Bacteria Detected by Next-Generation Sequencing Demonstrate a High Probability of Periprosthetic Joint Infection: An Analysis of 2,389 Synovial Fluid Samples

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INTRODUCTION: A growing body of evidence has demonstrated the utility of molecular techniques, such as next-generation sequencing (NGS), in the identification of infecting pathogens in patients with periprosthetic joint infection (PJI). The purpose of this study was to determine whether a positive NGS signal for specific microorganisms conferred a higher probability of infection.

METHODS: A total of 2,389 synovial fluid specimens sent for NGS were included in the analyses. All included samples were analyzed in order to measure the levels of synovial C-reactive protein, white blood cell count (WBC) and polymorphonuclear leukocyte percentage (PMN%). Using the 2018 International Conesus Meeting (ICM) definition of PJI, patients that had positive results for all three of the aforementioned synovial markers were categorized as having "high probability" for infection. We evaluated the concordance between a commercial microbial NGS assay and infection probability, determined by ICM validated biomarker screening.

RESULTS: Overall, 451 samples (18.9%) were NGS positive and 496 (20.8%) were classified as having a high probability infection. NGS detection was generally concordant with biomarker classifications, with 90.1% [95%CI: 88.8%-91.3%] mean accuracy in matching between the two methods. Individual species were assessed for positive predictive value to high probability infection. Strongly correlated taxa were then used to build a multivariate logistic regression model which could predict high probability infection with 75.1% accuracy using only 10 bacterial species.

DISCUSSION AND CONCLUSION:

Bacteria which predicted high probability infection should be considered priority organisms in managing infection risk, whereas those which did not differentiate between low and high probability (i.e., *Cutibacterium acnes*) are less clear in their contribution to infection and may not warrant antibiotic therapy.