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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 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 vancomycin⁸ 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 vancomycin⁸ 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 were diagnosed with 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.

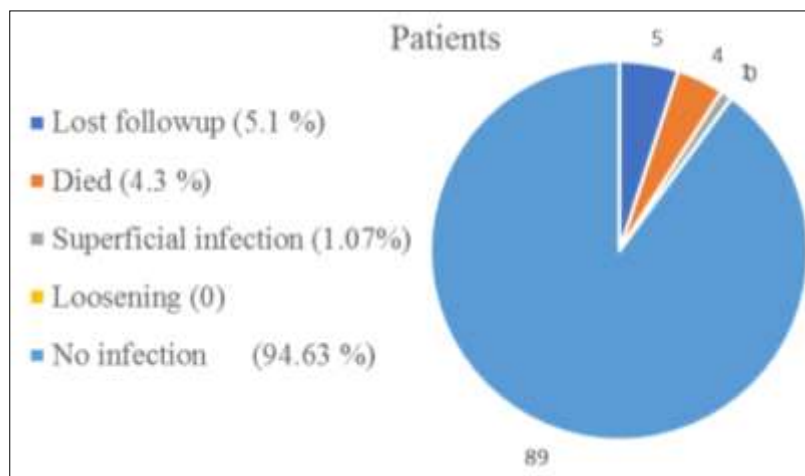


Fig 1: Outcome distribution.



Fig 2: Instruments for bone cementing.



Fig 3: Post op TKR



Fig 4: Post op hemiarthroplasty



Fig 5: Post op THR.

Table 1: Age and gender wise distribution of study participants

Age group	Male		Female		Total	
	n	%	n	%	n	%
40-49	4	8.67	2	3.85	6	6.12
50-59	9	19.56	13	25	22	22.45
60-69	19	4.13	23	44.23	42	42.86
70-79	9	19.56	14	26.92	23	23.47
80-89	5	10.87	0	00	5	5.10
	46	46.93	52	53.06	98	100

Table 2: Distribution of participants based on the diagnosis

Diagnosis	Male		Female		Total	
	n	%	n	%	n	%
avn	10	22.22	00	00	10	1.02
Hip arthritis	01	2.22	01	1.89	02	2.04
ITNF #	03	6.67	03	5.66	06	6.12
neck femur #	13	28.89	23	43.40	36	36.73
OA KNEE	16	35.56	17	32.08	33	33.67
old amp failure	00	00	02	3.77	02	2.04
old bipolar failure	01	2.22	00	00	01	1.02
old neck femur	01	2.22	02	3.77	03	3.06
RA KNEE	00	00	05	9.43	05	5.10
	45	100	53	100	98	100

Table 3: Distribution of participants based on the surgery performed

Surgery	Male		Female		Total	
	n	%	n	%	n	%
Cemented bipolar hemiarthroplasty	15	28.85	25	54.35	40	40.82
cemented THR	15	28.85	05	10.87	20	20.41
TKR	22	42.31	16	34.78	38	38.76
	52	100	46	100	98	100

Discussion

The aim of this study was to use of antibiotic bone cement in primary arthroplasty to prevent deep joint infections. The most common cause of implant failure in arthroplasty is deep

infection [9]. Many factors are contributing the infection like patient factors (systemic diseases, local skin condition, etc) surgical factors (operation theatre, implant, antibiotic usage, post op wound care)

Buchholz *et al.* [10] in 1969, introduced usage of antibiotics with bone cement. In 1970 Palacos bone cement with gentamicin powder was introduced commercially and CMW was introduced in 1990. Since staphylococcal species are the primary bacterial infection 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 resuturing 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

References

1. Prophylactic use of antibiotic-loaded bone cement in primary total knee arthroplasty: Justified or not? Srivastav AK, Nadkarni B, Srivastav S, Mittal V, Agarwal S. Indian J Orthop 2009;43(3):259-63.
2. Regis D, Sandri A, Samaila E, Benini A, Bondi M, Magnan B. Release of gentamicin and vancomycin from preformed spacers in infected total hip arthroplasties: measurement of concentrations and inhibitory activity in patients' drainage fluids and serum. Scientific World Journal 2013, 752184.
3. Neut D, Kluin OS, Thompson J, van der Mei HC, Busscher HJ. Gentamicin release from commercially-available gentamicin-loaded PMMA bone cements in a prosthesis-related interfacial gap model and their antibacterial efficacy. BMC Musculoskelet Disord

- 2010;11:258.
4. Hsu YM, Liao CH, Wei YH, *et al.* Daptomycin-loaded polymethylmethacrylate bone cement for joint arthroplasty surgery. *Artif Organs* 2014;38:484-492.
 5. Martinez-Moreno J, Mura C, Merino V, Nacher A, Climente M, Merino-Sanjuan M. Study of the influence of bone cement type and mixing method on the bioactivity and the elution kinetics of ciprofloxacin. *J Arthroplasty* 2015;30:1243-1249.
 6. Snir N, Meron-Sudai S, Deshmukh AJ, Dekel S, Ofek I. Antimicrobial properties and elution kinetics of linezolid from polymethylmethacrylate. *Orthopedics* 2013;36:e1412-e1417.
 7. Antibacterial activity of joint fluid in cemented total-knee arthroplasty: an *in vivo* comparative study of polymethylmethacrylate with and without antibiotic loading. *Ueng SW, Hsieh PH, Shih HN, Chan YS, Lee MS, Chang Y Antimicrob Agents Chemother* 2012;56(11):5541-6.
 8. Van de Belt H, Neut D, Schenk W, van Horn JR, van Der Mei HC, Busscher HJ. Staphylococcus aureus biofilm formation on different gentamicin-loaded polymethylmethacrylate bone cements. *Biomaterials* 2001;22:1607-1611.
 9. Fish DN, Hoffman HM, Danziger LH. Antibiotic-impregnated cement use in U.S. hospitals. *Am J Hosp Pharm* 1992;49:2469-74.
 10. Buchholz HW, Gartmann HD. Infection prevention and surgical management of deep insidious infection in total endoprosthesis. *Chirurg* 1972;43:446-53.
 11. Jiranek WA, Hanssen AD, Greenwald AS. Antibiotic-Loaded Bone Cement for Infection Prophylaxis in Total Joint Replacement. *J Bone Joint Surg Am* 2006;88:2487-500
 12. Robertsson O, Knutson K, Lewold S, Lidgren L. The Swedish knee arthroplasty register 1975-1997: an update with special emphasis of 41,223 knees operated on in 1988-1997. *Acta Orthop Scand* 2001;72:503-13.