Prophylactic vancomycin mixed bone cement in primary joint replacement surgery

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Abstract

Background: Infection is most serious complication in joint replacement surgeries. Apart from maintaining sterility in operation theatre and preoperative intravenous antibiotic prophylaxis, local antibiotic delivering systems are proven to be effective1. Currently Polymethylmethacrylate (PMMA) is widely used as bone cement for delivering antibiotics and accepted as the current standard antibiotic delivery vehicle in orthopaedic surgery. Considering cost effectiveness of the commercially available antibiotic loaded bone cement (ALBC) and feasibility in rural India, we decided to mix vancomycin with bone cement manually and studied its effectiveness in joint replacement surgeries.

Methods: This was a prospective randomized case series study. Total 98 patients having 40 cemented bipolar, 20 cemented THR, 38 TKR involved in the study. Posterior approach was taken for THR and bipolar hemiarthroplasty, medial parapatellar approach was taken for TKR. 40 grams of bone cement is mixed manually mixed with 1 gram of vancomycin powder. Cement was used as standard technique in these surgeries. Weight bearing done as for the tolerance and were followed up at 1, 3 and 6 months assessed with CBC, ESR, CRP and X rays.

Results: Out of 98 patients 5 patients lost follow up in which there were 3 Bipolar hemiarthroplasty and 2 THR. Out of 93 patients two bipolar, one THR and one TKR patient died because of causes not related to our study. In total remaining 89 patients, there was superficial infection in one TKR patient which was treated with superficial debridement resuturing.

Conclusions: We found that by this technique infection rate is significantly reduced, however we have small sample size and we don’t have control group.

Keywords: Patients: arthroplasty, antibiotic bone cement, joint infections

Introduction

Infection is most serious complication in joint replacement surgeries. It increases morbidity, affects quality of life, drains financially to patients and increases stress, hopelessness for treating surgeon and also it adds to the national health expenditure. Therefore, prophylaxis is given utmost importance in any joint replacement surgeries. Apart from maintaining sterility in operation theatre and preoperative intravenous antibiotic prophylaxis, local antibiotic delivering systems are proven to be effective [1]. Currently Polymethylmethacrylate (PMMA) is widely used as bone cement for delivering antibiotics and accepted as the current standard antibiotic delivery vehicle in orthopaedic surgery.

The proven advantage of this direct antibiotic release is achievement of high concentrations at the site of action, and minimal or no systemic toxicity [2]. Various research has been made with bone cement mixed with antibiotic such as gentamycin [3], daptomycin [4], ciprofloxacin [5], vancomycin, linezolid [6]. However, a study suggests that vancomycin with bone cement might increase the duration of its antibacterial activity in the joints from 28 to 40 hours [7]. And also considering cost effectiveness of the commercially available antibiotic loaded bone cement (ALBC) and feasibility in rural India, we decided to mix vancomycin with bone cement manually and studied its effectiveness in joint replacement surgeries.

Methods

This was a prospective case series study. The study period was 24 months i.e. from December 2017 to December 2019.
Institutional ethics committee approval was obtained for the study. Written informed consent was taken from all the participants willing to participate in the study. Inclusion criteria was, all patients indicated in partial or total joint replacement surgeries. Exclusion criteria were, uncemented arthroplasties, revision arthroplasties, patients with severe cardiovascular compromise and patients allergic to vancomycin. All hip surgeries were done through posterior approach and knee surgeries done through medial parapatellar approach with inflating tourniquet. One hour before the surgery, Intravenous 1.5 gm cefuroxime sodium was given as preoperative antibiotic prophylaxis and continued twice daily for 5 days. One gram of vancomycin is used in 40 grams of bone cement. Palacose bone cement is used in 38 patients, simplex is used in 60 patients. One gram of vancomycin added with bone cement powder and thoroughly stirred, this is mixed with monomer liquid. Cement gun is used to insert bone cement in to the medullary cavity of the femur in THR and bipolar hemiarthroplasty, acetabulum bone cement put manually in doughy form. Weight bearing done as per tolerance from next day of the surgery. Drain removal done on second day and suture removal done on 12th to 14th post op day. Patient follow up done at one month, three months and six months. During follow up patients are assessed clinically for local signs of infection and investigation like CBC, ESR, CRP, X rays done in all follow-ups. Data was tabulated in Microsoft excel spread sheet and percentages and proportions were estimated.

**Results**

At the end of the study all the data is combined and produced as a result. Out of 98 participants included in the study 46.93% were male and 53.06 % were female (Table 1). 42.86% of the participants were in the age group of 60-69 years followed by 23.47% in the age group of 70 to 79 years. In 50 to 59 years age group there were 22.45% of participants. Majority of the participants 36.73 % had fracture neck of femur, 33.67% had osteoarthritis of knee (Table 2). 40.82% of participants underwent Cemented bipolar hemiarthroplasty, 20.41% of participants underwent cemented THR and remaining 38.76% of participants had TKR. Out of 98 patients 5 patients were lost for follow up among these participants 3 participants had bipolar hemiarthroplasty and 2 had THR performed. Out of 93, there were 4 mortality 2 were of bipolar, one was of THR and one was of TKR patient. In remaining 89 who were followed up superficial infection was observed in one TKR patient. There was no loosening of implants in any of the patients.
The aim of this study was to use of antibiotic bone cement in joint replacement surgeries. Antibiotic mitigating staphylococcus species are more effective in ALBC as studied by Jiranek et al. [11]. The commercial available gentamicin bone cement provides sufficient concentration to be bactericidal even against methicillin-resistant staph aureus. In addition, the level of gentamicin in the joint is often 10 times greater than safe blood levels, and the efficacy is excellent.

But in developing countries, the availability of ALBC is precarious, and also risk of infections are more because of lack of infrastructure, training and noncompliant patients. There are studies, documented as 1 gram of vancomycin [8] in 40 grams of bone cement, causes minimal change in chemical and physical properties of bone cement. Most common cause of deep infections in joint replacement surgeries is staphylococcus species, which is sensitive to vancomycin. Therefore, we decided to use 1 gram of vancomycin in 40 grams of bone cement in our study.

The Swedish Knee Registry reports an infection rate of 1.7% in patients with osteoarthritis and 4.4% in patients with rheumatoid arthritis [12]. In present study there was only one (1.07 %) patient out of 89 patients got superficial infection which was treated with local debridement and resutting and patient did well afterwards. There was no infection in bipolar and THR cases. Therefore, in our study there was significant reduction in infection rate (1.07%) comparing to Swedish Knee Registry (1.7 %).

Conclusion
In our study, we have assessed the rate of infection by using bone cement mixed with vancomycin in joint replacement surgeries. We found that by this technique infection rate is significantly reduced, however we have small sample size and we don’t have control group. To confirm our results further study required having large sample size, longer follow-up with control group.

Declarations
Funding: None
Conflict of interest: None

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