Microbiological Profile and Pathogen Turnover Across Sequential Debridement in Orthopaedic Infection

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INTRODUCTION

Orthopaedic infection is commonly managed on the assumption that organisms identified at initial debridement represent the causative pathogens throughout treatment. However, the stability of microbiological findings across sequential debridement procedures is poorly understood. This study aimed to evaluate microbiological concordance and turnover between index and subsequent debridement procedures.

METHODS

A retrospective cohort study was conducted of patients undergoing surgical management for fracture-related infection (FRI) or prosthetic joint infection (PJI) over a 41-month period. Culture results from deep intraoperative samples were analysed, and results were compared between index and subsequent debridement procedures. Concordance was assessed among patients with culture-positive results at both timepoints and classified as exact (identical organisms), partial (at least one shared organism), or complete discordance (no shared organisms). At the organism level, taxa were classified as stable, lost, or gained between procedures.

RESULTS

In our cohort, 166 patients underwent at least one debridement operation for infection during this period. At index debridement, *Staphylococcus aureus* (39.3%) and *Staphylococcus epidermidis* (15.4%) were the most common organisms isolated; the same two organisms were also the most frequent isolates at subsequent debridement.

Among 100 patients with repeat sampling, 45 were culture-positive at both timepoints. 28 had no growth initially but yielded organisms at subsequent sampling, whereas 18 had positive cultures at index but no growth subsequently. Nine patients had no growth at either timepoint.

Among 45 patients with culture-positive results at both timepoints, exact concordance was observed in 14 (31.1%), partial concordance in 18 (40.0%), and complete discordance in 13 (28.9%). As such, 32/45 (71.1%) demonstrated at least partial concordance with their index procedure. Per individual organism, microbiological turnover between sequential debridements was high. Organisms identified at index debridement were compared with those identified at subsequent procedures, with 16.4% of organisms identified at index also detected at subsequent procedures. In contrast, 28.0% were no longer detected, and 55.6% were newly identified at subsequent procedures. Four fungal infections were identified on subsequent debridement, whilst none were isolated at the time of index surgery ($p<0.05$).

CONCLUSION

Orthopaedic infection demonstrates substantial microbiological instability across debridement procedures, with frequent discordance in culture results and dynamic turnover of infecting organisms. Loss of organisms on culture may reflect successful response to surgical debridement and antibiotic treatment. However, 55.6% of organisms were newly identified at repeat procedures, suggesting that targeted antibiotic treatment based on index cultures alone may be unreliable.

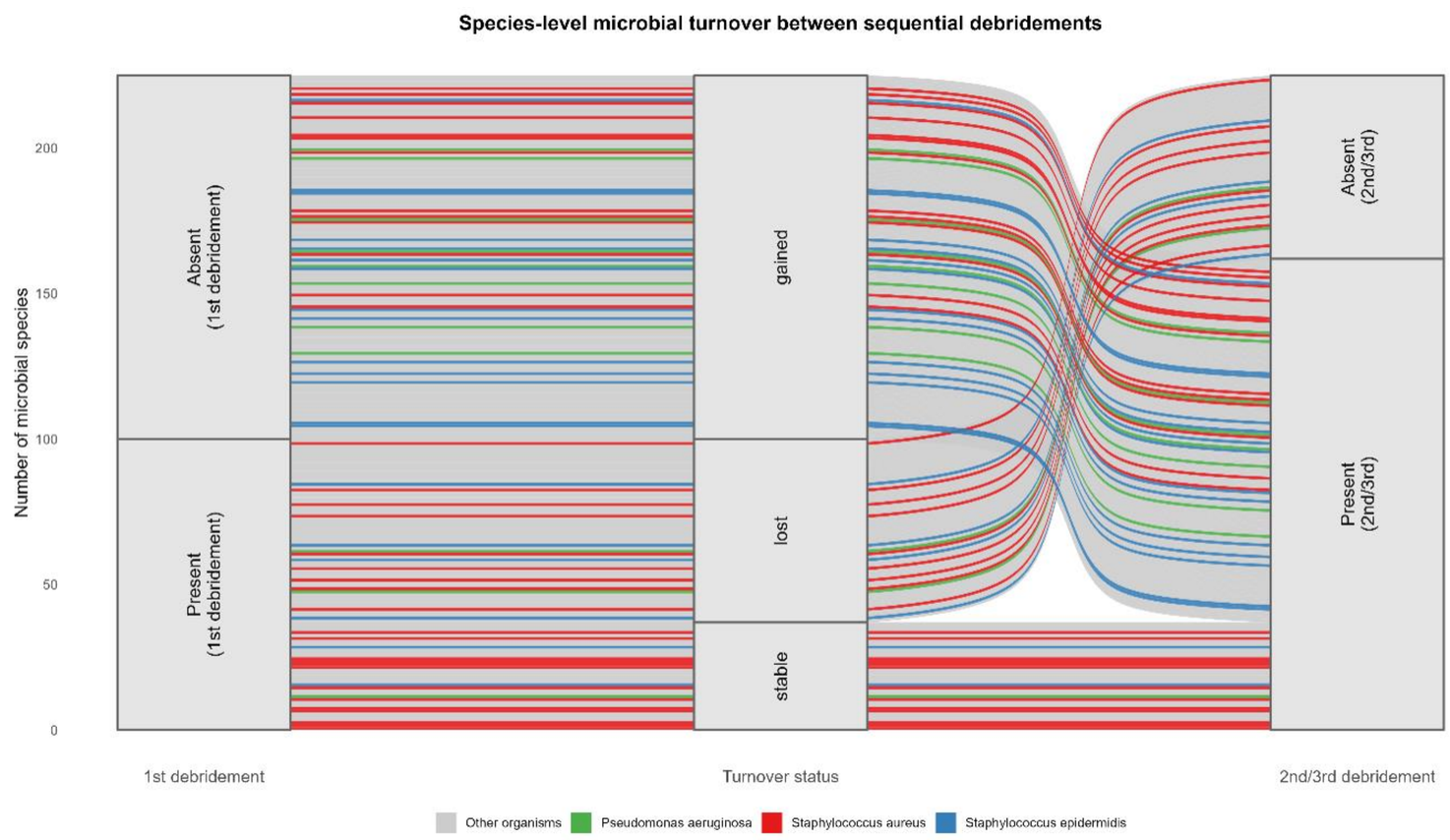

Figure 1: Microbiological Species Turnover between Index Procedure and Subsequent Operations. 3 most common organisms highlighted. Analysis restricted to culture-positive samples; samples with no microbiological growth were excluded.