Staphylococcus aureus population genetics and immune responses: correlation with ethnic variation in the incidence of bacteraemia

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I dedicate this work to my late friend Professor Peter Black. Peter always encouraged me to pursue an interest in research and was always excited to hear about progress and offer advice. I miss the enlightening conversations we had in the hallways around the hospital and the medical school.

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Abstract

Introduction: *Staphylococcus aureus* [SA] is a common cause of disease in New Zealand, in particular the incidence of SA bacteraemia [SAB] is high. SAB is more common in Māori and Pacific people than people of other ethnicities, but the reasons for this discrepancy are not known.

Aim: This thesis investigated a range of reasons for ethnic variation in the incidence of SA infections in Auckland. In particular, the genetic structure of SA populations in Auckland, Samoa, Fiji and Tonga were determined and the adaptive immune responses to SA toxins were determined.

Materials and Methods: 150 cases of SAB were interviewed and provided serum samples for analysis. 424 healthy population members were interviewed and cultures were performed of nasal swab specimens. Multi-locus sequence typing was performed on SA isolates from 150 cases of SAB in Auckland, 94 healthy nasal carriers in Auckland, 96 people with skin and soft tissue infection in Samoa, 109 people with predominantly skin and soft tissue infection in Fiji and 18 people with a variety of diseases in Tonga. Radioimmunoassay was used to measure antibody concentrations against toxic shock syndrome toxin [TSST-1] and four staphylococcal superantigen-like proteins [SSL] in acute and convalescent sera from 148 cases of SAB and sera from 21 healthy population members.

Results: The incidence of SAB was higher in Māori and Pacific people, but was not caused by a higher prevalence of nasal colonisation or infection with different, more virulent strains of SA. The SA populations in Auckland, Samoa and Fiji were not substantially different; furthermore, the SA populations in the Pacific were not substantially different to SA populations in other parts of the world. Indicators of socioeconomic deprivation were more common in cases of SAB, but Māori and Pacific cases of SAB reported similar access to healthcare as cases of other ethnicities. Sera from Māori and Pacific SAB cases had lower concentrations of neutralising antibody against TSST-1 and SSL9 compared with sera from SAB cases of other ethnicities.

Conclusion: Ethnic variation in the incidence of SAB is multi-factorial; socioeconomic deprivation, increased rates of illness requiring invasive medical devices and adaptive immune responses all contribute.

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