



CORR Insights

CORR Insights®: Periprosthetic Joint Infection Is the Main Cause of Failure for Modern Knee Arthroplasty: An Analysis of 11,134 Knees

Christina Ilona Esposito PhD

Where Are We Now?

Periprosthetic joint infection (PJI) is perhaps the most-challenging complication following TKA because the presentation can be varied, the diagnosis is often difficult to make, and the

This CORR Insights® is a commentary on the article “Periprosthetic Joint Infection Is the Main Cause of Failure for Modern Knee Arthroplasty: An Analysis of 11,134 Knees” by Koh and colleagues available at: DOI: [10.1007/s11999-017-5396-4](https://doi.org/10.1007/s11999-017-5396-4).

The author certifies that neither she, nor any members of her immediate family, have any commercial associations (such as consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article. All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research®* editors and board members are on file with the publication and can be viewed on request.

The opinions expressed are those of the writers, and do not reflect the opinion or policy of *CORR®* or The Association of Bone and Joint Surgeons®.

This *CORR Insights®* comment refers to the article available at DOI: [10.1007/s11999-017-5396-4](https://doi.org/10.1007/s11999-017-5396-4).

treatments and treatment outcomes are often diverse. Though the rate of PJI is less than 2%, with the continued growth in the numbers of TKAs being performed, nearly 70,000 Americans may experience a PJI every year by 2030 [6]. The sheer size of this number underscores the need for data about the reasons TKAs undergo revision, given the severe associated morbidity and costs.

Recent large clinical and national joint registry studies show infection to be the main early cause of revision with other reasons overtaking PJI after 5 years [1, 13]. The current study by Koh and colleagues, for example, shows that infection is the main cause of revision during the first 15 years after primary TKA.

These studies differ from earlier outcome studies that reported polyethylene wear as the predominant reason for failure [12]. The incidence of

wear particle-induced osteolysis and subsequent aseptic loosening has reduced considerably during the past 15 years thanks to the introduction of improved polyethylenes with good oxidative stability [11]. Therefore, a shift in the reasons for reoperations after TKA has occurred from implant-related mechanisms like wear to surgeon- and patient-related mechanisms such as infection, instability, malalignment, and arthrofibrosis. Appropriately, new surgical techniques and antibacterial surface treatments of implants are being proposed as strategies to reduce the risk of early infection.

Where Do We Need To Go?

Assessing the effectiveness of new approaches intended to reduce infection rate is challenging because of the relative infrequency of this complication, which results in the need for large study populations. Multicenter, national registry, and insurance-database studies that collect data on both primary and revision procedures often can provide sufficient sample sizes to

C. I. Esposito PhD (✉)
Department of Biomechanics, Hospital
for Special Surgery, 535 East 70th
Street, New York, NY 10028, USA
e-mail: espositoc@hss.edu

CORR Insights

evaluate epidemiology, cost effectiveness, and payer reimbursement with regard to TKA. Unfortunately, large registries can be limited by compliance, accuracy of diagnosis, and procedural coding. In the study by Koh and colleagues, they successfully described causes of reoperations and revisions following TKA over time, but they had insufficient data to employ statistical models or risk calculators to identify preoperative, intraoperative, or postoperative factors associated with TKA reoperation.

Future studies should use risk stratification to identify high-risk patients. Proper patient selection is essential for achieving a good result after TKA, and host factors (such as diabetes, malnutrition, smoking, steroid use, obesity, and alcoholism) clearly contribute to the risk of infection. If these factors prove to be modifiable, new strategies can be developed to decrease the likelihood of subsequent reoperations for PJI. For example, modifying a patient's medications and advising a patient on options like smoking cessation should lower the risk for surgical-site infections [9].

How Do We Get There?

Patients at high risk for PJI would benefit most from new preventative,

diagnostic, and treatment methods. For example, antibacterial implant surfaces to avoid biofilm formation have been developed as a preventative strategy [5] and synovial fluid biomarkers are promising discoveries for improving the accuracy of infection diagnosis [2–4, 10]. Determining the success of such approaches requires large patient databases, which need to be designed in such a way that they can be used to differentiate failure mechanisms, suggest fruitful areas for research into the effects of patient, surgical, and implant factors that affect outcome, and provide means for testing new diagnosis and treatment paradigms. Future research studies must rely on appropriate, standardized protocols for data collection across multiple orthopaedic centers, while overcoming the challenges that come with such collaborative efforts. For example, the Multicenter Orthopaedic Outcomes Network (MOON) group has meaningfully contributed to patient outcomes research following surgical reconstruction of ACL tears by prospectively collecting granular baseline and followup data at seven institutions to perform sophisticated multivariate analyses to identify modifiable predictors to improve ACL reconstruction outcomes [7, 8]. To the field of orthopaedics, this study design is novel and provides high-quality evidence for physician decision

making. Currently, there are few registries or prospective multicenter studies designed in such a way to study TKA, though with the support of organizations like the Knee Society, large, comprehensive, prospective TKA studies are underway.

References

1. Australian Orthopaedic Association National Joint Replacement Registry. Hip, knee, and shoulder arthroplasty. Annual report. Available at: <https://aoanjrr.sahmri.com/documents/10180/275066/Hip%2C%20Knee%20%26%20Shoulder%20Arthroplasty>. Accessed June 16, 2017.
2. Deirmengian C, Hallab N, Tarabishy A, Della Valle C, Jacobs JJ, Lonner J, Booth RE. Synovial fluid biomarkers for periprosthetic infection. *Clin Orthop Relat Res*. 2010;468:2017–2023.
3. Gollwitzer H, Dombrowski Y, Prodinge PM, Peric M, Summer B, Hapfelmeier A, Saldamli B, Pankow F, von Eisenhart-Rothe R, Imhoff AB, Schaubert J, Thomas P, Burkgart R, Banke IJ. Antimicrobial peptides and proinflammatory cytokines in periprosthetic joint infection. *J Bone Joint Surg Am*. 2013;95:644–651.
4. Jacovides CL, Parvizi J, Adeli B, Jung KA. Molecular markers for diagnosis of periprosthetic joint infection. *J Arthroplasty*. 2011;26:99–103.
5. Kuehl R, Brunetto PS, Woischnig A-K, Varisco M, Rajacic Z, Vosbeck J, Terracciano L, Fromm KM, Khanna N. Preventing implant-associated

CORR Insights

- infections by silver coating. *Antimicrob Agents Chemother.* 2016;60:2467–2475.
6. Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am.* 2007;89:780–785.
 7. Lynch TS, Parker RD, Patel RM, Andrish JT, MOON Group, Spindler KP, Amendola A, Brophy RH, Dunn WR, Flanigan DC, Huston LJ, Jones MH, Kaeding CC, Marx RG, Matava MJ, McCarty EC, Pedroza AD, Reinke EK, Wolf BR, Wright RW. The impact of the Multicenter Orthopaedic Outcomes Network (MOON) research on anterior cruciate ligament reconstruction and orthopaedic practice. *J Am Acad Orthop Surg.* 2015;23:154–163.
 8. Magnussen RA, Reinke EK, Huston LJ, MOON Group, Hewett TE, Spindler KP. Effect of high-grade preoperative knee laxity on anterior cruciate ligament reconstruction outcomes. *Am J Sports Med.* 2016;44:3077–3082.
 9. Moucha CS, Clyburn TA, Evans RP, Prokuski L. Modifiable risk factors for surgical site infection. *Instr Course Lect.* 2011;60:557–564.
 10. Parvizi J, Jacovides C, Adeli B, Jung KA, Hozack WJ, Mark B, Coventry Award: Synovial C-reactive protein: A prospective evaluation of a molecular marker for periprosthetic knee joint infection. *Clin Orthop Relat Res.* 2012;470:54–60.
 11. Schroer WC, Berend KR, Lombardi AV, Barnes CL, Bolognesi MP, Berend ME, Ritter MA, Nunley RM. Why are total knees failing today? Etiology of total knee revision in 2010 and 2011. *J Arthroplasty.* 2013;28:116–119.
 12. Sharkey PF, Hozack WJ, Rothman RH, Shastri S, Jacoby SM. Insall Award paper. Why are total knee arthroplasties failing today? *Clin Orthop Relat Res.* 2002;404:7–13.
 13. Sharkey PF, Lichstein PM, Shen C, Tokarski AT, Parvizi J. Why are total knee arthroplasties failing today—Has anything changed after 10 Years? *J Arthroplasty.* 2014;29:1774–1778.