CASE REPORT

Dual mobility total hip dislocation—femoral stem loosening while attempting closed reduction: a cautionary note

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Accepted 12 December 2017

SUMMARY

A 77-year-old man sustained an acetabular fracture after falling from a staircase and landing on his right side. He fractured the anterior column of his acetabulum and the quadrilateral plate. He underwent a single-stage open reduction and internal fixation of the fracture combined with a dual mobility total hip arthroplasty (THA). He sustained a traumatic hip dislocation 1 month postoperatively. Closed reduction was attempted at another hospital, and the femoral stem was pulled out. We believe this was caused by the polyliner being hitched either to the acetabular cup or in the soft tissues around the ilium. We present this case to caution orthopaedic surgeons that dual mobility THA dislocations are difficult to diagnose as the polyliner is not clearly seen on X-rays, and reduction attempts may lead to worsening of an already difficult situation.

BACKGROUND

Low-energy acetabular fractures have increased in incidence and are related to osteoporosis in the elderly population.¹ With increasing life expectancy and improved healthcare, we can expect the incidence of low-energy fragility fractures of the acetabulum to increase further. Elderly patients tend to have a different fracture pattern compared with younger patients. Medial displacement and a separate quadrilateral plate component are more frequent in the elderly which are associated with poor outcome.² These radiological features were seen in our case (figures 1–4).

In a young patient with better bone stock, it is possible to fix such fractures adequately but the patient must remain non-weight-bearing postoperatively. In the elderly, with multiple medical comorbidities, the aim is to provide a stable reconstruction which allows accelerated rehabilitation and full weight-bearing mobilisation. THA combined with fixation is a viable option in such cases. The aim of fixation is not anatomical reduction but to provide a stable buttress for the implantation of the acetabular component. When embarking on acetabular fixation and THA (fix and replace), a higher rate of morbidity is expected as these patients are elderly with pre-existing comorbidities and often have preceding degenerative disease increasing the risk of dislocation. At our centre, the ‘fix and replace’ is preferred for elderly patients (>70 years) with displaced acetabular column fractures regardless

of any preceding hip pain. Being a busy pelvic surgery unit, we do on an average of 20 to 25 ‘fix and replace’ procedures a year. The dual mobility concept was first described by Bosquet, a French orthopaedic surgeon, in 1974³ and has gained widespread popularity as a means of providing stability in primary and revision total hip arthroplasty.⁴

Intraoperative dislocation is a unique complication of the dual mobility THA. It is the dissociation of the larger outer polyethylene from the smaller metal/ceramic femoral head. This complication is mainly attributed to the reduction attempts made which leads to the separation of the polyethylene liner and femoral head.⁵ In our case, there was no dissociation of the liner and head after attempting reduction, instead the stem was pulled out of the cemented femoral canal.

CASE PRESENTATION

A 77-year-old man was transferred from a regional hospital after a fall downstairs, sustaining an isolated injury to his right hip. His medical history included osteoporosis, type 2 diabetes mellitus with peripheral neuropathy, previous parathyroidectomy, history of recurrent falls with previous pelvis fracture treated conservatively and prostate cancer radically treated. He was independently mobile before the fall, used no walking aids and had no previous hip pain.

On examination, he had bilaterally reduced sensation in L4–S1 dermatomes (due to peripheral neuropathy) with no associated motor or vascular deficit. There was swelling and tenderness in his right hip, with shortening and extremely painful movements.

He was examined radiographically and demonstrated a fracture of the anterior column of the acetabulum along with a comminuted fracture of the quadrilateral plate (femoral head migrated medially—central fracture dislocation) (figures 1–4). He was optimised for surgery. Surgical options were discussed with the patient, which included:

1. conservative management±delayed THA
2. ORIF right acetabulum±delayed THA
3. ORIF right acetabulum+THA (single stage—fix and replace).

The patient opted for fix and replace surgery. He was on low molecular weight heparin for thromboprophylaxis preoperatively and postoperatively. An Inferior Vena Cava (IVC) filter was placed

To cite: Dotivala S, Coomber R, Chowdhry M, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-222408

Figure 1 Preoperative radiograph—complex acetabular fracture with medial femoral head displacement.

preoperatively. He was adequately counselled and consented for all possible complications including dislocation.

The acetabular fixation was performed first under general anaesthetic in the supine position via a modified Stoppa approach. Antibiotics and tranexamic acid administered prior to incision. The acetabular fracture was stabilised with a suprapectineal quadrilateral buttress plate (Stryker, USA) with three screws proximally and distally.

Under the same anaesthetic, after repeating the antibiotic dose the patient was put in a lateral position. A standard posterior approach was used. The acetabulum was reamed to take a 62 mm trabecular metal cup, multiple screws were inserted and a dual mobility cup was cemented into the shell, this also ensures the screw heads are locked. A standard polished tapered cemented

Figure 2 Preoperative CT scan showing medial displacement of femoral head and separated quadrilateral plate fracture.

stem (CPT stem, Zimmer, USA) was inserted with 10° anteversion. The joint was deemed stable in all directions intraoperatively. Standard closure of the capsule and external rotators was performed using transosseous ethibond sutures through the posterior part of the greater trochanter.

The patient mobilised full weight-bearing from the first postoperative day and had an uneventful postoperative period. He was discharged to the regional hospital on his fifth day postoperatively. The immediate postoperative X-rays (figures 5 and 6) were satisfactory with a well-fixed fracture and well-aligned THA. We accept that the cement mantle proximally could be improved on. However, because of the age and comorbidities of the patients undergoing this technique, as well as the prolonged procedure, we are very cautious with the cementing process to

Figure 3 Preoperative three-dimensional CT scan showing medial displacement of femoral head and separated quadrilateral plate fracture.

Figure 4 Preoperative CT image showing medial displacement of femoral head and separated quadrilateral plate fracture.

reduce the risk of bone cement implantation syndrome. Thus, we consider the cementation to be different to a standard THA; however, we do accept that a better cement plug would be better. This procedure was number 40 in a current case series with a large number performed before in the series.

One month postoperatively, on his way home in an ambulance, the patient developed acute pain in his right hip. Prior to the ambulance ride he was pain free. He reported that he was in the sitting position during the ambulance ride and that he was alone in the back of the ambulance. It was a bumpy ride and by the time he reached home, he was in severe pain and was unable to move his right lower limb.

He was transferred back to the regional hospital in the same ambulance where X-rays showed a right hip dislocation. On close examination of the X-rays, the polyethylene liner had dislocated from the acetabulum; however, its relationship with the femoral head was still maintained (radiolucent halo on X-rays; [figures 7 and 8](#), marked with red arrows). This information may not have been recognised by the treating surgeon as closed reduction under propofol sedation was attempted in the emergency department (ED). This was not successful and postmanipulation

Figure 5 Postoperative radiograph showing initial fix and replace procedure: anteroposterior view.

Figure 6 Postoperative radiograph showing initial fix and replace procedure: lateral view.

X-rays ([figure 7](#); after an initial attempt at reduction in ED) showed that the stem had pulled out of the femur. He was then taken to theatre for closed reduction but this resulted in the stem being pulled out further with rotation ([figure 8](#)). The patient was referred back to our hospital at this stage.

On reviewing his history and X-rays, it was concluded that the bumpy ride in the ambulance led to the dislocation as the lower limb was moving around without control. The polyethylene liner may get caught in the soft tissues around the ilium or get hitched to the lateral part of the acetabulum. This might have caused the stem to loosen and pull out slightly with the uncontrolled

Figure 7 Postemergency department manipulation radiograph showing stem pull-out; radiolucent halo of poly liner shows maintained relation between poly liner and femoral head (marked with a red arrow).

Figure 8 Postattempted closed reduction under anaesthesia—further stem pull-out with rotation; radiolucent halo of polyliner shows maintained relation between polyliner and femoral head (marked with red arrows).

movements. The stem further loosened and displaced completely by the traction and rotation manoeuvre during reduction.

Surgical treatment was definitely warranted at this stage, and the patient was investigated and optimised for surgery. There were no clinical or laboratory signs suggestive of infection. He already had an IVC filter and was covered with low molecular weight heparin as prophylaxis against Deep vein thrombosis.

Under general anaesthetic, in a lateral position, via the same incision and posterior approach, the hip was opened. The stem was loose and out of the femoral shaft, the polyethylene liner was still attached to the femoral head which was still attached to the stem; there were no signs of infection. Samples were taken for culture and sensitivity. The loose stem was incarcerated in the iliac wing. The capsule and the short external rotators had ripped off. The stem was removed with the head and liner. Acetabular components were well fixed. Ultrasonic bone cement remover (OSCAR) was used to remove cement from the lateral wall, a rasp was used to lateralise the stem further and a cement-in-cement revision of the stem was carried out using a size smaller stem with an extended offset for added stability. The shoulder of the stem was covered with cement. Stability was satisfactory and standard closure and dressing perused.

Full weight-bearing mobilisation was started from the third postoperative day. He was discharged from hospital 1 week after the surgery. Postoperative X-rays were satisfactory (figures 9 and 10).

Five months postoperatively, the hip remained stable and pain free. He was walking full weight-bearing with a frame. There was no infection, and cultures were negative. Wounds were well healed, and he was planned for removal of the IVC filter.

Figure 9 Postoperative radiograph: after revision of stem—anteroposterior view.

DISCUSSION

A low-energy acetabular fracture in an elderly patient with osteoporosis is a challenge for the treating surgeon. The aim of treating these fractures is to achieve a stable joint to allow immediate weight-bearing and faster rehabilitation, reducing the duration of inpatient stay thereby reducing the cost of treatment. The standard treatment of displaced acetabular fractures is to anatomically reduce the joint surface; however, there is significant risk of early and late local complications associated with treatment for this type of injury in the elderly.²

Ferguson *et al*² in an epidemiological study showed that there is a difference in the mechanism of injury in acetabular

Figure 10 Postoperative radiograph: after revision of stem—lateral view.

fractures in the young and in the elderly (>60 years). Falls from standing height accounted for 50% of acetabular fractures in patients over 60 years old, while 82% of fractures in younger patients were as a result of high-energy mechanisms. Due to this, younger patients tend to have more associated injuries, whereas elderly patients have fewer or no associated injuries (less than 30%).

Conservative treatment is an option for treating these fractures which is mainly reserved for undisplaced or minimally displaced fractures and for those patients deemed unfit to undergo surgery.⁶ However, elderly patients benefit most from early mobilisation and conservative treatment needs at least 6 weeks of bed rest or non-weight bearing mobilisation. Traditionally, these fractures are treated with open reduction and internal fixation;⁷ however, the failure rate of acetabular ORIF are high, especially in the elderly population with reported surgical reintervention (THA) rates from 30% to 50%.^{8,9} Up to 30% of patients who are managed non-operatively have an unacceptable functional result¹⁰ and mortality rate as high as 25%.¹¹

Simultaneous fracture fixation and THA is also called 'fix and replace', the term first coined by Murphy and Carrothers.¹² To achieve the aim of immediate mobilisation postsurgery, a radical shift is required from the prolonged immobilisation associated with non-operative treatment or operative fixation alone to surgical treatment that enables immediate weight-bearing.¹³ THA aids in the goal of early full weight bearing. Non-weight bearing or restricted weight-bearing is difficult or impossible for older patients. It also increases their dependence on care workers and makes the patients physically and psychologically weak. Hence, early weight-bearing is very important in the rehabilitation process of these patients. In a series of 19 'fix and replace' cases, Tissingh *et al*¹³ reported a mean time to get out of bed of 2.5 days.

The use of specially designed quadrilateral buttress plates is a relatively newer trend. They are precontoured and a single implant can stabilise the anterior column and buttress the quadrilateral plate to prevent medial migration of the head. Kistler *et al*¹⁴ in an in vitro study found the quadrilateral buttress plates superior to standard forms of fixation in resisting motion at the fracture and medial subluxation.

Instability following THA remains a major complication, and the dual mobility bearing has been extensively used in primary and revision THA to improve stability. The incidence of instability after THA in the primary and revision setting has been reported as high as 7% and 25%, respectively.¹⁵ Post-operative stability of the hip depends on many factors and on the prosthetic design. The elderly population remain at a high risk of instability post-THA.⁸ In a retrospective study, Mohammed *et al*¹⁶ reviewed 44 primary and revision hips with dual mobility bearings, mean patient age was 70.8 years, they found no instability at 22 months mean follow-up.

Waddell *et al*¹⁷ carried out a systematic review of dislocation rates following the use of dual mobility hips. After reviewing 59 articles covering 17908 dual mobility hips (primary and revision included) they concluded that the mean rate of dislocation was 0.9% in the primary THA group and 3.0% in the revision THA group. The mean rate of intraprostatic dislocation was 0.7% in primary and 1.3% in revision THAs.

Intraprostatic dislocation is a complication of dual mobility hips. This complication occurs when the polyethylene liner gets caught at the rim of the metallic acetabular shell, and subsequent forceful limb traction results in the dissociation of

the small head from the large polyethylene liner, similar to a bottle opener effect.¹⁷ The reduction attempts have been identified as the underlying cause of intraprostatic dislocations.¹⁸

Dislodgement of a cemented polished femoral stem while attempting closed reduction of a dislocated bipolar hemiarthroplasty has been reported in the literature in the past.^{19,20} However, the same has not yet been reported in a dual mobility total hip replacement. In both the case reports reviewed, the initial cementing was adequate and it was treated with an open reduction and driving the stem into the old cement mantle. In our case, we opted to go for cement in cement revision of the stem with additional cement to cover the shoulder of the stem.

In our case, there was no intraprostatic dislocation, although the mechanism was similar to that of intraprostatic dislocation. We believe that the polyethylene head was caught at the lateral part of acetabulum or was incarcerated in the soft tissues around the ilium and with traction and rotation forces applied during the reduction manoeuvre instead of the liner separating from the head, the femoral stem pulled out from the cement mantle. We have not found any report of a similar complication of dual mobility hips in the literature.

Contributors All authors made substantial contributions to conception and design, acquisition of data and interpretation of data, revising the article critically for important intellectual content and final approval of the version to be published.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Learning points

- Low-velocity fragility acetabular fractures in the elderly can be treated using the 'fix and replace' principle as it provides the benefit of early full weight-bearing mobilisation, thereby preventing early and late complications of the traditional treatment methods.
- Instability post-THA remains a concern and the dual mobility bearings provide a viable option for treating and reducing instability. Intraprostatic dislocation is a complication unique to the dual mobility system and may be iatrogenic in many cases. Surgeons treating these complications must be aware of the dual mobility principle and the methods to diagnose them on X-rays. Radiolucent halo of the polyliner is often visible and gives an idea of the position of the liner. Once dislocated, the polyliner can hitch against the lateral part of the acetabulum or get caught in the soft tissues near the ilium, traction and rotation forces cause an intraprostatic dislocation or loosening and pulling out of the stem as we have reported.
- Lastly, a word of caution to surgeons treating these dislocations—a bad situation can be made worse if you are not aware of the dual mobility concept. These should not be treated as a simple manipulation under anaesthesia (MUA) under sedation in the emergency department but should be performed in theatre under image intensifier screening with a low threshold for open reduction.

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