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Heidi Walkden  
*Bond University*, heidi_walkden@bond.edu.au

James St John  
*Griffith University*

Lynn Nazareth  
*Bond University*, lynn_nazareth@bond.edu.au

Jenny Ekberg  
*Bond University*, jenny_ekberg@bond.edu.au

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Burkholderia pseudomallei enters the brain and spinal cord via the trigeminal nerve

Heidi Walkden1,2, James St John2, Lynn Nazareth1,2, Michael Batzloff3, Ifor Beacham3, Jenny Ekberg1,2,3

1 Faculty of Health Sciences and Medicine, Bond University, 2 Eskitis Institute for Drug Discovery, Griffith University, 3 Institute for Glycomics, Griffith University

Background

The trigeminal nerve is the largest cranial nerve responsible for sensation in the face and motor functions such as chewing. It constitutes a direct route from the nasal cavity into the brain (Fig. 1). Despite this, only a handful of microorganisms are thought to infect the brain via this route.

The tropical disease melioidosis caused by Burkholderia pseudomallei is endemic to the northern Australia and south-east Asia. The main route of transmission is via inhalation of droplets and soil. The Australian variant can result in brain infection, but the mechanism of infection is unknown.

Here, we investigated whether B. pseudomallei could invade the brain via the trigeminal nerve.

Methods

We have developed transgenic mice in which olfactory glia and Schwann cells fluoresce red and olfactory neurons fluoresce green (Fig. 1B) so that these cells can be easily visualised in vivo and in vitro.

Mice were intranasally inoculated with B. pseudomallei. Cryostat tissue sections of the olfactory system, trigeminal nerves and the brain were analysed 24 hours after inoculation and examined for the presence of infection and cellular responses.

Results

B. pseudomallei, the bacteria causing melioidosis, are able to evade phagocytosis and infect the brain via the trigeminal nerve (Fig. 2).

B. pseudomallei are able to travel along the trigeminal nerve, enter the central nervous system, and infect the spinal cord within 24 h of intranasal inoculation (Fig. 3).

Conclusion

The bacteria, B. pseudomallei, are able to travel along the trigeminal nerve and reach the spinal cord within 24 hours of inoculation. This is a new pathway into the brain (central nervous system) for bacteria and could have implications for many other diseases.