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Should Preoperative Antibiotics Be Tailored According to Patient's Comorbidities and Susceptibility to Organisms?

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ABSTRACT

Background: Preoperative antibiotic prophylaxis remains one of the most important strategies for preventing periprosthetic joint infection (PJI). Current guidelines recommend giving universal antibiotic prophylaxis to all total joint arthroplasty patients regardless of their medical conditions or immune status; however, no studies have evaluated the individualizing of antibiotics. The aims of this study were (1) to determine if comorbidities influence the organism profile of PJIs, and (2) to investigate if the efficacy of two different perioperative antibiotics (cefazolin or vancomycin) for preventing PJI is affected by patient's comorbidities.

Methods: Using an institutional database of 1022 PJIs, the influence of different patient's comorbidities on the organism profile was evaluated. To investigate the influence of perioperative antibiotics (cefazolin or vancomycin monotherapy) on PJI rate, 8575 primary total joint arthroplasties were identified, crossmatched for PJI, and analyzed based on the comorbidities of the cohort. The PJI rate of each antibiotic within each comorbidity was compared.

Results: Although no comorbidities were associated with an increased rate of Gram-positive infections or Gram-negative infections, metastatic disease (odds ratio [OR] 5.71, $P = .018$), congestive heart failure (OR 2.2, $P = .010$), chronic pulmonary disease (OR 1.76, $P = .015$), and diabetes mellitus (OR 1.66, $P = .019$) were associated with antibiotic resistant organisms. However, there was no difference in the PJI rate between cefazolin and vancomycin monotherapy when stratifying for diabetes mellitus, rheumatoid arthritis, liver disease, and hypothyroidism.

Conclusion: The results of the present study support the current recommendations of a universal antibiotic prophylaxis protocol rather than an antibiotic regimen individualized to a patient's comorbidities.

Periprosthetic joint infection (PJI) is the one of the most devastating complications after total joint arthroplasty (TJA). As life expectancy and the number of TJAs continue to rise [1], the burden of PJI is also expected to increase. Thus, it will become increasingly important for orthopedic surgeons to ensure that they minimize the risk of infection before surgery.

Antibiotic prophylaxis is an important strategy used to minimize the risk of infection after surgical procedures [2]. The goal of perioperative antibiotics is to ensure a sufficient concentration of antibiotics in the serum, tissue, and wound during the period that the incision is open and susceptible to infection [3,4]. Selection of antibiotics should thus be based on the most likely pathogens of PJI. Currently, a first or second-generation cephalosporin (cefazolin or cefuroxime) remains the routine perioperative antibiotic regardless of the type of surgery (revision or primary), comorbidity, or immune status [2,3,5-7]. This recommendation was confirmed in an International Consensus Meeting on PJI, as commensal Gram-positive bacteria are the most common organisms [3]. Vancomycin is only recommended in patients who are chronic methicillin-resistant *Staphylococcus aureus* (MRSA) carriers or have a penicillin allergy [3]. However, many medical diseases are prevalent in the TJA population, such as diabetes mellitus (DM), rheumatoid arthritis (RA), and liver disease that are associated with well-documented immune system deficits [8], and an increased

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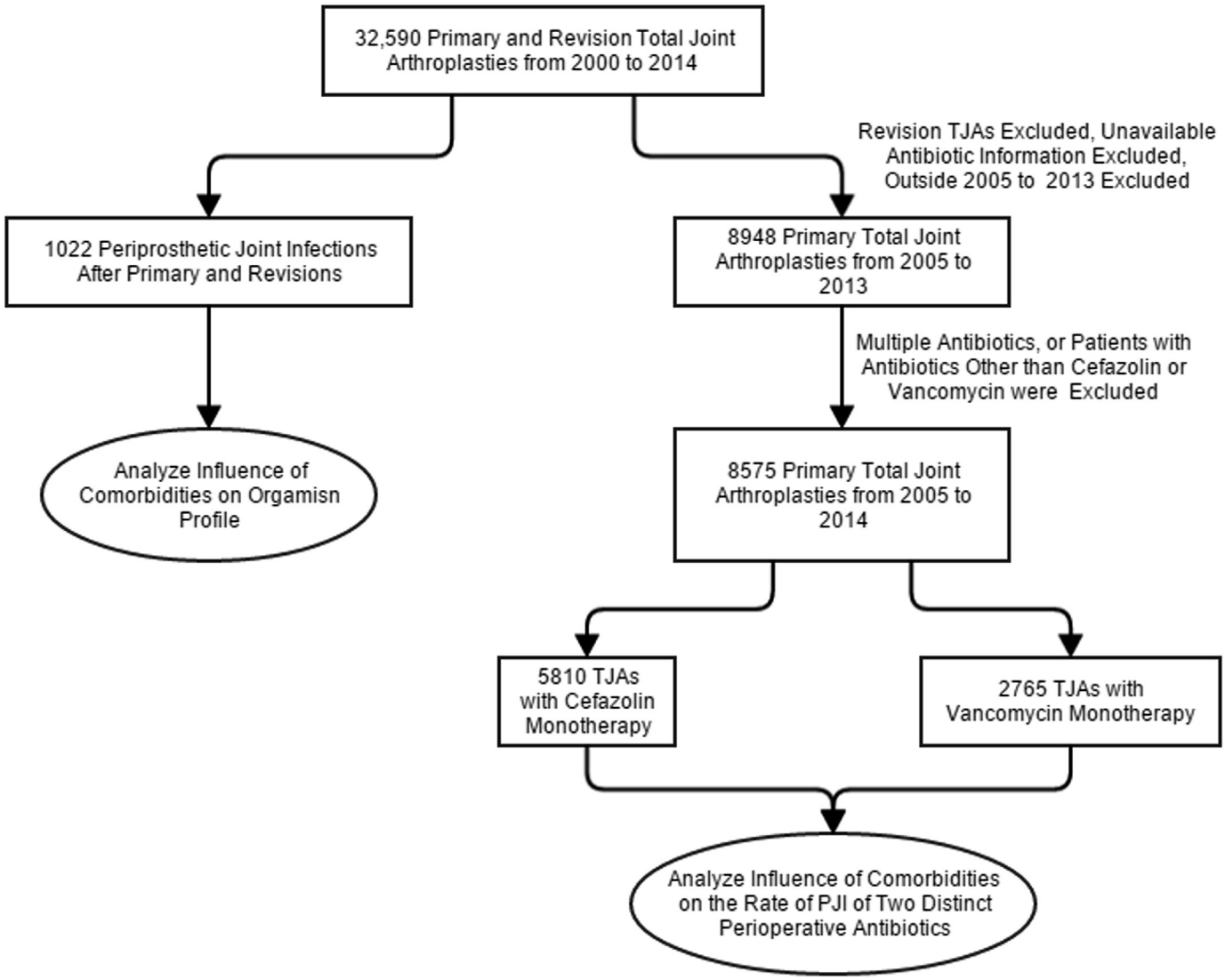

Fig. 1. Flowchart of the study design. PJI, periprosthetic joint infection; TJA, total joint arthroplasty.

risk of PJI [9-14]. Thus, each patient has a unique set of immune defenses against infection that may predispose one to an increased risk of infection or specific bacteria types.

Although certain medical conditions may predispose patients to PJI with specific organisms and an overall increased risk of PJI, current guidelines recommend routine antibiotic prophylaxis for these individuals rather than a personalized approach. To our knowledge, no studies have investigated the efficacy of personalizing preoperative antibiotics in TJA cases to a patient's comorbidities; however, there are different situations in orthopedics where antibiotic prophylaxes are tailored to the patient's condition. For example, vancomycin is selectively used in patients who are MRSA carriers or at high risk of MRSA colonization, such as nursing home patients and healthcare workers [3]. However, the rationale behind this recommendation likely stems from the paucity of literature regarding this topic, including both the influence of comorbidities on organism profile and the efficacy of different preoperative antibiotics for patients with high risk comorbidities for PJI.

Thus, the aims of our study were (1) to determine if specific comorbidities predispose a patient to PJI with a particular organism, and (2) to establish if the efficacy of the 2 most frequently used antibiotics as preoperative prophylactic monotherapy (cefazolin or vancomycin) for preventing PJI is affected by patient's comorbidities.

Materials and Methods

Following Institutional Review Board's approval, a retrospective institutional study was performed in 2 parts; first, to determine the influence of comorbidities on organism types of PJIs at our institution and second, the rate of PJI after primary TJA based on patient's comorbidities with the use of 2 different preoperative antibiotics.

Influence of Comorbidities on Organism Profile

To first determine the influence of comorbidities on specific organism types, all PJIs at our institution were identified using a prospectively collected institutional database between January 2000 and December 2014. From a total of 32,590 TJAs in 26,432 patients, a total of 1022 PJIs (559 knees and 463 hips) in 1001 patients after both primary and revision TJAs were identified using International Classification of Diseases, Ninth Revision (ICD-9)