

A full-thickness chemical burn to the hand using formic acid-based anti-wart treatment: a case report and literature review

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Abstract



Introduction: Chemical burns are comparably rare but often result in full-thickness skin defects with frequent involvement of underlying structures. Hands are the most commonly affected injury site and impaired functional outcome is common. We present a case of an unusual chemical burn to the dorsum of the hand of a child secondary to application of a topical anti-wart treatment containing formic acid.



Case report: An 11-year-old girl was referred to our outpatient department with a full-thickness injury resulting from a chemical burn having used a topical formic acid solution in the treatment of common warts. On examination, a 20-mm circular full-thickness defect was noted to the dorsum of the hand. The extensor tendons were not involved and there were no signs of infection. She required surgical debridement and local flap coverage. The postoperative recovery was unremarkable.



Conclusion: Through a comprehensive literature review, four common topical solutions used in anti-wart treatment were identified to be associated with burns. Together with our case, this highlights the importance of careful patient education in the usage of common topical over-the-counter treatments.

Keywords

Formic acid, wart, chemical burn, third degree burn, paediatric burn, burn reconstruction

Lay Abstract

Viral warts to the skins are common and are expected to heal by themselves with time. However, they can be associated with stigma and discomfort, leading many people to seek treatment for their removal. There are many different types of treatment options, the most common being to freeze them (cryotherapy) or using a solution that is painted on to the wart. Recently, there has been a rise in the number of different types of solutions that are used in the treatment of warts, including formic acid. Here we describe a case of an 11-year-old girl who used a formic acid-based solution to treat a wart on her hand. This resulted in a deep chemical burn that required surgery under local anaesthetic. She did not have any immediate complications from her surgery. On reviewing the literature, we identified two other acid-based solutions, salicylic acid and monochloroacetic acid, and a third chemical called other glutaraldehyde, that are commonly found in anti-wart treatments and have been described to cause chemical burns. These anti-wart treatments are widely available over the counter and we would like to highlight the importance of proper patient education when used to minimise the risk of chemical burns.

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Background

Chemical burns account for approximately 3%¹ of patients within the burn population but can result in severe injuries associated with significant morbidity and mortality. The most commonly affected body parts in chemical burns are the upper extremities, most often the hands. Chemical burns on the hands and wrists are often deep and can result in temporary or permanent loss of function.^{2,3} Chemical burns occur most commonly in the working environment. Iatrogenic chemical burns have rarely been described but are usually associated with topical skin treatments.^{4,5}

Cutaneous viral warts are common lesions, particularly in young people of whom an estimated 5%–30% are affected.^{6–8} They often resolve spontaneously;⁹ however, the associated stigma and often unsightly appearance lead patients to seek treatments for their removal. There exists a wide array of anti-wart treatments available including cryotherapy, chemical destruction, laser therapy, electrosurgery and immunotherapy, often with little evidence for their use.¹⁰ The most common treatments used are topical application of salicylic acid-based formulations and cryotherapy.¹¹

Topical formic acid-based solutions have been reported as effective, safe and inexpensive anti-wart treatments.^{12–14} The mechanism of action remains unknown but is hypothesised to act by dehydrating and destroying the infected tissue.¹² We report a case of a third-degree chemical burn in a child having used a formic acid-based solution for treatment of a cutaneous wart of the hand.

Case report

An 11-year-old patient was referred to our clinic for assessment of a full-thickness wound to the dorsum of her left hand. Eleven days previously she had used an over-the-counter topical solution containing formic acid to treat a common wart. She applied the solution once, limiting exposure to the confines of the affected tissue. The wound was subsequently covered with an occlusive dressing, although this was advised against on the pack insert. Two days after application, a necrosis had developed at the site. The patient attended her local primary care clinic where she was advised to dress the wound daily with aluminium acetate-tartrate-soaked gauze. Nine days after application she presented to the paediatric emergency department for a wound review. The attending

doctor noted a dry necrosis and debrided the wound bedside under local anaesthesia. Two days after debridement she re-attended the emergency department due to increasing pain and was prescribed a course of oral antibiotics for a local wound infection. She was previously fit and well with topical eczema to her hands for which she occasionally used topical steroids. She was left-hand dominant.

Upon review, her main concern was pain from the wound limiting her ability to write. Examination of the dorsum of her left hand revealed a 20-mm diameter circular wound with a bed of granulation tissue, proximal to the first metacarpophalangeal joint (Figure 1). There were no signs of local or systemic infection. Given the size of the wound and the localisation directly over the thumb extensor tendons, the decision was made to surgically close the wound with a local flap.

The wound was closed with a rhomboid flap under local anaesthesia 18 days after the initial application of the ointment (Figures 2 and 3). The postoperative period was uneventful and hand function was fully restored six weeks after surgery (Figure 4).

Discussion and conclusions

We describe a case of a full-thickness chemical burn following topical application of a solution containing formic acid on a common wart to the dorsum of the hand. Based on this case, a literature review was undertaken on burns associated with the use of formic acid. To the best of our knowledge, this is the first case of a full-thickness burn reported in a child.

A search of the literature was conducted on 1 October 2019 via PubMed® using the search terms ‘formic acid burn’ and ‘chemical burn wart treatment’. The article titles in the search results were screened for relevance. Only papers published in English describing iatrogenic burns as a result of chemical wart treatment were included. Reports of iatrogenic burns resulting from topical application of garlic—a household remedy frequently applied for the cure of skin conditions—were not included, since this topic has already been extensively reviewed.^{15,16} Burns secondary to cryotherapy were not included. Based on the aforementioned criteria, six articles were identified. Balagué et al. reported a case of third-degree burn on a digit in an adult using a solution containing formic acid continuously for 6 h in combination with an occlusive dressing. This healed spontaneously; however, a sensory deficit in the course of the underlying ulnar



Figure 1. Preoperative image taken during the time of operation, 18 days after application of the ointment, revealing a 20-mm circular defect distal to the first metacarpophalangeal joint.



Figure 2. Intraoperative image of the defect and rhomboid flap design. The flap margin marked A was transposed to align with the wound margin marked a.

collateral nerve was noted.¹⁷ Tong et al. reported a case of inappropriate use of anti-wart treatment containing formic acid in an adult resulting in a full-thickness injury over the little finger proximal interphalangeal joint (PIPJ) and secondary cellulitis requiring extensive debridement and reconstruction. In this case the injury resulted in significant functional impairment due to PIP and distal interphalangeal joint (DIPJ) stiffness.¹⁸



Figure 3. Image of the transposed rhomboid flap now covering the wound bed and sutured into place using single non-resorbable nylon sutures.



Figure 4. Postoperative image taken six weeks after surgery showing a well-healed rhomboid flap covering the entirety of the previous defect.

When reviewing the literature, we identified further reports of other common anti-wart treatments whose use have been associated with chemical burns, including salicylic acid,¹⁹ monochloroacetic acid^{4,20} and glutaraldehyde.²¹ Table 1 details data from all reported cases, including patient characteristics, agent used, theorised reason for injury, resulting injury and outcome. All wounds subsequently healed with the majority requiring debridement and surgery. Functional and aesthetic impairments were common, including nail loss, scar hypertrophy and permanent malposition of joints. In most cases, patients used the treatments incorrectly, for example combing the ointment with an occlusive dressing or applying the treatment repeatedly in quick succession.

Table 1. Results from a literature review detailing the age and gender of the patients described in each identified journal article as well as localisation of injury, anti-wart agent used, assumed reason for injury, degree and extent of injury, treatment and outcome.

Reference	Age (years)/gender	Localisation	Agent	Assumed reason for injury	Degree and extent of injury	Treatment	Outcome
<i>Own case</i>	11/F	Back of hand	Formic acid	Prolonged exposure (8 h) and occlusive dressing	20-mm diameter, full-thickness burn	Debridement, revision + local flap surgery (local anaesthesia)	Full recovery
<i>Balague, 2014</i>	58/M	Palmar surface of middle finger	Formic acid	Prolonged exposure (6 h) and occlusive dressing	18-mm diameter, full-thickness burn, injury of digital nerve	Debridement, healing by secondary intention	Full recovery of motion, sensory deficiency
<i>Tong, 2015</i>	33/F	Dorsal surface of little finger	Formic acid	Prolonged exposure (12 h)	3 × 2 cm, full-thickness burn including central extensor tendon slip and joint capsule	Debridement, revision, and cross-finger flap, flap division surgery	Patent skin coverage, PIPJ stiffness (5°–10° motion), 70° extension lag, immobile DIPJ
<i>Tiong, 2009</i>	9/F	Elbow	Salicylic acid	Unresolved	4 × 6 cm partial-thickness burn	Conservative	Healed after 1 week
<i>Tiong, 2009</i>	13/F	Elbow	Salicylic acid	Unresolved	3 × 8 cm partial-thickness burn	Conservative	Healed after 2 weeks
<i>Baser, 2008</i>	10/M	Dorsum of little finger	Monochloroacetic acid	Unresolved	Full-thickness burn above DIPJ (extent not reported)	Debridement, conservative treatment with splint	Full healing, but ulnar deviation at DIPJ level
<i>Chapman, 2006</i>	14/M	Dorsum of big toe	Monochloroacetic acid	Prolonged exposure (24 h), occlusive dressing	Full-thickness burn including nail matrix, bone and extensor tendon exposure, wound infection	Debridement and systemic antibiotics, revision and dorsal interosseus perforator artery flap	Full recovery, except for nail loss and scar hypertrophy
<i>Fujisawa, 2009</i>	26/M	Ball of right sole, right great toe	Glutaraldehyde	Uncritical self-medication	Full-thickness injury 15 mm (toe) and 25 mm (sole) diameter	Debridement, conservative treatment	Healed with slight scar after 1 month

DIPJ, distal interphalangeal joint; PIPJ, proximal interphalangeal joint.

In our own case, prolonged exposure to the ointment in combination with an occlusive dressing was the probable cause of injury.

Given the popularity of self-diagnosis and self-medication, the instructions of proper use of over-the-counter medications need to be abundantly clear. This particularly applies to the self-treatment of common warts to limit severe but

preventable complications such as full thickness wounds.

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Ethical approval

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References

1. American Burn Association. *The National Burn Repository*, version 14.0. Chicago, IL: American Burn Association.
2. Robinson EP and Chhabra AB. Hand chemical burns. *J Hand Surg Am* 2015; 40(3): 605–612.
3. Brinskelle P, Smolle C, Prandl EC, et al. The Krampus and the old, dark christmas-full-thickness contact alkali burn with soot, milking grease and baby oil. *J Burn Care Res* 2019; 40(1): 140–142.
4. Chapman T, Mahadevan D, Mahajan A, et al. Iatrogenic full-thickness chemical burns from monochloroacetic acid. *J Burn Care Res* 2006; 27(4): 545–547.
5. Supradeeptha C, Shandilya SM, Naresh A, et al. Aqueous based Povidone-iodine related chemical burn under the tourniquet (a case report) and literature review. *J Orthop* 2013; 10(3): 152–154.
6. Kyriakis K, Pagana G, Michailides C, et al. Lifetime prevalence fluctuations of common and plane viral warts. *J Eur Acad Dermatol Venereol* 2007; 21(2): 260–262.
7. Kilkenny M, Merlin K, Young R, et al. The prevalence of common skin conditions in Australian school students: I. Common, plane and plantar viral warts. *Br J Dermatol* 1998; 138(5): 840–845.
8. van Haalen FM, Bruggink SC, Gussekloo J, et al. Warts in primary schoolchildren: prevalence and relation with environmental factors. *Br J Dermatol* 2009; 161(1): 148–152.
9. InformedHealth.org (DE). Wart: Overview. Cologne, DE: Institute for Quality and Efficiency in Health Care. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK279586/>
10. Sterling J, Gibbs S, Haque Hussain S, et al. British Association of Dermatologists' guidelines for the management of cutaneous warts 2014. *Br J Dermatol* 2014; 171: 696–712.
11. Gibbs S, Harvey I, Sterling JC, et al. Local treatments for cutaneous warts. *Cochrane Database Syst Rev* 2003; (3): CD001781.
12. Bhat RM, Vidya K and Kamath G. Topical formic acid puncture technique for the treatment of common warts. *Int J Dermatol* 2001; 40(6): 415–419.
13. Faghihi G, Vali A, Radan M, et al. A double-blind, randomized trial of local formic acid puncture technique in the treatment of common warts. *Skinmed* 2010; 8(2): 70–71.
14. Schianchi R, Brena M and Veraldi S. Treatment of common recalcitrant warts with topical formic acid. *Int J Dermatol* 2018; 57(2): e3–e4.
15. Filobos G, Chapman T and Gesakis K. Iatrogenic burns from garlic. *J Burn Care Res* 2012; 33(1): e21.
16. Das S. Garlic burn: the real facts. *Burns* 2009; 35(8): 1193; author reply 1193–1194.
17. Balagué N, Vostrel P, Beaulieu JY, et al. Third degree formic acid chemical burn in the treatment of a hand wart: a case report and review of the literature. *Springerplus* 2014; 3: 408.
18. Tong E, Dorairaj J, O'Sullivan JB, et al. Deep full thickness burn to a finger from a topical wart treatment. *Ir Med J* 2015; 108(9): 283–284.
19. Tiong WH and Kelly EJ. Salicylic acid burn induced by wart remover: a report of two cases. *Burns* 2009; 35(1): 139–140.
20. Baser NT, Yalaz B, Yilmaz AC, et al. An unusual and serious complication of topical wart treatment with monochloroacetic acid. *Int J Dermatol* 2008; 47(12): 1295–1297.
21. Fujisawa Y, Furuta J, Kawachi Y, et al. Deep plantaris ulceration secondary to the topical treatment of wart with glutaraldehyde. *J Dermatol* 2009; 36(11): 618–619.

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