Aquatically acquired *Aeromonas hydrophila* wound infection

A report of 3 cases

H. SACHO, P. J. MOORE, G. R. HIDE

Summary

The occurrence of *Aeromonas hydrophila* wound infections in healthy hosts after water-associated injury is being reported more frequently. This paper reports our experience with 3 such cases and outlines the importance of recognising the association between a water-related injury and this organism.

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The occurrence of *Aeromonas hydrophila* wound infections in healthy hosts after water-associated injury was first emphasised in 2 cases of mixed infection associated with swimming accidents.[1] Recently focal *Aeromonas* infections have been reported with increasing frequency.[2,3]

Case reports

Case 1

A 49-year-old man was admitted to Johannesburg Hospital after having sustained a laceration on the sole of the left foot while paddling in a river 2 days earlier. The injury had become progressively more painful and swollen. On admission he had a temperature of 38,5°C and the left foot was swollen, erythematous and tender with an obviously infected 10 mm laceration over the left 5th metatarsal. A small quantity of pus could be expressed from the wound and the ipsilateral lymph nodes were tender and enlarged. Radiographs of the foot did not reveal any foreign bodies and the results of laboratory investigations were normal apart from a white cell count of $17,6 \times 10^9/l$.

In addition to tetanus toxoid the patient was given intravenous penicillin, amikacin and metronidazole pending the microbiological results of a pus swab of the wound taken on admission. While his pyrexia settled over the next 3 days, the local inflammation and cellulitis worsened, necessitating operative debridement. At operation no abnormalities other than deep-seated plantar fat pad necrosis were found.

Bacteriological cultures revealed a profuse growth of *A. hydrophila* and the antibiotic regimen was changed to ceftazidime and amikacin.

Department of Experimental and Clinical Pharmacology, University of the Witwatersrand, Johannesburg
H. SACHO, M.B. B.CH., B.SC., F.F.PATH. (S.A.)
P. J. MOORE, M.B. B.CH., DIP. MID. C.O.G. (S.A.), F.C.O.G. (S.A.), M.R.C.O.G., HONS. B.SC. GENEESK. WET. (STELL.)
Department of Surgery, Johannesburg Hospital and University of the Witwatersrand, Johannesburg
G. R. HIDE, M.B. B.CH.

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Postoperatively the wound healed satisfactorily and he was discharged without further complications.

Case 2

A 35-year-old woman was admitted to Johannesburg Hospital after having been bitten by a crocodile while swimming in a river in Botswana. She had sustained injuries to both buttocks and the right thigh. On examination, although pale, she was haemodynamically stable and her temperature was 37,5°C. There was extensive loss of skin and muscle of both buttocks and the lateral aspect of the right thigh. The anus had been spared and the sphincter was functional. The clinical suspicion of a stable pelvic fracture was confirmed radiologically and cystography and urethrography showed the lower urinary tract to be intact. The haemoglobin concentration was 6,9 g/dl and the white cell count was $11,4 \times 10^9/l$.

After blood transfusion and tetanus toxoid administration, the patient underwent operative debridement and treatment with a triple antibiotic regimen consisting of penicillin, amikacin and metronidazole was started. Blood cultures revealed the presence of *A. hydrophila* and an operative specimen of debrided tissue showed a profuse growth of *A. hydrophila* as well as a moderate growth of anaerobic organisms and *Pseudomonas aeruginosa*. In view of these results and the patient's clinical septicaemia the antibiotic regimen was changed to ceftazidime and amikacin. A repeat debridement was performed 2 days later and the fashioning of skin flaps for subsequent defect closure was commenced. Over the next 3 days her pyrexia settled and she showed marked clinical improvement. Definitive closure of the tissue defects by a skin flap combined with split-skin grafting was undertaken on the 8th day after the injury with a successful result.

Case 3

A 31-year-old man sustained a crush injury to the right leg in a power boat accident on a dam in Botswana. He was evacuated by air to Johannesburg Hospital, where he was found to be haemodynamically stable. He had a temperature of 38,0°C and a large 150 × 150 mm stellate laceration on the posterior aspect of the right calf with extensive loss of skin and muscle.

Radiological and Doppler studies confirmed that there was no bone or vascular injury and clinically no neurological deficit was found. Besides a white cell count of $12,6 \times 10^9/l$ the results of laboratory investigations were normal.

Tetanus toxoid was administered, treatment with antibiotics in the form of penicillin, amikacin and metronidazole commenced and operative debridement was performed. On the 4th day microbiological examination of an operative tissue specimen revealed the presence of a profuse growth of *A. hydrophila*. In view of his clinical toxicity and these results, the antibiotics were changed to ceftazidime and amikacin. The patient's pyrexia rapidly settled thereafter and on day 8 he was transferred to Windhoek for subsequent skin grafting.

Discussion

The genus *Aeromonas* has frequently been isolated from water sources, marine animals and soil. *A. hydrophila* was cultured from human sources as early as 1937[4] and is being recognised increasingly in human *focal* and systemic infections.[2]

After gastro-intestinal infections manifesting as diarrhoeas, skin and soft-tissue infections are the second most common site for *A. hydrophila* isolation. Most of these infections are directly related to water- or soil-associated injury,[1,2,5–7] with the lower extremity being involved in 75% of cases.[8] The condition is characterised by a rapid onset of cellulitis and purulent discharge, which remains localised in healthy hosts. Dissemination from localised wound infections has been observed in compromised hosts.[5]

Aeromonas species are particularly pathogenic for muscle[9–11] and cause intense local muscle inflammation and necrosis.[2,5,6,7,12] The necrotising myositis appears to be a metastatic localisation of haematogenous infection with the organism.

Aeromonas species comprise a group of non-fastidious, fermentative Gram-negative bacilli, excluded from the family of Enterobacteriaceae primarily because they produce cytochrome oxidase. *Aeromonas* species share some characteristics with *Vibrio* and *Pleisiomonas* species. The genus *Aeromonas* currently includes 3 motile species (*A. caviae, A. hydrophila,* and *A. sobria*) and 1 non-motile species (*A. salmonicida*). Only the motile species are considered potential human pathogens. As the species name hydrophila ('water lover') indicates, the natural habitat of *Aeromonas* species is fresh or sea waters, where they commonly cause infectious disease in cold-blooded aquatic animals. These bacteria also reside in sink traps and drainpipes and can be recovered from tap-water faucets and distilled water supplies, which are potential sources of organisms involved in nosocomial infections.

On blood agar, many strains of *Aeromonas* species show a large zone of β-haemolysis, but non-haemolytic strains do occur. On enteric differential agars the majority of strains are non-lactose-fermenting, although a minority of strains yield lactose-fermenting colonies. However, enteric media are frequently inhibitory for *Aeromonas* species. In the routine diagnostic laboratory, the most important characteristics that should lead to a presumptive diagnosis of infection with *Aeromonas* species are growth on MacConkey agar, a positive oxidase reaction, and fermentation of carbohydrates. The oxidase test in aeromonads is positive if perfomed with the reagent on colonies from blood agar, but may be negative if performed on colonies from enteric agars. On triple-sugar iron agar or Kligler iron agar, most strains yield acid butts and slants — however, alkaline slants, gas formation or both may occur, but not H_2S formation. If oxidation-fermentation media with carbohydrates are used, acidification occurs in both 'open' and 'closed' tubes.[13,14] In conjunction with traditional or commercial kit systems, the abovementioned tests should lead to a correct bacteriological diagnosis.

The majority of isolates of *Aeromonas* species are susceptible *in vitro* to chloramphenicol, tetracyclines, co-trimoxazole, and the newer aminoglycosides and cephalosporins. Most penicillins, the first-generation cephalosporins and older aminoglycosides (e.g. streptomycin and kanamycin) are ineffective for treating *Aeromonas* infections. The organism is variably susceptible to erythromycin and piperacillin, and their use remains controversial.[6] As early as 1966, Bulger and Sherris[9] found that *A. hydrophila* appeared to elaborate a β-lactamase enzyme. This finding was later confirmed when it was found that the organism produces a chromosomally mediated β-lactamase enzyme (termed AER-1), which hydrolyses both penicillins and first-generation cephalosporins.[15] This explains the minimal activity of the first-generation cephalosporins and of ampicillin against this organism. Published data now indicate that co-trimoxazole is effective for the treatment of the majority of *Aeromonas* infections,[16] but that a combination of aminoglycoside (e.g. gentamicin or amikacin) together with an extended-spectrum cephalosporin (e.g. ceftazidime or cefotaxime) is preferred for bacteraemia or severe sepsis.[8]

Conclusion

These cases illustrate the importance of considering *A. hydrophila* among the causes of post-traumatic infection, especially when trauma has been associated with a fresh-water environment or marine animals. Our antibiotic recommendations are to use a third-generation cephalosporin such as ceftazidime together with an aminoglycoside such as amikacin as empirical therapy in patients who present with a soft-tissue water-related injury, especially if there is evidence of severe inflammation.

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