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## LETTER TO THE EDITOR

# *Pseudomonas aeruginosa* retro-orbital abscess and cerebritis leading to a diagnosis of interleukin-1 receptor-associated kinase-4 deficiency



Dear Editor,

Invasive ocular infections due to *Pseudomonas aeruginosa* infections are rare. Previous studies have reported cases in immunocompromised hosts,<sup>1</sup> patients after surgery (radial keratotomy),<sup>2</sup> as well as in neonates.<sup>3</sup> Herein, we present the case of a healthy male infant who at 9 months of age presented to the emergency department with a right upper eyelid preseptal cellulitis. He neither had a history of eye trauma nor abnormal family history. On Day 3 after admission, he had worsening inflammation, prompting us to examine him under anesthesia. The results of the examination revealed a marked area of necrosis affecting the right upper eyelid margin. The necrosis was later excised by making a linear crease incision above the upper eyelid lid margin. *P. aeruginosa* was isolated from the eye swab used. The identity and antibiotic susceptibility of the bacterium were determined using VITEK 2 system (bioMérieux), which showed the isolate to be sensitive to piperacillin–tazobactam, ciprofloxacin, gentamicin, and meropenem. Antibiotic treatment was changed to piperacillin–tazobactam, which was administered for 5 days after which the child was discharged home, with 5 days of ofloxacin eyedrops recommended.

Two weeks later the child was re-admitted with recrudescing preseptal cellulitis and was treated with intravenous flucloxacillin and gentamicin. On Day 6, he developed cough, and influenza A infection was diagnosed. On Day 11, the child rapidly developed orbital cellulitis with a mild proptosis. A computed tomography scan of the orbits showed a right subperiosteal collection adjacent to the olfactory plate, which was surgically drained. On Day 14, he became obtunded. Magnetic resonance imaging scan of the

brain demonstrated early adjacent cerebritis. Pus collected from the collection grew a fully sensitive *P. aeruginosa* with a variable-number tandem-repeat profile identical to the first isolate. Meropenem and ciprofloxacin were intravenously administered for 4 weeks. Subsequent clinical progress was uneventful and he was discharged home in good condition. Peripheral lymphocyte immunophenotyping demonstrated no apparent T-cell, B-cell, or natural killer-cell abnormality. Serum immunoglobulin levels were normal and so was the granulocyte respiratory burst.

The child subsequently suffered episodes of invasive *Streptococcus pneumoniae* infection at the ages of 2 and 3, which was characterized by septic arthritis with bacteremia and meningitis, respectively. Further immunological testing revealed a lack of interleukin-18 (IL-18)-mediated interferon gamma production and defective shedding of CD62 ligand in response to lipopolysaccharide. Sequencing of IL-1 receptor (IL-1R)-associated kinase-4 (IRAK-4) gene demonstrated a homozygous mutation conferring IRAK-4 deficiency. The child is now doing well and is vaccinated against capsulated organisms, receives penicillin prophylaxis with regular subcutaneous immunoglobulin injections.

IRAK-4 is a serine–threonine kinase acting downstream from most Toll-like receptors (TLRs) and IL-1R. Its deficiency results in defective granulocyte activation and inability to mount a fever and raise C-reactive protein early in an infection. Patients with IRAK deficiency are particularly susceptible to invasive *P. aeruginosa*, *Staphylococcus aureus*, and *S. pneumoniae* infections, commonly presenting before the age of 2.<sup>4</sup> Persistent bacterial carriage causing repeated infections has been described in patients with IRAK-4 deficiency.<sup>5</sup> Patients in this age group who are apparently immunocompetent and present with severe

invasive ocular *P. aeruginosa* infections should prompt testing of the TLR pathway given the frequency of *P. aeruginosa* infections in this set of conditions. Prompt institution of vaccination and prophylaxis may reduce future morbidity and mortality due to this set of immunodeficiencies.

### Conflicts of interest

The authors have no conflicts of interest to declare.

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Andrew Rosser\*

Department of Infection and Tropical Medicine,  
University Hospitals of Leicester NHS Trust,  
Leicester, UK

Deborah E. Modha

Department of Medical Microbiology,  
University Hospitals of Leicester NHS Trust,  
Leicester, UK

\*Corresponding author. Department of Infection and  
Tropical Medicine, Leicester Royal Infirmary,  
Infirmary Square, Leicester LE1 5WW, UK.  
E-mail address: [Andrew.Rosser@uhl-tr.nhs.uk](mailto:Andrew.Rosser@uhl-tr.nhs.uk)

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