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Effect of weight-adjusted antimicrobial antibiotic prophylaxis on post-operative dosage and surgical site infections incidence in total joint arthroplasty

Gupta A *et al.* Weight-adjusted AMP and SSI in TKA/THA

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Abstract

Surgical site infections (SSI) following total joint arthroplasty (TJA) pose a significant concern for both providers and patients across the globe. Currently, administration of antimicrobial antibiotic prophylaxis (AMP) 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 on determining the effect of administration of weight-adjusted AMP regime on the incidence of SSI and post-operative dosage reduction compared to conventionally used regime during TJA. The results demonstrated similar efficacy between both regimes with respect to the incidence of SSI. In addition, weight-adjustment led to reduced post-operative 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

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Core Tip: This editorial emphasizes on evaluating the efficacy of weight-adjusted antimicrobial antibiotic prophylaxis regime on the incidence of surgical site infections and post-operative dosage reduction compared to 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 post-operative dosage and has the potential to reduce chances of achieving lower therapeutic concentration, drug resistance, drug toxicity and costs.

INTRODUCTION

² Total joint arthroplasty (TJA), including total knee arthroplasty (TKA) and total hip arthroplasty (THA), is one of the most common elective orthopedic surgery performed throughout the world^[1]. Although good long-term results are reported in majority of the patients, infections pose a considerable clinical challenge^[1]. Surgical site infections (SSI), which frequently precedes periprosthetic joint infections (PJI), remains a significant source of morbidity, poor quality of life and mortality in patients undergoing TJA^[1]. As ³ the number of TJA procedures continue to increase annually, so will the incidence of succeeding PJI, instilling anxiety in both surgeons and patients^[2]. Up till now, prevention has been identified as the single most important strategy in combating SSI^[1].

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Administration of antimicrobial antibiotic prophylaxis (AMP) prior to the surgery to attain higher serum and tissue levels compared to the minimum inhibitory concentration (MIC) of likely faced microorganisms that pose elevated risk for infection have shown potential to reduce SSI post TKA or THA^[3]. It is also reported that SSI is lowest when AMP is administered pre-operatively, followed by intra-operatively and during the immediate post-operative phases^[4]. Its efficacy diminishes 24 h post-operatively^[4]. In addition, presently, AMP is 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 MIC 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. To 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 \geq ⁴ 35 or weight \geq 100 kg may serve as a cut-off for 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]'s study. 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 post-operative dose at 2 h only (new regime) with a conventional (old regime) single pre-operative dose (2 g cefazolin IV in all patients, regardless of the weight) and two post-operative antibiotic doses, 2 h and 8 h, respectively. No significant differences in the rate of deep and superficial infection between the groups two 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 will provide valuable insight to arthroplasty surgeons on benefits of using weight-adjusted dosage regime to prevent SSI, while reducing the post-operative 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 multi-center, prospective study which reported that administration of adequate, weight-adjusted dose and early, pre-operative delivery of AMP can reduce SSI in TJA^[11]. Furthermore, machine learning models, such as 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 weight-adjusted AMP dosage regime is equivalent to conventional AMP dosage regime in terms of SSI incidence in TJA. In addition, weight-adjustment led to reduction in post-operative dosage, incidence for drug resistance and toxicity and overall costs.

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SIMILARITY INDEX

PRIMARY SOURCES

1	Tosan Okoro, Michael Wan, Takura Darlington Mukabeta, Ella Malev et al. "Assessment of the effectiveness of weight-adjusted antibiotic administration, for reduced duration, in surgical prophylaxis of primary hip and knee arthroplasty", World Journal of Orthopedics, 2024	32 words — 3%
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