

Exploring Synergistic Interactions Between *Acinetobacter baumannii* and *Pseudomonas aeruginosa*

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Background: Burn wounds are highly dynamic, nutrient-rich environments that can support complex polymicrobial communities and promote colonization by opportunistic pathogens. Despite growing appreciation for the microbiome in human health, the burn wound microbiome has been relatively understudied. As a result, the diversity of burn wound-associated communities and functional interactions between organisms remain poorly defined. We **hypothesized** that burn wounds harbor distinct microbial signatures and that microbial interactions contribute to inflammatory outcomes. **Methods & Results:** We performed next-generation sequencing on burn wound samples and identified 65 unique bacterial species, with communities ranging from 2–15 organisms per wound site. Notably, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* were frequently detected. To assess whether these organisms could coexist and exhibit cooperative behaviors, we established mono- and co-cultures and quantified growth across three media conditions using CFU enumeration and imaging. Both species grew robustly in co-culture, indicating stable coexistence without competitive exclusion. Conditioned media generated from mono- and co-cultures did not enhance proliferation of either organism, suggesting that secreted soluble factors were not sufficient to promote growth. Using Biolog Phenotypic Microarrays, we found evidence of niche partitioning, with *P. aeruginosa* preferentially utilizing arginine and lysine while *A. baumannii* consumed distinct amino acid substrates. Co-culture did not increase quorum sensing activity, and biofilm biomass in co-culture was comparable to *P. aeruginosa* mono-culture. Despite limited synergy in growth or biofilm formation, co-cultures exhibited significantly increased antibiotic resistance to kanamycin and tetracycline compared to mono-cultures. Finally, murine keratinocytes exposed to conditioned media from mono- or co-cultures demonstrated increased inflammatory cytokine production. **Conclusions:** These data show that *A. baumannii* and *P. aeruginosa* can stably coexist and that community context enhances antibiotic tolerance and inflammatory signaling even without synergistic growth or biofilm phenotypes. This highlights the importance of polymicrobial dynamics in burn wound infections and therapeutic susceptibility.