

Case report

Successful Treatment of an Osteoporotic Posterior Fracture-Dislocation of the Hip in a Low-Resource Setting Using the Combined Hip Procedure

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ABSTRACT

The prevalence of osteoporotic acetabular fractures and fracture-dislocations of the hip is increasing worldwide. These injuries are difficult to treat, and outcomes using traditional methods of osteosynthesis have been generally disappointing. Currently, there is debate about the management strategies with no widely held consensus on which technique is best. Studies from tertiary centers in North America and Europe have reported excellent results using the “combined hip procedure” which merges osteosynthesis and acute hip arthroplasty to treat these challenging fractures. As our population ages, these injuries are likely to occur more commonly in the developing world. We describe a case of an 80-year-old man who sustained a posterior fracture-dislocation of his hip and underwent successful treatment using the combined hip procedure in a low-resource setting.

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Introduction

The elderly population in the developing world is increasing, and it is predicted that by the year 2050, twenty per cent would be aged 60 years or older [1]. This vulnerable group is at an increased risk of falls and osteoporotic hip fractures, estimated to reach 6.3 million cases worldwide by 2025 [2]. Less noticeable has been the parallel yet understudied increase in osteoporotic acetabular fractures. Recent studies have shown an increased incidence of acetabular fractures in the elderly, which now comprise up to 20% of all osteoporotic fractures [3–5]. Treatment strategies have traditionally alternated between conservative management and open reduction internal fixation (ORIF), both of which have produced inconsistent outcomes and frequently result in the need for total hip arthroplasty (THA) [6–9].

Poor clinical results, wide practice variation, and the lack of consensus have prompted some surgeons to advocate for the combination of ORIF and acute THA, the so-called combined hip procedure (CHP), to improve outcomes [10–13]. Previous reports on the CHP have originated from specialized units in developed countries, which have resources far greater than those in the developing world. Low-resource health-care settings are often deficient in infrastructure, materials or supplies, and human resource. Surgeons working under these conditions face fundamental challenges especially when treating complex injuries that require subspecialist training or implants. However, broad management strategies for treating osteoporotic acetabular fractures should apply to any health-care system.

We describe the case of an 80-year-old man who sustained a posterior fracture-dislocation of his hip, which was successfully treated with a CHP in a low-resource setting.

Case history

The patient is an 80-year-old man who fell while walking through his 5-acre cocoa estate and was brought to the accident

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and emergency department. At presentation, his right lower limb was observed to be mildly internally rotated and shortened with intact pedal pulses and a normal neurological examination. Radiographs and an axial computerized tomography scan confirmed that he had sustained a posterior fracture-dislocation of his right hip, with comminution of the rim and one major fragment (Thompson and Epstein Type III) (Figs. 1a, b and 2). The patient underwent immediate closed reduction under general anesthetic, and his leg placed in light skin traction. His medical history was complicated by hypertension, atrial fibrillation, and a transient ischemic attack. He also had a dual-chamber pacemaker and was on multiple drugs, including dabigatran (Pradaxa; Boehringer Ingelheim Pharmaceuticals Inc., Biberach, Germany) and aspirin.

Using a shared decision-making model in consultation with the cardiology and internal medicine specialists, we discussed the treatment options with the patient. In spite of his complicated cardiac history, the patient maintained a very active lifestyle, and in addition to long walks, he also played golf twice weekly. Collectively, it was felt that he would benefit from a single definitive operation that would allow early full weight-bearing ambulation. The risks and benefits of acetabular fixation and immediate total hip replacement were explained to the patient, who gave informed consent for surgery, including the use of his deidentified information for this article.

In theater, the patient was anesthetized using a combined spinal-epidural anesthetic technique and placed in the lateral decubitus position. We used a Kocker-Langenbach surgical approach to access the hip joint, taking care to protect the sciatic nerve throughout the procedure. After exposing the hip, we noted that the short external rotators were completely avulsed from their femoral attachment along with multiple acetabular fragments. Upon dislocation of the hip, the femoral head was observed to have a deep chondral injury on its posterolateral aspect.

The femoral head was osteotomized, which allowed an unobstructed view of the acetabulum and facilitated its reconstruction. We used 2 3.5-mm cortical screws to reattach the main acetabular fragment, and a seven-hole reconstruction plate was contoured and placed along the posterior rim to buttress the fragment. The femoral head was used as morselized autograft to fill any cavity defects on the nonarticular side.

The acetabulum was then prepared in routine fashion taking care to avoid overreaming of the floor. A 54-mm multihole R3 acetabular shell (Smith and Nephew, Memphis, TN) was impacted, parallel to the transverse acetabular ligament in approximately 40°



Figure 2. Axial computerized tomography scan of the right hip showing a displaced fracture of the posterior acetabular wall.

of abduction and 15° of anteversion. Five screws were used to augment the shell, ensuring that their placement did not destabilize the acetabular reconstruction. Femoral preparation proceeded in a routine fashion, and a No. 14 uncemented Synergy stem (Smith and Nephew, Memphis, TN) was implanted with a standard 36-mm cobalt-chrome femoral head. The joint was taken through a full range of movement to confirm the stability of both the hip joint and the acetabular reconstruction. The wound was closed in a routine fashion with repair of the posterior capsule and external rotators.

The patient was sent to the high dependency unit for 48 hours, where he had an uneventful recovery. Postoperatively, he reported mild pain and had no neurological deficits. His postoperative radiographs were satisfactory, and we allowed him to ambulate fully weight-bearing with a walker while maintaining standard hip precautions. The patient made rapid progress and was discharged home 5 days after surgery.

He was followed up in the clinic at 2 weeks, 6 weeks, 3 months, and 1 year from surgery. At his annual follow-up, he reported no hip pain but used a cane while walking. Although he returned to

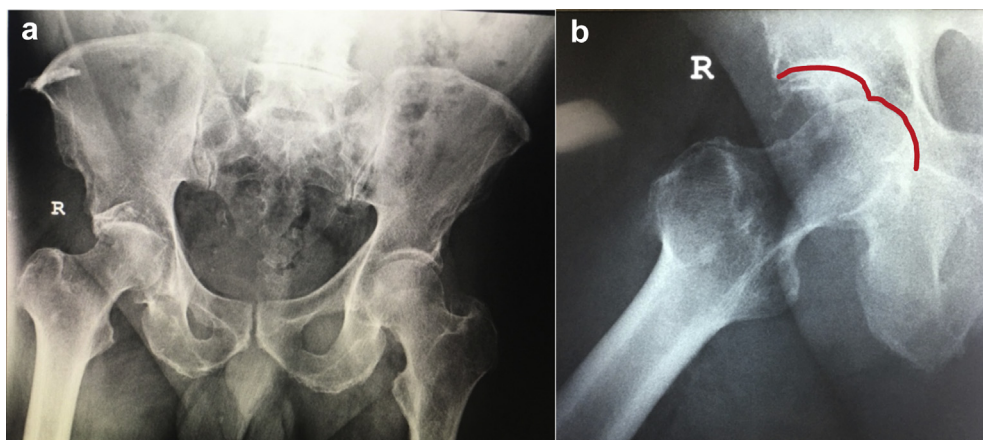


Figure 1. Initial anteroposterior radiograph (a) and lateral radiograph (b) in accident and emergency demonstrating the Gull-wing sign (red) pathognomic of a posterior wall fracture and subluxation of the femoral head.

walking on his estate, the current coronavirus disease 2019 (COVID-19) restrictions did not allow him to restart golf. Physical examination demonstrated an excellent range of hip movement, and his Oxford Hip Score and EuroQoL 5 Dimensions were 44 and 0.843, respectively. Radiographs confirmed solid union of the acetabular fracture, and all implants were noted to be stable (Fig. 3a and b).

Discussion

Worldwide, falls are the leading cause of trauma in the elderly. A recent cross-sectional study from Trinidad and Tobago reported that 94.7% are low-energy injuries associated with osteoporotic fractures [14].

Several epidemiological studies have reported an increase in the incidence of osteoporotic pelvic fractures sustained in elderly patients [15–17]. Ferguson et al., in a retrospective review of medical records over a 27-year period, found that the percentage of acetabular fractures in patients older than 60 years increased from 10% to 24% [17]. Furthermore, Central Statistical Office data from Trinidad and Tobago predicts that by 2050, 28.2% of the population will be aged 60 years or older [18]. With a growing elderly population and the increasing incidence of osteoporotic acetabular fractures, there is a need to examine the treatment of these injuries in greater detail.

Most osteoporotic hip fractures are due to falls which occur indoors. This finding is supported by a prospective observational study conducted in Trinidad, which reported that 86.3% of elderly patients fell in their homes [19]. The inability to protect themselves while falling results in patients “tipping over” onto their side sustaining either hip fractures, lateral compression pelvic injuries, or anterior wall/column acetabular fractures produced by the medially directed force along the anteverted femoral neck [4,17,20].

Our patient demonstrates several typical features; he is an octogenarian and fell from a standing height, both of which are common for this type of injury. Noteworthy, however, are his atypical features. First, he fell on his cocoa estate, having already walked several miles. Second, his injury pattern of a posterior acetabular wall fracture and hip dislocation is seen more commonly in younger patients, consistent with a forward fall onto a flexed knee [20]. Given his high activity levels and physiologically younger age, we felt that this patient would benefit from the CHP.

Debate continues about the best strategies for the management of acetabular fractures in the elderly. Nonoperative treatment leads to generally poor results, especially with comminuted posterior wall

fractures, as in this case [21]. Conventional open reduction and internal fixation (ORIF) is the most commonly used treatment method; although good outcomes have been found after anatomical reduction in young patients, these results have not been reproduced in an older cohort. A 2014 systematic review of acetabular fractures in patients older than 55 years treated with ORIF found that 23.1% required late conversion to a THA compared with 8% in younger patients [20]. Of note, poor outcomes are more likely in cases involving a posterior fracture-dislocation of the hip, making our patient an unsuitable candidate for this method of treatment [22].

In 1952, at the Annual Meeting of the American Academy of Orthopedic Surgeons, Lipscomb first presented the use of a primary vitallium mold arthroplasty for the treatment of fracture-dislocations of the hip [23]. Many years later, Coventry reported the successful outcome of an 80-year-old man with a posterior fracture-dislocation of the hip treated by a one-stage THA [24]. Interestingly, Coventry noted that his decision to perform the procedure in one stage was influenced by the patient’s medical problems, making him a poor candidate for a two-stage procedure. This case is arguably the first report of an acute THA used to treat a fracture-dislocation of the hip and has several similarities to our case. The term, CHP was first used by Herscovici et al. in 2010, and they described the CHP as consisting of ORIF of the acetabulum combined with an acute THA during the same anesthetic for the management of specific acetabular fractures in the elderly [25].

In 2019, Borg et al. reported the only cohort study comparing CHP with ORIF alone to treat displaced comminuted acetabular fractures in the elderly [26]. A total of 27 patients, 13 treated with a CHP and 14 with ORIF alone with an average age of 72.2 years (range, 50–89 years), were followed up for a minimum of 2 years. At the final follow-up visit, no patient in the CHP group required further surgery while 71.4% (10 out of 14) of the patients in the ORIF group underwent revision procedures, 9 patients revised to a THA, and one patient had a Girdlestone procedure.

Despite these encouraging results, some surgeons have raised legitimate concerns over the use of the CHP in elderly patients. In a resource-poor setting as exists in the Caribbean, surgeons need to be especially careful in choosing this treatment option. For example, in this case faced with the increased risk of hip dislocation and the unavailability of dual-mobility implants, the surgeon should be even more meticulous in his positioning of the components and soft-tissue balancing to avoid instability. In addition, we do not have access to the comprehensive home health-care services

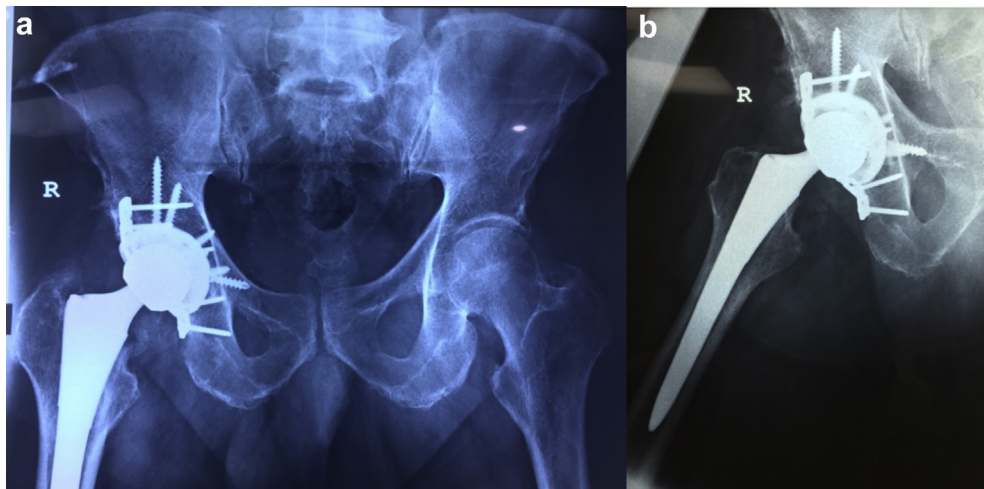


Figure 3. Anteroposterior (a) and lateral radiographs (b) 1 year after surgery illustrating union of the acetabular fracture with stable hip implants and no evidence of loosening.

including nursing care, physical and occupation therapy, and medical social services that are an essential part of a successful contemporary arthroplasty program in developed countries. With this in mind, several points should be considered to increase the likelihood of success.

First, although applicable to elderly patients with multiple comorbidities, these patients should be moderate- to high-activity individuals to gain maximum benefit from the CHP. It is mandatory that they undergo preoperative medical clearance to ensure that they have the cardiovascular capacity to withstand both the operation and the rehabilitation [20,27,28].

Second, success with the CHP requires a mixed skillset for pelvic and acetabular osteosynthesis as well as advanced hip arthroplasty. This combination may not be found in one individual, and it is recommended that the CHP operations are performed by 2 surgeons with extensive experience in trauma and arthroplasty [26,28]. Our surgical team included 2 experienced consultant orthopaedic surgeons, the lead surgeon having subspecialty training in hip arthroplasty.

Third, concerns have been raised about early aseptic loosening and high rates of hip dislocation [25]. This has resulted in a variety of elaborate implants used in several studies [6,12,26,28,29]. Osseointegration requires both good primary implant stability and >50% host bone-implant contact [30]. We estimated that excising the posterior acetabular fragment would have resulted in approximately 25% uncovering of the acetabular shell but chose instead to reconstruct the posterior wall. Adler et al. demonstrated experimentally that a rim or peripheral fit was the most important factor in determining the mechanical stability of the cup [31]. This is due to the hoop stress that are generated perpendicular to the cup at the acetabular rim [31]. Removal of 27% of the posterior wall has been shown to result in a loss of hoop stress, which is only partially restored after anatomical reduction and internal fixation of the posterior fragment [32]. Our decision was based on our objective to achieve primary stability of the cup and expedite solid osseointegration while allowing the patient unrestricted weight-bearing. This we believe is facilitated by maximizing the host bone-implant contact. We therefore created a stable acetabular osseous bed using a 3.5-mm reconstruction plate with lag screws and then implanted a porous-coated multihole shell stabilized with multiple screws as recommended by Buller et al. [27].

In the elderly patient with osteoporosis, the use of a hybrid THA (uncemented acetabulum and cemented stem) may be considered. A prospective cohort study comparing uncemented THA with hybrid THA in octogenarians found that uncemented THA resulted in fewer intraoperative complications but suggested that surgeons should be guided by bone quality when choosing the most appropriate implant [33]. This patient had a Dorr Type B femur and excellent femoral bone quality, which influenced our decision to use an uncemented stem. We used a large femoral head (36 mm) and a porous-coated stem in combination with accurate component positioning and soft-tissue balance to achieve hip stability [26]. This is critical because we have no access to dual-mobility components, and the use of constrained implants increases the risk of aseptic loosening. At the end of the procedure, the construct provided good structural and hip stability to allow full weight-bearing and mobilization using standard hip precautions.

Summary

There is a rising incidence of low-energy osteoporotic acetabular fractures in the elderly. Currently, the treatment of these injuries remains controversial, with fixation methods failing to produce consistently good clinical outcomes. The AceFIT study (ISRCNTN16739011), a prospective randomized study, will provide

more robust data on the most appropriate treatment for acetabular fractures in older patients; however, the results will not be available for several years [34]. Until the results of this study are known, we believe that the CHP may offer a solution to this challenging problem and be safely used in a low-resource setting. We recommend that surgeons consider using the CHP to treat osteoporotic acetabular in carefully selected patients.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

Informed patient consent

The author(s) confirm that informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

References

- [1] United Nations. World population ageing 1950–2050. <http://www.un.org/esa/population/publications/worldage>; 2002 [accessed 05.01.21].
- [2] Cooper C, Campion G, Melton 3rd LJ. Hip fractures in the elderly: a worldwide projection. *Osteoporos Int* 1992;2(6):285.
- [3] Mears DC. Surgical treatment of acetabular fractures in elderly patients with osteoporotic bone. *J Am Acad Orthop Surg* 1999;7(2):128.
- [4] Callaway DW, Wolfe R. Geriatric trauma. *Emerg Med Clin North Am* 2007;25(3):837.
- [5] Meldon SW. Trauma in the very elderly: a community-based study of outcomes at trauma and nontrauma centers. *J Trauma* 2002;52(1):79.
- [6] Mears DC, Velyvis JH. Primary total hip arthroplasty after acetabular fracture. *Instr Course Lect* 2001;50:335.
- [7] Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. *J Bone Joint Surg Am* 1996;78(11):1632.
- [8] Romness DW, Lewallen DG. Total hip arthroplasty after fracture of the acetabulum. Long-term results. *J Bone Joint Surg Br* 1990;72(5):761.
- [9] Weber M, Berry DJ, Harmsen WS. Total hip arthroplasty after operative treatment of an acetabular fracture. *J Bone Joint Surg Am* 1998;80(9):1295.
- [10] Simko P, Braunsteiner T, Vajcziková S. [Early primary total hip arthroplasty for acetabular fractures in elderly patients]. *Acta Chir Orthop Traumatol Cech* 2006;73(4):275.
- [11] Jauregui JJ. Total hip arthroplasty for acute acetabular fractures: a review of the literature. *Expert Rev Med Devices* 2015;12(3):287.
- [12] 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(1):1.
- [13] Lin C. Functional outcomes after total hip arthroplasty for the acute management of acetabular fractures: 1- to 14-year follow-up. *J Orthop Trauma* 2015;29(3):151.
- [14] Naraynsingh R. Trauma in the elderly in Trinidad and Tobago: a cross-sectional study. *Eur J Emerg Med* 2015;22(3):219.
- [15] Kannus P. Epidemiology of osteoporotic pelvic fractures in elderly people in Finland: sharp increase in 1970–1997 and alarming projections for the new millennium. *Osteoporos Int* 2000;11(5):443.
- [16] Laird A, Keating JF. Acetabular fractures: a 16-year prospective epidemiological study. *J Bone Joint Surg Br* 2005;87(7):969.
- [17] Ferguson TA. Fractures of the acetabulum in patients aged 60 years and older: an epidemiological and radiological study. *J Bone Joint Surg Br* 2010;92(2):250.
- [18] Central Statistical Office. Trinidad and Tobago 2011 population and housing census: demographic report. http://www.tt.undp.org/content/trinidad_tobago/en/home/library/crisis_prevention_and_recovery/publication_1.html; 2012 [accessed 05.02.21].
- [19] Yogi RR. Falls in older people: comparing older and younger fallers in a developing country. *Eur J Trauma Emerg Surg* 2018;44(4):567.
- [20] Daurka JS. Acetabular fractures in patients aged > 55 years: a systematic review of the literature. *Bone Joint J* 2014;96-b(2):157.

- [21] Tile M. *Fractures of the pelvis and acetabulum*. Baltimore (MD): Williams and Wilkins; 1995.
- [22] Zha GC, Sun JY, Dong SJ. Predictors of clinical outcomes after surgical treatment of displaced acetabular fractures in the elderly. *J Orthop Res* 2013;31(4):588.
- [23] Lipscomb PR. Primary Vitallium Mold arthroplasty for fracture dislocation of the hip with fracture of the femoral head. *J Bone Joint Surg Am* 1958;40-A(3):675.
- [24] Coventry MB. The treatment of fracture-dislocation of the hip by total hip arthroplasty. *J Bone Joint Surg Am* 1974;56(6):1128.
- [25] Herscovici Jr D. The combined hip procedure: open reduction internal fixation combined with total hip arthroplasty for the management of acetabular fractures in the elderly. *J Orthop Trauma* 2010;24(5):291.
- [26] Borg T, Hernefalk B, Hailer NP. Acute total hip arthroplasty combined with internal fixation for displaced acetabular fractures in the elderly: a short-term comparison with internal fixation alone after a minimum of two years. *Bone Joint J* 2019;101-b(4):478.
- [27] Buller LT, Lawrie CM, Vilella FE. A growing problem: acetabular fractures in the elderly and the combined hip procedure. *Orthop Clin North Am* 2015;46(2):215.
- [28] Rickman M. Managing acetabular fractures in the elderly with fixation and primary arthroplasty: aiming for early weightbearing. *Clin Orthop Relat Res* 2014;472(11):3375.
- [29] Malhotra 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(6):1005.
- [30] Paprosky WG, Bradford MS, Younger TI. Acetabular reconstruction with massive allograft and cementless prosthesis. *Chir Organi Mov* 1994;79(4):379.
- [31] Adler E, Stuchin SA, Kummer FJ. Stability of press-fit acetabular cups. *J Arthroplasty* 1992;7:295.
- [32] Olson SA, Bay BK, Pollak AN, Sharkey NA, Lee T. The effect of variable size posterior wall acetabular fractures on contact characteristics of the hip joint. *J Orthop Trauma* 1996;10:395.
- [33] Ahmad A, Mirza Y, Evans AR, Teoh KH. A comparative study between uncemented and hybrid total hip arthroplasty in octogenarians. *J Arthroplasty* 2018;33(12):3719.
- [34] National Institute for Health Research. *AceFIT acetabular fractures in older patients intervention trial*. <https://fundingawards.nihr.ac.uk/award/PB-PG-0815-20054>; 2017 [accessed 03.03.21].