



Preventing mechanical complications of hip spacer implantation : technical tips and pearls

Pedro BARREIRA, Pedro LEITE, Pedro NEVES, Daniel SOARES, Ricardo SOUSA

From Department of Orthopaedics, Centro Hospitalar do Porto – Hospital de Santo António, Porto, Portugal

Periprosthetic joint infection is a frequent complication after total hip replacement. Two-stage exchange with the use of a temporary cement spacer is commonplace. Several complications are possible with its use. In addition to infection persistence, mechanical complications such as dislocation or fractures are among the most common.

Several risk factors can and should be addressed during first stage or spacer implantation surgery in order to minimize complications. Technical aspects as well as practical tips and pearls to overcome common nuisances such as spacer instability or femoral and acetabular bone loss will be discussed.

Keywords : arthroplasty, replacement, hip ; prosthesis-related infections ; postoperative complications ; bone cements.

INTRODUCTION

Total joint arthroplasty (TJA) is one of the most successful procedures in orthopaedics and excellent results are expected in virtually all cases. Periprosthetic joint infection (PJI) though unusual, is one of the most frequent and challenging complications after TJA. It is the third most common cause of revision in total hip replacement, responsible for up to 15% of all cases (1).

In the past few years several improvements have been made in the management of an infected total hip prosthesis. Nevertheless it remains a challeng-

ing problem for the orthopaedic surgeon. Although numerous studies report favourable outcomes after one-stage revision surgery, two-stage has traditionally been considered as the gold standard for management of chronic infections (2). Two-stage exchange consists of debridement, resection of infected implants and usually temporary placement of an antibiotic-impregnated cement spacer before reimplantation of a new prosthesis.

Spacers can be classified as static or articulating. The goals of using an articulating antibiotic loaded cement spacer are two-fold : to enhance the clearance of infection by local antibiotic therapy and dead-space management while maintaining joint function during treatment thus improving the functional outcome at reimplantation. Still, hip spacer

- Pedro Barreira.
- Pedro Leite.
- Pedro Neves.
- Daniel Soares.
- Ricardo Sousa.

Department of Orthopaedics, Centro Hospitalar do Porto – Hospital de Santo António, Porto, Portugal.

Correspondence : Ricardo Sousa, Department of Orthopaedics, Centro Hospitalar do Porto – Hospital de Santo António, Largo do Professor Abel Salazar, 4099 – 001 Porto, Portugal.
E-mail : ricardojsousa@gmail.com

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Table I. — Risk factors for hip spacer dislocation that can be influenced by the surgeon

Decreased Leg length/Spacer insertion depth
Spacer anteversion
Spacer head/acetabular diameter mismatch (undersized head)
Spacer geometry (neck to head ratio, offset)
Acetabular deficiency (superior, lateral, posterior)
Femoral bone deficiency (proximal)

implantation is not innocuous and there are several possible complications (3). The purpose of this paper is to report on technical aspects that should be taken into consideration in order to prevent the most frequent mechanical complications.

Spacer Dislocation

Dislocation is the most frequent mechanical complication when using an articulated hip spacer (3,4). Several risk factors play a role in this event. Some of them such as history of hip dislocation, multiple prior surgeries, abductor muscle insufficiency and patient compliance to the required partial weight bearing protocol are not under direct control by the surgeon. Others such as spacer's geometry (e.g. neck to head ratio or femoral offset), size mismatch between spacer's head and acetabulum, technique of femoral fixation and addressing acetabular and/or femoral bone defects can and should be addressed during spacer implantation (Table I).

Spacers can either be manufactured or prefabricated. When choosing which spacer to use or produce in a specific case, the surgeon must keep in mind the importance of the neck to head ratio. If the neck is too large, it will impinge in the acetabular rim and cause the head to dislocate. Leunig *et al* (8) found that dislocated spacers had a significantly higher neck to head-ratio (0.96 ± 0.19) when compared to spacers free of complications (0.76 ± 0.05). Another spacer design related issue is the femoral offset. Dislocations tend to occur when femoral offset is decreased as compared with the preoperative configuration. A decrease in the femoral offset leads to decreased muscle tension, which might cause spacer dislocations, despite an intact bone and muscle situation and a normal spacer articulation (6).

Another possible cause for dislocation is a mismatch between acetabular cup and spacer head size. If the head is too small it will not provide sufficient stability. In such a case we prefer to choose a slightly larger head spacer and if necessary, ream the acetabulum in order to enlarge it and find adequate head coverage.

Another common cause for spacer dislocation is an insufficient femoral fixation (8). A loose stem may also dislocate from the femoral canal but most importantly it does not offer control over leg length or rotational stability. We believe the best solution is to improve femoral fixation of the spacer stem by avoiding a simple *press fit* method and using the *glove* cementing technique. This consists of cementing the spacer into the femur using a small amount of cement to form a collar around the proximal part of the spacer and calcar (Fig. 1). This allows the surgeon to control height and anteversion of the spacer while avoiding the drawbacks and difficulties of extracting cement from the femoral canal associated with normal cementing techniques. This technique has been shown to be effective and extracting the spacer during second stage surgery is relatively simple (7).

Femoral and/or acetabular bone loss is also a major cause of dislocation. Extensive bone loss may even contraindicate the use of a spacer if a stable and mechanical sound configuration cannot be achieved. Proximal femur bone defects may be addressed by using a long stemmed spacer (Fig. 2). In such cases cementing it to the femur is especially critical to maintain appropriate length and muscle tension thus minimizing the risk of dislocation. Extensive acetabular bone defects, especially those with bone loss on the floor of the acetabulum may contraindicate its use. Using a spacer in these circumstances may cause it to migrate into the pelvis. Bone loss in the superior-lateral and posterior-superior part of the socket also provides inadequate support and stability to the spacer, dramatically increasing the risk of dislocation. In such cases it is advisable to augment the acetabular surface by creating a temporary cement "tectoplasty" providing an improved biomechanical scenario in order to reduce the risk of spacer dislocation (5) (Fig. 3). This technique also allows the surgeon to create a

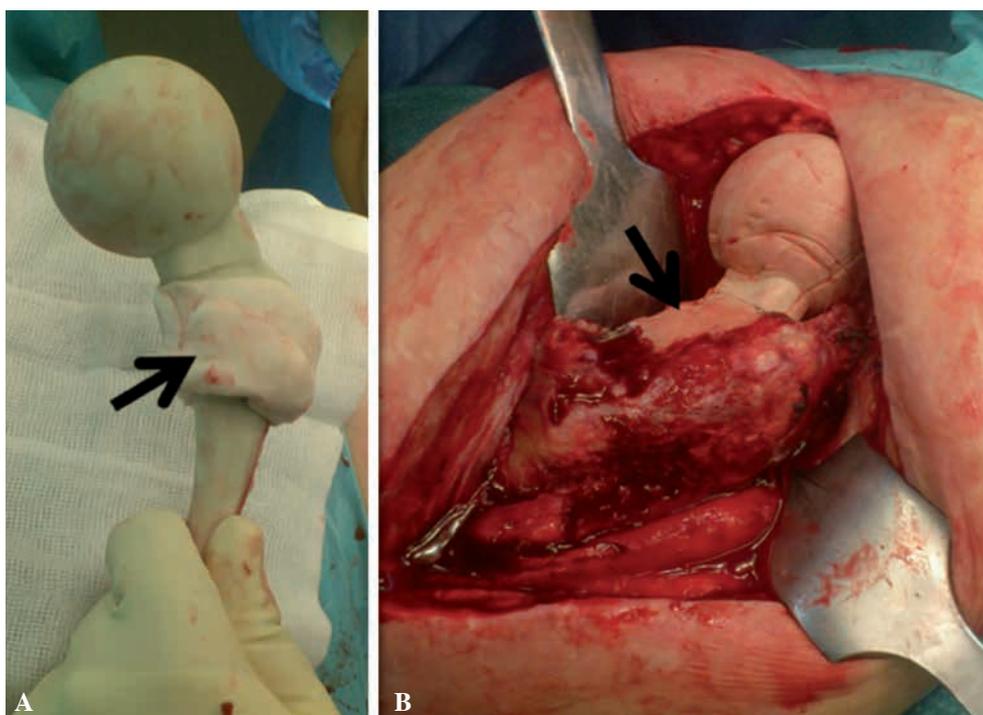


Fig. 1. — A. Cement collar around the proximal part of the spacer. B. Spacer implantation with cement collar helping control height and anteversion.

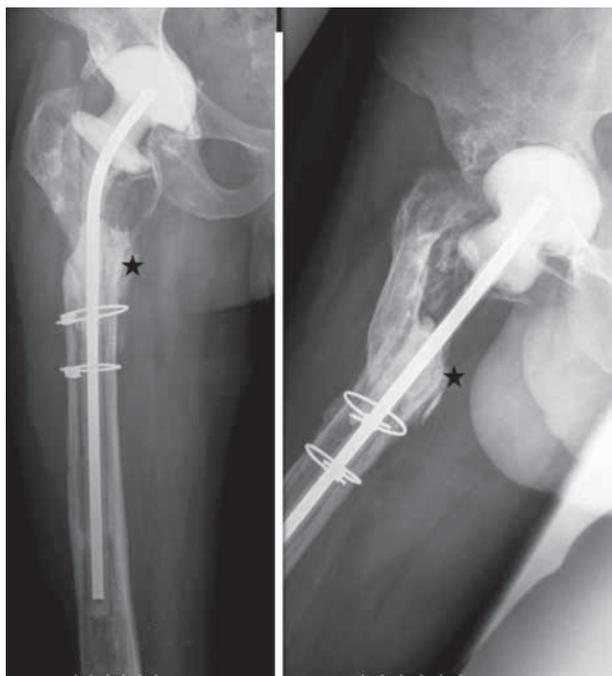


Fig. 2. — Right hip long stem spacer to overcome proximal femur bone loss. Star emphasizes cement collar around the proximal part of the spacer.

better match between a smaller spacer head size and the residual socket space if a larger head is not available or cannot be used (5).

Spacer and Periprosthetic Femur Fracture

Spacer fractures can be classified into symptomatic or asymptomatic. The first kind is typically located on the neck of the spacer (Fig. 4). They tend to occur after prolonged periods of time and/or excessive weight bearing. Asymptomatic fractures are typically found in the middle or the lower part of the stem and most of the times do not require specific treatment. Femoral periprosthetic fractures are usually symptomatic as they cause an unstable joint situation, limit patient mobility and endanger second stage surgery.

Loss of proximal femoral bone support or prior extended femoral osteotomy for removal of the infected femoral component are known risk factors for both spacer and femoral fracture. The use of a long stemmed spacer to bypass stress risers such as an osteotomy site is advisable. Any loose implant is

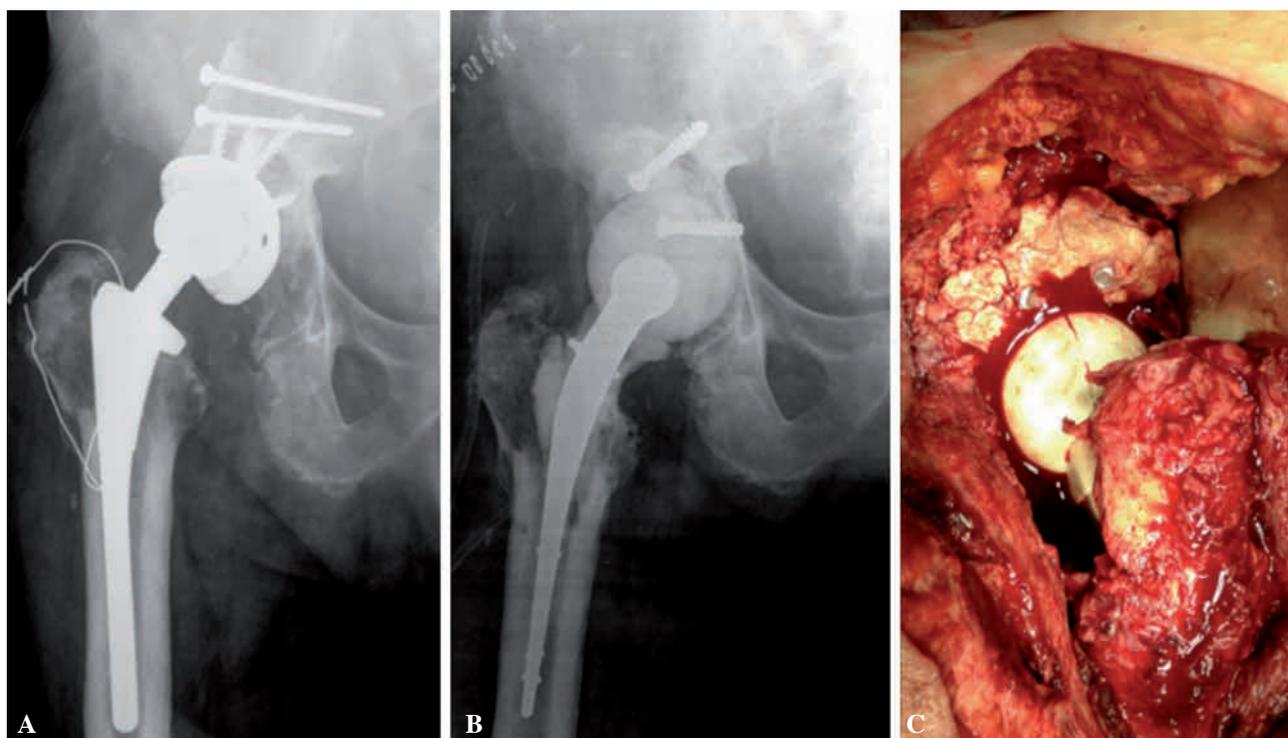


Fig. 3. — A. Preoperative aspect of an infected right total hip revision surgery. B. Radiological view of a spacer with a stabilizing tectoplasty. C. Intraoperative detail of the same case.

a risk factor for fracture and this is another reason why we advocate spacer cement fixation.

In the past few years we have been using spacers reinforced with a central metallic core in order to prevent fractures. There are some reports showing that these endoskeletons can endure greater loads (9) and our own experience has been favourable. However, it is still unclear whether the insertion of a metallic endoskeleton may actually have a negative influence on the pharmacokinetics of antibiotic elution.

Treating these conditions depends chiefly on the infection status. If infection is not yet under control a spacer exchange or stabilization surgery may be necessary. On the other hand, it is possible to go ahead with second stage revision surgery if infection is deemed to be eradicated.

CONCLUSION

The primary goal of using a spacer is to help eradicate infection. As such the persistence of infection is probably the most relevant complication. Other complications such as antibiotic related systemic toxicity or adverse reactions may also occur. Discussing these biologic complications is beyond the scope of this paper.

Going forward, one must consider not just eradicating infection but also the importance of restoring function. In this regard using a mobile spacer adds an element of physiologic motion that both increases patient comfort between stages and facilitates re-implantation surgery. Conversely, mechanical complications are one of the major consequences of this preference. Be that as it may there are ways



Fig. 4. — Right hip spacer with a neck fracture

to minimize these problems. It is the surgeon responsibility to optimize mechanical circumstances as much as possible.

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