Utility of Extended Culture Holds for *Cutibacterium acnes* (*Propionibacterium acnes)* for Periprosthetic Joint Infection in Revision Shoulder Arthroplasty

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INTRODUCTION:

Cutibacterium acnes (formerly *Propionibacterium acnes)* is a major cause of periprosthetic shoulder infections. It is also a commensal skin organism and is therefore often a culture contaminant. In periprosthetic joint infections, *Cutibacterium* is often treated as an infection if two or more cultures grow the organism but as a contaminant if only recovered in one culture. The organism has a slow doubling time and requires additional incubation time for recovery. The standard minimum hold time is debated but tends to be between 14 and 21 days. From a laboratory perspective, multiple bacterial cultures per procedure with extended holds creates additional resource and personnel demands on the microbiology laboratory, especially in centers that perform higher volumes of revision arthroplasty. From a clinical perspective, extended holds can prolong empiric antibiotic treatment for *Cutibacterium* and increase the potential for the growth of contaminating organisms, potentially confusing the clinical picture. The purpose of this study was to assess the utility of holding bacterial cultures for periprosthetic shoulder revisions for 21 days and determine if a 14 day hold would be sufficient to identify *Cutibacterium* infections.

METHODS:

This was a retrospective review performed at a tertiary academic medical center with a dedicated shoulder orthopaedic service. During the study time period (01/19/2010 to 06/25/2020), aerobic and anaerobic bacterial cultures were routinely held for 21 days for all shoulder periprosthetic specimens received for bacterial culture. A data query was submitted to identify all bacterial cultures from joint procedures during the study time period and included the site of collection, the dates of collection, daily culture updates and the organisms that were recovered in culture. A total of 192,484 daily culture observations were identified. The data were transformed and analyzed to narrow the data to the number of shoulder cases, the number of cases and cultures that grew *Cutibacterium*, and the day *Cutibacterium* was first recovered in culture. A chart review was performed on patients with two or more cultures positive for *Cutibacterium* only after 14 days of incubation. It had been at least two years since the procedure for all patients marked for chart review. Chart review identified if these patients were treated for *Cutibacterium* and the subsequent outcome after treatment.

RESULTS:

A total of 1,696 orthopedic shoulder cases with bacterial cultures were identified with 4,890 total bacterial cultures performed. Of these, *Cutibacterium* grew in 1,044 cases (61.5%) and in 1,773 cultures (36.2%). 570 of these cases had two or more cultures positive for *Cutibacterium* which was considered as the threshold for treatment of infection. Of these diagnostic cases, 544 (95.4%) grew *Cutibacterium* on or before day 14, four (0.7%) grew two or more *Cutibacterium* cultures only after day 14, and 22 (3.9%) grew one *Cutibacterium* culture on or before day 14 and one or more additional *Cutibacterium* cultures after day 14. Of the four patients with cultures only positive after day 14, one was treated for *Cutibacterium* with good outcome, two were not treated and had good outcomes, and one patient was not treated and required a re-operation two years later.

DISCUSSION AND CONCLUSION:

The vast majority of *Cutibacterium* from periprosthetic shoulder cultures grew on or before day 14. Reducing the culture hold time from 21 to 14 days would result in 26 of 1,696 cases (4.6%) with two or more cultures to have been missed. However, if the policy were to continue culture hold until 21 days if at least one culture grew *Cutibacterium* on or before day 14, then only 4 (0.7%) cases would have missed a potentially true *Cutibacterium* infection. A maximum 14-day hold for orthopedic shoulder infections is sufficient for identifying most *Cutibacterium* infections, and the utility of holding cultures for longer than 14 days is questionable.

Time to Positivity for *Cutibacterium* in Diagnostic Cases

Scenario	Cases
Total diagnostic *Cutibacterium* cases (2 or more positive cultures)	570
Two or more cultures positive ≤ 14 days:	544 (95.4%)
Two or more cultures positive only > 14 days:	4 (0.7%)
One culture positive ≤ 14 and one or more positive cultures > 14 days:	22 (3.9%)