

## CLINICAL CASE REPORT

Not just simple cellulitis: a case report of polymicrobial *Aeromonas* infection from rural Queensland

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## ABSTRACT:

**Context:** The Gram-negative organism *Aeromonas* is found in freshwater and marine environments and can cause a range of disease in humans, most commonly gastrointestinal illness and soft tissue infections. The severity of soft tissue infections can vary, ranging from cellulitis to rapidly spreading soft tissue infection. Prompt recognition of this pathogen is needed as empirical antibiotics for cellulitis generally do not provide sufficient cover for *Aeromonas*. Additionally, while cellulitis is generally managed medically, early surgical intervention may be required when *Aeromonas* is the causative pathogen.

**Issues:** A Caucasian male aged 39 years injured his right foot falling in a creek bed in the Darling Downs region of rural Queensland, sustaining a laceration in the webbing between his first and second toes. He was seen in two rural hospitals following this event, with oral antibiotics prescribed following his second presentation to cover for a localised soft tissue infection.

Circumstances meant he did not take these, and he finally presented to a third hospital after noting erythema tracking up his leg and discharge emanating from the wound on his foot. He was admitted and commenced on empirical antibiotics, however severity of the infection necessitated surgical team involvement and multiple debridements. Due to the extent of tissue removal, a skin graft was required. Intraoperative specimens revealed polymicrobial *Aeromonas* as the causative pathogen.

**Lessons learned:** This case report documents a polymicrobial soft tissue infection in a systemically well young male requiring prompt surgical intervention, even without systemic symptoms of illness. Lack of early recognition of risk factors for infection may have delayed appropriate antibiotic therapy. It highlights the importance of early recognition and appropriate antibiotic cover to prevent spreading infection in individuals in whom *Aeromonas* may be the suspected pathogen. Empirical antibiotics for cellulitis

generally do not include the agents to which *Aeromonas* is susceptible, hence guidelines recommend a regime of trimethoprim–sulfamethoxazole or ciprofloxacin in addition to either dicloxacillin or flucloxacillin. Initiation of appropriate

## Keywords:

*Aeromonas*, Australia, cellulitis, soft tissue infections.

## FULL ARTICLE:

### Context

*Aeromonas* is a genus of Gram-negative bacteria primarily classified into two groups: non-motile species, which mainly infect aquatic animals; and motile species associated with a range of human diseases<sup>1</sup>. They are globally distributed and found in a range of aquatic environments. Contact with these environments is the most common source of infections in humans.

Two main disease processes are associated with *Aeromonas* organisms in humans: gastroenteritis and soft tissue infection<sup>2</sup>. Although gastroenteritis is the most common clinical manifestation of *Aeromonas* infections, these infections are generally self-limiting, although in certain cases antibiotic management may be required. *Aeromonas* soft tissue infections, while uncommon, can vary in severity. These infections generally occur after traumatic injury in an aquatic environment, creating a portal by which the pathogen can enter. These infections have been documented to range from cellulitis (the most common soft tissue infection associated with *Aeromonas*), to more severe infections such as myonecrosis and necrotising fasciitis. Recognition that *Aeromonas* may be the causative pathogen in soft tissue infections is important as this pathogen may not be covered by empirical antibiotics for cellulitis.

This case highlights the rare but significant soft tissue infections than can occur in otherwise immunocompetent and seemingly healthy individuals. Additionally, while the literature generally recommends early antibiotics as sufficient treatment, the case demonstrates that early surgical intervention may be required in certain cases.

### Ethics approval

Consent to publish this case was obtained from the patient.

### Issues

A Caucasian man aged 39 years sustained an injury to his right foot in 2020. He described falling near a creek in the Darling Downs region of rural Queensland, Australia, and landing on his foot in the creek, during which he sustained a small laceration in the webbing between his first and second toes. He presented to a local hospital, where his wound was cleaned and dressed. No antibiotics were prescribed at this time. He subsequently commenced a drive to the Northern Territory (more than 3000 km away by road); however, ongoing pain prompted him to stop at a second hospital after 4 hours. Here the foot was imaged by x-ray, with no fracture identified. He was given a script for oral antibiotics

antibiotics earlier in this case may have prevented the need for surgical intervention. This case also demonstrates that early surgical referral and intervention may be warranted in suspected *Aeromonas* infections.

(cephalexin); however, given the distance left to drive he did not get this filled. He eventually stopped again at a regional hospital after a 9-hour drive due to increasing pain and redness tracking up his foot in addition to clear discharge from the wound. He did not admit to any fevers, rigors, nausea or other signs of systemic illness.

His medical background was significant for non-alcoholic fatty liver disease, which was stable and under surveillance. He did not have any other medical background, regular medications or allergies. He was a non-smoker and drank occasional alcohol.

On review in the emergency department he was normotensive, had a heart rate of 80–90 beats per minute in sinus rhythm, was afebrile with no oxygen requirement or tachypnoea. He had a wound discharging serous exudate between his first and second toes on his right foot, the laceration itself extending approximately 2 cm vertically. Its depth was unable to be ascertained due to pain on examination. Surrounding this site, erythema and induration were tracking up to the patient's hindfoot with nil palpable subcutaneous crepitus. Active and passive range of motion at the ankle and toes were fully maintained. There was nil palpable inguinal lymphadenopathy. The discharge was swabbed and sent for microscopy and culture. Initial investigations showed his white cell count was elevated at  $13.9 \times 10^9/L$  with a neutrophilia of  $11.16 \times 10^9/L$ . C-reactive protein was elevated at 102 mg/L. Liver and renal function were within normal parameters. Repeat x-ray of the foot was performed, which noted air inclusions between the first and second metatarsals with soft tissue swelling over the forefoot. He was given empirical intravenous piperacillin–tazobactam, after which intravenous metronidazole was added to broaden antimicrobial cover. A tetanus booster was also administered due to uncertainty about how recently the patient had received a tetanus vaccine.

The patient was seen by the surgical team and admitted. Due to the extent of the erythema and progression prior to presentation, there were concerns regarding a deep tissue infection and he was taken to theatre the following day for debridement. Intraoperative specimens were taken, and his antibiotic regime was changed to include vancomycin and lincomycin. The swabs taken on initial arrival in the emergency department grew *Aeromonas veronii* *bv sobria* and *Aeromonas hydrophila*. The intraoperative specimen also grew *Aeromonas hydrophila*. On advice from the local infectious diseases team, all intravenous antibiotics were ceased, and he was commenced on oral trimethoprim–sulfamethoxazole. Six days after initial washout he was taken back to theatre for a repeat washout and further debridement of the wound, which was

then left open due to the extensive debridement, with the view that a skin graft may be needed. Four days later he returned to theatre for a repeat washout and split skin graft with the donor site his lateral left thigh.

The patient was continued on oral antibiotics until he had completed 14 days total antibiotic therapy (intravenous and oral) and was discharged after a 22-day total admission. He was later seen in surgical outpatient clinic; the skin graft had taken and there was no recurrence of infection since completion of antibiotics. He required physiotherapy on discharge to assist with improving mobility in the foot due to the skin graft.

### Lessons learned

This case report highlights the importance of prompt recognition and management of water-immersed traumatic injuries and infection.

Injuries sustained with water exposure are considered highest risk for soft tissue infection where the water exposure in question is still, fresh water<sup>3</sup>. Organisms that can cause secondary infection are varied and are dependent on type of water in addition to mechanism of injury. Gram-negative bacteria are associated with both freshwater- and saltwater-exposed soft tissue infections. These pathogens include, but are not limited to, *Aeromonas*, *Burkholderia pseudomallei* and *Pseudomonas* in fresh water, and *Vibrio* and *Shewanella* in salt water. Individual patient factors also increase the risk of soft tissue infection, with immunocompromised patients and people with underlying liver disease at higher risk of developing clinically significant or severe infection following exposure<sup>2-4</sup>.

The patient discussed in the case report, while systemically well, did report a background of non-alcoholic fatty liver disease. It appears this was not recognised on his initial two presentations to hospitals in rural Queensland. Recognising that this individual did have these risk factors may have prompted earlier empirical therapy and prevented the need for surgical intervention.

Culture and intraoperative samples noted polymicrobial *Aeromonas* growth. *Aeromonas veronii* and *Aeromonas hydrophila* were identified. Amongst the *Aeromonas* organisms, *Aeromonas veronii* and *Aeromonas hydrophila* are among the most commonly isolated species contributing to serious disease<sup>3</sup>.

Within Australia, *Aeromonas* has been found to be highly prevalent in waterways throughout South East Queensland as well as in metropolitan water supplies<sup>5,6</sup>. Despite this, significant infection remains relatively rare: between 1990 and 2006 there was an average of 11 cases per year of *Aeromonas* bacteraemia reported in Victoria<sup>7</sup>. Due to the widespread nature of these organisms yet relatively rare infection rate, both route of entry/mechanism of injury and underlying patient factors have been postulated to impact the chance of clinically significant infection.

The initial antibiotic regime for this patient included intravenous piperacillin–tazobactam and intravenous metronidazole, subsequently changed to vancomycin and lincomycin. On review,

this was likely unnecessarily broad, with no clear guidelines followed on initial patient review in the emergency department. Bedside rationale was that *Pseudomonas* may be present given the mechanism (hence the piperacillin and tazobactam), with metronidazole given for additional Gram-negative cover. However, this contrasts with current clinical guidelines for freshwater-immersed or exposed wounds. Therapeutic Guidelines, under the section regarding water immersed wound infections, advises to:

*... treat patients with risk factors for developing severe disease (eg liver disease, iron overload, immune compromise due to immunosuppressive medications, diabetes or malignancy) as for infection associated with systemic symptoms or involving deeper tissues even if the infection is localised.*<sup>8</sup>

Additionally, the guidelines recommend that:

*... [for] wounds not associated with systemic features or involving deeper tissues use trimethoprim/sulfamethoxazole or (as a two-drug regimen) ciprofloxacin plus either dicloxacillin or flucloxacillin.*<sup>8</sup>

For infections involving deeper tissue or with systemic features, recommended empirical treatment is intravenous flucloxacillin and ciprofloxacin, and to consider the addition of vancomycin if risk factors for methicillin-resistant *Staphylococcus aureus* are present.

Initial antibiotic treatment for the patient was broad; however, on culture sensitivity to trimethoprim–sulfamethoxazole provided a more targeted treatment option. Penicillin resistance has been documented in numerous *Aeromonas* strains, while most strains are susceptible to trimethoprim–sulfamethoxazole, quinolones, second- and third-generation cephalosporins and aminoglycosides<sup>2</sup>. The ability to produce beta-lactamase has been noted in some *Aeromonas* species, and carbapenem resistance has also been documented. Regional resistance patterns may influence suitability of certain antimicrobial agents, highlighting the importance of obtaining a culture. There does not appear to be any strong evidence to suggest an optimum duration of therapy. It is important to note that the resistance patterns in waterborne pathogens may mean standard therapy for soft tissue infections is inadequate.

Cellulitis is the most common soft tissue infection secondary to *Aeromonas*, although more significant myonecrosis and necrotising fasciitis have also been documented<sup>9-11</sup>. In these significant infections, surgical intervention has been required to prevent progression of the infection. The case discussed adds further evidence that early antibiotics and early surgical referral may be beneficial in these infections.

### Conclusion

In soft tissue and skin infections sustained in an aquatic environment, particularly after skin-penetrating trauma, careful consideration regarding the causative pathogen is needed. *Aeromonas* has the ability to cause a spectrum of disease; however, it can be aggressive and potentially lead to permanent disability or death. This patient's delayed presentation and initial inappropriate

antibiotic management required prompt, broad-spectrum antibiotics and repeated surgical intervention. The case presented demonstrates the importance of recognising and treating *Aeromonas* in penetrating aquatic injuries and soft tissue infections, and that early surgical referral may be required to prevent rapid spread of disease. Additionally, earlier recognition of

risk factors and the potential of exposure to *Aeromonas* may have led to more appropriate initial therapy and avoidance of surgical intervention. Adherence to current guidelines would suggest an initial approach of either trimethoprim–sulfamethoxazole or ciprofloxacin in addition to dicloxacillin–flucloxacillin be adopted in future similar scenarios.

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