HK28: Should intraoperative culture be obtained in ALL patients undergoing revision arthroplasty?

Jacem Saadana, Martin Rottman, Paul McKenna, Valeriy Murylev, Martin Pietsch, Saad Tarabichi, Mel Lee, Yuhan Chang, Evan Muldoon, Hichem Abid

Response/Recommendation: Yes. Samples for culture should be obtained in all revision arthroplasty cases.

Level of Evidence: Moderate

Delegate Vote:

Rationale:

Surgeons should employ a high index of suspicion for periprosthetic joint infection (PJI) in any patient that is undergoing revision total joint arthroplasty (TJA) **[1, 2, 3, 4]**. When there is diagnostic ambiguity, intraoperative cultures often are performed, and these cultures may influence the postoperative care of these patients, sometimes resulting in more surgery or the use of extended courses of parenteral antibiotics.

This is important because unnecessary treatment with antibiotics due to a false-positive test can result in major emotional and financial hardship on patients, morbidity, and the development of antibiotic resistance. However, not treating an infected patient due to a false negative result can have even more devastating consequences.

A multitude of factors can lead to an arthroplasty revision surgery, with the specific causes varying from patient to patient and depending on the joint affected. Instability, aseptic loosening, periprosthetic fractures, and chronic, unexplained pain are frequently cited as reasons for revision. However, PJI after arthroplasty is always a concern. The problem is that there are occasional cases of occult infection that are difficult to detect preoperatively with the use of conventional microbiologic culture techniques**[11-12**]. It is also important to note that multiple causes for failure can exist. Thus, having a reason for revision does not mean that infection cannot exist in a given patient who has a discrete cause of failure.

The necessity of intraoperative sampling in prosthetic revision surgery raises an important clinical question. When periprosthetic joint infection (PJI) is either suspected or confirmed—based on clinical, laboratory, and radiological findings—intraoperative sampling is unequivocally mandatory **[7]**, irrespective of the anatomical location (hip, knee, and shoulder). This practice is crucial as the microbiological data obtained directly influence the optimal treatment strategy for the patient even if the infective organism is previously identified by aspiration**[10]** and increases the odds of treatment success **[8]**.

We realize that the decision to take intraoperative samples during revision surgery for presumed aseptic reasons is complex and controversial. There is an ongoing debate in

the orthopaedic community about the necessity of this practice. The incidence of occult PJI justifies systematic intraoperative sampling **[5]**. Anagnostakos et al. demonstrated that approximately one out of eleven aseptic revision arthroplasties had positive intraoperative cultures. The incidence of positive findings was 9.3% (14 out of 151 cases) for the hip and 7.8% for the knee joint (six out of 77 cases).
Infection is one of the most common reasons for revision total hip arthroplasty (THA) in the USA (15%). Close to 50,000 revisions are performed per year, with PJI being one of the most frequently cited reasons for revision in the first five years following the primary procedure **[5]**. In the study by Renard et al., the causes of revision in 523 THA were instability (42%), aseptic loosening (25%), periprosthetic fracture (19%), unexplained pain (6%), and others (8%)**[5]**. Among all revisions for instability, 16% (n = 15) met the infection criteria. When assessing only the early dislocations (before three months), this percentage increased to 23%. This incidence of infection was 12% among periprosthetic fractures, 3.2% among cases of aseptic loosening, and 2.8% in cases of polyethylene wear/osteolysis **[5-6]**.
A short time between primary THA and revision or an early postoperative dislocation are some examples of signs that are concerning for infection **[5]**. Patients undergoing conversion THA from prior hip or acetabular fracture have a high rate of positive intraoperative culture**s[13]**. In revisions of THA involving the acetabulum, the proportion of patients who have one or more positive intraoperative cultures (PIC) was 15% (39 of 260). Of the 260 patients who underwent a cup revision, 85% had no PICs (221 of 260), 8% had one PIC (21 of 260), and 7% had two or more PICs (18 of 260) **[14]**.
Shoulder surgeons need to maintain a high index of suspicion for periprosthetic infections after shoulder arthroplasty, as many of the conventional clinical and laboratory markers may be negative. At this time, multiple cultures taken at the time of revision surgery have been shown to have the highest diagnostic utility for PJI **[15]**. Surgeons need to balance the cost and morbidity of a potential missed diagnosis of a PJI with those of potentially over-treating an aseptic revision shoulder arthroplasty.
Ahmadi et al. found that 169 of the 537 surgeries (31.5%) had positive intraoperative cultures **[16],** Positive culture results, however, must be viewed in the context of the overall clinical picture as well as the appearance of the tissues at the time of revision surgery [15.16]. Intraoperative tissue culture should be in accordance with clinical and preoperative findings. Causative microorganisms are also an important factor.

Given the therapeutic implications of intraoperative culture results obtained during prosthesis revision surgery and regardless of the clinical, biological, or radiological factors prompting the revision, obtaining intraoperative samples enables the detection of occult infections where the diagnosis may be solely microbiological.

References :

1. Bauer TW, Parvizi J, Kobayashi N, Krebs V. Diagnosis of periprosthetic infection. J

Bone Joint Surg Am. 2006;88:869–882.

2. Bernard L, Lubbeke A, Stern R, Bru JP, Feron JM, Peyramond D, Denormandie P, Arvieux C, Chirouze C, Perronne C, Hoffmeyer P. Value of preoperative investigations in diagnosing prosthetic joint infection: retrospective cohort study and literature review. Scan J Infect Dis. 2004;36:410–416.

3. Della Valle C, Parvizi J, Bauer TW, Dicesare PE, Evans RP, Segreti J, Spangehl M, Watters WC 3rd, Keith M, Turkelson CM, Wies JL, Sluka P, Hitchcock K. Diagnosis of periprosthetic joint infections of the hip and knee. J Am Acad Orthop Surg. 2010;18:760–770

4. Ritter MA, Stringer EA. Intraoperative wound cultures: their value and long-term effect on the patient. Clin Orthop Relat Res. 1981;155:180–185.

5. Guillaume Renard1,2 & Jean-Michel Laffosse1 & Meagan Tibbo3 & Thibault Lucena1 & Etienne Cavaignac1 & Jean-Louis Rouvillain2 & Philippe Chiron1 & Mathieu Severyns2 & Nicolas Reina: Periprosthetic joint infection in aseptic total hip arthroplasty revision / International Orthopaedics (2020) 44:735–741/ https://doi.org/10.1007/s00264-019-04366-2

6. Delaunay C, Hamadouche M, Girard J, Duhamel A (2013) What are the causes for failures of primary hip arthroplasties in France? Clin Orthop Relat Res 471:3863–3869

7. Pulido L, Ghanem E, Joshi A, Purtill JJ, Parvizi J. Periprosthetic joint infection: the incidence, timing, and predisposing factors. *Clin Orthop Relat Res*. 2008;466(7):1710-1715. doi:10.1007/s11999-008-0209-4

8. Yang J, Parvizi J, Hansen EN, et al. 2020 Mark Coventry Award: Microorganism-directed oral antibiotics reduce the rate of failure due to further infection after two-stage revision hip or knee arthroplasty for chronic infection: a multicentre randomizes controlled trial at a minimum of two years. *Bone Joint J*. 2020;102-B(6_Supple_A):3-9. doi:10.1302/0301-620X.102B6.BJJ-2019-1596.R1

9. Positive Microbiological Findings at the Site of PresumedAseptic Revision Arthroplasty Surgery of the Hip and Knee Joint:Is a Surgical Revision Always Necessary? Konstantinos Anagnostakos , Andreas Thiery, Christof Meyer, and Ismail Sahan, BioMed Research International Volume 2020, Article ID 2162136, 8 pageshttps://doi.org/10.1155/2020/2162136

10. Are Intraoperative Cultures Necessary If the Aspiration Culture Is Positive? A Concordance Study in Periprosthetic Joint Infection.
K.Keely Boyle, MDMilan Kapadia, BSYufen Chiu, MS Tyler Khilnani,

BS · Andy O. Miller, MD Michael W. Henry, MD · Stephen Lyman, PhD · Alberto V. Carli, MD. the journal of arthroplasty, Volume 36, Issue 7, Supplement S4-S10July 2021.

11. Nelson CL, McLaren AC, McLaren SG, Johnson JW, Smeltzer MS. Is aseptic loosening truly aseptic? Clin Orthop Relat Res. 2005;437:25-30.

12. Trampuz A, Piper KE, Jacobson MJ, Hanssen AD, Unni KK, Osmon DR, Mandrekar JN, Cockerill FR, Steckelberg JM, Greenleaf JF, Patel R. Sonication of removed hip and knee prostheses for diagnosis of infection. N Engl J Med. 2007;357:654-63.

13. The fate of positive intraoperative cultures following conversion total hip arthroplasty. Kyle H Cichos, Maxwell Detweiler, Javad Parvizi, Gerald McGwin, Jr, Alex R Heatherly, and Elie S Ghanem. Hip International, Volume 32, Issue 1

14. Positive Intraoperative Cultures in Cup Revisions of THA: What Happens to the Stem? Karsten D. Ottink MD1 , Desiree M. J. Dorleijn MD, PhD ′ 1 , Willemijn Spierenburg MD1 , Joris J. W. Ploegmakers MD, PhD1 , Wierd P. Zijlstra MD, PhD2 , Harmen E. Ettema MD, PhD3 , Bas L. E. F. ten Have MD4 , Paul C. Jutte MD, PhD1 , Marjan Wouthuyzen-Bakker MD, PhD5 , on behalf of the Northern Infection Network Joint Arthroplasty (NINJA) Clin Orthop Relat Res (2024) 482:779-786

15. Routine cultures for seemingly aseptic revision shoulder arthroplasty: are they necessary? Tyler J Brolin 1, Daniel J Hackett 2, Joseph A Abboud 1, Jason E Hsu 2, Surena Namdari, J Shoulder Elbow Surg. 2017 Nov;26(11):2060-2066

16. Significance of Perioperative Tests to Diagnose the Infection in Revision Total Shoulder Arthroplasty. Shahryar Ahmadi, MD; Thomas M. Lawrence, MD; Shawn Sahota, MD; Cathy D. Schleck, BS; William S. Harmsen, MS;
Robert H. Cofield, MD; John W. Sperling, MD Arch Bone Jt Surg. 2018; 6(5): 359-364