

ORIGINAL ARTICLE

Acute management of acetabular fractures by total hip arthroplasty using an anterior approach[☆]



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KEYWORDS

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Abstract

Introduction: Acetabular fractures in elderly patients present a therapeutic challenge, since their osteosynthesis may be hindered by comminution and poor bone quality. In certain cases, a good solution is acute total hip arthroplasty (THA) by direct anterior approach with or without minimal associated osteosynthesis. The objective of this study was to establish the indications and evaluate the clinical/functional, radiological results and complications, in the short and medium term, of acute THA using an anterior approach after acetabular fractures.

Material and methods: We analysed 15 patients collecting: demographic data, classification of fractures, surgical data, clinical/functional and evolutionary radiographic evaluation, together with perioperative complications.

Results: The mean follow-up of the patients was 40 months with a final functional assessment of 96.5 for Harris Hip Score, and Merle D'Aubigné excellent in 93%. The radiological controls were satisfactory without prosthetic loosening. Only 2 patients presented low-grade heterotopic calcifications. Ninety-four percent of the patients presented optimal postoperative recovery, with immediate loading. There was only one death for reasons unrelated to the surgery.

Conclusions: Given certain acetabular fractures, acute THA using a direct anterior approach in the supine position and under scope control with a revision cup plus associated minimal osteosynthesis, if necessary, facilitates adequate fracture stabilisation with full functional recovery of the patient with immediate loading and excellent results in the short and medium term with minimal complications.

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PALABRAS CLAVE

Acetábulo;
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Anterior

Manejo agudo de las fracturas acetabulares mediante artroplastia total de cadera con abordaje anterior**Resumen**

Introducción: Las fracturas acetabulares en pacientes de edad avanzada presentan un reto terapéutico, ya que su osteosíntesis puede estar dificultada por la conminución y la mala calidad ósea. En determinados casos, una buena solución es la artroplastia total de cadera (ATC) aguda por vía anterior directa, con o sin mínima osteosíntesis asociada. El objetivo de este estudio es establecer las indicaciones y valorar los resultados clínico-funcionales, radiológicos y complicaciones, a corto y medio plazo, de la ATC aguda mediante abordaje anterior tras fracturas acetabulares.

Material y métodos: Analizamos a 15 pacientes, de los que recogimos: datos demográficos, clasificación de las fracturas, datos quirúrgicos, evaluación clínico-funcional y radiográfica evolutiva, junto con complicaciones perioperatorias.

Resultados: El seguimiento medio de los pacientes ha sido de 40 meses con una valoración funcional final de 96,5 para Harris Hip Score y de excelente para Merle D'Aubigné (93%). Los controles radiológicos fueron satisfactorios, sin aflojamientos protésicos. Solo 2 pacientes presentaron calcificaciones heterotópicas de bajo grado. El 94% de los pacientes presentó una óptima recuperación posquirúrgica, con carga inmediata. Solo se observó un fallecimiento por causas no relacionadas con la cirugía.

Conclusiones: Ante determinadas fracturas acetabulares, la ATC aguda con abordaje anterior directo en decúbito supino y bajo control de escopia con un cotilo de revisión más osteosíntesis mínima asociada, si precisa, nos facilita una adecuada estabilización de la fractura, con recuperación funcional completa del paciente, con carga inmediata, excelentes resultados a corto y medio plazo y mínimas complicaciones.

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Introduction

In recent years there has been an increase in the rate of low energy acetabular fractures in elderly patients. This may be explained by the increase of mean age in the population (higher number of osteoporotic patients in good physical shape).¹

In these patients these fractures pose a high therapeutic challenge for the orthopaedic surgeon,² since they present with poor bone quality, a fracture line which is usually complex (often affecting both columns or with an anterior line associated with a transverse one, that is usually the most frequent occurrence), a certain degree of impaction of the femoral or acetabular head, associated fracture of the femoral head (frequently hidden) and associated comorbidities.³

As a rule treatment strategies have been highly varied and without consensus regarding indications.⁴

Conservative treatment with bed rest until fracture consolidation (with or without traction) is sometimes used, or even with deambulation, depending on pain tolerance. Different studies have demonstrated how non surgical treatment of acetabular and femoral fractures (aetiologically and pathologically similar to acetabular fractures) increases mortality, and in cases of survival, the secondary hip pain will eventually require a total hip arthroplasty (THA) (up to 18% of the acetabular fractures in patients over 60 will require conversion to THA after 2 years).⁵

However, surgical treatment with reduction and osteosynthesis which offers favourable outcomes in young patients,¹ would not be suitable to elderly patients due to the before mentioned complications.⁶

Another option which has recently increased its popularity is acute THA. Different authors refer to rapid recovery in these patients.⁷

The standard approach has always been posterolateral,⁸ but recent popularisation of the anterior supine intermuscular (ASI) approach we believe may offer additional advantages both for reduction and patient recovery, with a major reduction of possible complications.

The objective of this study was to establish and assess the clinical and functional outcomes, postsurgical complications and radiological results, in short and medium term follow-up, of acute treatment with ASI type THA in a series of cases of elderly patients with acetabular fractures.

Material and methods

We conducted a retrospective review of patients who presented with acetabular fractures between July 2007 and August 2016 in the Hospital La Fe, Valencia. Out of a cohort of 186 patients, 95 were excluded with acetabular fractures treated conservatively, 38 patients were excluded for having been treated with open reduction and osteosynthesis and another 38 who, after an initial conservative period, had been subsequently treated with THA. Finally, 15 patients



Figure 1 Gull sign in left acetabulum (compromise of the posterior column with marginal impaction).

received treatment with acute THA during their hospital stay.

Initial diagnosis of the fracture was made in the emergency department area of our hospital using imaging studies (X-rays and CT).

Iconographic tests, clinical files and examination were used to assess whether our criteria for treatment with acute THA were met:

1. Patients met with some of the factors defined as poor prognosis for open reduction and internal fixation: comminution, severe impaction or erosion of the joint surface, gull sign (Fig. 1), and associated fracture of the femoral head or neck.³
2. Fracture due to bone fragility (low energy impact, osteoporosis).
3. American Society of Anaesthesiologists (ASA) \leq level 3.
4. Existence of previous osteoarthritis of the hip.

Patients' baseline characteristics were collected which included gender, age, ASA classification, production mechanism and type of fracture (Appendix Table 1). The Judet-Letournel⁹ classification was used to assess fracture pattern.

With regard to the surgical characteristics, all patients were treated from the beginning at the same hospital, with the same surgical protocol, and by 2 surgeons who were experienced in hip operations. The approach in the majority of cases was ASI¹⁰ in the supine position, with which our surgical team is greatly experienced. It should be noted that in one patient a somewhat wider variation of this approach was used in order to associate minimal additional osteosynthesis to achieve greater reduction and stabilisation of the fracture. In another patient, due to the fracture pattern, it was necessary to use a double approach (prior posterior approach to stabilise the exaggeratedly displaced posterior column). During surgery the hip was not dislocated in any case at any time so as not to increase displacement of the columns. To do this the neck was previously osteotomised and the femoral head extracted with the help of the corkscrew femoral head extractor.

In all cases a total hip prosthesis with Pinnacle Grip-tion impacted oversized revision cup (with tangential fixing screws on the inside and radial locking screws on its edges) and Corail cementless stem (DePuy Orthopaedics EME, Johnson & Johnson Medical Limited) were used. In 6 cases it was necessary to use additional minimal osteosynthesis (cannulated screws) as the necessary primary stability for insertion of the cup was not observed.

Regarding the revision acetabulum, we would highlight that it offers the advantage of presenting multiple orifices with radial locking and tangential screws and a surface with a higher grip coefficient. This facilitates both primary reconstruction and fixation in this type of fracture, as it acts like osteosynthesis material. To offer greater stability to the cup the acetabular cavity was filled with milled autogenous bone graft from the patient's femoral head: the fracture lines, possible cavity defects and associated segmental points were filled.

Regarding surgical bleeding, this was assessed by haemoglobin (Hb) and haematocrit values, both presurgically and postsurgically. There was also a need for transfusion of red blood corpuscles during the hospital stay.

Patient follow-up was undertaken in the hip unit of our hospital. With clinical and functional evolution being assessed in addition to radiologic control one month after surgery and then after 3, 6 and 12 months. After this, follow-up was annual (Appendix Table 2).

Functional outcome was assessed using dichotomous criteria of whether the patient required assistance from a walker/stick for deambulation and using the Harris Hip Score (HHS) and Merle D'Aubigné scales.

Results

Demographically mean age was 63 years (standard deviation [SD] of 10.9 years). With regards to gender, there was a slight predominance of men at 60%. The ASA of the patients was found in all cases within the 2–3 range. Production mechanism was low energy in 80% of patients.

The most common fracture patterns according to the Judet-Letournel⁹ classification were those which involved both columns (46%) and "T" fractures (26%).

Regarding surgical bleeding, postsurgical Hb control values were obtained which were very similar to those present in total primary hip prosthesis surgery (with a mean Hb value of 9). Only 2 patients required a blood transfusion during the postsurgical period.

After surgery, 93% of patients obtained good primary stability of fixture, and were therefore authorised from day one to stand up with total or partial weight-bearing, with the help of a walker or crutches.

Mean hospital stay was 15 days (with SD of 6.11 days). It is of note that delay in waiting for operation to be programmed was what considerably increased the mean.

All the patients were discharged with analgesic treatment and antithrombotic therapy with low molecular weight heparin for 30 days.

Immediately following surgery only in one case (6.66%) did a complication arise. Despite the instructions to rest and for initial axial non weight-bearing (due to initial not totally satisfactory stability), the patient did walk, and had an acci-

dental fall. They presented with a cup mediatisation, but there was no displacement of the fracture line, or apparent loosening or dislocation. Conservative treatment was administered with total non weight-bearing by the patient for a month, with no further complications and a subsequent satisfactory clinical evolution.

Mean patient follow-up was 40 months, with a range of 20–130 months. The final mean HHS was 96.2 (with a SD of 4.3) (Fig. 1) and *Merle D'Aubigné score* as "excellent" for 93% of the patients. Both results may be marked within the range of excellent regarding functional recovery of patients, who often went back to the activities of their lives prior to the fracture. Lastly, only 2 patients required assistance in walking outside the home, one with sticks and another with a walker (more due to apprehension of fearing a second fall).

No intraoperative or postoperative fracture, dislocation or nervous condition, vascular complication or postsurgical infection was detected. An early death occurred, due to causes unrelated to the orthopaedic disease.

Regarding radiologic assessment and follow-up, there was no stem subsidence or varus or valgus displacement or any misplacement of the cup component (except the patient who presented with acetabular component medialisation). In 100% of cases the acetabular component was fixed intraoperatively in accordance with the Lewinnek safety criteria (they were fairly precise and constant about this, with the aid of intraoperative fluoroscopy).

Only 2 patients of the series (13.3%) presented with grade II heterotopic calcifications, according to the Brooker¹¹ classification (patient nos. 3 and 8), but there was no worsening of clinical and functional abilities in any case nor was there any need for any type of additional treatment as a result. In 100% of cases dysmetry was below 5 mm (except in the case of the additional fall).

Discussion

Acetabular fractures with poor associated prognostic factors such as low energy fractures due to bone fragility (osteoporosis), major comminution, severe impaction or erosion of the joint surface, gull sign, fracture associated with the femoral head or neck, pre-existing osteoarthritis,^{3,6,12} which require reduction surgery and osteosynthesis will present frequent complications in the short and medium term and high morbidity.^{4,13} This is mainly due to the impossibility of axial loading on the affected limb, with prolonged non weight-bearing which would last for several weeks and even months,¹⁴ due to compromised attachment and a poor primary stability.

If they also require secondary rescue surgery for total secondary hip prosthesis we must take into account that the outcomes will not be as satisfactory as those of the conventional primary THA.^{6,12,15}

As a result, at present there is a tendency to stabilise these fractures with more or less conventional minimal osteosynthesis and insert a total hip prosthesis in the conventional manner during the same operation.¹⁶ However, this means performing 2 consecutive operations in the same surgical act and often moving the patients from supine to lateral position. All of this may cause associated morbidity, and particularly in elderly patients.

The direct ASI type anterior approach enables fracture stabilisation (non reduction) during this same approach with cannulated screws, the spongy stem and oversized revision prosthetic cup, which acts as an internal fixation plate of the acetabulum with abundant tangential and radial screws. Morbidity is very low and highly acceptable postoperative stability ensues, with a postoperative evolution which, except in highly comminuted fractures, is very similar to that of the standard primary prostheses using anterior approach.

The objectives of this acute THA will be to:

- Minimise the approach and time in surgery.
- Avoid complex operations with insufficient reduction and fragile osteosynthesis.
- Obtain adequate fracture stabilisation (non reduction) for accurate final fitting.
- Achieve early deambulation of the patient with immediate weight-bearing, preventing possible early complications.

In order to achieve all of these objectives we used the direct ASI approach, under scope control, since this assisted us in both stabilisation and prosthetic attachment.¹⁰

This approach is performed through an intermuscular and internervous plane, which leads to muscle preservation with secondary improvement of stability (reducing the risk of dislocation). Furthermore, it presents a postoperative evolution with minimal pain, a reduced hospital stay and a highly satisfactory clinical evolution. Similar results already appear reflected in the literature when this approach is used for primary THA.^{17,18}

A key aspect of this type of approach is its comfortable use of radioscopy, which is of great value both intraoperatively and for the final result of the fitting, as the patient who is in a supine position on the operating table is easily accessed (AP projections, inlet, outlet). This is crucial to ensure accurate reduction and insertion of prosthetic materials.

Another major advantage of this ASI approach is the fact it allows us to have a much better view of the fracture lines and the different fragments involved, and to manage them (either directly or indirectly).

Malhotra et al.¹⁹ already mentioned in their study that the posterior approach aided fracture reduction of posterior walls, but we should bear in mind that the most prevalent fractures in these patients are anterior, and we therefore believe that in these cases, the ASI approach would be a much better choice.

The majority of studies reflected in the literature for treating this type of patients with acetabular fractures with acute THA refer to the use of a posterior approach, with numerous early complications.^{8,19} Mears¹⁵ in his series of 57 patients uses the acute THA with posterior approach, but with a non weight bearing period of 6 weeks. Capone et al.⁷ mention good outcomes in THA using the posterior approach with regards to open reduction and internal fixation, but with a high number of complications. Ortega-Briones et al.,¹⁶ report using a posterior approach in a similar study to ours regarding population, number of patients, results and follow-up, also with a short initial period of non weight-bearing.



Figure 2 Patient for whom THA was used together with a cannulated screw to improve fixation and stability of the system.

Rickman et al.⁸ already postulated that there is no reported long series in the literature where acetabular fractures are treated surgically and where immediate weight-bearing is permitted. In this same article, they use the Kocher–Langenbeck posterior approach and confirm the importance of achieving early loading to achieve a faster patient recovery.

In our series, deambulation was permitted in all but one case with weight-bearing 24–48 h after surgery.

Rickman⁸ presents a mean hospital stay of 18 days, which is similar to the 15 days we obtained in our patient group, but it should be noted the majority of these days were taken up by waiting for surgery to be programmed since the post-operative period of the series was mostly 2–3 days, after which the patient was discharged and sent home.

We found no current studies showing outcomes from acetabular fractures treated with acute THA with ASI approach.

In certain cases we were forced to use minimal osteosynthesis to improve the stability of the fitting.

In the majority of them, 6.5 mm diameter cannulated screws were used. When the fracture presented with criteria of instability compromising the final stability of the final acetabular component these screws were used. Similarly to Salama et al.,²⁰ in these cases the outcome was still as excellent as with the remaining patients (Fig. 2).

In the evolutional follow-up, from a functional viewpoint we found there were good and excellent scores and these were similar to those published in the literature, both in the HHS and the *Merle D'Aubigné score*.²¹

With regard to radiographic follow-up, we only observed a medial displacement of the acetabular component in one patient, who immediately after the operation had several falls in their home, and did not heed previously given medical indications.

In 2 cases heterotopic calcifications were observed (common in this type of pain) which did not interfere in the clinical perception of the patients. Tippets et al.²² assessed the rate of this heterotypical ossification in patients with primary THA through an anterior approach, which was 40%, much higher than ours.

This study suffers from some limitations, such as the fact it is retrospective and presents with a relatively low final patient number. On the one hand, this may be justified by the low incidence of these cases and on the other, by the difficulty in finding patients who meet all the inclusion criteria for this type of treatment.

Conclusions

To conclude, early use of THA with an ASI type approach and under intraoperative scope control is a valid option for the management of certain acetabular fractures which have a poor prognosis, because it offers us the ability to improve final stability, with excellent immediate postoperative outcome due to the stability gained. This leads to early weight-bearing of the affected limb in all patients, reduced morbidity and greater simplicity.

In the short and medium term follow-up clinical and functional outcome and X-rays have been satisfactory and promising, with a low rate of unremarkable complications.

However, apart from appropriate and meticulous presurgical planning, we believe that previous extensive experience is required regarding both the type of approach and treatment of these pelvic-acetabular fractures.

Further, more numerous multi-centre studies are needed to compare treatments in order to shed greater light on this expanding issue.

Level of evidence

Level of evidence III.

Conflict of interests

The authors have no conflict of interests to declare.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.recote.2018.07.013>.

References

1. Ferguson TA, Patel R, Bhandari M, Matta JM. Fractures of the acetabulum in patients aged 60 years and older: an epidemiological and radiological study. *J Bone Joint Surg Br.* 2010;92:250–7.
2. Letournel E, Judet R. In: Elson RA, editor. *Fractures of the acetabulum*. Berlin, Heidelberg: Springer Berlin Heidelberg; 1993.
3. Butterwick D, Papp S, Gofton W, Liew A, Beaulé PE. Acetabular fractures in the elderly: evaluation and management. *J Bone Joint Surg Am.* 2015;97:758–68.
4. Daurka JS, Pastides PS, Lewis A, Rickman M, Bircher MD. Acetabular fractures in patients aged >55 years: a systematic review of the literature. *Bone Joint J.* 2014;96-B:157–63.
5. Jain R, Basinski A, Kreder HJ. Nonoperative treatment of hip fractures. *Int Orthop.* 2003;27:11–7.
6. Henry PD, Kreder HJ, Jenkinson RJ. The osteoporotic acetabular fracture. *Orthop Clin North Am.* 2013;44:201–15.

7. Capone A, Peri M, Mastio M. Surgical treatment of acetabular fractures in the elderly: a systematic review of the results. *EFORT Open Rev.* 2017;2:97–103.
8. Rickman M, Young J, Trompeter A, Pearce R, Hamilton M. Managing acetabular fractures in the elderly with fixation and primary arthroplasty: aiming for early weightbearing. *Clin Orthop Relat Res.* 2014;472:3375–82.
9. Judet R, Judet J, Letournel E. Fractures of the acetabulum: classification and surgical approaches for open reduction. Preliminary report. *J Bone Joint Surg Am.* 1964;46:1615–46.
10. Den Hartog YM, Mathijssen NM, Peters SJ, Vehmeijer SB. The anterior supine intermuscular approach for total hip arthroplasty: reducing the complication rate by improving the procedure. *Hip Int J Clin Exp Res Hip Pathol Ther.* 2015;25:28–33.
11. Medina-Gálvez N, García-Manzanares MD, Pedraz-Penalva T, Tornero-Jiménez D, Sunyer-Catlà M, González-Martínez R. Actualización sobre el diagnóstico y tratamiento de la osificación heterotópica. *Rehabilitación.* 2008;42:34–43.
12. Pagenkopf E, Grose A, Partal G, Helfet DL. Acetabular fractures in the elderly: treatment recommendations. *HSS J.* 2006;2:161–71.
13. Aigner R, Hellige R, Knippel S, Oberkircher L, Ruchholtz S, Buecking B. Internal fixation of acetabular fractures in an older population using the TIMI approach – midterm results of a prospective study. *Injury.* 2017;48:890–6.
14. Bellabarba C, Berger RA, Bentley CD, Quigley LR, Jacobs JJ, Rosenberg AG, et al. Cementless acetabular reconstruction after acetabular fracture. *J Bone Joint Surg Am.* 2001;83-A:868–76.
15. Mears DC. Surgical treatment of acetabular fractures in elderly patients with osteoporotic bone. *J Am Acad Orthop Surg.* 1999;7:128–41.
16. Ortega-Briones A, Smith S, Rickman M. Acetabular fractures in the elderly: midterm outcomes of column stabilisation and primary arthroplasty. *BioMed Res Int.* 2017:2017.
17. Berend KR, Kavolus JJ, Morris MJ, Lombardi AV. Primary and revision anterior supine total hip arthroplasty: an analysis of complications and reoperations. *Instr Course Lect.* 2013;62:251–63.
18. Miller LE, Gondusky JS, Bhattacharyya S, Kamath AF, Boettner F, Wright J. Does surgical approach affect outcomes in total hip arthroplasty through 90 days of follow-up. A systematic review with meta-analysis. *J Arthroplasty.* 2018;33:1296–302.
19. Malhotra R, Singh DP, Jain V, Kumar V, Singh R. Acute total hip arthroplasty in acetabular fractures in the elderly using the octopus system: mid term to long term follow-up. *J Arthroplasty.* 2013;28:1005–9.
20. Salama W, Mousa S, Khalefa A, Sleem A, Kenaway M, Ravera L, et al. Simultaneous open reduction and internal fixation and total hip arthroplasty for the treatment of osteoporotic acetabular fractures. *Int Orthop.* 2017;41:181–9.
21. Mears DC, Velyvis JH. Acute total hip arthroplasty for selected displaced acetabular fractures: two to twelve-year results. *J Bone Joint Surg Am.* 2002;84-A:1–9.
22. Tippets DM, Zaryanov AV, Burke WV, Patel PD, Suarez JC, Ely EE, et al. Incidence of heterotopic ossification in direct anterior total hip arthroplasty: a retrospective radiographic review. *J Arthroplasty.* 2014;29:1835–8.