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Guest Editorial

Revolutionizing orthopedics: Robotic-assisted joint replacement and the battle against periprosthetic joint infection

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Robotic total joint arthroplasty has brought significant advancements in orthopedic surgery, offering greater precision and efficiency. This technology has the potential to improve patient outcomes, reduce complications, and enhance overall satisfaction. However, even with these advances, the issue of periprosthetic joint infection (PJI) remains a significant challenge, threatening the success of joint replacement procedures.

I would like to start by expressing my sincere thanks to the authors who have dedicated so much time and effort to share their research findings. Their commitment has made the rich content of these manuscripts possible. I also want to acknowledge the reviewers for their invaluable time, expertise, and constructive feedback. Their careful evaluations and insightful suggestions were key in ensuring the high quality and scientific integrity of the papers in this special section of *Technology and Health Care*. Additionally, I'm grateful to the editorial team for their steadfast support and guidance, which played a crucial role in the success of this special section.

This special section includes several notable manuscripts that have made meaningful contributions to the „future arthroplasty". One such study, titled "Relationship between serum vitamin D levels and the prevalence of knee osteoarthritis: A retrospective study on 3424 subjects," offers important insights into how nutritional deficiencies might affect the onset and progression of osteoarthritis (OA). The authors emphasize the potential for preventive strategies that focus on monitoring and managing vitamin D levels in populations at risk.

Robotic-assisted surgery has become a key focus in orthopedic advancements, with several studies in this issue examining its impact on hip and knee arthroplasty. For example, CT-based, robotic-arm assisted total hip arthroplasty (THA) performed through the anterior approach has shown improved accuracy in placing the acetabular cup, although this does not always lead to better clinical outcomes compared to traditional methods. The advantages of robotic systems become more apparent in complex cases, such as those involving obesity or severe deformities. Another study, "Lower 90-day inpatient readmission and 1-year reoperation in patients undergoing robotic versus manual total hip arthroplasty through an anterior approach," highlights the potential for robotic systems to enhance patient safety and outcomes in hospital settings.

Yet, despite the successes of robotic surgery, the ongoing threat of periprosthetic joint infection casts a shadow over these achievements. PJI remains one of the most serious complications after joint replacement surgery, posing significant clinical and economic challenges. Despite strict infection control measures and advances in antimicrobial treatments, the incidence of PJI continues to be a concern, affecting patient outcomes and placing a heavy burden on healthcare systems worldwide. This special section discusses several new techniques for diagnosing PJI. However, achieving perfect accuracy in diagnosing PJI is still difficult, raising questions about the feasibility of such a goal in the future. In particular, the article titled "Use of intra-operative fluorescence imaging in periprosthetic joint infection: State of the art and future perspectives" explores current technologies in managing PJI. The authors discuss the use of intraoperative fluorescence imaging in PJI management, highlighting its ability to improve real-time identification of infected tissues during surgery. The use of 5-Amino-Levulinic Acid (5-ALA) shows potential to revolutionize PJI treatment, much like its impact in certain tumor surgeries. However, more research is needed to evaluate its effectiveness specifically in the context of PJI. This approach could help surgeons better define the boundaries of infected tissues during radical debridement, which is crucial for effectively treating the infection. Even with these advancements, the battle against PJI is far from over. Ongoing research is essential to better understand the complex factors that contribute to infection risk and to refine preventive, diagnostic, and treatment strategies accordingly. Additionally, as robotic technology continues to evolve, it is important that rigorous training and certification protocols are developed to ensure its safe and effective use in various clinical settings.

In summary, robotic total joint arthroplasty represents a major shift in orthopedic surgery, offering unmatched precision and effectiveness in treating degenerative joint disease. However, the ongoing risk of periprosthetic joint infection highlights the need for continued vigilance and innovation in infection prevention, diagnosis, and treatment strategies. By combining the strengths of robotic technology with robust infection control measures, we can work toward a future where joint replacement surgery is not only technologically advanced but also inherently safe and sustainable. Looking ahead, integrating intraoperative fluorescence imaging into the management of periprosthetic joint infections could be the next big step in surgical innovation. Though still in its early stages, this technology holds promise for real-time, precise identification of infected tissues, potentially transforming how PJIs are treated.