

Currently applied sonication protocols for implant-associated infections in orthopaedics

A scoping review of 146 clinical studies

Nader Maai, Florian A. Frank, Martin Clauss, Sonostandard Research Group, Richard A. Kuehl, Mario Morgenstern, Peter M. Keller

AO Research Institute Davos, Switzerland · Department of Orthopaedics and Trauma Surgery, University Hospital Basel
Centre for Musculoskeletal Infections (ZMSI) · Centre for Infectious Diseases Diagnostics, University Hospital Basel, Switzerland

How is sonication of explanted implants actually performed and reported?

PRISMA-ScR scoping review · PubMed, Embase, Scopus · 2007 to October 2025 · 312 records screened, 146 studies included

Container

Hard plastic 54.8%
Bag 1.4%

[not reported 43.2%]

CFU threshold

≥50 CFU/mL 28.8%
≥50 CFU/plate 2.1%
≥1 CFU/plate 7.5%

[not reported 43.8%]

Handling

Vortexing 55.5%
Manual shaking 7.5%

[not reported 37.0%]

Fluid

Ringer 40.4%
Saline 21.9%

[not reported 33.6%]

Frequency

40 kHz 28.8%
40 ± 2 kHz 13.0%
25 to 67 kHz reported

[not reported 49.3%]

Culture media

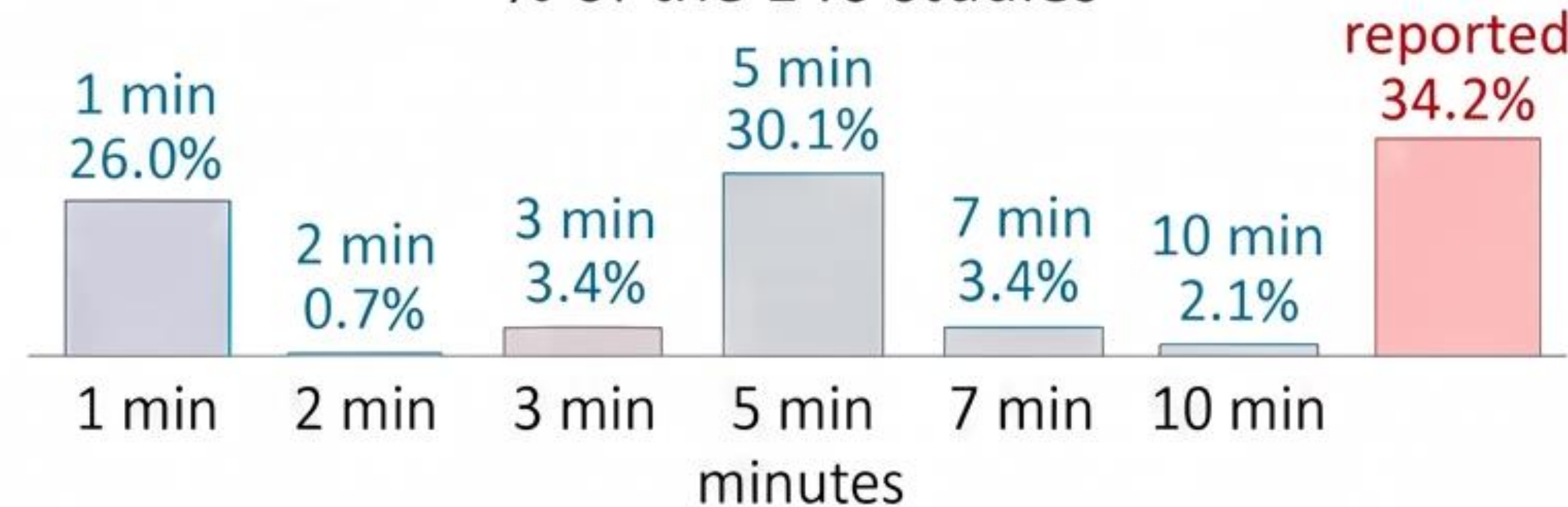
Blood agar 67.8%
Chocolate agar 28.1%
Thioglycolate 22.6%

[not reported 21.2%]



Sonication time

% of the 146 studies



not reported = share of the 146 included studies giving no information on that parameter

Image created with Adobe Firefly

Conclusions

- Great heterogeneity across all methodological aspects
- Descriptions often lacking, key variables rarely reported
- Reproducibility hampered, no universally accepted diagnostic threshold
- Consensus needed on device settings, fluid, handling, culture conditions
- Standardization before thresholds can be validated for routine practice



Full paper, open access