Promising novel molecular approaches compared to culture for detecting periprosthetic joint infections

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Background

The microbiological diagnosis of **periprosthetic joint infections (PJI)** by culture is complicated by biofilm formation on the prosthesis.

Opportunity: molecular diagnostics

- Culture independent
- Faster turn-around-times (TAT)
- Enhanced sensitivity

Methods

Design Retrospective single centre observational cohort

Participants

- 18 hip and knee PJI (2019-2023)
- European Bone and Joint Infection Society (EBJIS) criteria
- 21 sonication fluid samples = culture of implant material

Measures Concordance at genus and species level

Evaluation including:

- Culture results non-sonication samples: synovial fluid, tissues
- Culture interpretation: pathogen or contaminant
- Culture time to positivity

Analysis Comparison of culture with

- IS-pro (Molecular Culture®, inBiome B.V.) with Antoni software
- 16S rRNA sequencing (MinION™, Oxford Nanopore Technologies) with in-house bioinformatics

Conclusion

Key advantages of molecular approach:

- **Rapid TAT**
- **Enhanced pathogen detection**
- **Improved differentiation between pathogens and contaminants**

Results

	16S rRNA sequencing	IS-pro
Concordance: genus	**86.4%** (19/22)	**81.8%** (18/22)
Concordance: species	**77.2%** (17/22)	**81.8%** (18/22)

Aiding microbiological interpretation

- **Fast TAT:** 1-2 days versus 1-14 days (Md:4 days) with culture
- **Contaminants** in culture (*n*=5): **confirmed** by negative results with both techniques
- **Differentiation of pathogen vs. contaminant**
  Proteus mirabilis (*n*=1) in 1/2 enriched media, with no other positive samples: negative result with both techniques, suggestive for contamination
- **Improved sensitivity**
  Negative culture result (*n*=1) vs. positive IS-pro result:
  Streptococcus dysgalactiae, the causative pathogen found in other samples of the same patient

Next steps

- **Expand pilot study: circa 200 samples**
- **Determine appropriate detection thresholds of molecular techniques**
- **Cost-efficiency analysis: antibiotic use and hospital bed days**

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