

NexGen Sequencing (NGS) is more accurate than culture and sensitivity (CS) in PJIs

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Significance & Hypothesis/Techniques: NexGen Sequencing (NGS) has been used over the last 10 years for identifying microorganisms and their resistance based on the NIH database. This database offers 56,000 separate genetic identifications for bacteria, viruses, fungi, and their known resistant genes. In the past, culture and sensitivity (CS) has been the gold standard to identify organisms in periprosthetic joint infections (PJI). However, culture retrieval is at best 50-60% recovery for one organism alone. With preoperative treatment of PJI with antibiotics, the rate is anticipated to be much lower. We hypothesized that NGS will demonstrate higher organism recovery rate compared to CS, will have less susceptibility to pre-operative antibiotic administration, and more effectively detect polymicrobial infections and resistance genes in PJI.

Innovation: This study uniquely applies NGS to draining sinus tract aspirates from patients with chronic PJI, a setting where traditional culture methods frequently fail due to biofilm formation and prior antibiotic exposure. By directly analyzing the wound environment, this approach allows for a more complete characterization of the infection beyond conventional cultures in complex cases.

Approach: 168 patients underwent NGS for PJI as defined by the Consensus document from MSIS and EBJIS. These aspirations were taken from open draining sinus tracts around PJI, including 113 knees, 40 hips, 3 lower legs, 5 shoulders, and 7 upper extremities.. A retrospective study was initiated, looking at the recovery rates of microorganisms and their resistant genes in these PJI.

Results: Of the 168 patients analyzed by NGS, at least one organism was identified in all cases (100%), with an average of 2.6 organisms per patient. When using CS, the average was 0.6 organisms per patient, with only 75 (44.6%) recovering at least one organism. NGS identified polymicrobial infections in 103 (61.3%) patients as opposed to 21 (12.5%) polymicrobial infections identified by CS. When antibiotics were administered prior to culture, 55.4% came back culture-negative, while NGS still recovered one or more organisms in all of these cases. Resistant genes were also identified in 44.1% of patients with NGS. Using Fischer's exact test, all p-values < 0.0001 indicate significant differences between NGS and CS.

Discussion & Impact: Based on the results of our study, NGS is more accurate, reliable, and provides more in-depth analysis for the detection of pathogens in draining, culture-negative, and positive wounds. The recovery rate of traditional culture methods has been shown to be severely inhibited with the use of preoperative antibiotics. The primary advantage of NGS is evident in its consistent recovery rates even when preoperative antibiotics are administered. NGS can also provide information about antibiotic resistance and, with PCR-driven technologies, can give the results quicker than the standard 48 hours to 6 weeks for culture and sensitivity. NGS may be the future standard of identifying organisms associated with biofilm-based infections, so that targeting with local carriers and systemic antibiotics will be more practical and allow for better antibiotic stewardship.