



## *Shewanella algae*에 의한 소아의 건막염

홍석원<sup>1</sup> · 최환준<sup>1,2</sup> · 이다운<sup>1</sup>

<sup>1</sup>순천향대학교 의과대학 성형외과학교실, <sup>2</sup>순천향대학교 조직재생연구소

## Tenosynovitis on Finger in Children due to *Shewanella algae*

Seok Won Hong<sup>1</sup>, Hwan Jun Choi<sup>1,2</sup>, Da Woon Lee<sup>1</sup>

<sup>1</sup>Department of Plastic and Reconstructive Surgery, Soonchunhyang University College of Medicine, Cheonan, Korea

<sup>2</sup>Institute of Tissue Regeneration, Soonchunhyang University, Cheonan, Korea

Infection of the hands is a relatively common disease that can occur after the injury of the fingers. Commonly, these common diseases can be treated with empirical antibiotic therapy within accurate and detailed information from their patients. But, some health care providers often simply think about this disease as simple infection and inflammation and just prescribe the empirical antibiotics without precise medical examination. Depending on the source of the infection, some patients will not readily fit into the standard antibiotic regimens that are commonly used for community pathogen. If accurate diagnosis within early treatment is delayed, it will cause the complications such as tenosynovitis, osteomyelitis and necrotizing fasciitis. By way of example, we describe the rare case of critically exacerbated from simple laceration to tenosynovitis caused by *Shewanella algae* whose infection was related to his initial injury and not the subsequent treatment.

**Key Words:** *Shewanella*, Hand, Tenosynovitis, Sea water

Infection of the hands is a relatively common disease that can occur after the injury of the fingers. Commonly, these common diseases can be treated with empirical antibiotic therapy within accurate and detailed information from their patients. But, some health care providers often simply think about this disease as simple infection and inflammation and just prescribe the empirical antibiotics without precise medical examination. However, hand infections are one of the few surgical emergencies for hand surgeons and account for up to 35% of patients

who treated to hand surgery<sup>1</sup>. If accurate diagnosis within early treatment is delayed, it will cause the complications such as tenosynovitis, osteomyelitis, and necrotizing fasciitis. The progression of this disease may be more severe in children with weakened immune system. Generally, *Staphylococcus aureus* had been reported to cause up to 80% of hand infections<sup>1-3</sup>. Although, *S. aureus* is the most common culprit of hand infection, it is helpful to consider the etiology of the infection and associate it with the possible offending microbial organism. Depending on the

Received January 17, 2019, Revised [1] February 23, 2019, [2] March 11, 2019, Accepted March 12, 2019

Corresponding author: Hwan Jun Choi

Department of Plastic and Reconstructive Surgery, Soonchunhyang University Cheonan Hospital, 31 Sooncheonhyang 6-gil, Dongnam-gu, Cheonan 31151, Korea

TEL: +82-41-570-2195, FAX: +82-41-574-6133, E-mail: medi619@hanmail.net

Copyright © 2019 by Korean Society for Surgery of the Hand, Korean Society for Microsurgery, and Korean Society for Surgery of the Peripheral Nerve. All Rights reserved.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

source of the infection, some patients will not readily fit into the standard antibiotic regimens that are commonly used for community pathogen<sup>4</sup>. By way of example, we describe the rare case of critically exacerbated from simple laceration to tenosynovitis caused by *Shewanella algae* whose infection was related to his initial injury and not the subsequent treatment, as well as a pertinent literature review.

## CASE REPORT

A 6-year-old boy who was healthy and never had undergone any disease was admitted with infection of his index finger. He was slipped down on the beach and got simple lacerative wound on his finger. After the injury, he was treated his finger by primary repair with the laceration and empirical antibiotics at local clinic. Although, the treatment was maintained during 4 days with simple dressing, his finger was exacerbated and seemed to be cellulitis on his finger. Five days after the initial treatment he developed pain, swelling, and redness of his index finger with small multiple blisters. When he transferred to our department for management, induration accompanied by yellowish turbid discharge progressed from fingertip to proximal phalanx of his index finger (Fig. 1). On admission, he had temperature of 37.7°C



**Fig. 1.** A 6-year-old boy with tenosynovitis on left index finger. Immediate image on his admission. Raw surface accompanied by diffuse induration with swelling and yellowish turbid discharge.

and appeared irritable. Tenderness along the course of flexor sheath and symmetric swelling of the index finger was shown and the finger was held in a slightly flexed position. The patient experienced severe pain with active and passive flexion and extension. Flexion and extension within distal-interphalangeal joint were limited. Blood cultures, a full blood count and a wound microbiology swab were taken and he was promptly commenced on intravenous cefotaxime, analgesia, hand elevation, immobilization, and general bed rest. Radiologic inspection was carried out to confirm the presence of minute foreign body. There was tiny radiopaque densities seen as foreign body (Fig. 2). We performed wound irrigation with focal surgical debridement for removal of foreign bodies and minute debritic tissues. Foreign bodies were uncertain, but seemed like sands or seashell. The full blood count showed minor leukocytosis ( $11.1 \times 10^9/L$ ). There was no growth in the blood cultures. The Gram stain of the culture revealed gram-negative bacteria. The organisms grown from the tissue culture included *S. algae*. *S. algae* was sensitive to piperacillin, cefotaxime, ciprofloxacin, and resistant to amoxicillin and cefazolin. He responded well to the treatment and was discharge after 12 days of hospitalization (Fig. 3).



**Fig. 2.** Radiologic inspection images (left index finger lateral view). (A) Immediate radiologic image on his admission. Minute radiopaque densities seen as foreign bodies. (B) Immediate postoperative radiologic image: no visual foreign body and gross bony abnormalities.



**Fig. 3.** Two months after discharge image. Wound was totally healed without any complications.

## DISCUSSION

Hands, especially fingers, are a part of the body that people use most in their activities and are always exposed to the risk of injury and infection. A variety of causes can result in hand injuries, which can lead to the inflow of a wide variety of bacteria and the resulting infection. Hand infections are common with diverse factors; however, most are the result of direct inoculation of bacteria from penetrating trauma and lacerations<sup>5-7</sup>. It is important to have a high index of suspicion to diagnosis and treat hand infections expeditiously in order to prevent morbidity and maximize outcomes. If diagnosis within early treatment is delayed, it will cause the complications such as tenosynovitis, osteomyelitis, and necrotizing fasciitis. The progression of this disease may be more severe in children with weakened immune system. If the wound is worse as a complication, not a simple inflammation, surgical treatment may be necessary and may result in sequelae. In general, most of the causes of hand infection are *Staphylococcus* and *Streptococcus* species. Because it is often treated with the use of empirical antibiotics in combination with simple dressing, health care providers often consider easy and miss the golden time of treatment, often causing wounds to worsen. Especially for

children, they have a weaker immune system than adults and infection can proceed easily. That is why health care providers should be able to think about the precise etiology of the infection and causes of injury. If necessary, it should be able to perform surgical debridement and bacterial examination to find the culprit of the infection rather than simple wound disinfection.

The diagnosis of flexor tenosynovitis is based on the presence of 1 or more of the 4 cardinal signs of Kanavel and then confirmed by microbiologic or histopathologic evaluation when possible. In this report, the patient showed all Kanavel signs.

*S. algae* is a facultative anaerobic, aquatic, gram-negative bacillus belonging to the family *Vibrionaceae*<sup>8</sup>. This species was first reported by Derby and Hammer<sup>9</sup> in 1931 after being isolated from putrefied butter. This microorganism was named after Dr. James Shewan for his contributions to fishery microbiology<sup>10</sup>. *Shewanella* can find commonly in nations, but most found in marine environments.

*Shewanella* was initially termed *Achromobacter putrefaciens* before being reclassified as a member of the *Pseudomonas* family<sup>11</sup>. *S. algae* was also initially misidentified by phenotypic tests as *Shewanella putrefaciens*; correct identification relied on 16S RNA gene sequence analysis establishing a novel species in the early 1990<sup>12</sup>. *S. algae* infections are only infrequently associated with human disease. When it occurs, those infections are most commonly due to *S. algae* as opposed to other *Shewanella* spp.<sup>11</sup>. *S. algae* infections range from superficial abscess, cellulitis, osteomyelitis, and bacteremia to necrotizing fasciitis<sup>11</sup>. In warm temperature including United States, South Africa, Australia, Asia, and Southern Europe, the prevalence of *Shewanella* infections is higher and most infections are related to contact with seawater<sup>11</sup>.

Although *Shewanella* species infections in humans are rare, the number of reports has significantly increased recently. In 2013, two extensive studies from Liu et al<sup>13</sup> and Vignier et al<sup>14</sup> were reported. In 2017, retrospective analysis of the infections of *S. algae* from Martín-Rodríguez et al<sup>15</sup> were reported. These studies suggested that the manifestations of the infection of *S. algae* can

be shown variously such as serious soft tissue infections, otitis media, spondylodiscitis, and necrotizing fasciitis. According to Fluke et al.<sup>16</sup>, pyogenic flexor tenosynovitis by *S. algae* has a high risk for poorer outcome if not treated. This study reported *S. algae* infection appears to be a much more virulent than other marine bacterium and poorer prognosis. Thus, to minimize occurring complication or morbidity, the distinction between infection by *S. algae* and other pathogens must be quickly when a patient presents with flexor tenosynovitis after water exposure.

As mentioned above, *S. algae* infections are rarely to human being, but can induce critical complication such as necrotizing fasciitis and has poor prognosis. Inadequate and delayed treatment are correlated with increased mortality. In our case, young healthy individual had undergone injury and seawater exposure. Because of its poor prognosis and high virulence, physicians should consider *S. algae* infections in patients with tenosynovitis to treat and minimize morbidity appropriately, especially after seawater exposure.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

## ACKNOWLEDGEMENTS

This work was supported by the Soonchunhyang University Research Fund.

## REFERENCES

1. Tosti R, Ilyas AM. Empiric antibiotics for acute infections of the hand. *J Hand Surg Am.* 2010;35:125-8.
2. McDonald LS, Bavaro MF, Hofmeister EP, Kroonen LT. Hand infections. *J Hand Surg Am.* 2011;36:1403-12.
3. Osterman M, Draeger R, Stern P. Acute hand infections. *J Hand Surg Am.* 2014;39:1628-35; quiz 1635.
4. Jacob-Kokura S, Chan CY, Kaplan L. Bacteremia and empyema caused by *Shewanella* algae in a trauma patient. *Ann Pharmacother.* 2014;48:128-36.
5. Fowler JR, Ilyas AM. Epidemiology of adult acute hand infections at an urban medical center. *J Hand Surg Am.* 2013;38:1189-93.
6. Houshian S, Seyedipour S, Wedderkopp N. Epidemiology of bacterial hand infections. *Int J Infect Dis.* 2006;10:315-9.
7. Türker T, Capdarest-Arest N, Bertoch ST, Bakken EC, Hoover SE, Zou J. Hand infections: a retrospective analysis. *PeerJ.* 2014;2:e513.
8. MacDonell MT, Colwell RR. Phylogeny of the Vibrionaceae, and recommendation for two new genera, *Listonella* and *Shewanella*. *Syst Appl Microbiol.* 1985;6:171-82.
9. Derby HA, Hammer BW. Bacteriology of butter. IV, bacteriological studies on surface taint butter. Ames: Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts; 1931.
10. Hau HH, Gralnick JA. Ecology and biotechnology of the genus *Shewanella*. *Annu Rev Microbiol.* 2007;61:237-58.
11. Janda JM, Abbott SL. The genus *Shewanella*: from the briny depths below to human pathogen. *Crit Rev Microbiol.* 2014;40:293-312.
12. Nozue H, Hayashi T, Hashimoto Y, et al. Isolation and characterization of *Shewanella* alga from human clinical specimens and emendation of the description of *S. alga* Simidu et al., 1990, 335. *Int J Syst Bacteriol.* 1992;42:628-34.
13. Liu PY, Lin CF, Tung KC, et al. Clinical and microbiological features of *shewanella* bacteremia in patients with hepatobiliary disease. *Intern Med.* 2013;52:431-8.
14. Vignier N, Barreau M, Olive C, et al. Human infection with *Shewanella putrefaciens* and *S. algae*: report of 16 cases in Martinique and review of the literature. *Am J Trop Med Hyg.* 2013;89:151-6.
15. Martín-Rodríguez AJ, Martín-Pujol O, Artiles-Campelo F, Bolaños-Rivero M, Römling U. *Shewanella* spp. infections in Gran Canaria, Spain: retrospective analysis of 31 cases and a literature review. *JMM Case Rep.* 2017;4:e005131.
16. Fluke EC, Carayannopoulos NL, Lindsey RW. Pyogenic flexor tenosynovitis caused by *Shewanella* algae. *J Hand Surg Am.* 2016;41:e203-6.

## Shewanella algae에 의한 소아의 건막염

홍석원<sup>1</sup> · 최환준<sup>1,2</sup> · 이다운<sup>1</sup>

<sup>1</sup>순천향대학교 의과대학 성형외과학교실, <sup>2</sup>순천향대학교 조직재생연구소

손의 감염은 손가락의 손상 이후에 발생할 수 있는 상대적으로 흔한 질환이다. 보통, 이러한 손의 감염은 환자들의 정확하고 자세한 병력청취 및 진찰하에 경험적인 항생제 치료로 치료될 수 있다. 하지만 일부 의사들은 이를 간단한 감염 또는 염증으로 단순하게 생각하고 정확한 진찰을 하지 않은 채 단순히 경험적 항생제를 처방하고 지켜보는 경우가 종종 있다. 경험의 원인이 되는 요인에 따라 일부 환자들의 경우 지역사회 감염에 일반적으로 사용되는 본편적 항생제 요법에 반응하지 않는 경우가 있다. 만약 정확한 진단을 기반으로 한 조기의 치료가 이루어지지 않는 경우, 이는 건막염, 골수염, 괴사성 근막염 등의 치명적인 합병증으로 진행될 수 있다. 이에 대한 예시로, 환자에 대한 적절한 검사 및 치료가 이루어지지 않아 *Shewanella algae*에 의한 감염이 악화되어 건막염으로 진행된 건강한 환자의 희귀한 사례에 대하여 보고하고자 한다.

**색인단어:** *Shewanella* 균, 손, 건막염, 바닷물

접수일 2019년 1월 17일 수정일 1차: 2019년 2월 23일, 2차: 2019년 3월 11일 게재확정일 2019년 3월 12일

교신저자 최환준

31151, 천안시 동남구 순천향6길 31, 순천향대학교 천안병원 성형외과

TEL 041-570-2195 FAX 041-574-6133 E-mail medi619@hanmail.net