

HK19- Should joint aspiration be performed in patients undergoing revision arthroplasty for presumed aseptic failure?

Fatih Yıldız, Mustafa Alper Incesoy, Jiří Gallo, Marta Sabater-Martos, Ruben A Limas, AbdulRahman A Babaqi, Rosa Elena Silva, Parag Sancheti, Kerem Başarır

Response/Recommendation: Yes. All joints undergoing revision arthroplasty for assumed aseptic failure should be aspirated, whenever possible. The aspiration can be done either preoperatively or at the time of surgery before arthrotomy.

Level of Evidence: Moderate

Delegate Vote:

Rationale:

We reviewed the available evidence on the utility of routine preoperative aspiration before total joint arthroplasty (TJA) revisions. However, robust studies directly comparing patients who undergo routine preoperative aspiration to those who do not are currently unavailable. Therefore, we present the working group's statement, reflecting a consensus-based belief in the value of this practice.

While clinical presentations and radiographic findings often lead to a presumptive diagnosis of aseptic failure in patients requiring revision arthroplasty, definitively excluding periprosthetic joint infection (PJI) before a revision surgery is crucial but may not be always feasible. The failure to identify an underlying infection can result in severe consequences, including persistent pain, implant failure, further revision surgeries, and even life-threatening systemic complications [1]. A large proportion of patients undergoing revision arthroplasty for presumed aseptic reasons are, in fact, infected [2,3]. Reported rates of unexpected intraoperative positive cultures in patients who have a preoperative diagnosis of aseptic failure range from 6.9 to 28% [2,3]. These high rates of misdiagnosis are attributed to the difficulty in distinguishing aseptic failure from PJI [4].

In patients who do not have apparent symptoms of PJI such as fistula, erythema or warmth, or a previous history; the second step is often, to check serum levels of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) to exclude septic failure. However, normal serum markers do not reliably rule out infection. Some studies indicate that serum CRP and/or ESR levels can be within normal ranges in about 15% of patients who have septic failure [2]. Considering the relatively high rates of unexpected intraoperative positive cultures after presumed aseptic revisions and the impact of undiagnosed PJI on the outcomes of revision TJA, we emphasize that some patients do not get investigated thoroughly. Joint aspiration, a relatively simple procedure, provides an opportunity to obtain synovial fluid analysis for more accurate diagnosis and should be part of a routine preoperative workup before revision surgery. It is particularly useful for identifying low-grade infections that may not be detected through other diagnostic methods because they often do not present with typical signs of inflammation [5,6].

Synovial fluid analysis plays a key role in diagnosis of PJI according to criteria of Musculoskeletal Infection Society (MSIS) and International Consensus Meeting (ICM)-2018 [7]. Based on these guidelines, aspirated synovial fluid should be analyzed for cultures, leucocyte esterase strip test, cell count and CRP level [8,9]. Beyond traditional analyses, several synovial fluid biomarkers, including alpha defensin and calprotectin, have been investigated for their potential to diagnose or exclude PJI [5,8,10,11].

Besides decreasing the rate of misdiagnosed failures as a result of infection, identifying the causative pathogen is essential for developing an appropriate surgical plan and initiating targeted antibiotic therapy [6,12]. In recent years the role of non-culture molecular methods (next-generation sequencing; second generation of multiplex PCR, spell out etc.) has been explored in the identification of pathogens in culture-negative PJI or early failure of TJA that may be a result of pathogen's difficult to culture or occult infection [13–18].

In conclusion, since the combination of clinical examination and serum serological markers may be insufficient to rule out PJI, surgeons should ensure thorough preoperative evaluation, including synovial fluid analysis. Joint aspiration is a simple, safe, cost-effective, and highly informative procedure that plays a vital role in managing patients undergoing revision arthroplasty for presumed aseptic failure. Given its important advantages and minimal risks, joint aspiration should be considered an indispensable part of the preoperative or intraoperative evaluation of each patient undergoing revision arthroplasty for presumed aseptic failure.

References

- [1] Parvizi J, McKenzie JC, Cashman JP. Diagnosis of periprosthetic joint infection using synovial C-reactive protein. *J Arthroplasty* 2012;27:12–6. <https://doi.org/10.1016/j.arth.2012.03.018>.
- [2] Staphorst F, Jutte PC, Boerboom AL, Kampinga GA, Ploegmakers JJW, Wouthuyzen-Bakker M. Should all hip and knee prosthetic joints be aspirated prior to revision surgery? *Arch Orthop Trauma Surg* 2021;141:461–8. <https://doi.org/10.1007/s00402-021-03791-6>.
- [3] Barberis L, Abdelrahman T, Driscoll DA, Daşcı MF, Gehrke T, Citak M. Unexpected Positive Cultures in Hip and Knee Periprosthetic Fractures. *J Arthroplasty* 2024;39:1834–9. <https://doi.org/10.1016/j.arth.2024.01.030>.
- [4] Rasouli MR, Harandi AA, Adeli B, Purtill JJ, Parvizi J. Revision total knee arthroplasty: infection should be ruled out in all cases. *J Arthroplasty* 2012;27:1239–43.e1–2. <https://doi.org/10.1016/j.arth.2011.01.019>.
- [5] Morgenstern C, Cabric S, Perka C, Trampuz A, Renz N. Synovial fluid multiplex PCR is superior to culture for detection of low-virulent pathogens causing periprosthetic joint infection. *Diagn Microbiol Infect Dis* 2018;90:115–9. <https://doi.org/10.1016/j.diagmicrobio.2017.10.016>.
- [6] Kwon Y-M, Antoci V, Leone WA, Tsai T-Y, Dimitriou D, Liow MHL. Utility of Serum Inflammatory and Synovial Fluid Counts in the Diagnosis of Infection in Taper Corrosion of Dual Taper Modular Stems. *J Arthroplasty* 2016;31:1997–2003. <https://doi.org/10.1016/j.arth.2016.02.020>.
- [7] Parvizi J, Tan TL, Goswami K, Higuera C, Della Valle C, Chen AF, et al. The 2018 Definition of Periprosthetic Hip and Knee Infection: An Evidence-Based and Validated Criteria. *J Arthroplasty* 2018;33:1309–1314.e2. <https://doi.org/10.1016/j.arth.2018.02.078>.
- [8] Vale JS, Castelo FS, Barros BS, Ribau AC, Carvalho AD, Sousa RJG. Synovial Fluid Biomarkers for the Diagnosis of Periprosthetic Joint Infection-A Systematic Review and Meta-Analysis of Their Diagnostic Accuracy According to Different Definitions. *J Arthroplasty* 2023;38:2731–2738.e3. <https://doi.org/10.1016/j.arth.2023.06.017>.
- [9] Schindler M, Walter N, Maderbacher G, Sigmund IK, Alt V, Rupp M. Novel diagnostic markers for periprosthetic joint infection: a systematic review. *Front Cell Infect Microbiol* 2023;13:1210345. <https://doi.org/10.3389/fcimb.2023.1210345>.

- [10] Kanwar S, Al-Mansoori AA, Chand MR, Villa JM, Suarez JC, Patel PD. What Is the Optimal Criteria to Use for Detecting Periprosthetic Joint Infections Before Total Joint Arthroplasty? *J Arthroplasty* 2018;33:S201–4. <https://doi.org/10.1016/j.arth.2018.02.072>.
- [11] Deirmengian C, Hallab N, Tarabishy A, Della Valle C, Jacobs JJ, Lonner J, et al. Synovial fluid biomarkers for periprosthetic infection. *Clin Orthop Relat Res* 2010;468:2017–23. <https://doi.org/10.1007/s11999-010-1298-4>.
- [12] Kleiss S, Jandl NM, Novo de Oliveira A, R  ther W, Niemeier A. Diagnostic accuracy of alpha-defensin enzyme-linked immunosorbent assay in the clinical evaluation of painful hip and knee arthroplasty with possible prosthetic joint infection: a prospective study of 202 cases. *Bone Joint J* 2019;101-B:970–7. <https://doi.org/10.1302/0301-620X.101B8.BJJ-2018-1390.R2>.
- [13] Bos MP, van Houdt R, Poort L, van der Stel A-X, Peters EJ, Saouti R, et al. Rapid Diagnostics of Joint Infections Using IS-Pro. *J Clin Microbiol* 2023;61:e0015423. <https://doi.org/10.1128/jcm.00154-23>.
- [14] van Schaik TJA, Heesterbeek PJC, van Susante JLC, Rijnen WHC, Goosen JHM. Multiplex PCR test as an intra-operative diagnostic tool for periprosthetic joint infection in presumed aseptic revision hip and knee arthroplasty: a 1-year follow-up study of 200 cases. *J Bone Jt Infect* 2024;9:9–16. <https://doi.org/10.5194/jbji-9-9-2024>.
- [15] Pascual S, Noble B, Ahmad-Saeed N, Aldridge C, Ambretti S, Amit S, et al. Potential value of a rapid syndromic multiplex PCR for the diagnosis of native and prosthetic joint infections: a real-world evidence study. *J Bone Jt Infect* 2024;9:87–97. <https://doi.org/10.5194/jbji-9-87-2024>.
- [16] Sangaletti R, Andriollo L, Montagna A, Franzoni S, Colombini P, Perticarini L, et al. Diagnosis and Treatment of Acute Periprosthetic Infections with the BioFire® System within a Time-Dependent and Bacterium-Dependent Protocol: Review and Prosthesis-Saving Protocol. *Biomedicines* 2024;12. <https://doi.org/10.3390/biomedicines12092082>.
- [17] Kildow BJ, Ryan SP, Danilkowicz R, Lazarides AL, Penrose C, Bolognesi MP, et al. Next-generation sequencing not superior to culture in periprosthetic joint infection diagnosis. *Bone Joint J* 2021;103-B:26–31. <https://doi.org/10.1302/0301-620X.103B1.BJJ-2020-0017.R3>.
- [18] Tan J, Liu Y, Ehnert S, N  ssler AK, Yu Y, Xu J, et al. The Effectiveness of Metagenomic Next-Generation Sequencing in the Diagnosis of Prosthetic Joint Infection: A Systematic Review and Meta-Analysis. *Front Cell Infect Microbiol* 2022;12:875822. <https://doi.org/10.3389/fcimb.2022.875822>.