Journal of Orthopedic Oncology
ISSN 2472-016X

Patel et al., J Orthop Oncol 2020, 6:2

Mini Review Open Access

Is Antibiotic Loaded Bone Cement Cost-Effective in Routine Primary Hip and Knee Arthroplasty?

Jay N Patel[1], **Tyler Hoskins**[1*], **Christopher Mazzei**[1], **David Goyette**[1], **Bishoy Saad**[1,2], **Jaclyn Jankowski** [1,2] **and James C Wittig**[1]

[1]*Department of Orthopaedic Surgery, Morristown Medical Center-Atlantic Health System, Morristown, NJ, United States of America*

[2]*Department of Orthopaedic Surgery, Jersey City Medical Center-RWJ Barnabas Health, Jersey City, NJ, United States of America*

[*]**Corresponding author:** Tyler Hoskins, Department of Orthopaedic Surgery, Morristown Medical Center-Atlantic Health System, Morristown, NJ, United States of America, E-mail: Tyler.Hoskins@atlantichealth.org

Received date: July 07, 2020; **Accepted date:** July 23, 2020; **Published date:** July 30, 2020

Abstract

Post-operative infection following total joint arthroplasty is becoming increasingly more prevalent across the nation and can result in grave consequences for patients. In order to limit the incidence rate, surgeons have recently opted to use antibiotic loaded bone cement (ALBC) over plain bone cement (PBC) due to its theoretical potential to lower infection rates. However, the cost-effectiveness of this intervention still remains under scrutiny.

Keywords: Infection; Arthroplasty; Hip; Knee; Joint; Bone cement; Antibiotics

Introduction

One of the most dreaded complications following total joint arthroplasty (TJA) is deep infection. With the advent of highly cross-linked polyethylene and other technological advances, one of the most common reasons for revision joint arthroplasty is now deep infection. Antibiotic-loaded bone cement (ALBC) was first introduced and used in lieu of plain bone cement (PBC) by Buchholz and Englebrecht in 1970 in an effort to decrease infection rates [1].The literature has not been clear on the effectiveness of ALBC in decreasing infection rates in TJA patients. Furthermore, studies have reported that when high doses antibiotics (>4.5 grams of antibiotic powder per 40 grams of cement) are used, mechanical complications such as hardware loosening can occur much more frequently [2-5]. Acute renal failure has also been reported in patients who received ALBC during TJA [6-9].Moreover, with the rise of bundled payment models the potentially unnecessary costs such as that of routine ALBC use have been increasingly scrutinized by hospital systems. With this in mind, the authors recently published a retrospective review of over 4100 consecutive patients who underwent cemented primary total knee arthroplasty (TKA), total hip arthroplasty (THA), unicondylar knee arthroplasty (UKA), and hip hemiarthroplasty using either ALBC or PBC [10].

In our series, we performed a retrospective review of 4139 consecutive cases performed between 2016 and 2018 at a suburban, regional, tertiary care center. We retrospectively collected data in regards to patient demographics and any readmissions due to deep infection. During the study period there were a total of 4016 knee cases (423 ALBC, 3593 PBC) and 123 hip cases (63 ALBC, 60 PBC). There was a total of 3021 unilateral TKAs, 705 bilateral TKAs, 290 UKAs, 46 THAs, 34 hip resurfacing cases, 43 bipolar hip hemiarthroplasty cases. At our institution, the average cost for one bag of ALBC is $336.42 while one bag PBC costs an average of $72.14.There were ten total patients who were readmitted due to deep infection, all of which had undergone TKA. This resulted in an infection rate of 0.19% in the ALBC group and 0.62% PBC group, with no statistically significant difference (p=0.103). There was a diverse group of bacteria causing deep infections in both groups. The PBC group included 2 cases of Methicillin-Resistant *Staphylococcus aureus* (MRSA) while the ALBC group included 1 case of Extended-spectrum beta-lactamase-positive *Escherichia coli* and no cases of MRSA. Also, when the patients were stratified for various comorbidities (diabetes, chronic obstructive pulmonary disease, congestive heart failure, renal disease, obesity) there was no statistically significant difference in the rate of deep infection in the ALBC group versus the PBC group. A total of 778 bags of ALBC were used in 423 knee cases and 98 bags of ALBC were used in 63 hip cases. The total cost for ALBC in the knee surgery group was $261,734.76 and $32,969.16 in the hip surgery group. If PBC had been used during all index knee and hip procedures, it would have resulted in a total savings of $231,509.28 for our hospital.

One of the major limitations of this study was that there were multiple surgeons involved, each with different surgical techniques that were not controlled for. Furthermore, the patients were not randomized leading to potential cement type selection bias, however when sub stratifying the various comorbidities there was no significant difference in deep infection rates. Lastly, this review only included 4139 cases. The rate of deep infection in the literature has been shown to be less than 1-2% in primary TJA. With the rate of deep infection so low the present study may be underpowered and would require a greater number of patients in order to see if there are any significant differences between the two groups, especially when looking specifically at various comorbidities within the ALBC and PBC groups.

The study adds to the growing body of literature that is calling into question the regular use of ALBC in routine primary hip and knee arthroplasty cases. Larger, randomized, multicenter studies may be needed to further validate the findings of this study. As more hospitals transition to a bundled payment model, it becomes important for providers to decrease any unnecessary costs while increasing efficiency and maintaining high quality patient care.

Conclusion

The study adds to the growing body of literature that is calling into question the regular use of ALBC in routine primary hip and knee

arthroplasty cases. Larger, randomized, multicenter studies may be needed to further validate the findings of this study. As more hospitals transition to a bundled payment model, it becomes important for providers to decrease any unnecessary costs while increasing efficiency and maintaining high quality patient care.

References

1. Buchholz HW, Engelbrecht H (1970) Depot effects of various antibiotics mixed with Palacos resins. Chirurg 41:511-515.
2. Kleppel D, Stirton J, Liu J, Ebraheim NA (2017) Antibiotic bone cement's effect on infection rates in primary and revision total knee arthroplasties. World J Orthop 8:946-955.
3. Lautenschlager EP, Jacobs JJ, Marshall GW, Meyer PR (1976) Mechanical properties of bone cements containing large doses of antibiotic powders. J Biomed Mater Res 10:929-938.
4. Seldes RM, Winiarsky R, Jordan LC, Baldini T, Brause B, et al. (2005) Liquid gentamicin in bone cement: A laboratory study of a potentially more cost-effective cement spacer. J Bone Joint Surg Am 87:268-272.
5. Jiranek WA, Hanssen AD, Greenwald AS (2006) Antibiotic-loaded bone cement for infection prophylaxis in total joint replacement. J Bone Joint Surg Am 88:2487-2500.
6. Patrick BN, Rivey MP, Allington DR (2006) Acute renal failure associated with vancomycin- and tobramycin-laden cement in total hip arthroplasty. Ann Pharmacother 40:2037-2042.
7. Dovas S, Liakopoulos V, Papatheodorou L, Chronopoulou I, Papavasiliou V, et al. (2008) Acute renal failure after antibiotic-impregnated bone cement treatment of an infected total knee arthroplasty. Clin Nephrol 69:207-212.
8. Luu A, Syed F, Raman G, Bhalla A, Muldoon E, et al. (2013) Two-stage arthroplasty for prosthetic joint infection: a systematic review of acute kidney injury, systemic toxicity and infection control. J Arthroplasty 28:1490-1498.e1.
9. Courtney PM, Melnic CM, Zimmer Z, Anari J, Lee GC (2015) Addition of vancomycin to cefazolin prophylaxis Is associated with acute kidney Injury After Primary Joint Arthroplasty. Clin Orthop Relat Res 473:2197-2203.
10. Hoskins T, Shah JK, Patel J, Mazzei C, Goyette D, et al. (2020) The cost-effectiveness of antibiotic-loaded bone cement versus plain bone cement following total and partial knee and hip arthroplasty. J Orthop 20:217-220.