Original Article

Cefuroxime-impregnated cement and systemic cefazolin for 1 week in primary total knee arthroplasty: An evaluation of 2700 knees

Chao-Ching Chianga,b, Fang-Yao Chiu a,b,*

a Department of Orthopaedics and Traumatology, Taipei Veterans General Hospital, Taipei, Taiwan, ROC
b Department of Surgery, National Yang-Ming University, Taipei, Taiwan, ROC

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Abstract

Background: Infection is one of the most devastating complications after primary total knee arthroplasty (TKA). Antibiotics-impregnated cement has been used and proven effective in preventing deep infection. This study was to evaluate the long-term results of using cefuroxime-impregnated cement and systemic cefazolin for one week to assess their efficacy in preventing infection of primary TKA.

Methods: From 1999 to 2007, 2700 cases of primary TKA were performed with cemented fixation of all patellar, tibial, and femoral components. Cefuroxime-impregnated cement for fixation and systemic cefazolin for one week were selected in all cases. The average follow-up period was 89 months (range, 40–140). The effects of this selected regime in the periprosthetic infection were evaluated.

Results: A total of eight infections occurred after primary TKA, including five deep infections (0.19%) and three superficial infections (0.11%) in the 2700 knees. No loosening or osteolysis was noted.

Conclusion: Comparable with other measurements, cefuroxime-impregnated cement, accompany by systemic cefazolin for 1 week was shown to control postoperative deep infection to 0.19% (after primary TKA was performed in an operative setting without lamina flow and body exhaust suit).

Keywords: antibiotics-impregnated cement; body exhaust suit; deep infection; lamina flow; prevention; total knee arthroplasty

1. Introduction

One of the most devastating and costly complications of total knee arthroplasty (TKA) is deep infection. The deep infection rate in TKA has ranged from < 1%–23%,1–21 in series ranging in size from 112–12,118 knees examined. Perioperative antibiotics with or without special measures have been very effective in lowering the rates of deep infection, but, there remains a constant 1%–2% incidence of deep infection in most of the large series,5–21 which range in size from 576–12,118 knees. In our previous reports,22–24 cefuroxime-impregnated cement was shown to be effective in preventing deep infection after primary total knee arthroplasty in three different series of patients. Since 1999, cefuroxime-impregnated cement was routinely used in the fixation of our primary total knee prostheses. After a 9-year period of routine clinical application, this study was performed to evaluate the long-term effect of cefuroxime-impregnated cement, supplemented by the systemic use of cefazolin for 1 week in the prevention of infection of primary TKA. This was completed in a setting in which so-called clean air measurements such as laminar flow and body exhaust suits were not available.

2. Methods

From 1999 to 2007, 2700 consecutive primary TKA procedures were performed in 1935 patients (765 bilateral TKA). Patients with any kind of lower extremity infection (19 knees) or osteomyelitis (six knees) or loss of follow-up (85) had been excluded from this study. All operations were conducted in a standard operating room without ultraviolet (UV) light,
laminar flow, and isolation space suits. All TKA were performed via the midline incision/midvastus approach. The type of prostheses used were NexGen high-flexion total knee arthroplasty system (NexGen LPS-Flex, Zimmer, Warsaw). All TKA were fixed in full-cemented form with cefuroxime-impregnated cement\(^{16}\) (2 g cefuroxime per 40 g Simplex P cement [Stryker, Limerick, Ireland]). This study was approved by our Institutional Review Board. Prior to operation, all patients received explanations of the operation and provided written informed consent. The average patient age was 71 years (range, 32–99). There were 1210 men and 1490 women, and there were 1498 left knees and 1202 right knees. The preoperative diagnoses were osteoarthritis in 2507 knees, rheumatoid arthritis in 92 knees, traumatic arthritis in 52 knees, osteonecrosis in 35 knees, gouty arthritis in 12 knees, and psoriatic arthritis in two knees. A total of 209 patients had diabetes mellitus. 91 patients were under treatment of immunosuppressive agents for various medical diseases, 15 patients had a history of malignant tumor, 14 patients had peripheral arterial occlusive disease, and 245 patients were habitual smokers.

Preoperatively, each patient had intravenous bolus injections of cefazolin (500 mg) and gentamicin (80 mg), and intravenous injections of cefazolin 500 mg Q6H were given for 24 hours after the operation. Then, oral antibiotics with cefazolin 500 mg Q6H were given for 6 days. A drain was used for 24 hours, and then removed after the first postoperative day. From postoperative Day 1 to the day of discharge, continuous passive motion (CPM) was used. Weight bearing on the operated-on knee was allowed from the second postoperative day, and crutches were used as needed. The mean hospital stay was 7 days (range, 5–14). Type of anesthesia, operative time, tourniquet time, estimated blood loss, postoperative transfusion, wound condition, and improvement of range of motion (ROM) were all recorded for each patient.

Patients were examined postoperatively at 3 weeks, 8 weeks, 6 months, and every 6 months thereafter. The average follow-up was 89 months (range, 40–140). Radiographic evaluations were performed at every follow-up visit, and a functional evaluation was performed starting with the third postoperative visit, utilizing the Hospital for Special Surgery (HSS) score. The infections were classified as superficial or deep,\(^{16}\) and the deep infections were further categorized according to the classification system modified by Estrada, Tsukayama, and Gustilo.\(^{19}\) All deep infections were confirmed by laboratory parameters (erythrocyte sedimentation rate (ESR) and C-reactive protein) and joint fluid culture.

### 3. Results

The preoperative HSS knee scores was 48 (range, 38–62) points and the postoperative HSS knee score was 91 (range, 83–98) points. No loosening or osteolysis was noted.

Five deep infections (0.19%) and three superficial infections (0.11%) occurred in these 2700 knees (Table 1). All of the infections developed in patients who underwent the unilateral operation. Case 3 with deep infection had erythroderma and was under frequent immunosuppressive treatment. The other seven patients with infection had no history of diabetes mellitus, immunologic disorder, treatment with immunosuppressive agents for various medical diseases, malignant tumor, peripheral arterial occlusive disease, or habitual smoking. Case 4 with deep infection cultured coagulase negative staphylococcus (CNS), which was sensitive to cefuroxime; the other four patients with deep infection had cultural results of CNS or methicillin resistant staphylococcus aureus (MRSA), which were all resistant to cefuroxime. Three superficial infections occurred in the early postoperative period (6–12 days) with culture results of one CNS and two MRSA. All of the infections were managed accordingly with results shown in Table 1.

### 4. Discussion

The major focus of this study was to evaluate the effect of antibiotics (cefuroxime)-impregnated cement plus an extended period of oral antibiotics for 1 week to prevent infection in primary TKA, in an operational setting which lacked clean air measures. The incidence of superficial infection in this series is similar to those in other reports,\(^{1–37}\) and it was shown again that cefuroxime-impregnated cement had no effect in prevention of superficial infection.

In this larger series, the cefuroxime-impregnated cement could not eradicate deep infection as completely as those reported in our previous studies, and the incidence of deep infection (0.19%) in this study is still lower than those reported in other series.\(^{1–21,25–29}\) However, our operative environment has no UV light for disinfection, no laminar flow,
and no body exhaust system. Thus, it was increasingly evident, following a larger series in a longer follow-up, that cefuroxime-impregnated cement combined with systemic antibiotics for 7 days, was shown to be helpful in reducing early or intermediate deep infection for patients with or without risks of medical comorbidity. It should be stressed again that we do not believe that cefuroxime-impregnated cement alone will prevent most deep infections, but should be combined with other preventive procedures. Theoretically, the effect of antibiotics-impregnated cement would lessen as time passed, so the antibiotics might have little effect in prevention of late infection. This might have been reflected in the condition of case 4 with deep infection. In this series, seven infections developed in cases with no definite risk factor, and one deep infection (Case 3 with the deep infection; this is shown in Table 1) was thought to be originating from his skin lesions of erythroderma.

The choice of cefuroxime for impregnation in bone cement in our study was based on the reports by McQueen and Innes.

Their studies showed effective prophylaxis of infection after total joint replacement by cefuroxime in bone cement. The effect of cefuroxime on the mechanical property of cement had been discussed before.22–24 After a larger series with a longer follow-up, without any loosening of the prostheses, it was demonstrated that up to 2 g of cefuroxime per 40-g package of cement would have no adverse effect in its clinical use, similar to results in other reports.

Besides, we used hand-mixed antibiotics loaded cement instead of premixed cement. Hand-mixed and premixed antibiotic-loaded bone cement have been proven to have similar homogeneity and elution kinetics.39 Adding 2 g of cefuroxime just adds about $5 (USD) to the cost of one primary TKA procedure in Taiwan.

Concerns and limitations regarding routine use of antibiotics impregnated bone cement for prophylaxis of infection after primary TKA need to be considered. In North America, given reasons for not adopting the routine use of antibiotics-impregnated cement for primary TKA include toxicity, allergic reaction, inadequate efficacy, increased cost, bacterial resistance, and mechanical and elution properties of antibiotic-loaded bone cement.30,41 However, there is lack of strong evidence supporting these reservations against adding 2 g of antibiotics in bone cement. On the other hand, an increasing volume of evidence favors the benefits of antibiotics loaded cement for primary TKA.

In conclusion, based on these data in a larger series with extended follow-up, we did not find that the use of antibiotics-impregnated cement in primary total knee arthroplasty caused any outbreak of drug-resistant infection. On the contrary, it achieved a reasonably low infection rate in combination of other medically prudent measures, such as systemic cefazolin, meticulous wound management, and reduced tourniquet time.

References


