

CASE REPORT

AEROMONAS HYDROPHILA WOUND INFECTION FOLLOWING A TIGER BITE IN NEPAL

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Abstract. *Aeromonas hydrophila* is a rare human pathogen. Reports of zoonotic infection developing after large feline bites are even rarer. We are documenting the first case of human wound infection with *A. hydrophila* following a tiger bite. The patient responded well following wound debridement, secondary suturing and combination antibiotic therapy.

INTRODUCTION

Aeromonads were discovered more than 100 years ago. Their taxonomy has undergone a "sea of change" (Carnahan, 1993) but their role in human infections are just being scientifically validated in the last few decades, predominantly by three species: *A. hydrophila*, *A. caviae* and *A. veronii* biotype *sobria*. Gastrointestinal tract infections are the commonest source of aeromonads followed by wound infections. In immunosuppressed individuals or those with hepatobiliary disease, aeromonads can cause otitis media, meningitis, endocarditis, peritonitis, cholecystitis, hemolytic uremic syndrome and septicemia (Janda and Abbott, 1998). Zoonotic infections developing after large feline bites have been recognized but their reports are limited. *A. hydrophila* is a pathogen among fishes, snakes, lizards, frogs, turtles and other cold-blooded animals. It causes infections following water related injuries (Semel and Trenholme, 1990). To the best of our knowledge there are no reports of wound infections

in humans due to *A. hydrophila* following a tiger bite. We are documenting the first case of such an infection in Nepal.

CASE REPORT

A 50-year-old man was mauled by an adult tiger in the village of Bhalam, Western Region, Nepal. He was immediately attended to at a local clinic, where the wound was cleaned and bandaged. For further radiological investigations, he was brought to our tertiary care hospital within 2 hours of the bite. Upon arrival his vital signs were within the normal range. On examination, he had multiple abrasions over his back and on the upper third of his left forearm; there were multiple lacerated wounds, the largest measuring approximately 2 cm x 1 cm. There was swelling and tenderness over the elbow joint. He had difficulty in moving his fingers and there was pain on movement at the elbow joint. Radial pulses were palpable, and neurovascular examination revealed no abnormality. Radiological investigation revealed a nondisplaced chip fracture of the upper third of the left ulna. The wound was washed thoroughly and dressed daily with povidone iodine. On the third day, the patient was febrile and purulent discharge soaked the bandage. Blood

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and pus samples were sent for culture. Wound debridement was performed under general anesthesia; multiple small lacerations were seen over the forearm of which three were muscle deep and other two were bone deep. No pus was seen in the deeper plane. The patient was empirically started on intravenous cloxacillin, amikacin and metronidazole. A week later the wounds were closed by secondary suturing. The aerobic wound culture grew *A. hydrophila* and a fully sensitive strain of *Escherichia coli*. Anaerobic culture was not performed. *A. hydrophila* was resistant to penicillin by disk diffusion method but sensitive to ciprofloxacin, gentamicin, cefuroxime, cefotaxime and trimethoprim-sulfamethoxazole. The patient was discharged on ciprofloxacin and had an uneventful recovery.

The *Aeromonas* species was identified by Gram's staining of the purulent material, which showed plenty of polymorphonuclear leukocytes and gram-negative bacilli. It was inoculated on blood agar, chocolate agar and MacConkey agar. Heavy growth of beta hemolytic colonies was seen on blood agar and non-lactose fermenting colonies on MacConkey Agar. They were motile, both catalase and oxidase positive. It grew at 37°C and not at 4°C. Colonies were buff-colored and did not grow on TCBS. An array of biochemical tests was performed; the isolate was a fermentative gram-negative bacillus; it was anaerogenic and produced acid from glucose, maltose, mannitol, mannose, arabinose, sucrose but not from lactose, sorbitol and salicin. It reduced nitrate, hydrolyzed esculin, decarboxylated lysine, dihydrolysed arginine, produced hydrogen sulphide and indole on sulphide indole motility media. The Voges-Proskauer's test was positive. It did not utilize citrate as a sole source of carbon. It did not have urease and phenylalanine deaminase activity. Based on these phenotypic characteristics, the isolate was identified as *Aeromonas hydrophila* (Abbott *et al*, 2003).

DISCUSSION

Bite injuries account for 1-2% of all emergency room visits annually in the USA, costing over US\$100 million; human bites are the most prevalent mammalian bites after those of dogs and cats, accounting for 2-3% of bites (Goldstein, 1992), however this does not reflect the incidence as most bites are self treated, thus seldom reported. Mammalian bite wound infections are polymicrobial in nature and the microbes isolated represent the oral flora of the mammal, skin flora of the victim, and environmental contaminants of the wound. A bacteriological analysis of infected dog and cat bites reported that the most frequently isolated aerobes were *Pasteurella* followed by Streptococci, Staphylococci, *Neisseria*, *Corynebacterium* and *Moraxella*; the commonest anaerobes were *Fusobacterium*, *Bacteroides*, *Porphyromonas*, *Prevotella* and *Propionibacterium* (Talan *et al*, 1999). Descriptions of the microbes from animal bite wound infection in humans reflect the evolution of modern microbiology rather than any change in the actual etiology of the disease process (Love *et al*, 2000). A literature search for organisms associated with bite wound infections yielded many for cats, dogs and humans but were limited for tiger bites as it is an uncommon cause for wound infection in humans. The microbe isolated from tiger bite wound infection in humans was *Pasteurella multocida*. This commonly colonizes the oral cavity of tigers and other cats (Burdge *et al*, 1985; Woolfrey *et al*, 1985; Isotalo *et al*, 2000). *P. multocida* has been reported to be isolated in pure culture from cat bite wound infections of humans as early as the 1930s (Kapel and Holm, 1930). Phenotypic variants of *P. multocida* have been reported from large cat bite wound infections in humans and the dental-gingival junction of several species of large cats (Woolfrey *et al*, 1985). The sucrose negative variants of *P. multocida* belong genotypically to two distinct groups; those isolated from

large cat bite wounds belong to a new taxon (taxon 45 of Bisgaard) (Burdge *et al*, 1985). *Bergeyella zoohelcum* was previously known as *Weeksellia zoohelcum*; historically this species was referred to as "CDC group II j". It was isolated from a wound infection in a 35-year old man attacked by a Siberian tiger (Isotalo *et al*, 2000). *Neisseria weaveri*, previously known as "CDC group M-5", is a gram-negative bacillus associated with dog and cat bites. It was isolated from a wound infection in a 7 year old attacked by an adult white Siberian tiger (Christian *et al*, 2002).

Aeromonas wound infections have an incubation period of 1-2 days and may be even as short as 8 hours. It resembles streptococcal infection due to its rapid progression. Tissue adherence, cytotoxins, enterotoxin production and extracellular substances contribute towards its pathogenicity (Minnaganti *et al*, 2000). The origin of our isolate could have been either from the soil in the field or a part of the tiger's oral flora (colonization/infection) or a nosocomial pathogen. We visited the site and observed that the incident had occurred in a dry field. Soil samples collected from the site were processed for aerobic culture. *A. hydrophila* was not isolated from the soil culture. An outbreak of *Aeromonas* wound infections among participants of a "mud football" competition was reported in Australia. The source of *Aeromonas* was identified to be a nearby river and probably the irrigation system which was used to irrigate the football field (Vally *et al*, 2004). *A. hydrophila* has survived in soil up to 140 days after initial contamination and their virulence factors were preserved even after growth in soil (Brandi *et al*, 1996). Strains of *Aeromonas* have been reported to be present in hospital water supplies and an incidence of hospital acquired *Aeromonas* infection ranging from 30% to 50% has been documented (Hanninen and Siitonen, 1995; Ko and Chuang, 1995). Indwelling device-related *Aeromonas* infections have also been re-

ported (Hsueh *et al*, 1998). During this period we did not isolate any strains of *Aeromonas* from our in-patients or from the hospital environmental samples which we studied as a part of our hospital infection control surveillance. Since we did not isolate *Aeromonas* from other probable sites, this supports our hypothesis the source of the bacteria was the tiger oral flora might sound better.

Large numbers of bacteria have been described following animal bites. This emphasizes the need to characterize the oral flora of felines and continuously monitor antibiotic susceptibility patterns. It will help emergency room physicians in initiating appropriate antibiotic therapy following feline bites. Proper irrigation, debridement, delayed wound closure and appropriate antibiotic selection are essential (Minnaganti *et al*, 2000). Fluoroquinolones are advocated as the drug of choice for treatment of *Aeromonas* infection. If the strain is resistant to nalidixic acid and sensitive to ciprofloxacin, it indicates a mutation in the *gyrA* gene; a second mutation of resistance is easily attainable thus generating a minimum inhibitory concentration (MIC) of ciprofloxacin above the cut-off point (Vila *et al*, 2002); under such circumstances, ciprofloxacin should be avoided. Gentamicin and amikacin have better activity than tobramycin (Overman and Janda, 1999). Empiric therapy with penicillins or cephalosporins is of no therapeutic use. Antibiotic resistance in *Aeromonas* is due to chromosomally mediated inducible beta-lactamases. Use of cefotaxime may promote the selection of depressed mutants that constitutively produce beta-lactamase (Ko and Chuang, 1998). Thus, clinicians should closely observe patients with *Aeromonas* infection under cephalosporin therapy for treatment failure. Strains of *Aeromonas* developing resistance to beta-lactam agents during therapy remained susceptible to aminoglycosides and fluoroquinolones (Ko and Chuang, 1998). An appropriate choice of antibiotic in this case

would be trimethoprim-sulfamethoxazole, tetracycline, aminoglycosides, ciprofloxacin (Gold and Salit, 1993), or a combination of an aminoglycoside with fluoroquinolones.

The objective of our report was to disseminate information regarding probable sources for this isolate and to urge emergency room physicians to think about the variety of possibilities when initiating therapy for rare large cat bites.

REFERENCES

- Abbott SL, Cheung WW, Janda JM. The genus *Aeromonas*: biochemical characteristics, atypical reactions, and phenotypic identification schemes. *J Clin Microbiol* 2003; 41: 2348-57.
- Brandi G, Sisti M, Schiavano GF, Albano A. Survival of *Aeromonas hydrophila*, *Aeromonas caviae* and *Aeromonas sobria* in soil. *J Appl Bacteriol* 1996; 81: 439-44.
- Burdge DR, Scheifele D, Speert DP. Serious *Pasteurella multocida* infections from lion and tiger bites. *JAMA* 1985; 253: 3296-7.
- Carnahan AM. *Aeromonas* taxonomy: a sea of change. *Med Microbiol Lett* 1993; 2: 206-11.
- Christian MC, Inmaculada AH, Robin P, Micheal BI, Thomas GB. Wound infection with *Neisseria weaveri* and a novel subspecies of *Pasteurella multocida* in a child who sustained a tiger bite. *Clin Infect Dis* 2002; 34: e74-e76.
- Gold WL, Salit IE. *Aeromonas hydrophila* infections of skin and soft tissue: report of 11 cases and review. *Clin Infect Dis* 1993; 16: 69-74.
- Goldstein EJ. Bite wounds and infection. *Clin Infect Dis* 1992; 14: 633-8.
- Hanninen ML, Siitonen A. Distribution of *Aeromonas* phenospecies and genospecies among strains isolated from water, foods or from human clinical samples. *Epidemiol Infect* 1995; 115: 39-50.
- Hsueh PR, Teng LJ, Lee LN, et al. Indwelling device-related and recurrent infections due to *Aeromonas* species. *Clin Infect Dis* 1998; 26: 651-8.
- Isotalo PA, Edgar D, Toye B. Polymicrobial tenosynovitis with *Pasteurella multocida* and other Gram negative bacilli after a Siberian tiger bite. *J Clin Pathol* 2000; 53: 871-2.
- Janda JM, Abbott SL. Evolving concepts regarding the genus *Aeromonas*: an expanding panorama of species, disease presentations, and unanswered questions. *Clin Infect Dis* 1998; 27: 332-4.
- Kapel O, Holm J. *Pasteurella* infection in man after cat bite. *Hospitalstidende* 1930; 73: 1044-7.
- Ko WC, Chuang YC. *Aeromonas* bacteremia: review of 59 episodes. *Clin Infect Dis* 1995; 20: 1298-304.
- Ko WC, Wu HM, Chang TC, Yan JJ, Wu JJ. Inducible beta-lactam resistance in *Aeromonas hydrophila*: therapeutic challenge for antimicrobial therapy. *J Clin Microbiol* 1998; 36: 3188-92.
- Love DN, Malik R, Norris JM. Bacteriological warfare amongst cats: what have we learned about cat bite infections? *Vet Microbiol* 2000; 74: 179-93.
- Minnaganti VR, Patel PJ, Iancu D, Schoch PE, Cunha BA. Necrotizing fasciitis caused by *Aeromonas hydrophila*. *Heart Lung* 2000; 29: 306-8.
- Overman TL, Janda JM. Antimicrobial susceptibility patterns of *Aeromonas jandaei*, *A. schubertii*, *A. trota* and *A. veronii* biotype *veronii*. *J Clin Microbiol* 1999; 37: 706-8.
- Semel JD, Trenholme G. *Aeromonas hydrophila* water-associated traumatic wound infections: a review. *J Trauma* 1990; 30: 324-7.
- Talan DA, Citron DM, Abrahamian FM, Moran GJ, Goldstein EJC. Bacteriologic analysis of infected dog and cat bites. Emergency Medicine Animal Bite Infection Study Group. *N Engl J Med* 1999; 340: 85-92.
- Vally H, Whittle A, Cameron S, Dowse GK, Watson T. Outbreak of *Aeromonas hydrophila* wound infections associated with mud football. *Clin Infect Dis* 2004; 38: 1084-9.
- Vila J, Marco F, Soler L, Chacon M, Figueras MJ. In vitro antimicrobial susceptibility of clinical isolates of *Aeromonas caviae*, *Aeromonas hydrophila* and *Aeromonas veronii* biotype *sobria*. *J Antimicrob Chemother* 2002; 49: 701-2.
- Woolfrey BF, Quall CO, Lally RT. *Pasteurella multocida* in an infected tiger bite. *Arch Pathol Lab Med* 1985; 109: 744-6.