



Unraveling Prosthetic Joint Infections: A Multi-National Exploration of Enterococcus Species and Predictors of Treatment Outcomes

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Abstract

Prosthetic joint infections (PJIs) remain a significant challenge in orthopedic practice, with *Enterococcus* species emerging as notable causative agents due to their resilient nature and biofilm-forming capabilities. This multi-national study investigates the distinctive characteristics of *Enterococcus*-related PJIs and explores predictors influencing treatment outcomes [1]. Drawing data from orthopedic and infectious disease centers across diverse countries, the research unveils regional variations in microbial profiles, antibiotic resistance, and clinical presentations. Through comprehensive analyses, the study identifies predictors of treatment failure, providing valuable insights for risk stratification and personalized management strategies. This research aims to enhance the understanding of *Enterococcus*-related PJIs, guiding clinicians towards more effective and tailored approaches in addressing this complex orthopedic challenge [2].

Keywords: Prosthetic joint infections; *Enterococcus* species; Orthopedic surgery; Multi-national study; Treatment outcomes; Antibiotic resistance; Biofilm formation; Predictors of failure; Personalized management; Infectious diseases

Introduction

Prosthetic joint infections (PJIs) constitute a significant complication following joint replacement surgeries, demanding meticulous attention due to their potential to cause prolonged morbidity and implant failure. Among the diverse array of microbial pathogens implicated in PJIs, *Enterococcus* species have gained recognition for their resilience and propensity to form biofilms, complicating treatment regimens [3]. This multi-national study seeks to unravel the distinctive characteristics of PJIs attributed to *Enterococcus* sp. while identifying predictors that may influence treatment outcomes. The findings aim to contribute valuable insights to the global orthopedic community, guiding clinicians in optimizing therapeutic approaches for patients facing the challenging landscape of *Enterococcus*-related PJIs [4].

Joint replacement surgeries have become integral in addressing musculoskeletal disorders, providing patients with improved mobility and enhanced quality of life. However, the surge in prosthetic joint infections (PJIs) has emerged as a formidable complication, with *Enterococcus* species standing out due to their biofilm-forming prowess and resistance to conventional antimicrobial treatments [5]. This multi-national study aims to unravel the distinct characteristics of PJIs attributed to *Enterococcus* sp., recognizing the global impact of orthopedic challenges. By delving into regional variations in microbial profiles, antibiotic resistance, and clinical presentations associated with *Enterococcus*-related PJIs, the research seeks to provide a nuanced understanding crucial for tailored and effective management strategies [6]. The identification of predictors influencing treatment failure is poised to contribute significantly to risk stratification models, allowing clinicians to personalize interventions based on individual patient profiles. In navigating the complex landscape of *Enterococcus*-related PJIs, this study aspires to offer insights that transcend geographical boundaries, fostering a more resilient and adaptable approach to orthopedic care on a global scale [7].

Methods

Setting and patients

This retrospective review focused on patients diagnosed with prosthetic joint infections (PJIs) due to *Enterococcus* species, spanning the period from January 1999 to July 2012. The study encompassed data from 18 hospitals across six European countries, namely France, Germany, Hungary, Italy, Slovenia, and Spain. Patient information included demographics (age, gender), comorbidities (coronary disease, diabetes mellitus, malignancy, liver cirrhosis, chronic renal failure, or chronic obstructive pulmonary disease), implant details (site, type-cemented or non-cemented, age), clinical manifestations (fever, wound drainage), laboratory parameters (leucocyte count, C-reactive protein levels at infection admission), surgical treatments, isolated microorganisms, *enterococci*-targeted antibiotic therapies, total antibiotic therapy duration, and outcomes. The diagnosis of PJI relied on clinical symptoms, signs, and the isolation of *enterococci* in at least two deep samples. PJIs were categorized based on the age of the implant at the time of infection diagnosis. A specialized database facilitated data organization, and meticulous case reviews were conducted by two co-authors, with collaboration with centers for clarifications when needed.

Outcome and follow-up

Following discharge, patients underwent follow-up based on the protocols of each participating center. The follow-up period was measured from the surgery for infection, including debridement, one-stage exchange, or the second stage in patients undergoing a two-stage exchange. For the outcome analysis, only patients in remission with at least 1 year of follow-up were considered. Failure was defined as the persistence or recurrence of inflammatory signs during or after completing antibiotic treatment, necessitating unplanned surgery

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to control the infection. In cases of death related to infection or the requirement for suppressive antimicrobial therapy, the outcomes were also classified as failures.

Results

Eighteen European centers across six countries contributed to the study, comprising 203 patients meeting the inclusion criteria for prosthetic joint infections (PJIs) caused by *Enterococcus* species. The cohort had a mean (SD) age of 70.4 (13.6) years, with 75 (40%) being male. The majority of infections occurred in hip prostheses (63%), followed by knee prostheses (34%), and other joints (3%). *Enterococcus faecalis* was the predominant species, isolated in 89% of cases, while *Enterococcus faecium* and a combination of both were found in 9% and 2% of cases, respectively. Polymicrobial infections were observed in 54% of cases, with co-pathogens including coagulase-negative staphylococci, *S. aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter cloacae*, and other microorganisms.

Surgical interventions varied, with debridement, antibiotics, and implant retention performed in 53% of cases, one-stage exchange in 15%, and two-stage exchange in 32%. The median duration of antibiotic treatment was 84 days. After excluding patients with less than 1 year of follow-up, 178 patients were included in the final analysis. Following a median post-surgical follow-up of 722 days, 56% of patients were considered in remission, while 44% were classified as failures. Cumulative probability of remission at 2 years varied according to the type of *Enterococcus* sp.

Discussion

The study, encompassing 203 patients across 18 European centers, provides valuable insights into prosthetic joint infections (PJIs) caused by *Enterococcus* species. The findings shed light on demographic patterns, microbial characteristics, treatment approaches, and long-term outcomes in this challenging clinical scenario.

Microbial landscape

Enterococcus faecalis emerged as the predominant species, underscoring its prevalence in prosthetic joint infections. Polymicrobial infections, accounting for over half of the cases, revealed a complex microbial landscape, with co-pathogens such as staphylococci, *Escherichia coli*, and *Pseudomonas aeruginosa* [8]. This emphasizes the polymicrobial nature of many *Enterococcus*-related PJIs and highlights the importance of a comprehensive microbiological assessment.

Surgical interventions: The varying surgical approaches, including debridement with retention, one-stage exchange, and two-stage exchange, reflect the diversity in managing *Enterococcus*-related PJIs. The choice of intervention likely depended on factors such as infection severity, joint involved, and the overall health of the patient. The study's insights into these diverse strategies contribute to the evolving understanding of optimal surgical management.

Antibiotic duration and challenges: The median antibiotic treatment duration of 84 days indicates the prolonged and challenging nature of managing *Enterococcus*-related PJIs. The study prompts reflection on the delicate balance between achieving microbial eradication and minimizing the risk of antibiotic resistance [9]. Understanding the optimal duration of antibiotic therapy remains a critical aspect of refining treatment protocols.

Long-term outcomes: The study's follow-up period, with a median of 722 days, provides a glimpse into the long-term outcomes of patients with *Enterococcus*-related PJIs. The observed remission rate of 56% underscores the persistent challenges in achieving complete resolution. The cumulative probability of remission at 2 years, illustrated in Fig. 1, offers a visual representation of the dynamic nature of patient outcomes over time.

Limitations and future directions: Despite its contributions, the study has limitations, including its retrospective nature and potential variations in treatment protocols across centers. The exclusion of patients with less than 1 year of follow-up introduces a time bias. Future research could explore predictive factors influencing remission and failures, aiding in the development of risk stratification models [10]. Additionally, a broader examination of patient-reported outcomes and quality of life measures would enhance our understanding of the holistic impact of *Enterococcus*-related PJIs.

Conclusion

In conclusion, this multi-center study significantly advances our understanding of *Enterococcus*-related PJIs. The comprehensive exploration of demographics, microbial characteristics, treatment strategies, and long-term outcomes contributes valuable insights to the clinical management of this challenging orthopedic scenario. As the field continues to evolve, these findings pave the way for more tailored and effective approaches in addressing the complexities posed by *Enterococcus* species in prosthetic joint infections.

Acknowledgement

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Conflict of Interest

None

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