

## Time to Positive Growth of Synovial Fluid Cultures for Periprosthetic Joint Infection

Julia Grace Hatfield, Krista O'Shaughnessey Toler, John L. Miamidian, Alexander C McLaren, Carl A Deirmengian<sup>1</sup>

<sup>1</sup>Lankenau Hospital

### INTRODUCTION:

Anticipating time to positive (TTP) growth of microbiological culture and understanding differences between organisms and laboratories may be useful for setting expectations and determining how long to hold cultures. To date, no large-scale laboratory study has created or confirmed these benchmarks for culturing synovial fluid (SF) using a blood culture bottle system. The purpose of this study was to define the synovial fluid culture TTP benchmarks for microorganisms commonly associated with periprosthetic joint infection (PJI).

### METHODS:

From 2016 to 2022, 18,931 synovial fluid (hip, knee, shoulder) samples from 1,933 US institutions were tested for PJI at a centralized clinical laboratory and yielded a positive culture result. Samples underwent comprehensive testing, and the TTP was recorded for positive cultures. Samples were classified based on the synovial fluid section of the 2018 International Consensus Meeting (ICM) criteria as Not Infected (2.5%), Inconclusive (2.1%), or Infected (95.4%). Synovial fluid culture was performed using aerobic and anaerobic automated culture bottle technique, and were held for 7 days (standard) or 14 days (shoulder). The relationship between median TTP and microorganism type was examined within the Infected group.

### RESULTS:

The median TTP, in hours, for all 18,931 positive cultures was 19.8 (IQR 13.6 – 26.8). Median TTP was 28.3, 30.7, and 19.5 hours for Not Infected, Inconclusive, and Infected samples, respectively.

The majority of samples that were culture-positive had growth within days of culture initiation, with 94.4% of Infected samples having TTP < 2 days, and 99.1% having a TTP < 5 days. The fastest growing organism was *S. aureus* followed by Gram-Negative spp., *Streptococcus* spp., other Gram-Positive spp., *S. epidermidis*, *Candida* spp., and *C. Acnes* (Table 1).

### DISCUSSION AND CONCLUSION:

The current study establishes a benchmark for the incubation time required for synovial fluid culture to yield a positive result, with species-level analysis. Clear differences between the median time to positivity were identified when comparing various species. Surprisingly, more than half of all samples yielding a positive culture result did so within 20 hours of culture initiation. The median TTP in this study was 59% faster than that of a recent study reporting on SF culture timing, indicating the potential impact of methodologic differences between laboratories.

**Table 1.** 2016-2022 PJI ICM(+) samples – Median TTP

Microorganism	Median	IQR	n
<b>All Samples</b>	<b>19.5</b>	13.4 - 26.3	18,058
<i>Staphylococcus aureus</i>	12.6	10.3 - 16.1	3,946
Gram Negative	13.0	10.7 - 17.0	2,098
<i>Streptococcus</i> spp.	15.6	11.6 - 22.2	2,127
Other Gram Positive	22.3	18.0 - 29.7	4,449
<i>S. Epidermidis</i>	24.5	20.7 - 28.8	4,766
<i>Candida</i> spp.	31.9	27.0 - 38.2	612
<i>C. Acnes</i>	155.9	122.4 - 200.2	60