

ORIGINAL ARTICLE

Cementless acetabular component in coxarthrosis due to a acetabular fracture

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KEYWORDS

Hip;
Acetabular fracture;
Total hip arthroplasty;
Uncemented
components

Abstract

Objective: To evaluate the outcomes of cementless acetabular component for post-traumatic arthritis after acetabular fracture.

Material and method: A prospective study of twenty-four patients with a mean age of 56 years (range: 28-77) and a follow-up 8.4 years (range: 5-15) treated with cementless total hip arthroplasty. The time from fracture to total hip arthroplasty was 3 years (range: 5 months-14 years). The fracture had been treated conservatively in 15 cases and with internal fixation in 9 cases. A clinical assessment was made using with Harris hip score, along with radiology with special interest in the socket.

Results: Harris hip score increased from 35 points (range: 22-52) to 77 (range: 45-94). Unstable acetabular fixation was seen in 3 cases, 2 with osteolysis that required revision and 1 with a complete radiolucent line. The stem required revision in 1 case. There was 1 case of deep infection and 1 post-traumatic late dislocation. Survival for any cause at 12 years was 78.4%

Discussion and conclusions: There are few studies on this topic, and all with a small number of cases. Acetabular failure rate is higher than routine total hip arthroplasty for non-traumatic osteoarthritis. Cementless total hip arthroplasty is a suitable treatment for post-traumatic arthritis after acetabular fracture.

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PALABRAS CLAVE

Cadera;
Fractura de cotilo;
Prótesis total
de cadera;
Componentes no
cementados

Componente acetabular no cementado en coxartrosis por fractura de cotilo

Resumen

Objetivo: Valoración del componente acetabular no cementado en prótesis total de cadera por artrosis secundaria a fractura de cotilo.

Material y método: Estudio prospectivo de 24 pacientes con edad media de 56 años (rango: 28-77) y seguimiento medio de 8,4 años (rango: 5-15), que fueron tratados con acetábulo no cementado atornillado. El tiempo medio entre la fractura y la prótesis fue de

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tres años (rango: 5 meses-14 años). La fractura había sido tratada conservadoramente en 15 casos y con fijación interna en 9 casos. Se realizó valoración clínica con la escala de Harris y radiográfica, con especial interés en el acetábulo.

Resultados: La escala de Harris media se incrementó de 35 puntos (rango: 22-52) a 77 (rango: 45-94). Hubo tres aflojamientos de cotilo, dos con osteólisis que fueron revisados y uno con radiolucencia continua. El vástago femoral precisó revisión quirúrgica en un caso. Hubo un caso de infección profunda y una luxación tardía postraumática. La función de supervivencia de la artroplastia por cualquier causa a 12 años fue del 78,4%.

Discusión y conclusiones: Son escasos los estudios al respecto y todos con pequeño número de casos. La tasa de fallos acetabulares es superior que la tasa en los casos no traumáticos. La prótesis no cementada es un tratamiento adecuado para las secuelas de fractura de cotilo.

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Introduction

Acetabular fracture is a relatively rare injury with variable long-term outcomes. One of the primary late sequelae is post-traumatic coxarthrosis, seen in surgically treated displaced fractures as well as in conservatively treated non-displaced fractures.¹⁻³ This coxarthrosis may be due to the initial trauma itself, with bone or cartilage injury of the acetabular surface as well as the femoral head, or to avascular necrosis of the head, or else it may be due to a lack of articular congruence.

Total hip arthroplasty currently appears to be the most accepted solution for coxarthrosis;⁴ given that these cases usually involve young patients, however, there are the additional potential difficulties related to acetabular deformity, the presence of osteosynthesis materials, and bone quality after the fracture healing process.

We found few published series—some in which cemented acetabular components were used,⁵⁻⁸ with cementless components in the more current ones.⁹⁻¹² These were small series, generally, with 21 to 37 cases and a medium-term follow-up period; only one of them was prospective.¹⁰

Our objective was to complete a prospective evaluation of the results obtained with cementless acetabular components in a consecutive series of osteoarthritis secondary to acetabular fracture, with a minimum follow-up period of 5 years.

Materials and methods

In 1992, a prospective study was designed for treatment of coxarthrosis after acetabular fracture using cementless total hip arthroplasty. Given its low incidence, the inclusion criteria were all consecutive cases with acetabular fracture sequelae and indication for total hip arthroplasty. Exclusion criteria were contraindications to anaesthesia, non-acceptance of the informed consent, and follow-up of less than 5 years. The institution's CREC approved the project on the basis of ethics. All patients received information and gave their informed consent.

Between 1992 and 2005, 24 consecutive cases were enrolled in the study; no cases were excluded or lost in follow-up. There were 19 males and 5 females. The left side

was involved in 18 cases. All fractures were caused by moderate- or high-energy trauma; there were no cases of low-energy trauma.

According to Judet and Letournel,¹³ the types of fracture were 10 simple (8 posterior wall and 2 anterior column) and 14 associated (9 wall and posterior column, and 5 T-shaped). In 6 cases, there was an associated posterior dislocation of the hip, of which 5 were simple posterior wall fractures and 1 was an associated fracture of the wall and posterior column. Only 1 of the fracture-posterior dislocation cases presented with sciatic involvement due to the trauma.

Conservative treatment was employed in 15 cases with non-displaced or slightly displaced acetabular fracture; in 9 cases with displaced fracture, the patient underwent open reduction and osteosynthesis. A posterior approach was used in 7 of these 9 cases and an ilio-inguinal approach in the other 2 cases. The mean elapsed time between the trauma and implantation of the prosthesis was 3 years (range of 5 months to 14 years).

The mean age at the time of arthroplasty was 56.4 years (range of 28-77). In 13 cases, the sequela was coxarthrosis, and in 11 cases there was x-ray evidence of avascular necrosis of the head. Of these 11 cases, 3 were fracture-posterior dislocations, 4 were associated fractures of wall and posterior column without dislocation, and 4 were T-shaped fractures with protrusion of the head through the acetabulum.

All arthroplasties were performed in a laminar flow room using the modified Hardinge lateral approach.¹⁴ In all cases, porous titanium-coated, cementless, hemispheric acetabular implants were used. Because of chronological availability, the Vitalock model (Stryker, Mahwah, USA) was used, initially, in 18 cases; as of the year 2000, the Duofit model (Samo, Bologna, Italy) has been used in 6 cases. Supplemental fixation with screws was used in all cases—2 screws in 19 cases and 3 screws in 5 cases. Uncemented femoral rods, titanium with proximal porous coating, were used—initially Meridian (Stryker, Mahwah, USA) in 18 cases and then Duofit (Samo, Bologna, Italy) in 6 cases— and, in all cases, a 28-mm diameter metallic head and an ultra-high-molecular-weight polyethylene insert with 12° rim.

In preparation of the acetabulum, none of the cases required the previous osteosynthesis materials to be removed so that routine reaming of the cavity could be performed.

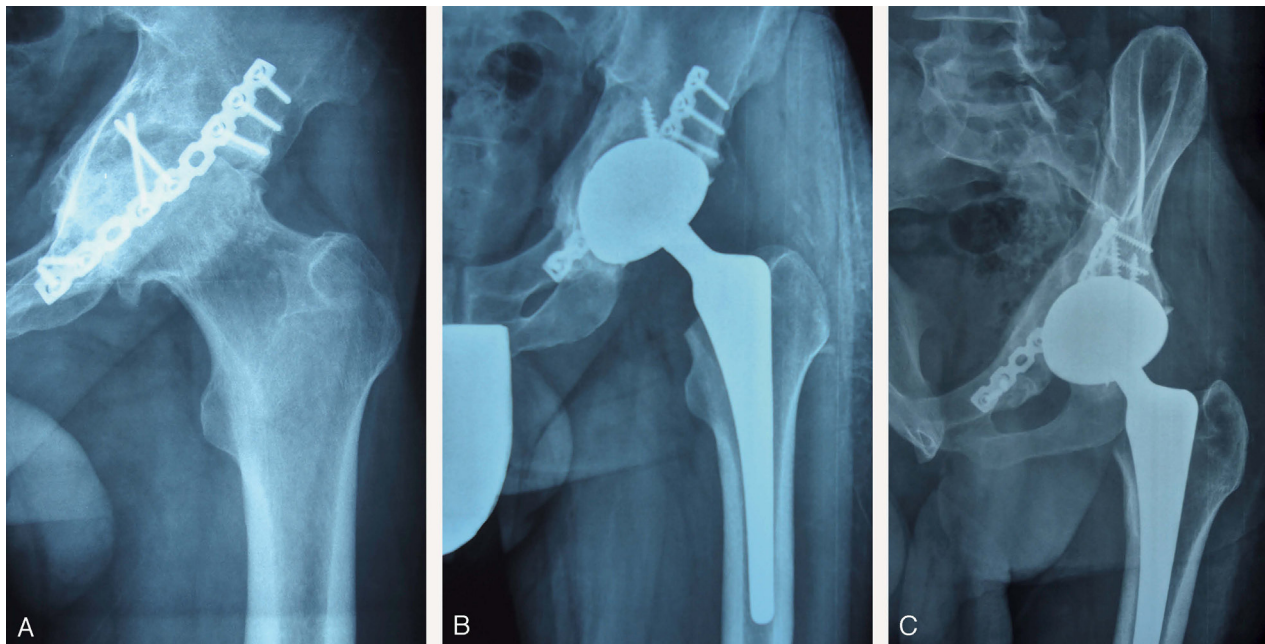


Figure 1 45-year-old male. A) Anterior-posterior x-ray of the hip. Coxarthrosis at 4 years after open reduction and synthesis of anterior column acetabular fracture. B) Anterior-posterior x-ray of hip, followed for 7 years after cementless total hip arthroplasty. Excellent results. C) Oblique x-ray of pelvis, followed for 7 years after cementless total hip arthroplasty. Excellent results.

There were no cases of pseudarthrosis and, therefore, no need of additional internal fixation. There were 4 cases with no significant acetabular bony defects. In those cases with bony defect, according to the AAOS classification,¹⁵ 5 were segmental, requiring no reconstruction; 6 were cavitory; and 9 were combined, with both types needing to be filled with impaction bone graft harvested from the femoral head removed. The combined defects did not require a structural graft to support the columns. The bone grafts were placed after reaming; then the acetabular component was impacted in a standard manner and checked for proper fit.

All patients received antibiotic prophylaxis (cephazolin 1 g IV prior to surgery and then another 3 doses every 8 hours) and thrombo-embolism prophylaxis (subcutaneous low-molecular-weight heparin until 30 days post-op) per standardized protocol.

Post-operatively, because there was proper acetabular fit in all cases, the standard total hip arthroplasty protocol was not modified: patients were sitting up in chair at 24 hours and began weight bearing with a walker as soon as the pain permitted (generally at 2 days post-op). They were using a cane at 15 days and were authorized to walk without assistance starting at 30 days.

All patients were evaluated clinically and by x-ray pre-operatively and then, post-operatively, at 3 months, at 6 months, at 1 year, and annually. The Harris score¹⁶ was used for the clinical evaluation, the results being classified as excellent (90-100 points), good (80-89), fair (70-79), or poor (69 or less).

X-ray evaluation consisted of anterior-posterior views of the pelvis and both hips, axial views of the affected hip, and CAT scan prior to the arthroplasty surgery. The DeLee and Charnley zones were used for the acetabulum.¹⁷ On the last x-rays, the acetabular component was evaluated for a possible

change of position with respect to those of the third post-operative month, using the measurements described by Martell et al.¹⁸ Acetabular fixation was classified into 3 types according to González Della Valle et al:¹⁹ bony fixation, if there were no radiolucencies, or they were incomplete and less than 1 mm, and no component movement of more than 2 mm or 2°; stable fibrous fixation, if incomplete radiolucent line of less than 2 mm, non-progressive, and no component migration; unstable fixation, if component migration, progressive, complete or incomplete, radiolucent line of more than 1 mm, or areas of osteolysis. In accordance with the Martell et al measurements,¹⁸ restoration of the hip centre of rotation was considered when the vertical or horizontal variations were less than 10 mm compared to the unaffected side.

The femoral component was evaluated in terms of the Gruen et al zones²⁰ and the fixation status per the Engh et al criteria.²¹ The degree of heterotopic ossification was determined per the Brooker et al classification.²²

Statistical analysis was performed with the SPSS program using the χ^2 test for qualitative variables and the independent Student's t-test for quantitative variables. The Spearman test was used for correlations. Survival function was calculated using the Kaplan-Meier method, with performance of or indication of the need for revision surgery, for any cause, considered to be the final event. *P* values equal to or less than .05 were considered significant.

Results

The mean follow-up period after total hip arthroplasty was 8.4 years (range: 5-15). There was no dependence between the type of sequela (coxarthrosis or avascular necrosis) and

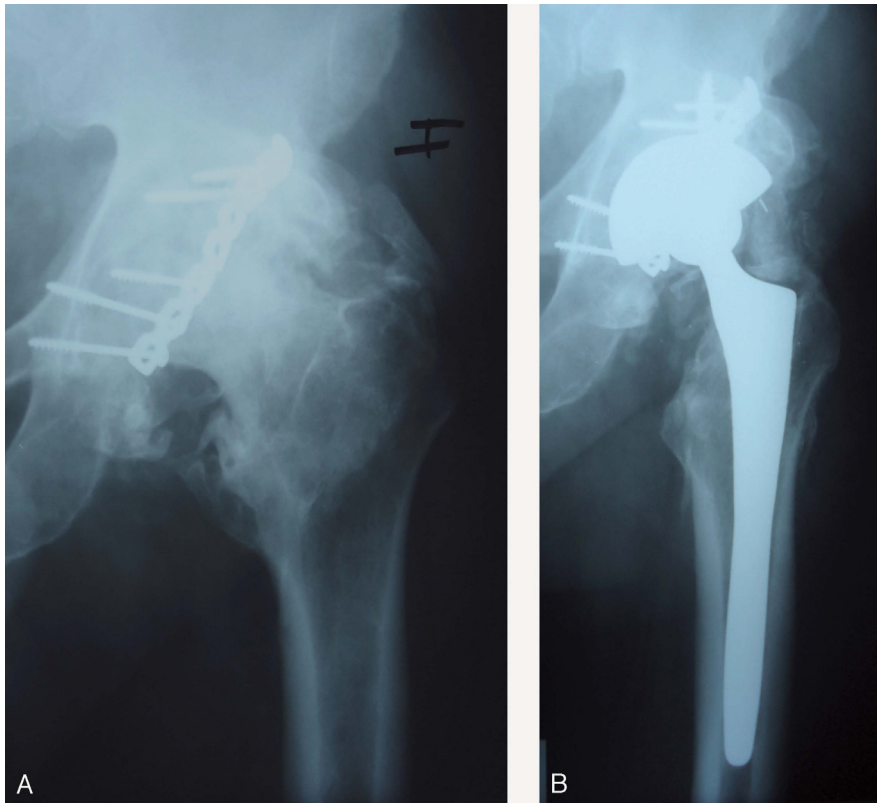


Figure 2 63-year-old male. A) Anterior-posterior x-ray of the hip. Coxarthrosis at 3 years after open reduction and synthesis of wall and posterior column acetabular fracture. Heterotopic ossifications grade III. B) Anterior-posterior x-ray of hip, followed for 6 years after cementless total hip arthroplasty. Heterotopic ossifications grade III. Fair results.

the type of acetabular fracture ($P=.56$), nor between avascular necrosis and hip dislocation ($P=.77$). The mean surgery time was 81 minutes (range: 65-96), with no significant difference between the types of previous treatment (orthopaedic or surgical) of the acetabular fracture ($P=.45$). In 4 cases, blood transfusion was required, usually 500 cc of packed red cells. No intra-operative or peri-operative complications were recorded.

The mean pre-operative Harris score was 35 points (range: 22-52); this was significantly increased at the last post-operative visit ($P=.001$) to 77 points (range: 45-94), with 3 excellent scores (fig. 1), 16 good, 1 fair, and 4 poor. Excluding 1 case of traumatic dislocation and 2 cases of acetabular loosening after at least 12 years, the final Harris score was 89 (range: 45-94).

There was no dependence between the final Harris score and the type of treatment for the acetabular fracture ($P=.06$); the type of acetabular fracture ($P=.92$); the type of acetabular defect ($P=.28$); the use of bone graft ($P=.21$); or the type of acetabular component used ($P=.81$). A significant relationship was found between the final Harris score and the age of the patient ($r=.676$, $P=.01$).

The case with the fair Harris score (75 points) was a 63-year-old male who was reporting mild pain with no limitation of activities; his acetabulum and rod were stable on x-ray, and there were type 3 heterotopic ossifications (fig. 2). Among the poor results, there was a case of a 50-year-old male with deep infection who required revision

at 6 months—the prosthesis pulling out and the patient rejecting the second time, thus remaining with a Girdlestone. In another case, a 30-year-old male experienced dislocation following a car accident at 20 months; this resulted in loosening of the acetabular component, which had to be replaced. A third case, a 45-year-old male, presented with periacetabular osteolysis at 15 years of follow-up, without migration, and the acetabular component was replaced. The fourth case, a 45-year-old male at 12 years post-op, presented with osteolysis and acetabular component migration along with loosening and variation of the rod, both components being replaced.

At the last evaluation, the acetabular component had a mean inclination of 43° (range: 30-60), mean height of 16 mm, and mean lateralization of 33 mm. The centre of rotation was restored in 19 cases, and the other 5 cases had variations greater than 10 mm. Besides the 2 cases with periacetabular osteolysis already described that underwent revision, there was another case of a 28-year-old male with incomplete and non-progressive 2-mm radiolucencies that did not require revision; in the end, he had a Harris score of 82 points. With the exception of the infection case, the remaining cases were stable with bony integration. There were no significant differences between the bony integration and the type of acetabular fracture ($P=.20$); the previous treatment of the fracture ($P=.21$); the acetabular defect found ($P=.16$); the use of a graft ($P=.70$); or the type of acetabular implant used ($P=.46$).

In terms of the femur, there was loosening of the two components in the case described above and in another case, which was not revised because the patient's Harris score at 12 years was 87 points. With the exception of the infection case, the remaining cases were stable with bony fixation. There were heterotopic ossifications in 2 cases, types I and III.

The mean arthroplasty survival at 12 years for any cause was 78.4% (CI 95% 86.4-69.2). Considering only aseptic causes, in the acetabular component it was 90.7% (CI 95% 88.3%-94.5%), and in the rod 93.8% (CI 95% 95.2-92.1).

Discussion

Some of the limitations of this study are that it gives no comparison with arthroplasty in non-trauma cases and that it uses 2 acetabular component models. Although the models were from different manufacturers, their composition and design were similar, and we found no significant differences between them in terms of results and complications. The strong points of the study were the duration of follow-up and the fact that it was prospective.

Despite advances in the treatment of acetabular fractures, post-traumatic osteoarthritis of the hip remains a significant sequela. Reconstruction of the hip via total arthroplasty after these fractures gives rise to certain difficulties and routinely has worse outcomes than in cases of non-traumatic osteoarthritis,⁵⁻¹⁰ primarily because these patients are younger and because of residual deformities, the presence of previous internal osteosynthesis materials, and changes in the quality of the acetabular bone bed.

The older studies were conducted on cemented acetabular components, and a high incidence of failures was reported, including loosening of the acetabular component, infection, and heterotopic ossifications.²³ Pomness and Lewallen⁶ used cemented components in 55 cases and found an incidence of acetabular complications that was 4 times higher (41% of loosening and 14% of revisions) than in prostheses implanted in non-traumatic osteoarthritis (3% of revisions). They concluded that the post-traumatic bone bed complicated acetabular preparation, making it likely that the components would be poorly oriented and positioned, and that being under 50 years of age was a risk factor. In a series of 66 cemented cases, Boardman and Charnley⁵ found a complications rate of 15%. Weber et al,⁷ in a 63-patient cemented acetabulum series, had mechanical failure in 25 cases and revision in 17 cases, indicating bone deficit as cause of the failure. Although it was a high rate of failures, all the authors believed that THA was a satisfactory treatment in this type of patient. A more recent study by Schreurs et al,⁸ of 20 patients with a mean age of 53 and mean follow-up of 9.5 years, reports improved results upon revising only 2 cases with impacted graft and cemented acetabular component.

The more modern cementless acetabular components appear to give better results. Huo et al⁹ studied 21 patients with cementless components, with a mean age of 52 years and mean follow-up of 65 months. They found that, compared with non-traumatic osteoarthritis, the surgery was more complex—with increased surgery time, greater

blood loss, and longer hospital stay—and reported 4 acetabular loosening on x-ray, though only 1 case required revision. Bellabarba et al¹⁰ studied 30 cases with screwed cementless acetabular component in patients with mean age of 51 years who were followed for an average of 63 months. They also reported that surgery time and blood loss were greater than in non-traumatic osteoarthritis but noted no differences with regard to previous treatment of the fracture, except that those treated with internal fixation had less bone deficit. They found acetabular radiolucencies in 67% compared to 41% in the non-post-traumatic, but only 3 patients presented with criteria for loosening. Berry et al¹¹ studied 34 cases using cementless components in patients with a mean age of 50 years and mean follow-up of 12 years. There was aseptic acetabular loosening in 4 cases that were revised. Panawat et al¹² studied 32 patients with a mean age of 52 years and mean follow-up of 4.7 years, using heterogeneous, screwed, cementless components. They found periacetabular radiolucencies in 5 cases; of these, 2 were revised, being associated with the lack of restoration of the centre of rotation, with variations of more than 20 mm. However, this lack of restoration was not related to the functional result.

Our results are similar to those of other authors who used cementless acetabular components and superior to those of studies in which cemented components were used. The surgery time in our series (81 minutes) was similar to that reported by Huo et al⁹ (97 minutes) and less than that of Bellabarba et al¹⁰ (179 minutes), possibly because we did not have to remove osteosynthesis materials. Complications in our series were somewhat less than those of others. Panawat et al¹² fall into the high rates of infection; in their series, however, there were patients who had had infection prior to implantation of the prosthesis. Our incidence of dislocations was very low, perhaps because we used an acetabular insert with 12° of elevation.

According to our results, cementless total hip arthroplasty is a satisfactory treatment for post-traumatic osteoarthritis of the acetabulum; however, in cases where removal of osteosynthesis materials or placement of a graft is required, the technique could be somewhat more laborious. We believe it is essential to restore the centre of rotation and to achieve good stability in the acetabular component through use of a bone graft when necessary.

Evidence level

Evidence Level IV.

Conflict of interest

The authors declare that they have no conflict of interest.

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