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Hand

Negative Pressure Wound Therapy for Gas Gangrene of the Fingertip with Prolonged Infection

Yasufumi Okamoto, MD*
Kazuhiro Maeda, MD, PhD*†
Mitsuhito Yukawa, MD*†
Reiji Nishimura, MD, PhD†‡
Yuji Nagamine, MD*†
Yuka Hadano, MD*†
Ayano Mandai, MD*†
Jun Udaka, MD, PhD§
Takeshi Miyawaki, MD, PhD‡
Mitsuru Saito, MD, PhD*

Background: We encountered a case of infected soft tissue defect of the fingertip treated using negative pressure wound therapy (NPWT). The development of NPWT was started in the early 1990s, and it is a relatively new treatment method included in insurance coverage in Japan in 2010. NPWT is used for intractable wounds; some reports have examined its use on infected wounds. However, to the best of our knowledge, no study has examined its use on infected fingertip wounds.
Methods: A patient with an infected soft tissue defect in the fingertip whose epithelialization period was prolonged despite continued antibiotic therapy was treated using NPWT in combination.
Results: After NPWT was started, signs of infection and wound granulation were good. Additionally, completion of epithelialization was confirmed 7 weeks after NPWT started.
Conclusions: Conventionally, skin flap or graft by hand surgeons have been performed on fingertip soft tissue defects with infection. NPWT does not require specialized and advanced surgical techniques; treatment for infected soft tissue defects can be administered by anyone if they have the required skills. In conclusion, NPWT may be considered a suitable alternative when treatment options such as flaps and skin grafts are not feasible. *(Plast Reconstr Surg Glob Open 2024; 12:e5782; doi: 10.1097/GOX.0000000000005782; Published online 1 May 2024.)*

INTRODUCTION

Fingertip soft tissue injuries manifest and appear in various forms depending on the etiology; that is, contused wounds caused by minor trauma, finger defects as a result of being crushed, and infection. Experienced hand surgeons have performed skin flaps and grafts for soft tissue defects. Negative pressure wound therapy (NPWT) is a relatively new treatment strategy. Owing to its excellent wound healing effect, it is used to treat a wide range of conditions,[1,2] such as traumatic wounds,[3] pressure sores, open abdomens, sternal wounds,[4] diabetic foot,[5] second-degree burns, skin flaps,[6] and skin graft recipient sites.[7] However, no study has examined and reported on treating fingertip infection–associated soft tissue defects using NPWT.

*From the *Department of Orthopaedic Surgery, The Jikei University School of Medicine, Tokyo, Japan; †Hand Surgery Center, The Jikei University Hospital, Tokyo, Japan; ‡Department of Plastic and Reconstructive Surgery, The Jikei University School of Medicine, Tokyo, Japan; and §Tetsujikai Medical Corporation Kasuga Clinic, Hiroshima, Japan.*

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Herein, we present the case of a patient with an infected soft tissue defect in the fingertip. The patient was treated with NPWT and showed favorable outcomes.

METHODS

Informed Consent

Written informed consent was obtained from the patients. The treatment for this patient is within the scope of medical insurance coverage and does not include experimental elements.

PATIENT CHARACTERISTICS

A 72-year-old woman presented to our department with pain, fever, and a green color change of her right thumb after having experienced increased swelling and redness of her thumb, with associated fever and pain, a few days after pruning trees. Symptoms at the initial visit included swelling with fluctuation in the periphery from the base of the right thumb, which was dark green (Fig. 1A, B). X-ray images revealed translucency at the base of the thumb distal phalanx and gas images at the nail base and the fingertip, in addition to prominent swelling of the subcutaneous tissues (Fig. 1C, D). Blood biochemical tests showed an increased inflammatory reaction, hepatic impairment, and elevated biliary enzymes. The fingertip

Disclosure statements are at the end of this article, following the correspondence information.

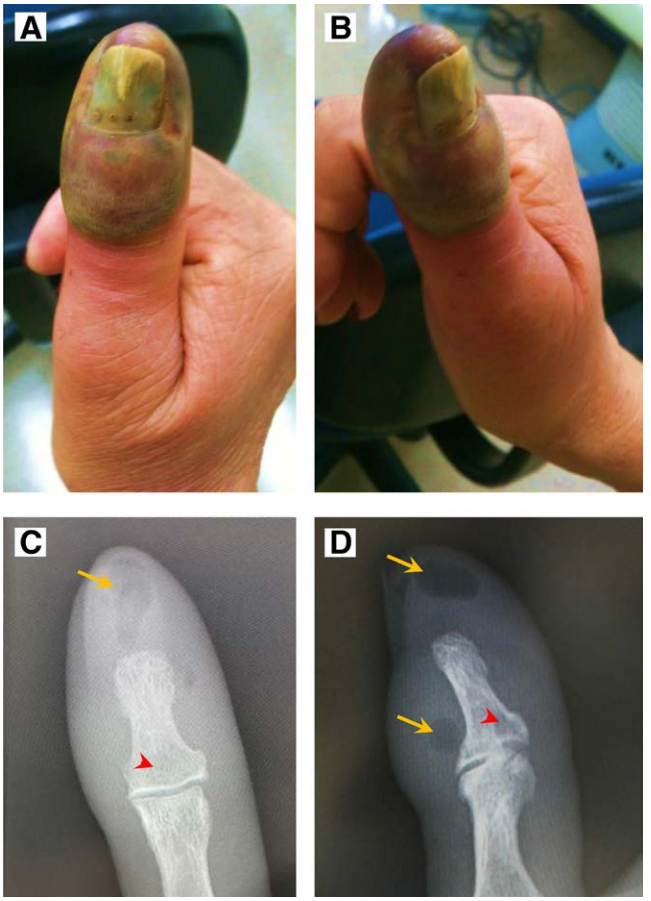

Fig. 1. External appearance and plain x-ray images of the right thumb at hospital visit. A–B, Swelling with fluctuation was observed in the periphery from the base of the right thumb, presenting dark green. C, Front view. D, Lateral view. Gas images were observed at the fingertip (yellow arrows), and transparent images were observed at the base of the distal phalanx (red arrowheads).

was punctured, and foul-smelling exudate flowed out. Based on the above, gas gangrene of the right thumb was diagnosed, penicillin G and clindamycin administration were started, and surgery was performed.

Surgical Method and Intraoperative Findings

The surgical findings observed in the present study were as follows: dorsal soft tissues, including the fingertip, finger pad, and nail, were remarkably contaminated. After preserving the volar neurovascular bundle, contaminated soft tissues, including the dorsal skin, were debrided (Fig. 2). Furthermore, two-thirds of the distal phalanx was resected, and the proximal bone marrow was debrided (Fig. 2). For skin loss, uncontaminated adipose tissues of the finger pad were turned to the dorsal side as a flap, covering the stump of the shortened distal phalanx and the exposed extensor pollicis longus tendon (Fig. 2). In the culture test, the blood culture was negative; however, *Proteus vulgaris* was detected in the puncture fluid.

Start of NPWT and Transition of Wound Condition

The postoperative course involved continued administration of the antibiotics; however, the patient showed prolonged inflammatory reaction and epithelialization, and exudate leakage from the wound persisted. Therefore, NPWT (−75 mm Hg, intermittent mode, changed twice a

Takeaways

Question: Is it possible to treat fingertip gas gangrene with prolonged infection using negative pressure wound therapy (NPWT)?

Findings: NPWT was effective in treating fingertip gas gangrene with prolonged infection.

Meaning: NPWT does not require specialized and advanced surgical techniques; treatment for infected soft tissue defects can be administered by anyone if they have the required skills. NPWT may be considered a suitable alternative when treatment options such as flaps and skin grafts are not feasible.

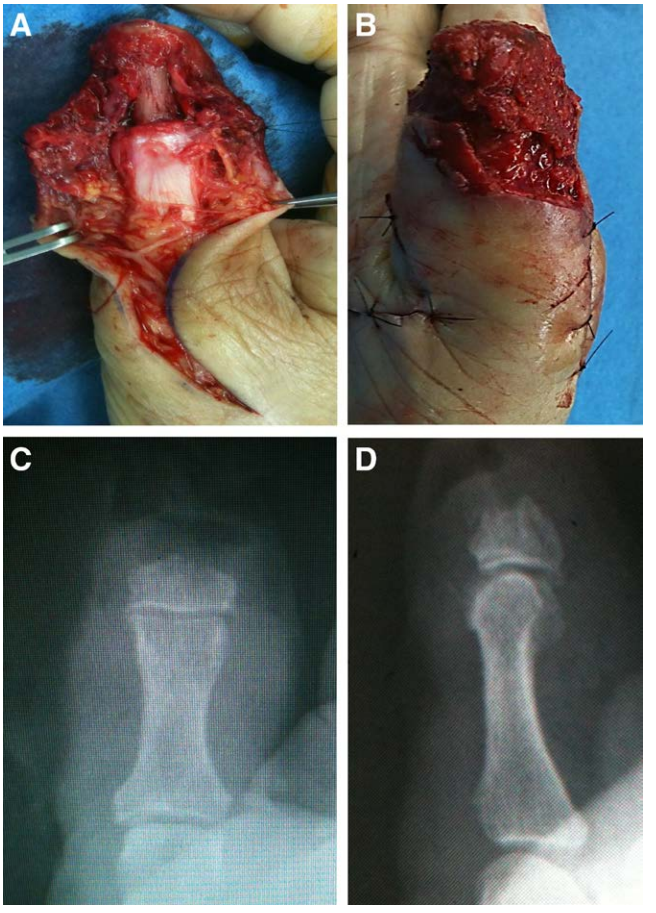

Fig. 2. External appearance during surgery and plain x-ray images of the right thumb immediately after surgery. A, After opening the volar side with a zig-zag skin incision and preserving the neurovascular bundle, contaminated tissues were debrided. Next, the dorsal side was opened, skin tissues, including the skin, were debrided, the distal phalanx was resected distally, and the proximal bone marrow of the distal phalanx was debrided using a curette. B, Uncontaminated adipose tissues of the finger pad were turned to the dorsal side as a pedicle flap, covering the stump of the distal phalanx and the exposed extensor pollicis longus tendon. C, Front view. D, Lateral view. Finally, distal two-thirds of the distal phalanx was amputated.

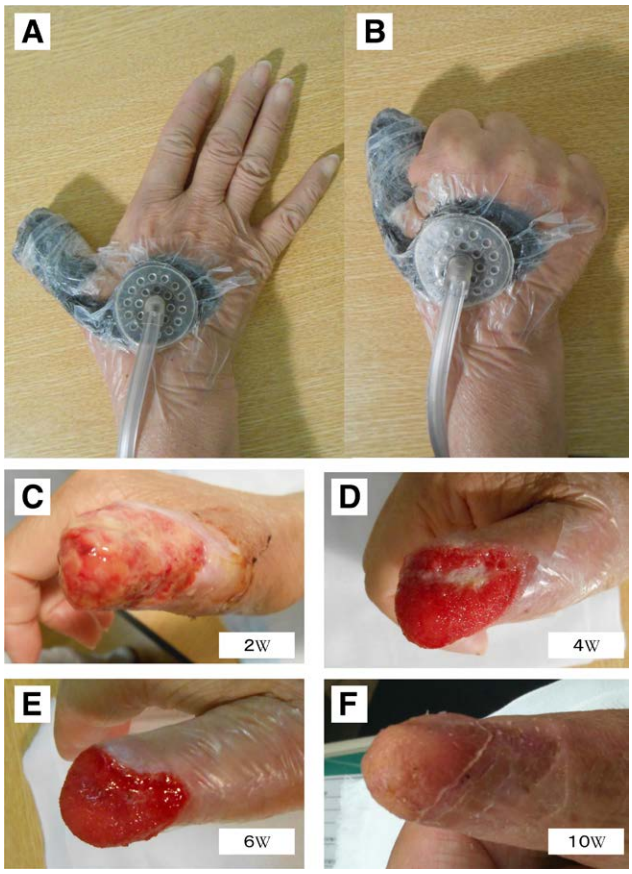

Fig. 3. Changes in postoperative appearance over time. External appearance after NPWT installation. A, A suction hole was set up at the dorsal side, and the sponge was installed from the dorsal side of the thumb to the fingertip. B, Finger ROM training was possible while installing NPWT. C, Changes in granulation tissues of the right thumb fingertip over time. Two weeks after surgery, wound epithelialization was prolonged, and exudate leakage persisted. D, Four weeks after surgery, 1 week after the start of NPWT. Exudate decreased, and good suitable granulation was observed, but part of the extensor pollicis longus tendon was exposed. E, Six weeks after surgery, 3 weeks after the start of NPWT. Good granules entirely covered the exposed extensor tendon. F, Ten weeks after surgery, the affected part is fully epithelialized.

week, with each exchange lasting approximately 30 minutes) was started on postoperative day 23 (Fig. 3). Twenty-six days after NPWT was started, signs of infection and wound granulation were good, and NPWT was ended (Fig. 4).

RESULTS

Upon completion of NPWT, the patient was discharged from the hospital and followed up once a week in the outpatient setting. Although range of motion (ROM) exercises could not be performed before NPWT due to gauze protection, these were initiated upon starting treatment, and the ROM of the metacarpophalangeal joint seemed to improve 10 degrees to 40 degrees 7 weeks postoperatively. Additionally, completion of epithelialization was confirmed 10 weeks after surgery (Fig. 3). At the follow-up, 7 years and 9 months after surgery, the interphalangeal joint ankylosed (Fig. 4A), and bone resorption of the distal phalanx was observed (Fig. 4B, C), the ROM of the metacarpophalangeal joint was 10–60 degrees, opposition to the little finger was possible, and there was no recurrence of infection.

DISCUSSION

The treatment period is often long in the case of epithelial tissue defects due to fingertip soft tissue injuries. Treatment methods for soft tissue injuries with defects are generally covered with a skin flap, stump-plasty, and conservative therapy using dressings.[8] Conservative therapy using film dressings and aluminum foil is occasionally administered, which takes approximately 2–12 weeks to heal.[8] NPWT use started in the early 1990s,[9] and satisfactory outcomes have been reported owing to increased granulation speed in the wound healing process.[1,2] NPWT is used on open wounds; it decreases the frequency of painful wound treatments and can reduce the treatment period by half.[10]

Furthermore, some articles showed that the implementation of NPWT reduces local bacterial load, leading to a decreased infection rate.[11] Reportedly, when used in cases of severe infection, it can play a role in relieving the infection and saving the affected limb.[12] Furthermore, satisfactory progress was achieved by using a new device that can perform NPWT while repeatedly cleansing the infected wound.[13] In our case, an infection that affected the patient's general condition developed, and prolonged wound healing and increased exudate were confirmed; however, NPWT use resulted in conservative wound healing. To the best of our knowledge, only one report exists on NPWT on the fingertip,[14] and none on the use of NPWT for treating the infection of the fingertip. The advantage of this method is that it does not require specialized and advanced surgical techniques, like skin flap surgery or skin graft surgery, by hand surgeons or plastic surgeons. Adequate debridement and coverage of the exposed bone with soft tissue are important, but anyone can perform a treatment if they have experience performing NPWT installation. Additionally, by devising the method of placing the sponge, it is possible to treat soft tissues while performing ROM training of the finger. However, its disadvantage is that NPWT may obstruct blood flow, which is one of the essential parameters to ensure that the infection subsides. However, even in cases where blood vessels are exposed at the wound, it is possible to preserve the affected limb by using appropriate coverage and suction pressure so as not to burden the exposed blood vessels.[15]

Herein, we encountered a case in which delayed epithelialization of the infected site was successfully treated with NPWT. After surgical debridement of finger soft tissue infection, NPWT may be considered a suitable alternative when treatment options such as flaps and skin grafts are not feasible. The main limitation of this report is that only one patient was included. Therefore, additional cases should be investigated in the future.

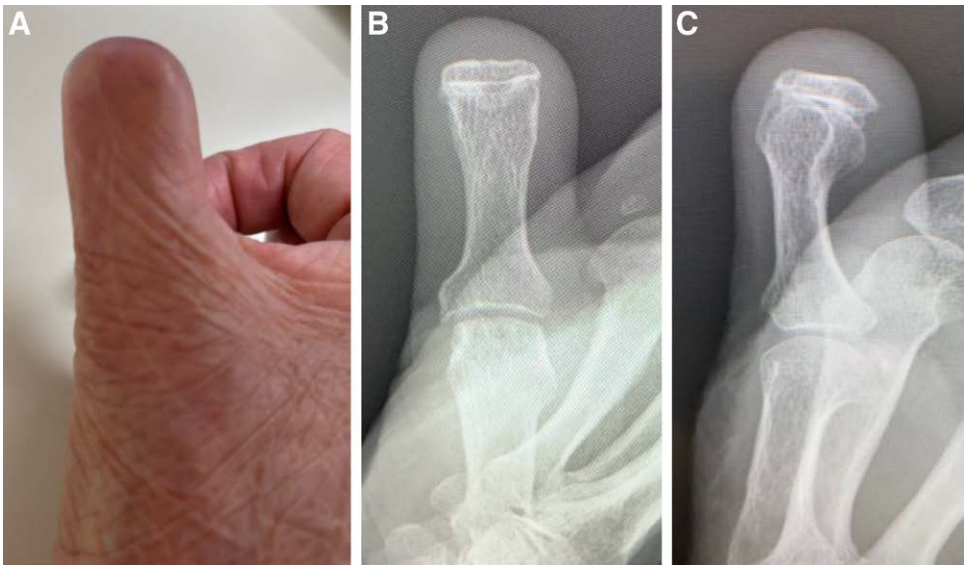

Fig. 4. External appearance and plain x-ray images at final follow-up 7 years and 9 months after surgery. A, No apparent recurrence of infection was observed, but the interphalangeal joint ankylosed. B, Front plain x-ray image. Bone resorption of the stump of the distal phalanx was observed. C, Lateral plain x-ray image. Same as above.

Kazuhiro Maeda, MD, PhD
Department of Orthopaedic Surgery
The Jikei University School of Medicine
3-25-8 Nishi-Shimbashi, Minato-ku
Tokyo 105-8461, Japan
E-mail: maeda@jikei.ac.jp

DISCLOSURE

The authors have no financial interest to declare concerning the content of this article.

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