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EDITORIAL

# Effect of weight-adjusted antimicrobial antibiotic prophylaxis on postoperative dosage and surgical site infection incidence in total joint arthroplasty

Ashim Gupta, Vijay Kumar Jain

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## Abstract

Surgical site infections (SSI) following total joint arthroplasty pose a significant concern for both providers and patients across the globe. Currently, administration of antimicrobial antibiotic prophylaxis is used throughout the world to reduce the incidence of SSI. However, the correct dosage and frequency of administration remains debatable. In this editorial, we emphasized the determination of the effect of administration of weight-adjusted antimicrobial antibiotic prophylaxis regime on the incidence of SSI and postoperative dosage reduction compared to the conventionally used regime during total joint arthroplasty. The results demonstrated similar efficacy between both regimes with respect to the incidence of SSI. In addition, weight-adjustment led to reduced postoperative dosage and has the potential to reduce chances of achieving lower therapeutic concentration, drug resistance, drug toxicity, and costs.

**Key Words:** Antibiotics; Antimicrobial prophylaxis; Weight-adjusted; Surgical site infections; Total joint arthroplasty; Knee arthroplasty; Hip arthroplasty

**Core Tip:** This editorial emphasized the evaluation of the efficacy of a weight-adjusted antimicrobial antibiotic prophylaxis regime on the incidence of surgical site infections and postoperative dosage reduction compared to a conventionally used regime during total joint arthroplasty. The results demonstrated similar efficacy between both regimes with respect to the incidence of surgical site infection. In addition, weight-adjustment led to reduced postoperative dosage and has the potential to reduce chances of achieving lower therapeutic concentration, drug resistance, drug toxicity, and costs.

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## INTRODUCTION

Total joint arthroplasty (TJA), including total knee arthroplasty and total hip arthroplasty, is one of the most common elective orthopedic surgeries performed throughout the world[1]. Although good long-term results are reported in the majority of the patients, infections pose a considerable clinical challenge[1]. Surgical site infections (SSI), which frequently precedes periprosthetic joint infections, remains a significant source of morbidity, poor quality of life, and mortality in patients undergoing TJA[1]. As the number of TJA procedures continue to increase annually, so will the incidence of succeeding periprosthetic joint infections, instilling anxiety in both surgeons and patients[2]. Currently, prevention has been identified as the single most important strategy in combating SSI[1].

## ANTIBIOTIC TREATMENT IN PRIMARY HIP AND KNEE ARTHROPLASTY

Administration of antimicrobial antibiotic prophylaxis (AMP) prior to the surgery to attain higher serum and tissue levels compared to the minimum inhibitory concentration of likely faced microorganisms that pose an elevated risk for infection have shown potential to reduce SSI after total knee arthroplasty or total hip arthroplasty[3]. It is also reported that SSI is lowest when AMP is administered preoperatively, followed by intraoperatively and during the immediate postoperative phases[4]. Its efficacy diminishes 24 h postoperatively[4]. In addition, AMP is presently administered globally in uniform dosages to all patients, irrespective of their weight. This approach may result in the delivery of either suboptimal or excessive therapeutic dosages in underweight or overweight patients, respectively. Suboptimal dosages may fail to achieve the minimum inhibitory concentration required to eliminate microorganisms, including bacteria, increasing the risk of drug resistance. On the other hand, prolonged and/or excessive dosages may lead to drug toxicity. Of note, obesity is identified as a major risk factor for SSI in TJA in various studies[5-8]. Moreover, it has been reported that a body mass index ≥ 35 or weight ≥ 100 kg may serve as a cutoff for a higher perioperative dosage of AMP[8]. Thus, an optimal dosage of systemic antibiotics adjusted by patient's body weight for prophylaxis is a significant protective factor for SSI [9]. Hence, a tailored AMP based on microorganisms likely to cause the infection, correct dosage, and frequency is essential to prevent SSI after TJA.

To some extent, an essential question regarding the best frequency and dosage of antibiotic treatment in primary hip and knee arthroplasty has been answered by Okoro *et al*[10]. They contrasted a weight-adjusted pre-operative dose [cefazolin 2 g intravenous (IV) for patients < 120 kg; cefazolin 3 g IV for patients > 120 kg] and a single postoperative dose at 2 h only (new regime) with a conventional (old regime) single preoperative dose (2 g cefazolin IV in all patients, regardless of the weight) and two postoperative antibiotic doses, 2 h and 8 h, respectively. No significant differences in the rate of deep and superficial infection between the groups 2 years after surgery were observed. Additionally, using an interrupted time series analysis and propensity score weighting, no statistically significant differences in the SSI rates between the two groups were observed. This study provided valuable insight to arthroplasty surgeons on benefits of using weight-adjusted dosage regime to prevent SSI, while reducing the postoperative dosage and chances of attaining lower therapeutic concentration, drug resistance, drug toxicity, and costs. The results from this study are in accordance with a recently published multicenter, prospective study that reported that administration of adequate, weight-adjusted dose and early, preoperative delivery of AMP can reduce SSI in TJA[11]. Furthermore, machine learning models, such as the neural network model, can be utilized to foretell patient-specific SSI following TJA to aid in clinical decision-making to improve results in at-risk patients[12].

## CONCLUSION

The efficacy of a weight-adjusted AMP dosage regime is equivalent to a conventional AMP dosage regime in terms of SSI

incidence in TJA. In addition, weight-adjustment led to reduction in postoperative dosage, incidence for drug resistance and toxicity, and overall costs.

## FOOTNOTES

**Author contributions:** Gupta A and Jain VK conceptualized the study and drafted, critically reviewed, and edited the manuscript. All authors approved the final version of the article for publication.

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