CASE REPORT

Cause of irreducible dislocation of a re-revision THR

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SUMMARY

Instability or recurrent dislocations are a common reason for revision of total hip replacements (THRs). Dual-mobility constructs can help improve stability by increasing the femoral head jump distance. These constructs are used to decrease the risk of re-revision in the setting of recurrent dislocation. This case describes an unusual case of irreducible dislocation of a re-revision THR due to intraprostatic dislocation. The patient required open reduction and revision of this construct to a tripolar implant. This is important to appreciate from an emergency medicine point of view as repeated attempts at reduction will be fruitless and may result in a femur fracture. This particular type of dislocation is very rare. Perioperative considerations should include early referral to the orthopaedic team for reduction in theatre, and having a low threshold for open reduction. Revision options should be available when bringing a case like this to the operating theatre.

BACKGROUND

Instability is a common indication for revision of total hip replacement (THR). Other indications include loosening (aseptic or infection), component wear or fracture. The underlying principle of the dual-mobility (DM) construct is the articulation of a femoral head (regular sized), inside of a larger polyethylene (PE) liner, snapped on to the head rather than into the cup, which then articulates with a metal liner snapped into a standard metal cup, which is press-fixed with or without additional screws to the acetabular bone.

Reports have generally been favourable with regard to this construct and its ability to reduce the revision dislocation rate. Concerns specific to the DM include the risk of intraprostatic dislocation and wear at the acetabular liner.

This case describes an unusual case of irreducible dislocation of a re-revision THR due to intraprostatic dislocation. This is important to appreciate from an emergency medicine point of view as repeated attempts at reduction will be fruitless and may result in a femur fracture.

Introduction

The incidence for instability in total hip arthroplasty (THA) is 3% for primary hips and up to 8% for revision THRs.^{1 2} The revision algorithm has changed throughout the years to meet the change in the design of primary THRs. The first attempt at a hip replacement occurred in Germany in 1891. The increasing survival of patients with THRs has led to an increasing need for revision THRs.

Various efforts to increase THR stability have included larger femoral sizes, elevated acetabular liner and a suitable ratio between head size and femoral neck diameter and finally constrained liners. The unconstrained tripolar implant (DM) has been popularised in France since the 1970s, as a primary THR. DM cups have also been gaining popularity in the USA in recent times. De Martino *et al*¹ demonstrated that DM components increased stability after THRs. The principle is based on Charnley's low friction principle with the McKee-Farrar concept of larger diameter heads to improve stability.³

Data from Hailer *et al*⁴ courtesy of the Swedish Joint Registry describes a 2% rate of dislocation in the DM cups undertaken in a revision setting. This does not distinguish classic dislocation from intraprostatic dislocation. A systematic review by de Martino *et al*¹ included 17 908 THAs. The rate of dislocation was 3% in revision THRs with a rate of 1.3% attributed to intraprostatic dislocation. This case presentation focuses on the indications for attempting closed reduction in the emergency department (ED) in dislocated THRs. Reduction of dislocated THRs can be associated with negative outcomes. It is important for the ED physician to appreciate the risk stratification involved, prior to embarking on a potentially fruitless procedure.

CASE PRESENTATION

A 64-year-old man dislocated his re-revision THR 15 months after re-revision surgery. He described bending at the waist with his legs straight to retrieve an object from the fridge. He experienced immediate pain and a sensation of dislocation in his right hip. His plain film radiographs confirmed what appeared to be a posterior dislocation of the implant (*figure 1*). He has a background history of primary, same-day, bilateral THR in 2015. His original femoral implants were poorly cemented Exeter stems. He sustained bilateral, simultaneous, spontaneous, atraumatic periprosthetic fractures 5 weeks post initial surgery. He went on to have bilateral staged periprosthetic fracture open reduction internal fixation, and revision hip surgery over the following 10 days.

He dislocated one of his revision hips twice. He then underwent a revision to new modular cemented stem in August 2015.

He had two further dislocations. He then underwent a further revision of that hip to a DM implant (Modular Dual Mobility MDM X3 Stryker) on July 2016 before subsequently dislocating this as described above, on February 2017 (*figure 2*).

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Figure 1 Posterior dislocation of dual-mobility implant.

He had two attempted reductions in the ED using sedation and muscle relaxation. When this was unsuccessful, he was brought to the operating theatre and had a further failed attempt at closed reduction. The head was felt entering the cup and impacting on metal without staying in joint. Live screening did not provide any additional information.

He underwent an open reduction using the previous incision, which was a posterolateral approach. This revealed a dislocated separated MDM PE liner, no longer attached to the metal head, lying in the soft tissues between gluteus medius and minimus superficial to the previously repaired capsulotomy (figure 3).

The stem was checked and found to be stable. The metal head was dislocated in a posterosuperior direction, and showed evidence of damage so it was exchanged from a 28 mm to a 32 mm head. The trunnion was inspected and there was no evidence of wear or debris at the junction. The original acetabular shell was found to be still stable, in good orientation and was thus left in situ. The DM liner was exchanged for a constrained tripolar implant with a 32 mm head. The hip was reduced and trialled and found to be stable (figure 4). Closure of the posterior layers was performed using Ethibond transosseous sutures. This man was placed in a brace for 6 weeks as a further precaution.

Figure 2 Predislocation image of dual-mobility implant.

Figure 3 Image of the retrieved implants.

INVESTIGATIONS

Radiographs and full blood count were performed including inflammatory markers. This patient had his stem checked for loosening intraoperatively. Intraoperative samples were sent to investigate for infection. This was not present. The preceding radiographs were scrutinised for any hardware failure in the lead up to this dislocation. The patient had several radiographs with no obvious abnormality.

OUTCOME AND FOLLOW-UP

This patient has now returned to independent mobilisation 2 years after his re-revision operation. He has had no further episodes of dislocations. He will be continued to be monitored in the orthopaedic outpatients.

DISCUSSION

Biomechanics

DM cups are thought to improve stability by a combination of increased range of movement,⁵ head:neck ratio,⁶ a larger effective head size⁷ and a greater jump distance.⁸ The device is held together by a snap fit mechanism. The acetabular cup hemisphere's diameter is less than the polyethylene (PE) diameter. Thus, the diameter of the PE is less than that of the femoral head. This can reduce the wear of a liner, the prevalence of a dislocation and liner dissociation. The PE liner has mobility in the cup which can reduce wear through dual articulation.⁹

Concerns

Concerns existing regarding liner wear, aseptic loosening of components¹⁰ and intraprostatic dislocation have been highlighted.^{11 12} Alternatives to the DM cup like the captive cup exist. However, the indications for using the captive cup include elderly patients, with low functional demand. Concerns exist over using this prosthesis in younger patients due to the failure rate after 5 years. This is thought to be due to the significant shear forces which are transmitted through the cement/bone

Figure 4 Postoperative image of constrained liner.

and cement/prosthesis interface.¹³ This is thought to produce accelerated wear and aseptic loosening. Thus, it would not have been an appropriate choice for this patient, given his relatively young age and high activity level. Acknowledged risks for dislocation include age,¹⁴ female gender, neuromuscular conditions, previous hip operations, alcohol abuse and abductor weakness.¹⁵ Surgical factors include the approach, failure to restore the offset or leg length, poor capsular repair, failure to preserve the abductor mechanism, experience of the primary operator, size of the femoral head and the head:neck ratio.^{16–18} It has been shown in the literature that larger femoral heads (>36 mm) can decrease the incidence of dislocation in both primary and revision THRs but concerns exist regarding potentially higher wear rates of the PE liners.¹⁵ Heads with a larger diameter tend to have more volumetric wear in younger active patients which could cross the threshold for osteolysis.¹⁹ Newer, highly cross-linked PE is a successful development in resisting these higher wear rates in THR surgery.²⁰

Similar cases

De Martino *et al*¹ conducted a systematic review and found that only 19 cases of intraprostatic dislocation were reported across the literature. The majority (15) were in the early postoperative period, 3.2 months, while only four occurred later at a mean of 15.1 months. Our patient's dislocation is even more unusual as it occurred at 8 months postoperatively. The rate of revision for dislocation of revision THRs was 3% when using the DM system.

Dislocation after THR has many associated risk factors. These are both related to the patient and the surgery. In our case, this patient had a weight of 142 kg with a body mass index (BMI) of 45. He had previously had a posterolateral approach with inadequately cemented stems. These factors predisposed him to sustain periprosthetic fractures. The requirement for ORIF and revision THR (notwithstanding the use of a modular femoral component to increase the anteversion) were an additional risk factor for future dislocation. He continued to dislocate and had a DM system implanted. He did not have a further dislocation for 24 months. At the last setting, he had a constrained tripolar implant inserted, a necessary but less than desirable choice given his BMI, age and history).

Potential concerns cited about using DM THR in the literature include PE wear. Given the design of the DM, there are two articulating surfaces for the liner which could lead to increased wear. There is the possibility that impingement of the neck on the rim of the liner could also lead to its damage and generate debris. Adam *et al*²¹ examined liners retrieved after a mean time of 8 years and found that the wear rate in the DM THR was the same as in conventional THR. The rate of revision for dislocation is favourable, being quoted at 5% to 30%. It continues to offer a viable option in unstable THRs.^{22–23} Further long-term follow-up on 'classic dislocations' in the DM system is required to ascertain if this is a significant or rare problem.

Fabry *et al*²⁴ reviewed intraprostatic dislocations around DM hips. One of the advantages of the DM implant is that the majority of the hip range of motion occurs at the smaller inner bearing. This combines low friction with an effective large-diameter femoral head.²⁵ In recent times, increasing awareness of intraprostatic dislocation is growing.^{21–26–28} The incidence has been reported from 0% to 5.3%.²⁴ There is no consensus on the timing of these dislocations occurring with some series reporting early dislocations¹ while other series have reported as distant as

16 years.²⁴ The bubble sign has been described as a pathognomonic indication of liner shell dissociation.

This case highlights the increasing complexity of unstable THRs. It is widely acknowledged that our ageing population will increase the need for revision THRs. In the USA, the number of THRs is expected to rise by 174% in 2030 in comparison to 2005, reaching 572 000 per year.²⁹ The number of unstable hips will rise in the future, as it is acknowledged the most common reasons for revision are instability and mechanical loosening.

Reductions in the ED

Generally accepted indications for reductions under conscious sedation in the ED are primary THRs, recurrent dislocators without any evidence of fracture and non-constrained implants.³⁰ It is important to recognise situations which might prove difficult or even impossible to obtain a successful closed reduction. The DM hip can be highly challenging or impossible to reduce closed, especially if there is an intraprostatic dislocation. Continued attempts can damage the prosthesis and may require complete revision of the components. This may complicate an already challenging situation. Other complications could include sciatic nerve palsy, periprosthetic fracture or loosening of a well-fixed stem through repeated fruitless attempts.

Reduction manoeuvres for DM hips can have a high rate of failure. It is important to scrutinise the pre-reduction radiographs to look for a bubble sign. It is important to educate ED staff on this type of dislocation as it may appear to be reduced on radiographs but still be dislocated. Eccentric placement of the head in the shell can be an indicator of a continued intraprostatic dislocation. Intraprostatic dislocations will require open reduction to be successful.

A recommendation is early orthopaedic involvement if the patient is known to have a DM implant. The rate of failure of closed reduction is high and may lead to a delay in definitive treatment. It would be prudent to involve the orthopaedic team on call early and discuss whether they feel it is appropriate to attempt a closed attempt in the ED versus planning for a definitive theatre attempt.

Learning points

- ▶ Early involvement of orthopaedics if the patient is known to have a dual mobility (DM) prosthesis in situ is imperative.
- ▶ Avoid repeated efforts to reduce a DM prosthesis as these can lead to a femur fracture or further damage the prosthesis in situ.
- ▶ Open reduction is most often necessary and it is imperative that preoperative planning takes into account the potential to increase stability and to have these implants available.
- ▶ The patient should be advised by their orthopaedic team to communicate with the emergency department physicians that they have a complex total hip arthroplasty in situ.

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