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Original Article

Two-stage arthroplasty using functional temporary prosthesis to treat infected arthroplasty and septic arthritis of the hip

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ABSTRACT

Aims: This study introduced a modified technique in two-stage revision arthroplasty to insert functional spacer using modular components coated with antibiotic-impregnated polymethylmethacrylate.

Methods: Since June 2006, we used the construct in twenty-three consecutive patients (17 with infected arthroplasty, and 6 with septic arthritis of the hip).

Results: Mean follow-up was 48 months (range 30–84 months). Two patients were excluded (no second stage), two patients had persistent infection, 19 patients received successful re-implantation at the second-stage.

Conclusion: The technique provides a construct that can be used safely and successfully as a functional, spacer in two-stage revision arthroplasty.

1. Introduction

Sepsis after total hip arthroplasty (THA) is a potentially devastating complication that may result in major morbidity for the patient and adversely affecting the functional outcome. Further operations are usually required to control the sepsis, which despite the best efforts, can ultimately end in a disfiguring result. Different treatment strategies that have been employed to clear infection and leave the patient with a functioning joint include: Antibiotic treatment alone resulting in resolution of infection (rarely achieved); prolonged suppressive antibiotics without removing the components (useful in the generally infirm with well-fixed components, highly sensitive organisms, and no systemic sepsis[1]); surgical debridement with retention of the original prosthesis (in early infection); one-stage exchange arthroplasty; two-stage exchange with or without a temporary spacer.

Sepsis in the adult native hip is an uncommon problem that has an increased incidence in the elderly and immune-compromised population with chronic diseases, with hematogenous spread resulting from urinary tract infection,

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pneumonia, endocarditis and skin infections is the most common route of infection. Patients with diabetes mellitus, cirrhosis, rheumatoid arthritis, systemic lupus erythematosus (SLE), have abnormal white blood cell (WBC) response, decreased complement and antibody function, and immune system dysfunction. Patients with local articular disorders like osteoarthritis, avascular necrosis (AVN), previous trauma, seronegative arthritides, sickle cell disease, neuropathic Arthropathy, and crystal-induced arthritis[2] have alteration of the normal joint environment interrupting the exchange process of nutrients and waste, increase in synovial permeability allowing bacterial invasion. Pyogenic arthritis and sepsis in an arthritic joint can pose difficult management problems since the risk of infection after total hip arthroplasty is very high. Treatment modalities for patients with end-stage septic arthritis include: debridement and fusion, resection arthroplasty, and reconstruction with a total joint arthroplasty after resolution of the infection in a two-stage procedure.

Two-stage revision arthroplasty is the gold standard for treatment of infection at the site of a total hip arthroplasty and different techniques have been described to perform the two-stage procedure. After removal of prosthetic components and thorough debridement carried in the first stage, the surgeon is left with choice between leaving the joint space empty, or, much better, inserting antibiotic-loaded spacer whether static[3] or functional.[4] Functional articulating spacers have the advantages of maintaining soft tissue tension, providing sufficient stability, preventing muscle contracture, and allowing the patient to ambulate partial weight-bearing the day after surgery, but have the disadvantage of high expenses.

In this study, we introduce a modified technique of two-stage arthroplasty for the management of patients with infected hip arthroplasty, and end stage septic arthritis of the hip. The technique described in this study has both advantages of using functional spacer after the first stage and low costs compared to other functional spacers.

2. Materials and methods

A prospective study was conducted using functional temporary hip prosthesis constructed by a modified technique since June 2006. The construct was used in twenty-three consecutive patients (15 men and 8 women) with a mean age of 45 years (Table 1); 17 patients with infected arthroplasty (15 patients with infected THA, and 2 patients with infected hemiarthroplasty) and 6 patients with adult native joint septic arthritis of the hip.

Two patients were excluded from the study (no second stage). Of the remaining twenty-one patients, only two patients had persistent infection after the first stage; nineteen patients received a successful re-implantation at the second-stage, and were followed for a mean of 48 months (range 30 months–84 months).

The diagnoses at the index operation in cases with infected arthroplasty are shown in Table 2

Data about each patient was documented and recorded onto case report forms. Data included patient's demographic data, medical history, index operation diagnoses, Harris Hip Score (HHS) before first stage, postoperative courses, HHS after second stage. Patients were included in the prospective study population if they met the following criteria: (1) end stage arthritis with hip infection was confirmed or suspected; (2) the patient had infection following total hip replacement, or hemiarthroplasty. Diagnosis of infection was suspected through patient's medical history, risk factors for infection, and whether there were wound complications in the post-operative period following the index operation in arthroplasty cases, clinical examination for discharging sinuses, laboratory investigations including elevated white blood cell count, ESR, C-reactive protein (CRP). Hip aspiration was performed under sterile condition prior to the first stage surgery at least 4 weeks after cessation of all antibiotic therapy. According to Parvisi J, we diagnosed periprosthetic joint infection (PJI) if one of the following 4 criteria occurs: 1) draining sinus tract, 2) positive culture on solid medium (>5 colonies), 3) purulence seen intraoperatively, 4) 3 abnormal values out of the following 4: a) ESR > 30 mm/h, b) CRP 1 mg/dl (10 mg/L), c) Joint aspirate analysis show neutrophils >1170 cells/uL for chronic PJI or 10,700 cells/uL for acute PJI, d) neutrophil percentage in joint aspirate >65% for chronic PJI or >89% for acute PJI.[5]

Patient is positioned in the true lateral position. Direct lateral approach was used in all cases. In infected arthroplasty cases with cemented femoral component (12 cases), the cemented femoral stem was loose; the difficulty mostly came with cement removal due to strong interdigitation at the bone-cement interface. Cement is then removed antegrade and completed with "scaphoid osteotomy technique", where a carefully planned osteotomy of the anterolateral cortex of the femur is performed starting at the site of the distal plug and extending for 8 cm proximal with rounded corners to minimize stress raisers to remove distal plug and the remaining cement. At the completion of the procedure, the osteotomy is fixed with cerclage wires. The acetabular components were easier to remove. Meticulous debridement and intraoperative tissue biopsy is taken (3 specimens from acetabulum and another 3 specimens from femoral side. The temporary functional hip prosthesis consists of a standard polyethylene liner, and an inexpensive modular femoral component or the removed femoral implant, which is autoclaved. We use trials of the acetabular component to dictate the size of the acetabulum. On the femoral side, we use trials for spacer G (TECRES S.P.A.), of which only 3 sizes are available (Fig. 1), to dictate the size that best fits into the femoral canal diameter, which is equivalent to the planned stem diameter together with its cement mantle.

After determining the size of acetabulum (eg 54 mm), we use the acetabular reamer tray of the same size (54 mm) as a mold and a sterile sofratol sheet is used to line reamer tray, antibiotic-impregnated polymethylmethacrylate is then

Table 1 – Demographic data.

Gender			Age		
	N	Percent	Mean age	Minimum	Maximum
Male	15	65	49	27	65
Female	8	35	37	22	59
Total	23	100.0	45	22	65