

Chemical-enzymatic Biofilm Dispersal Matches Sonication In Periprosthetic Joint Infection Diagnosis

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Introduction

- Culture-negative periprosthetic joint infection (PJI) has an incidence of approximately 20%.
- Often, PJI may be culture-negative because of the altered metabolic state of bacteria in biofilm, an organized extracellular polymeric matrix that is the normal pathologic state of the bacteria.
- Sonication improves diagnostic yield by disrupting biofilms, but it often requires specialized equipment and explanted components
- Chemical–enzymatic dispersal of tissue offers a simpler alternative
- This study compared the diagnostic accuracy of chemical-enzymatic versus mechanical dispersal by sonication.

Methods

- Prospective diagnostic accuracy study of 35 cases undergoing revision or resection arthroplasty.
- The Musculoskeletal Infection Society (MSIS) and the 2018 International Consensus Meeting (ICM) criteria served as the diagnostic reference standard.
- Cultures were obtained via three methods:
 - Periprosthetic tissue culture
 - Sonicate fluid culture
 - Chemical–enzymatic dispersal culture
- **Primary outcome:** microbiological diagnostic yield.
- Secondary outcomes: included sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) compared to sonication.

Results

- 24 of 35 (68.6%) met MSIS and ICM 2018 criteria for PJI; 11 aseptic revisions.
- Chemical-enzymatic dispersal achieved diagnostic yield of 95% (19 of 20 cases) compared to 100% for sonication (17 of 17 cases).
- 22 cases where both methods were performed concurrently, results concordant in 20 (90.9%).
- Both methods 100% specificity, no false positives.
- Conventional periprosthetic tissue culture demonstrated inferior sensitivity at 76.2% with NPV of 68.8%.

Chemical-enzymatic dispersal: 95% sensitivity, statistically comparable to sonication (100%), superior to tissue culture (76.2%)

Method	Sensitivity	Specificity	PPV	NPV
Tissue culture (16/21)	76.2%	100%	100%	68.8%
Sonication (17/17)	100%	100%	100%	100%
Dispersal (19/20)	95.0%	100%	100%	91.7%

Table 2. Diagnostic performance of periprosthetic synovial/tissue culture, sonicate fluid culture, and chemical–enzymatic dispersate culture for the diagnosis of periprosthetic joint infection (PJI) using Musculoskeletal Infection Society (MSIS) and 2018 International Consensus Meeting (ICM) criteria as the reference standard.

Conclusion

- Chemical-enzymatic biofilm dispersal comparable diagnostic yield to sonication PJI outperforming conventional tissue culture.
- Promising alternative in settings where sonication is unavailable.
- Multi-center studies to further validate these findings are encouraged.

Data are presented as mean (standard deviation) for continuous variables and number (percentage) for categorical variables. P-values reflect comparisons between PJI and aseptic groups.

Abbreviations: BMI, body mass index; ASA, American Society of Anaesthesiologists; PPV, positive predictive value; NPV, negative predictive value.

Characteristic	Total (n=35)	PJI (n=24)	Aseptic (n=11)	P-value
Age, years, mean (SD)	67.5 (11.0)	66.3 (12.0)	69.6 (7.9)	0.35
Women, n (%)	15 (45.5)	12 (52.2)	3 (27.3)	0.18
Men, n (%)	18 (54.5)	11 (47.8)	8 (72.7)	0.14
Diabetes mellitus, n (%)	6 (18.2)	5 (21.7)	1 (9.1)	0.18
Chronic kidney disease, n (%)	3 (9.1)	3 (13.0)	0 (0)	0.54
Steroid use, n (%)	2 (6.1)	1 (4.3)	1 (9.1)	1.00
Rheumatoid arthritis, n (%)	5 (15.2)	4 (17.4)	1 (9.1)	0.65
BMI, mean (SD)	31.5 (6.2)	32.2 (7.0)	30.1 (4.2)	0.34
ASA score 2, n (%)	12 (36.4)	6 (26.1)	6 (54.5)	0.11
ASA score 3, n (%)	21 (63.6)	16 (69.6)	5 (45.5)	0.13
ASA score 4, n (%)	1 (3.0)	1 (4.3)	0 (0)	1.00
Charlson Comorbidity Index, mean (SD)	2.9 (1.5)	2.8 (1.7)	3.1 (1.4)	0.55
Hip arthroplasty, n (%)	6 (18.2)	2 (8.7)	4 (36.4)	0.14
Knee arthroplasty, n (%)	28 (84.8)	21 (91.3)	7 (63.6)	0.08

Table 1. Demographic and Comorbidity Characteristics of Patients Undergoing Revision Arthroplasty

