

Molecular interactions of *Staphylococcus aureus*-induced osteomyelitis

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Background

Staphylococcus aureus is a commensal gram-positive organism of the skin and mucous membranes but may become pathogenic in the right circumstance. As a pathogen, *S. aureus* represents the most common cause of osteomyelitis and localised bone destruction. *S. aureus* binds to the osteoblast, is internalised and then inhibits osteoblast proliferation, leading to weakening of the bone.¹ Previous reports demonstrate that internalisation is mediated by *S. aureus* cell wall protein FnbpA binding to the osteoblast.² This paper investigates if *S. aureus* FnbpA plays a role in inhibiting osteoblast proliferation.

Methods

S. aureus strain SH1000 and a mutant lacking expression of FnbpA were grown to the exponential phase of growth for four hours in brain heart infusion broth. Bacteria fixed in formaldehyde were allowed to adhere to cell culture plates. Mouse osteoblast cells (2×10^5 cells/well) were added at 0 hour. Following a proliferation time of 24 and 48 hours, osteoblasts were removed and counted using a haemocytometer. The experiment was repeated three times with three wells allocated to each strain and the control. Statistical analysis was carried out using paired student t-tests.

Results

In the absence of *S. aureus*, osteoblasts exponentially proliferated over 24 hours and 48 hours. Addition of *S. aureus* strain SH1000 ablated proliferation at both 24 hours and 48 hours (0% growth at both time points, $p < 0.01$, $n=3$). Furthermore, deletion of FnbpA from *S. aureus* SH1000 failed to recover proliferation after 24 hours or 48 hours (0% growth, $p < 0.05$, $n=3$).

Conclusion

When *S. aureus* enters bone it binds viable osteoblasts, is internalised and then inhibits proliferation. Binding and internalisation is mediated by *S. aureus* protein FnbpA. Deletion of FnbpA from parent strain *S. aureus* SH1000 failed to recover the proliferation, which suggests that another protein expressed on *S. aureus* is responsible for preventing osteoblast proliferation. We therefore propose that *S. aureus* binding to osteoblasts is a multifactorial event involving several protein-protein interactions. Understanding the molecular mechanisms of osteomyelitis will aid in the development of novel treatments for this disease.

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References

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