

Intraoperative direct and conventional sonication for diagnosis of periprosthetic joint infection

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INTRODUCTION:

Conventional sonication is a routine diagnostic method for periprosthetic joint infection (PJI), but carries a contamination risk. We designed a handheld ultrasonic device for direct sonication of retrieved prostheses and soft tissue during surgery, to improve the efficacy of microbiological diagnosis of PJI and the incubation time of pathogens.

METHODS: A retrospective study of patients diagnosed with PJI or aseptic failure who underwent revision and either sonication method between July 2017 and June 2023. The removed implants and adjacent soft tissue were directly sonicated in a small metal container, without a sonication tube, then the sonication fluid was incubated in blood culture bottles in the operating room under laminar air flow. The conventional sonication was performed according to a standard procedure. The sensitivity, specificity, and time to positivity (TTP) of pathogen culture were compared between two sonications

RESULTS: Of the 415 included patients, 266 had PJI and 149 had aseptic failure. Fluid from intraoperative direct sonication and conventional method showed sensitivities of 88% and 69% ($p < 0.001$) and specificities of 84% and 93% ($p = 0.105$), respectively. Higher sensitivity was obtained by direct sonication of only soft tissue than by direct sonication of only the prosthesis (80% versus 75%). Culture results from intraoperative direct sonication soft tissue and prosthesis were inconsistent in 55 cases, 28 were cultured in soft tissue plus prosthesis, 17 were cultured only in soft tissue, and 10 were cultured only from prosthesis. Gram-positive organisms sonicated directly (TTP of soft-tissue, 2.12 [1.40 to 3.16], and TTP of prosthesis, 2.02 [1.08 to 3.04]), especially *staphylococcus aureus* and MRSE, grew significantly faster compared to those under conventional sonication (TTP, 2.92 [1.83 to 3.96]) ($p = 0.003$ and < 0.001 , respectively).

DISCUSSION AND CONCLUSION: Cultures of samples obtained by intraoperative direct sonication of soft tissues plus prostheses were more sensitive than conventional sonication for the microbiologic diagnosis of PJI, combined with similar specificity. Direct sonication shortened the TTP of common microorganisms, contributing to the early adjustment of the targeted antimicrobial therapy.