HK27: What is the optimal duration for holding cultures in patients undergoing revision for presumed aseptic failure?

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Response/Recommendation: For patients who have presumed aseptic failure undergoing revision arthroplasty, the culture incubation period should be extended to 14 days to enhance the detection of low-virulence organisms.

Level of Evidence: Limited

Delegate Vote:

Rationale:

The number of total joint arthroplasty (TJA) procedures continues to rise annually, leading to an increasing volume of revision surgeries(1). According to joint registry data, aseptic failure remains the leading cause of revision hip and knee arthroplasty, with periprosthetic joint infection (PJI) being the second most common cause(2,3). The Musculoskeletal Infection Society (MSIS) and International Consensus Meeting (ICM) have established internationally accepted criteria for the diagnosis of PJI(4,5).

A missed diagnosis of PJI can be devastating, resulting in recurrent operations, poor clinical outcomes, and the need for lifelong treatment. To mitigate this risk, it is considered good practice to obtain tissue and fluid cultures during revision surgery, even when the cause of failure is considered to be aseptic. However, no standardized guidance exists for culture incubation duration, which often varies between institutions, typically ranging from seven to 14 days. Extended culture durations increase the detection of low-virulence organisms such as *Cutibacterium acnes* and coagulase-negative *Staphylococci*(6). However, the clinical relevance of single positive cultures remains debated, as they may lead to unnecessary interventions and re-revision surgery(7).

The role of atypical pathogens, such as acid-fast bacilli (AFB) and fungi, in failed revisions, is also a critical concern. Routine use of extended culture protocols, which may require up to 45 days of incubation, is controversial due to the major cost implications and questionable diagnostic yield. Selective use of these cultures in cases of high clinical suspicion is recommended(8).
There is limited literature specifically addressing the optimal duration for culture incubation in aseptic revision cases. Most studies focus on identifying the prevalence of positive cultures in presumed aseptic revisions. The culture duration in these studies varies from seven to 15 days for standard cultures, with an average PJI detection rate of 14.1% in hip and knee revision surgeries undergoing single-stage procedures for presumed aseptic failure(6,9–12).

Schwarze et al. investigated unsuspected positive cultures (UPC) after 14 days of culture incubation in single-stage hip and knee revisions for aseptic failure. Among 434 cases, 160 (39.9%) demonstrated UPC, with *Cutibacterium acnes* and coagulase-negative *Staphylococci*

being the most common isolates. Of these, 44 cases (27.5%) subsequently developed PJI, with 31 of 44 (70.5%) requiring further staged revision surgery. Risk factors associated with UPC included men, obesity, and a preoperative CRP >10, suggesting a subgroup where prolonged cultures may be particularly beneficial(6).

Khalid et al. conducted a similar study reviewing 72 hip and knee revision cases for aseptic failure using cultures incubated for up to 15 days. They identified PJI in five cases (7%), with two cases detected on extended cultures at 10 days. The authors emphasized the importance of clinical suspicion and patient-specific risk factors in determining the need for extended cultures(9).

Tokarski et al. explored the role of atypical cultures in 1,717 hip and knee revisions for presumed aseptic failure. AFB cultures (held for 50 days) and fungal cultures (held for 32 days) yielded positivity rates of 0.5 and 1.7%, respectively. However, AFB cultures were 100% false-positive, and fungal cultures demonstrated a 73.3% false-positive rate. Given the high cost and limited diagnostic value, the authors recommended strict criteria for the selective use of atypical cultures(8).

Portillo et al. evaluated 63 hip and knee revisions for aseptic failure and identified single UPC in 13% of cases, with *Staphylococcus* species and *Cutibacterium acnes* being the predominant isolates. Anaerobic cultures were held for 14 days, while aerobic cultures were incubated for seven days. The study found no statistically significant difference in the rate of re-revision surgery at a median follow-up of 2.1 years between patients who have and who do not have UPC, suggesting that single positive cultures may often represent contamination rather than true infection(7).

In contrast, Ribera et al. analyzed 89 hip and knee revisions with cultures held for 10 days, reporting a 13.5% PJI detection rate and a 24.7% rate of single positive cultures. The authors emphasized that single positive cultures may represent indolent infections, which could contribute to early implant failure. They proposed the use of sonication to aid in distinguishing contaminants from true infections(12).

Conclusion:

The optimal duration for culture incubation in presumed aseptic revision hip and knee arthroplasty remains an area of debate. While extending culture duration to 14 days improves the detection of low-virulence organisms, the clinical relevance of single positive cultures requires careful consideration to avoid overtreatment. Atypical cultures for fungal or AFB pathogens should be selectively used in cases with high clinical suspicion, given their low diagnostic yield and high false-positive rates. Future research should aim to standardize culture protocols, assess cost-effectiveness, and integrate advanced diagnostic tools to refine the approach to detecting occult infections in revision arthroplasty.

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