Blood Culture Testing in Fracture-Related Infections: Low Yield and Near-Zero Concordance with Deep Tissue Pathogens

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INTRODUCTION:
Literature suggests that blood cultures in chronic or late-onset fracture-related infection (FRI) provide limited diagnostic value due to the absence of bacteremia. However, this finding has not been re-examined in recent years using the consensus definition of FRI. The purpose of this study was to assess the concordance between blood culture isolates and intraoperative deep tissue cultures in patients with confirmed FRI.
METHODS:
This Institutional Review Board-approved prospective study included patients diagnosed with a confirmed FRI according to the FRI Consensus Group criteria. Included patients underwent deep tissue sampling at time of irrigation and debridement (I&D), as well as concurrent blood culture testing at the onset of infection symptoms. Microbiological data were reviewed from the electronic medical record. Infections were classified as monomicrobial (either gram-positive or gram-negative), polymicrobial, or culture negative. Pathogen concordance between blood and intraoperative tissue cultures was analyzed.
RESULTS:
Of 297 patients identified with confirmed FRI, 84 underwent both intraoperative deep tissue sampling and concurrent blood culture testing. Microbial analysis of deep tissue specimens identified 29 gram-positive infections, 18 gram-negative infections, 33 polymicrobial infections, and 4 culture-negative cases. Blood culture results were discordant with their respective deep tissue culture isolates in 76 of 84 (90.4%) cases — in only 8 (9.6%) cases were blood tests able to identify at least one pathogen sampled from deep tissue. Of the 84 blood cultures analyzed, 69 (82.1%) were culture-negative and 15 (17.9%) were culture-positive, whereas only 4.8% of deep tissue samples were negative and 95.2% of deep tissue samples were culture-positive. Overall, blood samples yielded negative culture results 17 times as often as deep tissue samples. McNemar's test revealed a highly significant difference in culture-positivity rates ($\chi 2=65$, $p<0.0001$), while Cohen's Kappa for agreement was 0.022, indicating near-zero concordance between blood and deep tissue culture results.
DISCUSSION AND CONCLUSION:
These results suggest that blood cultures neither reflect the true pathogens nor contribute meaningful diagnostic information in most cases of confirmed FRI. Routine blood culture testing in patients with FRI appears unnecessary, and a more judicious approach to ordering these tests is recommended to avoid resource waste.