



Spacer-related problems in two-stage revision knee arthroplasty

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Although articulated cement spacers are frequently used in a staged approach of an infected total knee arthroplasty (TKA), no data are available on the incidence and type of spacer-related problems in these patients. A retrospective analysis of 154 patients who underwent a two-stage revision procedure for an infected TKA was performed. All patients received an articulating cement spacer at the implant removal procedure; their radiographs were analyzed for spacer-related issues such as spacer dislocation, fracture, tilting or translation, and knee subluxation. In 43% of the patients, the spacer was considered as optimal. The main finding of this study is the large incidence (57%) of spacer-specific problems in two-stage revision knee arthroplasty for infected TKA. Spacer tilting and mediolateral translation were found to be the most frequent spacer-specific problems, in 24% and 21% of the cases respectively. These were considered as minor problems. Major problems were seen in 12%: in 3% of the knees the spacer had dislocated, in 5% the spacer fractured and in 4%, although the spacer seemed to be adequately positioned relative to the femoral and tibial bone, frank knee subluxation could be noted. The impact of spacer-specific problems with articulating cement spacers on final outcome in two-stage revision knee surgery will be further investigated.

Keywords: articulating cement spacer; total knee arthroplasty; two-stage revision.

INTRODUCTION

Infection is a devastating complication after primary total knee arthroplasty (TKA), with a reported incidence of 1-4.4% (7,9,10,18). Infection compromises knee joint function, causes important pain and morbidity and places a significant financial burden on both the patient and the health care system as surgical revision is often unavoidable (13). Unlike aseptic TKA revisions, a staged approach is generally advocated. Several options are proposed, but most often involve a resection arthroplasty, with subsequent placement of a static antibiotic cement block or an articulating cement spacer. Sporadically, a one-stage intervention can be performed. Initially, static spacers were developed to maintain soft tissue tension and to provide local antibiotic treatment (2). Cement spacers have a satisfying infection control rate of up to 96% (5). Several complications of a

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two-staged procedure such as bone loss, extensor mechanism contracture, stiffness and loss of bone stock were noticed (3,4,15). To improve functional outcome, functional articulating spacers have been developed (4). These are thought to provide an improved final range of motion (ROM) and a higher number of successfully controlled infections (6,8,13). Re-infection rates are reportedly lower than after insertion of a block spacer (8). Although articulated cement spacers are thus frequently used in order to treat an infected TKA in a staged approach, current literature lacks data on the incidence and type of spacer-specific problems in these patients. In our own clinical experience, we noted an important incidence of problems such as spacer fracture, dislocation or joint subluxation. The purpose of this study was to study the incidence of issues associated with these spacers.

PATIENTS AND METHODS

A total of 155 articulating cement knee spacers that were implanted in 154 patients (62 male and 92 female) during the first stage of a two-stage intervention for infected TKA were retrospectively analyzed. Average age was 66 years (SD :11) and mean body mass index was 29 kg/m² (SD : 5.4).

All spacers were molded intra-operatively using the StageOne[®] Knee Cement Spacer Mold system (Biomet, Warsaw, USA) which allows medio-lateral tibial and femoral component sizing ranging from 65 to 80 mm, and 60 to 75 mm respectively. Study inclusion criteria were infections based on (1) a sinus tract communicating with the prosthesis ; or (2) a pathogen isolated by culture from at least two separate tissue or fluid samples obtained from the affected prosthetic joint ; or (3) at least four of the following six criteria : (a) an erythrocyte sedimentation rate [ESR] greater than 30 mm/hour and a serum C-reactive protein [CRP] greater than 10 mg/L ; or (b) an elevated synovial leukocyte count ; or (c) an elevated synovial neutrophil percentage ; or (d) presence of purulence in the affected joint ; or (e) isolation of a microorganism in one culture of periprosthetic tissue or fluid ; or (f) greater than five neutrophils per high-power fields observed from histologic analysis of peri-prosthetic tissue (16). Most common infecting organisms were coagulase-negative Staphylococci (48%) and Staphylococcus aureus (14%). At the first stage intervention, tibial, femoral and patellar prosthetic components were removed and

the synovial tissue was thoroughly debrided. Next, both tibial and femoral intramedullary shaft were rinsed with 10 liters of saline solution while the all-cement spacer was created. Tibial and femoral sizing was done by comparing the silicon molds to the removed components and the remaining bone tissue. In all spacers, antibiotics (Refobacin or Vancogenx) were added to the cement. The patella was left unresurfaced. No cement was used to attach the spacer components to the femoral or tibial bone surface. After the intervention, all patients were braced and partial weight bearing was allowed. Between stages, patients remained in hospital for intravenous antibiotic therapy and the surgical wound was monitored for signs of leakage or recurring infection. In 8 patients, at least one additional surgical intervention was indicated. In four of them, the cement spacer was exchanged before final revision TKA.

The ideal time to proceed with the second stage reconstructive intervention was determined by the intra-operative cultures and the patient's clinical and biochemical infection parameters after discontinuing antibiotic therapy. The second stage intervention was performed after a mean 55 ± 24 days. Knees were routinely analyzed by plain radiography one week after implantation of the spacer and the day before revision TKA. Radiographic spacer-specific findings were assessed by two observers and listed in the following categories : optimal size and position of the spacer (Fig. 1), spacer component tilting (Fig. 2), medio-lateral shift of the tibial component in relation to the femoral component (Fig. 3), component dislocation (Fig. 4) fracture of the spacer (Fig. 5) and, finally, knee subluxation (Fig. 6). In case of multiple spacer-specific problems, the most serious problem determined grading.

RESULTS

Sixty-seven spacers (43%) were considered as optimally sized and positioned. In 38 cases (24%), component tilting was found ; in the majority of these cases only the femoral (25 : 15%) or tibial (10 : 6%) component tilted, but in 4 patients (3%), both components showed significant tilt. Another 33 spacers (21%) had undergone a medio-lateral translation relative to each other. Tibial or femoral components were found dislocated in 4 cases (3%). In 7 patients (5%), the femoral spacer component had fractured and a total of six knees (4%) showed manifest anteroposterior joint subluxation between stages (Fig. 7).



Fig. 1. — Good position and size



Fig. 2. — Component tilting



Fig. 3. — Mediolateral translation

DISCUSSION

The main finding of this study is the large incidence (57%) of spacer-specific issues in two-stage revision knee arthroplasty for infected TKA. A major spacer-related problem occurred in 12% of our cases. Recently, Wan *et al* and Choi *et al* evaluated the use of different spacers in 2-stage treatment for infected TKA (1,17). Their analysis demonstrated that articulating spacers are safe and can provide good final results in terms of infection control and functional outcome in these two-stage approaches. However, their analysis lacks a thorough evaluation of spacer-related problems.

We retrospectively analyzed 154 patients in whom an articulating cement spacer has been implanted. In our series, only 43% of all spacers were considered optimal, although most spacer-specific issues were interpreted as minor. However, a total of 12% showed major spacer issues such as fracture



Fig. 4. — Component dislocation



Fig. 5. — Component fracture



Fig. 6. — Knee subluxation

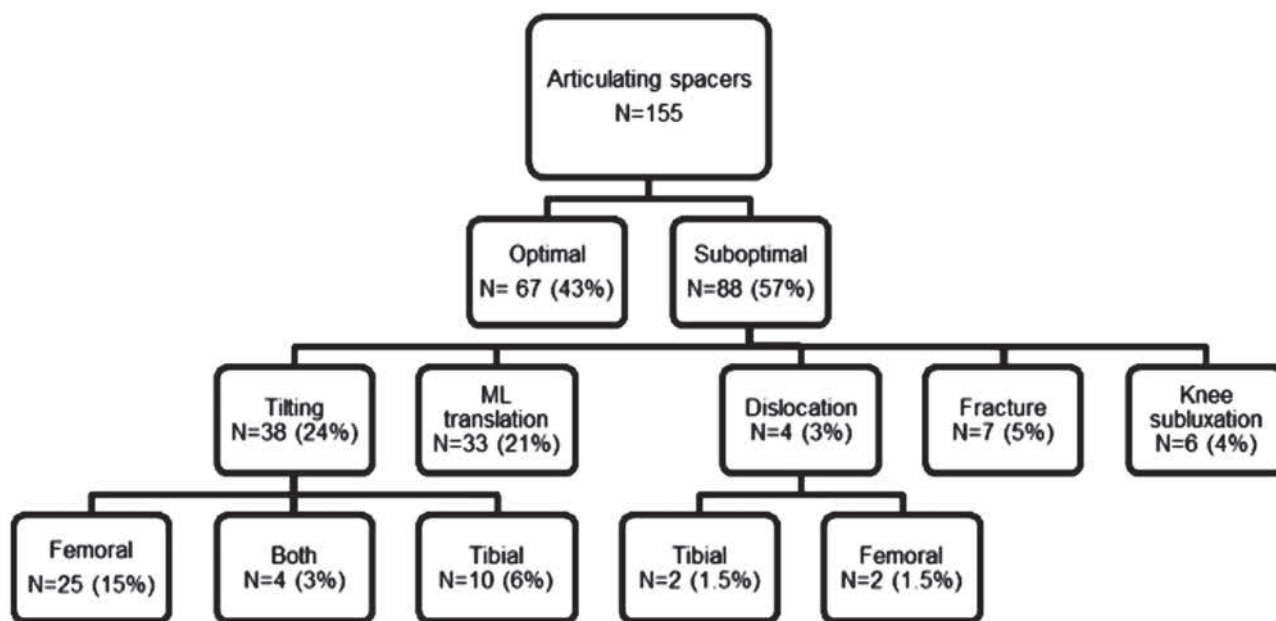


Fig. 7. — Incidence of complications

of the spacer, spacer dislocation or knee subluxation. As mentioned before, articulating spacers have been developed to improve final functional outcome (3,4,15). With radiological spacer-specific problems being so frequent, it is logical to assume

that at least some of these findings could compromise the final outcome after two-stage revision of an infected TKA. Very recently, Kasmire *et al* reported body mass index and preoperative KSS clinical scores to be independent predictors of post-

operative functional outcome in revision TKA following aseptic failure (12). We suspect spacer-specific problems could be another independent predictor in two-stage revision surgery. Recently, Mahmud *et al* evaluated functional outcome after two-stage revision TKA. In 253 revision procedures in 239 patients, they found a postoperative Knee Society Clinical Rating score [KSRS] of 65 (14), while the mean KSRS at follow-up was 80 after 12,261 primary TKA's (11). This study therefore has identified a potential window for the further improvement of functional outcome in these patients. Although the overall outcome after the use of these spacers is excellent, more research is needed to evaluate the impact of spacer-related issues on final outcome (6,15).

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