Sensitive Molecular Identification of Pathogens causing Implant and Tissue Infections (ITI)

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Objectives
Prosthetic infection is the most severe complication in joint arthroplasty. The diagnostic procedure is time consuming and in many cases unrewarding. Microbial growth can be slowed or suspended if the pathogens are weakened by antimicrobial therapy. Molecular diagnostics is a reliable complement for optimizing conventional microbiology by detecting bacteria that do not grow in culture. We used compact sequencing, a combination of highly-sensitive Polymerase Chain Reaction (PCR) with hybcell based identification, to detect and identify pathogenic bacteria or fungi in clinical tissue and synovial fluid samples. These samples were tested in parallel to bacterial culture in combination by MALDI-TOF. Our aim was to test the suitability of compact sequencing to detect and identify pathogens as an additional standard method to diagnose implant or tissue infections.

Method
52 samples were tested: 40 samples from joints (shoulder, elbow, hip and knee), 4 from ascites and 8 from other sources. Samples from infected tissue were divided into two aliquots. One was used for bacterial culturing on agar and in blood culture bottles for 6 weeks. The second aliquot was stored deep frozen (- 80° C) and later used for pathogen DNA extraction with SelectNa (Molzym, DE). The detection and identification of bacteria and fungi were done by compact sequencing based on hybcell ITI DNA xA (Cubic Dx, AT).

Results
The Cube Dx test shows a sensitivity of 93% and a specificity of 63%, a negative and positive predictive value of 96% and 50%, respectively and an accuracy of 71% in comparison to microbiological evaluation. The total number of samples testing positive for bacteria and fungi was higher for compact sequencing with 53% (28 of 52 samples) than for bacteriological culture with 29% (15 of 52 samples).

Conclusion
Our results demonstrate a good correlation between molecular and cultural detection. In 27% (14 of 52 samples) of all cases, molecular testing was more sensitive than culture. hybcell ITI DNA xA is well suited for use as an additional sensitive diagnostic tool for critical clinical samples in a routine lab.

[Flowchart diagram of workflow]