



Review Article

Static antibiotic spacers augmented by calcium sulphate impregnated beads in revision TKA: Surgical technique and review of literature

Salvatore Risitano^{a,c,*}, Luigi Sabatini^a, Francesco Atzori^b, Alessandro Massè^a, Pier Francesco Indelli^c

^a Department of Orthopaedic Surgery and Traumatology, University of Turin, “Città della salute e della scienza”-CTO Hospital of Turin, Turin, ITA, Italy

^b Department of Orthopaedic Surgery, Cottolengo Hospital, Turin, Italy

^c Department of Orthopaedic Surgery and Bioengineering, Stanford University School of Medicine and the Palo Alto Veterans Affairs Health Care System (PAVAHCS), Palo Alto, CA, USA

ARTICLE INFO

Keywords:

Total knee arthroplasty
Periprosthetic joint infection
Beads
DAPRI
Static cement-spacer
Local antibiotic therapy

ABSTRACT

Periprosthetic joint infection (PJI) is a serious complication in total knee arthroplasty (TKA) and represents one of the most common causes of revision. The challenge for surgeons treating an infected TKA is to quickly obtain an infection-free joint in order to re-implant, when possible, a new TKA. Recent literature confirms the role of local antibiotic-loaded beads as a strong bactericidal, allowing higher antibiotic elution when compared with antibiotic loaded spacers only. Unfortunately, classical Polymethylmethacrylate (PMMA) beads might allow bacteria adhesion, secondary development of antibiotic resistance and eventually surgical removal once antibiotics have eluted. This article describes a novel surgical technique using static, custom-made antibiotic loaded spacers augmented by calcium sulphate antibiotic-impregnated beads to improve the success rate of revision TKA in a setting of PJI. The use of calcium sulphate beads has several potential benefits, including a longer sustained local antibiotic release when compared with classical PMMA beads and, being resorbable, not requiring accessory surgical interventions.

1. Introduction

Periprosthetic joint infection (PJI) is a serious complication of total knee arthroplasty (TKA) with devastating effects on the local knee anatomy and on the general health of patients. Currently, infection in TKA represents one of the most common reasons for revision, causing 25% of overall failures¹; the incidence is reported nearly 2% within 20 years from primary TKA (41% of these occurring in the first 2 years) and between 8% and 12% from revision TKA.^{2,3}

Incidence is growing up rapidly: the demand for TKA increases over time and Parvizi et al.⁴ predicted an annual rate of PJIs between 38 000 and 270 000 in the United States by the year 2030. Furthermore, PJIs represent an important economic load on the health care system: an average cost for hospitalization of knee patients with PJI of \$25 300 (CI, \$22 500–\$28 100) in 2001 and \$24 200 (CI, \$22 800–\$25 600) in 2009 has been previously reported and an increasing annual cost from \$ 566 millions in 2009 to 1,62 billions in the 2020 is expected in the United States.⁵

Diagnosis a PJI is a challenge for surgeons but it is mandatory to

distinguish between an aseptic and a septic loosening in case of a painful TKA: infections jeopardize the general health status of patients, requiring prolonged hospitalizations and repeated surgical treatments. In some cases, these treatments can result in loss of implant, leading to limb deformity and reduction of autonomy during daily living activities.⁶

Physical examination, symptoms and an evaluation of risk factor and comorbidities are mandatory to determinate how likely or unlikely a PJI may occur. First, a “without doubt” diagnosis of PJI is still challenging at our days: there is not a universally recognized definition of deep periprosthetic infection and which variables participate in making a final call are still subjects of debate. In 2011, the workgroup of the musculoskeletal infection society⁷ tried to produce a “gold standard” definition for PJI to be universally adopted by physicians: several criteria were proposed, including the presence of a sinus tract communicating directly with the prosthesis and the identification of the pathogen is at least two samples of tissue or articular fluid obtained from the affected joint.

Second, surgeons are used to perform expensive and often useless

* Corresponding author at: Department of Orthopaedic Surgery and Traumatology, University of Turin, “Città della salute e della scienza”-CTO Hospital of Turin, Via Zuretti, 29, 10126 Turin, ITA, Italy.

E-mail address: srisitano@gmail.com (S. Risitano).

<https://doi.org/10.1016/j.jor.2018.02.008>

Received 26 September 2017; Received in revised form 16 January 2018; Accepted 18 February 2018

Available online 21 February 2018

0972-978X/ © 2018 Prof. PK Surendran Memorial Education Foundation. Published by Elsevier, a division of RELX India, Pvt. Ltd. All rights reserved.

multidisciplinary diagnostic tests trying to identify an infected TKA; unfortunately, the current literature showed no effective diagnostic tests for periprosthetic infections and proposed algorithms in case of suspected infection remain unclear. A clinical practice guideline has been adopted in 2010 by the American Academy of Orthopaedic Surgeons to facilitate diagnosis in suspected PJI: the initial screening of patients with a painful TKA includes the measurement of the levels of several systemic markers of inflammation, such as C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR), followed by an arthrocentesis performed for synovial fluid analysis to detect leukocyte counts and differentials and culture and sensitivity in those patients with elevated levels of CRP and ESR.

Third, CRP and ESR usually remain elevated for 3–8 weeks post-operative as markers of normal inflammation resulting after surgery; this might interfere with interpretation of the results in the diagnosis of early PJI.⁸ Furthermore, as showed by McArthur et al.⁹ in their study, almost 4% of patient with PJIs are seronegative showing normal values of ESR and CRP. Seronegative PJIs are associated with a lower aspirate cell count and lower incidence of staphylococcus Aureus infection.

Joint aspiration has become the “gold standard” in diagnosis of periprosthetic infections and it could also be repeated in case of discrepancy between clinic presentation and initial aspiration culture results. Fluid obtained from the joint should be sent for analysis of synovial fluid white blood cell count, percentage of neutrophils and culture for aerobic and anaerobic organism.¹⁰ Culture of aerobic and anaerobic organism usually require several days to verify presence or absence of germs; thus, interpretation of synovial fluid leukocyte count is faster and easier. Trampuz et al.¹¹ in their study concluded that a synovial fluid leukocyte of > 65% neutrophils had a sensitivity of 97% and a specificity of 98% detecting PJI while a leukocyte count of > $1,7 \times 10^3/\mu\text{l}$ had a sensitivity and a specificity of 94% and 88% respectively.

Currently, synovial biomarkers such as leukocyte esterase, Interleukine 6 and alpha defensin are showing promising results improving diagnostic accuracy¹² while nuclear imaging is nowadays weakly recommended in several guidelines, showing benefit only in case of strong discrepancy between clinical presentation and laboratory exams and establishing a lower or higher probability of infection.¹⁰

Conventionally, there are three different surgical options to treat an infected TKA: debridement, antibiotics and implant retention (DAIR), one stage exchange arthroplasty and a two-stage exchange implant using dynamic or static cement spacer. Arthrodesis or amputations are also two drastic options reserved for patients who have persistent infected TKA after a failed subsequent two-stage revision arthroplasty.

The DAIR Procedure is particularly indicated for acute (within 3 weeks from the original surgery) or hematogenous PJI, having the goal to reduce microorganism loads before of bacterial biofilm formation. This surgical procedure includes removal of skin margins and eventual sinuses, a radical, “tumor-like” synovectomy and exchange of polyethylene insert. Choi et al.¹³ have shown that leaving the original tibial insert is an important risk factor for failure.

Promising results have been shown comparing the success rate of DAIR for early versus chronic knee PJIs: treating acute infection showed a success rate between 31% and 100%, while a success rate between 28% and 62% is reported when treating chronic TKA infection.¹⁴ Furthermore, Vilchez et al.¹⁵ concluded that using debridement with implant retention treating Hematogenous PJI due to *S. Aureus* showed worse results than early post-surgical infections.

The current literature shows the current “gold standard” being a surgical procedure characterized by a total exchange of all components; however, which is the optimum management to treat infected TKA between one or two-stage revision is still unclear.¹⁶

One stage revision is a procedure where the removal of prosthetic components and debridement is immediately followed by the re-implantation, while, in two stage procedures, the re-implantation is performed after a period of systemic antibiotic treatment combined with

an intra-articular antibiotic loaded cement spacer, static or dynamic, to fill the intra-articular defect left by the removed components and to increase the local elution of antibiotics.¹⁷

Traditionally, the debate on one or two-stage revision has favoured two stage procedures; however, some studies suggest one-stage exchange arthroplasty may provide superior outcomes, including lower re-infection rates and superior function in selected patients. Interestingly, articles supporting one stage revisions have been published after 2000; before that time, no significant differences in re-infection rate between the two procedures were reported.^{18,19}

Historically, the surgical treatment has been combined by the use of local and systemic antibiotic therapy: different systemic antibiotic therapy protocols have been chosen, depending upon several factors like bacterial properties, metabolic activity and related antibiotic resistance. Unfortunately, the literature on the role of adjunctive local antibiotic therapy is sparse: the current study proposes a novel surgical technique for double-stage revision TKA using a custom-made static antibiotic spacer combined with calcium sulphate antibiotic impregnated beads aiming to increase the success rate in revision TKA for PJI.

2. Surgical technique for revision TKA using calcium sulphate antibiotic impregnated beads

At the senior author institution, in a PJI setting, we routinely use two different surgical techniques according to the PJI staging.⁷ The first technique is represented by Debridement, Antibiotic Pearls and Retention of the Implant (DAPRI); the second technique is a standard two stages technique modified by utilizing a static antibiotic spacer plus Calcium sulphate antibiotic impregnated beads to treat the deep periprosthetic infection of the knee. Both surgical techniques characterized by the use of calcium sulphate antibiotics impregnated beads were recently implemented by the other current authors to target patients affected by PJIs following a clinical diagnosis established by elevated values of systemic markers of inflammation, such as high CRP and ESR concentration and confirmed by a pre-operative synovial fluid analysis showing elevated white blood cells count and elevated percentage of neutrophils.⁶

These Calcium sulphate antibiotic impregnated beads (Stimulan, Biocomposites Ltd., Keele, UK) are a biocompatible and dissolvable antibiotic loaded intra-articular system to allow for an intraarticular, continuous delivery of antibiotics in the infected joint. They are composed by hydrophilic crystals, initially soft after hydration, which usually disappear on radiologic examination in a four to six weeks timeframe after being used as intra-articular devices.

At the senior author Institution, before surgery, all patients undergo standard antero-posterior, lateral and Merchant View of patella²⁰ in order to exactly detect the septic loosening of the implant. A CT study is often required in order to quantify the amount of bone loss following PJI and in all cases of painful TKA to evaluate eventual components malalignment. Patients are scheduled after blood and synovial testing confirming an acute or chronic infection of the implant. In the case of an acute or haematogenous infection⁷ with identification of the responsible organism and no sinus-tract, the current authors suggest a DAPRI procedure: this procedure include an aggressive tumor-like intra articular synovectomy and capsulotomy, a three minutes diluted povidone iodine bath, abundant irrigation with antibiotic-containing solution, exchange of the polyethylene insert and final addition of calcium sulphate antibiotic-impregnated (according to the culture and sensitivity test) custom made beads.

In the case of a delayed or chronic PJI,⁷ a two-stage revision is recommended. This second surgical technique deeply described here, includes a standard median parapatellar capsulotomy, following a skin incision routinely placed on the previous surgical scar: 3 soft tissues samples are intraoperatively obtained and sent for standard bacteriological exams. Following this, an aggressive synovectomy is

Download English Version:

<https://daneshyari.com/en/article/8720145>

Download Persian Version:

<https://daneshyari.com/article/8720145>

[Daneshyari.com](https://daneshyari.com)