algofunctional index of Lequesne [8] and the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) [1]. Radiography of the hip was performed before surgery and 3 days, 3, 6, 12 and 24 months after surgery. The estimation of the evolution was made using the ARCO classification [5]. The use of the ARCO classification allows us to take into account the severity of the collapse (stage 3=crescent sign, stage 4=flattening of the articular surface), the area involvement (A: <15% of the entire articular surface, B: =15–30%, C:>30%) and the dome depression (A:<2 mm, B:=2–4 mm, C:>4 mm). At the outset, one hip was stage 3B, five were stage 3C and four hips, stage 4A. For the stage 3 hips, the dome of depression was stage B for five hips and A for one hip.

Operative technique

The patient is placed in a supine position and the anterior capsule of the hip is exposed by a Smith-Peterson approach, using a skin incision from about 7 cm behind the anterior superior iliac spine, along the outer lip of the iliac crest and down over the groove between the sartorius and tensor of fascia lata, as described by Hernigou et al. [7]. A capsulotomy is performed to expose the anterior part of the femoral head. A pin is then driven in from the anterior neck to reach the junction of the living bone and the necrotic segment. The leverage on this pin elevates the necrotic bone and reduces the collapse. The pin is removed and replaced by a cannula, through which Palacos low-viscosity cement (Heraeus, Hanau, Germany) is injected with a cement gun. The injection is completed when the shape of the femoral head is restored.

After the operation, the patient is encouraged to mobilise the hip, but weight-bearing is only permitted after 3 weeks.

Statistical methods

Analysis of variance (ANOVA) for repeated measures were used in order to investigate a possible change with time in the three response variables, i.e. the VAS score, the Lequesne index and the WOMAC index. Any missing data were replaced by the latest measured value.

Table 1 Patient data and staging of the hips

No.	Age	Side	ARCO stage	Dome depression	Controlateral hip Ficat stage	THP (months)
1	50	R	3C	0	3	3
2		L	3C	0	3	12
3	46	R	4A	<2 mm	3	6
4	58	R	4A	<2 mm	4	3
5	58	R	4A	<2 mm	Unilateral ON	6
6	24	L	3C	0	2	No
7	70	R	4A	<2 mm	1	12
8	35	R	3C	0	2	No
9	25	R	3B	0	2	3
10	40	L	3C	0	2	24
Mean	45					8.6
SD	16					7

THP=total hip prosthesis

Table 2 Clinical evolution (mean±SD)

Mean	VAS	Lequesne	WOMAC
Baseline	64±20	14±4	62±20
3 months	48±21	14±3	52±23
6 months	45±17	13±5	50±26
12 months	44±15	13±3	46±15

Results

Clinical assessment

Before surgery, the mean VAS score was 64 ± 20 mm. The mean VAS score was 48 ± 21 mm at 3 months, 46 ± 17 at 6 months and 44 ± 15 at 12 months, showing no significant improvement ($P=0.122$). Neither the Lequesne index ($P=0.685$) nor the WOMAC score ($P=0.153$) were statistically different at 3, 6 and 12 months after surgery compared to before surgery (Table 2).

Radiology

Preoperatively, all femoral heads showed a crescent line and a loss of sphericity. The hip radiographs taken 3 days after surgery showed recovery of the shape of the femoral head. At three months, 8 of the 10 hips showed a worsening of the collapse and required total hip arthroplasty during follow up: three at 3 months, two at 6 months. The mean time before total hip replacement was 8.6 ± 7 months. The other two hips did not show any relapse of collapse or functional worsening at the maximum follow up of 5 years.

Discussion

Osteonecrosis of the femoral head has a bad prognosis with a high percentage exhibiting severe functional impairment requiring total hip prosthesis [11]. The early stage is characterised by a necrosis of the subchondral bone with an intact overlying cartilage. This stage can be only detected by biopsy or, with a sensitivity of 100%, by MRI [6]. Treatments have been proposed with some success in the early stages to prevent fracture and collapse such as core decompression [2, 3, 9] or, more practical bone marrow grafting [4]. But once collapse occurs, practical treatments should avoid total prosthesis because, in comparison with osteoarthritis, the patients are younger and the rate of loosening is higher [15].

Two studies using cement injection have been published. The first study concerned 16 hips in ten patients suffering from sickle-cell disease [7]. The technique we used was the same, except for the period without weight-bearing: only 5 days instead of 3 weeks in our study. At a mean follow up of 5 years (range 3–7 years), 14 of the 16 hips were still improved. Only two hips had required total hip prosthesis.

The second study concerned 22 hips in 21 patients [17]. The aetiological factors were various, with 10/22 cases of steroid use. The operative procedure was different, with a more aggressive approach: detachment of the abductor anterior, luxation of the femoral head, a 6-mm core with a

debridement of dead bone and a bone dowel graft to close the hole after the injection of cement. Furthermore, cementation was made with high-viscosity cement in 12 hips and low viscosity cement in 10 hips. At the mean 1.7 years follow up, six hips (six patients) needed total hip prosthesis. The radiological staging of the cases revealed a relationship between extension of the necrotic area (stage C) and poor results.

Our results are clearly worse. The study was planned to include 30 hips, but the failures were so frequent that we decided to prematurely stop the trial.

Cementation seems to be an inappropriate treatment for glucocorticoid-induced ON. Such an aetiological factor is known to be a bad prognostic factor. The bone quality could explain the different results found between sickle-cell disease and steroid use: in sickle-cell disease, reactive bone is present, whereas in glucocorticoid-induced ON, there is some osteoporosis with a lack of osteoblastic reaction [16]. Another explanation of the contrary results obtained in those three studies could be differences in the status of the cartilage. We observed many chondral fissures or flaps during the open procedure in several cases. But the chondral lesions were not quantified as they were in the two other studies [7, 17]. Ficat stage 3 means a normal joint space on X-rays. Classically, it is assumed that cartilage is preserved until late stage 4. Some studies using arthroscopy reported the presence of chondral lesions, including flaps, fractures and loose bodies in the early stages, not diagnosed by X-rays nor by MRI, with the sequences classically used in ON [4, 10, 13, 14]. In future studies, the cartilage status needs to be assessed.

In conclusion, we suggest that cement injection is not a treatment that should be proposed for glucocorticoid-induced ON.

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