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Case report

Clenched fist injury complicated by septic arthritis and osteomyelitis treated with negative pressure wound therapy: One case report

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ABSTRACT

We reported a 30 years old man who suffered a bite wound of the right hand in a fight. Two days after the injury, he was admitted in emergency because of stab wound above the head of the third metacarpal bone. He presented the swelling, redness, pain and fever. Primary revision confirmed only partial lesion of the extensor apparatus. During the following days, we recorded a deterioration of local findings and magnetic resonance imaging revealed osteomyelitis and septic arthritis of the third metacarpophalangeal joint. The wound was then revised several times using negative pressure wound therapy in combination with intravenous antibiotics. After resolution of clinical and laboratory findings, the wound was finally closed by delayed primary suture. Clenched fist injury is a medical emergency that requires immediate surgical revision. We treated clenched fist injury with the development of septic arthritis and osteomyelitis with negative pressure wound therapy and obtained good outcomes.

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Introduction

Clenched fist injury is resulted from hitting the other person into his front teeth, usually after a fight.^{1,2} Consequently, the tooth penetrates through the skin and in some cases it passes through the extensor tendon into the joint. Sometimes it is associated with cartilage damage or bone fracture.¹ The incidence of septic arthritis is about 2%, similar to that of osteomyelitis.³ The treatment aims to give early wound revision, debridement and perfect wash out. The wound should be left open.⁴ The literature describes several options of surgical treatment for such injuries, but negative pressure wound therapy (NPWT) is missing.

Case report

A 30 years old man was admitted into the emergency department with swelling and pain of the right hand. He reported to sustain an injury in training two days ago. Locally, a 5 mm long wound was presented over the third metacarpophalangeal (MP) joint with redness and swelling (Fig. 1).

Body temperature was 38.2 °C. Radiographs ruled out the presence of a fracture. Laboratory tests revealed increased number of white blood cells ($12.38 \times 10^9/L$) and elevated C-reactive protein level (55.01 mg/L). We performed the tissue debridement and took samples for microbiological examination. During the revision, we found partial lesions of the extensor mechanism. After washout, the wound was left open. Prophylactic antibiotic therapy was given by administration of cefuroxime. Microbiological tests cultivated massive *Streptococcus gordonii* and gram-positive anaerobic bacteria sensitive to cefuroxime and clindamycin. In the coming days of hospitalization, white blood cells and elevated C-reactive protein level were regressed (1.23 mg/L) while local findings were impaired. Magnetic resonance imaging scan was performed and indicated the osteomyelitis and septic arthritis of the third MP joint with the abscess foci (22 mm × 15 mm × 27 mm) in the dorsum of the right hand (Fig. 2). Throughout the second revision, NPWT with polyurethane foam and Redon drainage were applied. Skin wound over the foam position was closed by suture and foil (Fig. 3). Subsequently, the wound was revised for three times with repeated use of NPWT and wound suture over the foam placement. Microbial cultivation collected after the fourth revision remained negative. During the fifth revision, the wound was finally closed. The patient was discharged after a month of hospitalization. The wound healed with mild hypertrophic scar and a

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Fig. 1. The local findings at admission.

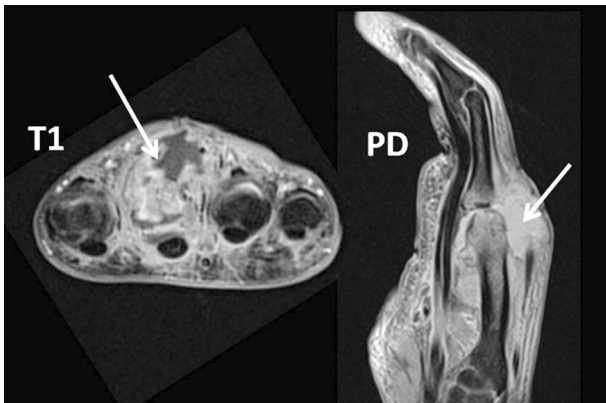


Fig. 2. The septic arthritis and osteomyelitis of the third metacarpophalangeal joint with the abscess foci (white arrow) of the dorsum of the right hand on magnetic resonance images (T₁ and PD).

painless unremarkable swelling, without fistulas or other signs of persistent infection. The functional deficits extension was 10° with preserved flexion at the last inspection six months after the accident. Afterwards we lost contact with the patient.

Discussion

A main problem in the treatment of the patient with a clenched fist injury is non-compliance.⁵ During the period of the last ten years, we treated seven patients with deep clenched fist injury with NPWT and almost all were non-compliant. The patients mostly hid the true cause of the injury as in our case.

The typical injury pattern of the clenched fist injury is tooth penetration of the dorsum of the hand over the third MP joint.¹ In our case, the wound was situated well over this joint.

Patients usually initially did not seek medical attention for a little stab wound with no apparent local reactions. They looked for the help later, after the occurrence of the swelling and pain. The median interval between the bite and presentation was about 58 h.³ The patient visited our department two days after injury, with already developed clinical symptoms.

During the surgical revision of the wound, there is often overlooked communication with the cavity of the joint because the hand is often revised in extension, but only revision in flexion demonstrates skin, tendon and joint sheaths in one line.¹ In our case, during the first revision, we had seen the only partial damage to the extensor tendon. We were aware of the possibility of cartilage and bone penetration, but found no signs until MRI revealed the overlying septic arthritis and osteomyelitis. Septic arthritis and osteomyelitis are dangerous complications of fight bite because they are extremely difficult to eradicate and associated with a high risk of amputation and permanent joint stiffness.⁶

The management of clenched fist injury complicated by joint and bone infections remains a challenge. Today, the accepted treatment of these injuries is an exploration of the wound with debridement and lavage. Different solutions may be used for irrigation (physiological saline, hydrogen peroxide, gentamicin).⁶ The literature also described the techniques such as cauterization with nitric acid.⁷ According to some studies, such wounds should be left to heal by secondary intention to avoid serious infectious complications.^{1,4,7} However, secondary healing and prolonged inflammation can impair wound healing and lead to marked scarring. Joint movements are significantly reduced when abscess and MP joint injury are presented.⁷

NPWT has been proven to be a reliable method to treat a diversity of wounds. The decrease in edema, removal of wound exudate with bacteria and microdeformations of the wound bed clinically indicate the improved healing potential.⁸ NPWT

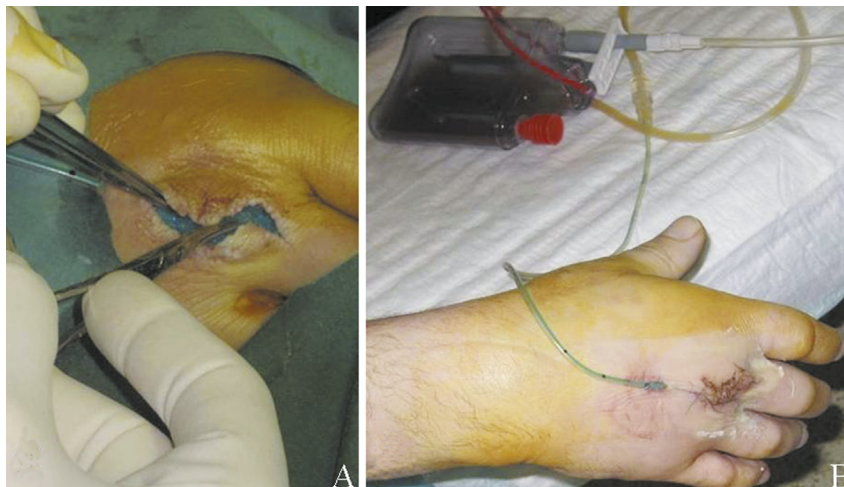


Fig. 3. The application of polyurethane foam and drainage (A). Redon drainage with skin closure over the polyurethane foam by suture and foil (B).

leads to increased local interleukin expression in the early phase of inflammation which may start accumulation of neutrophils and significantly decrease bacterial count.⁸ Application of NPWT has a significant effect on local expression of vascular endothelial growth factor in acute traumatic wound, which seems to play a crucial role in the accelerated granulation tissue formation.⁹

Human saliva contains a number of microorganisms per milliliter. The most frequently cultured bacteria are *Streptococcus*, *Staphylococcus*, *E. corrodens*, *Fusobacterium*, *Peptostreptococcus* and *Candida*.³ Mixed aerobic and anaerobic infection is the most frequent infection.³ In our patient, *Streptococcus gordonii* and gram-positive anaerobic species were isolated. In the clinical study and animal study, the vacuum sealing drainage leads to negative microbiological smears and decreased bacterial count.^{10,11}

In our patient, we debrided the wound and used NPWT and systemic antibiotics. Therefore final negative bacteriological samples were more the impact of combined therapy, but NPWT represented an important part of treatment, after which local findings were improved.

Each wound over the MP joints requires a thorough revision, debridement of damaged tissues and antibiotic prophylaxis. In diagnostic doubts, magnetic resonance imaging can diagnose the involvement of deeper structures. We believed that after surgical revision and wound debridement of clenched fist injury, NPWT will

enhance healing of infected wounds and avoid excessive joint stiffness of the hand.

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