Intraoperative Direct Sonication Improves the Time to Positivity of Culture in Patients with PJI

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INTRODUCTION: This study aimed to evaluate the impact of intraoperative direct sonication on the yield of traditional culture and the time to positivity (TTP) of cultures for periprosthetic joint infection (PJI), assessing its potential to improve diagnostic efficiency and reduce contamination risk.

METHODS: A prospective cohort study was conducted at a tertiary care center, involving 190 patients undergoing revision surgery for PJI from August 2021 to January 2024. Patients were included based on the 2018 International Consensus Meeting definition of PJI. The study utilized a novel sonication protocol, involving direct intraoperative sonication of the implant and tissue, followed by incubation in a BACT/ALERT 3D system. Primary outcomes included the number and percentage of positive culture samples, identified microorganisms, and TTP of each culture. Statistical analysis was performed using R software.

RESULTS: The study included 510 positive cultures from 190 patients, showing that sonication significantly improved the positivity rate for both tissue and prosthesis specimens ($p < 0.05$). The median TTP for all samples was 3.13 days, with sonicated samples showing a significantly shorter TTP compared to non-sonicated samples ($p < 0.05$). The shortest median TTP was observed in prosthesis post sonication samples. Gram-positive organisms had a shorter TTP than gram-negative organisms, with Staphylococcus aureus and MRSE showing the fastest TTP. Higher positivity rates were observed in chronic PJIs compared to acute PJIs for sonicated tissue samples.

DISCUSSION AND CONCLUSION: Intraoperative direct sonication combined with the BACT/ALERT 3D system significantly enhances the diagnostic yield of cultures and reduces TTP for common PJI pathogens. This technique improves pathogen detection, facilitates tailored antibiotic therapy, and potentially reduces contamination risk. These findings suggest that direct intraoperative sonication could be a valuable addition to current diagnostic protocols for PJI. Further research is needed to explore the clinical significance of TTP and its correlation with patient outcomes in PJI.