

Potassium permanganate use in the management of a wound induced by contact with *Paederus*: A case report

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Abstract. Pederin is a vesicant toxic amide, found in the hemolymph of the beetle genus, *Paederus*. Physical contact with these insects produces a type of irritant dermatitis with variable clinical symptoms. It has been identified that Pederin (a vesicant toxic amide responsible for the ulcerative lesion) is produced by Gram-negative endosymbiotic bacteria of the *Pseudomonas* genus. The present study describes the case of a patient who had come into contact with the insect *Paederus* sp. and developed an ulcerative lesion. He was first treated with topical steroids, as part of the conventional management, and following no response to treatment, he was treated locally with a 5% potassium permanganate solution, in conjunction with systemic antibiotic therapy, obtaining a good response in the healing process. On the whole, the present study demonstrates that potassium permanganate solutions, in conjunction with antibiotics and anti-inflammatories, may be beneficial in the treatment of dermatitis or ulcerative lesions caused by insects of the *Paederus* genus. However, further research is required to fully determine the complete benefits and any side-effects.

Introduction

The genus *Paederus* belongs to the order Coleoptera, the family Polyphaga and the sub-families Staphylinidae, Paederinae and Paederinae (Fig. 1) (1). They predominantly inhabit tropical zones, and frequently appear in seasons of rain and high humidity (2). At least 600 species of *Paederus* have been described worldwide, of which 20-30 have been associated with *Paederus* dermatitis (2,3). A database termed EncicloVida, developed by the National Commission for the Knowledge and Use of Biodiversity (CONABIO), indicates that Mexico has 20 species of the genus *Paederus*: *Paederus antiquus*, *cantoniensis*, *cordovens*, *currax*, *curticeps*, *erythroderus*, *femorals*, *filicornis*, *grandis*, *laetipes*, *laetus*, *mexicanus*, *neotropicus*, *rufitarsis*, *salvini*, *signaticornis*, *tempestivus*, *testaceitarsis*, *ustus*, *yucateca* (<https://enciclovida.mx/especies/76243-paederus>; accessed March 27, 2023). The *laetus* and *signaticornis* species have previously been found to produce skin lesions in humans (1). It is not known whether the other species that inhabit Mexico can cause dermatitis. They have the ability to produce a substance known as Pederin, a toxic substance present in the insect's hemolymph, which is more potent than cobra venom (4). Pederin (C₂₅ H₄₅ O₉ N) is an amide with two tetrahydropyran rings (5). When Pederin comes in contact with the skin of an individual, it can block cellular mitosis by inhibiting protein and DNA synthesis, causing a type of irritant contact dermatitis (5). Contact with this insect can lead to several clinical manifestations that range from mild erythema to ulcerative lesions with associated infections. This injury is not caused by a bite or sting, but rather by the accidental brushing or crushing of the insect over an exposed area of the human body (4,5). If not adequately treated, these manifestations can spread and create complicated cases of cellulitis and systemic affection (4). Pederin has been identified to be produced by Gram-negative endosymbiotic bacteria of the *Pseudomonas* genus, which are in part responsible for the associated infections (6,7).

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In general, the management of these patients is based on the administration of topical steroids, oral antimicrobial cycles and antihistamines (8,9). To date, to the best of our

knowledge, there are no large randomized controlled trials available to guide the therapy for *Paederus* dermatitis. There is a preclinical trial with guinea pigs, where linear dermatitis (or dermatitis linearis) induced by *Paederus* was managed with fluocinolone, or potassium permanganate with calamine, the latter being more effective (10). Despite the preclinical precedent of the efficacy of potassium permanganate for this type of dermatitis, there are no reports yet available that demonstrate its use in humans with this condition, at least to the best of our knowledge.

The present study describes the case of an individual affected by contact with the *Paederus* sp. insect, where potassium permanganate (Vikút antiseptic solution®, Grupo Salypro de Mexico S.A. de C.V.) was used as part of the treatment.

Case report

The present study describes the case of a 59-year-old male, with no history of diabetes or hypertension, with the important precedent of vitiligo and known allergy to pollen. The patient had come into contact with the insect popularly known as 'Panchos or Cuereres' (*Paederus* sp.) on his right thigh, while he was sleeping, in the city of Colima, Mexico, located in the western part of the Mexican Republic. Initially, the patient presented itching, heat sensation and local erythema in the place of contact. Within hours, this evolved into a papular lesion which grew to 2 cm in diameter. At 24 h after contact with the insect, the lesion evolved into a blister, and the patient requested care at a private medical center ('CEDA Centro de Educación en Diabetes y Autocontrol', Colima, Colima, Mexico). Therapy was initiated with a topical steroid (fluocinolone acetonide) cream, twice a day. At 72 h of evolution,



Figure 1. *Paederus* sp. photographed in Western Mexico. Photography: Ing. Gilberto Ponce Tejeda, Naturalista.mx (<https://www.naturalista.mx/observations/54745339>; accessed on March 1, 2023).

perilesional blisters were formed, and the initial diameter of the erythematous area expanded to ~7 cm. On the 4th day post-contact, the lesion became ulcerative at the center and dermic necrosis was observed. It progressively grew in diameter, and a perilesional dermatitis began to spread on the medial and lateral side of the patient's thigh. Topical steroid treatment was suspended on the 5th day, and management based on two daily applications of potassium permanganate for 4 weeks was initiated, with two weekly doses of benzathine penicillin of

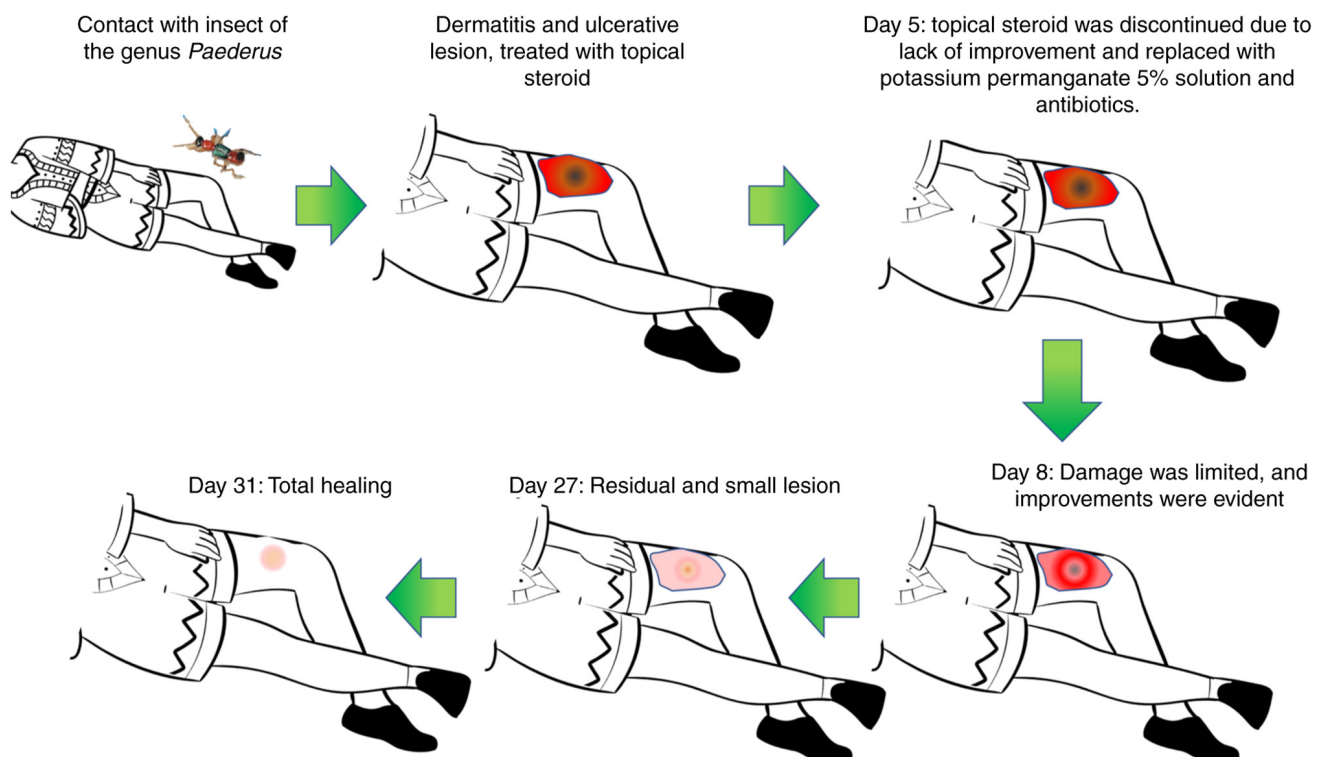


Figure 2. Clinical evolution of the patient. Timeline of the evolution of the case depicting the main events.

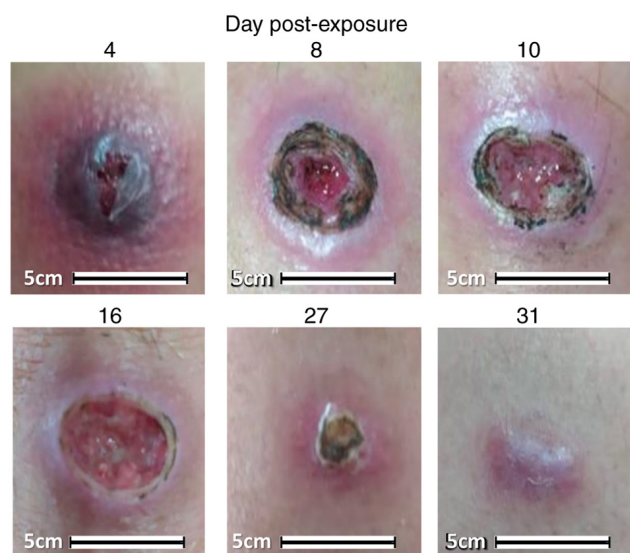


Figure 3. Evolution of a patient with *Paederus* dermatitis. The wound is shown on day 4, when potassium permanganate was added to the treatment, and up until the completion of the healing process on day 31.

1,2000,000 UI (intramuscular administration), with 400 mg ibuprofen every 8 h in the case that the patient felt pain. The 5% potassium permanganate solution used was a commercial presentation for topical application (Vikút antiseptic solution®, Grupo Salupro de Mexico S.A. de C.V.), which also contains the following ingredients: Salicylic acid, benzoic acid, ethanol and distilled water.

At 72 h following the initiation of treatment with potassium permanganate, the patient had a follow-up consultation, and he exhibited an attenuation of the damage to his skin and a marked improvement in the lesions. After 4 weeks, the healing process was completed, with only a hypopigmented blot remaining at the point of contact (Figs. 2 and 3).

Discussion

Outbreaks of *Paederus* dermatitis have been reported in Australia, Malaysia, Sri Lanka, Nigeria, Kenya, Iran, Central Africa, Uganda, Okinawa, Sierra Leone, Argentina, Brazil, Peru, Venezuela, Ecuador and India. In Mexico, there are two confirmed species that can cause this type of dermatitis and although they are widely distributed in the country, *Paederus* dermatitis in Mexico is rarely identified; therefore, reports of this type are limited (3). Several treatments are available for *Paederus* dermatitis, including topical steroids, cycles of oral antimicrobials and antihistamines (8,9). However, research on the therapy of this type of dermatitis is limited; thus, further research is required in this matter in order to provide other treatment options.

Potassium permanganate is obtained by the electrolytic oxidation of manganese (11). In the medical field, it is used as a potent oxidant that affects the cellular wall of pathogens, thus providing its functions as a substance of mineral origin with broad antimicrobial activity (12,13). It is a bactericide and fungicide, and it can also affect viruses. Furthermore, it favors the formation of collagen and granulation tissue, both critical components in the process of wound healing (12).

The use of potassium permanganate has been described over the past decades for the management of various types of wounds (12,14). In the case presented herein, its effectiveness in the management of dermatitis linearis was observed, secondary to contact with an insect of the *Paederus* genus, which is a relatively common ailment, and it is even endemic in several countries worldwide (15). Information about the management of this type of dermatitis is limited, apart from what is related to the use of topical steroids, oral anti-inflammatories, antibiotics and antihistamines (4). Potassium permanganate has been previously shown as capable of accelerating the healing process of ulcers of diverse characteristics, such as those in the diabetic foot (12). In the unique clinical case presented herein, potassium permanganate and antibiotics were used simultaneously; thus, it is not possible to determine whether a monotherapy would have produced a similar result. For this reason, further preclinical and clinical trials are required in the future.

In conclusion, potassium permanganate solutions (such as Vikút®), in conjunction with antibiotics and anti-inflammatories, may be of great benefit for the treatment of dermatitis or ulcerative lesions caused by insects of the *Paederus* genus. However, further research is required to determine the detailed effects.

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Availability of data and materials

The datasets used and/or analyzed in the current study are available from the corresponding author upon reasonable request.

Authors' contributions

IDE, ALE, IPRS and JGE designed the study and wrote the manuscript. YSMG, ADLB, MLMF, KILA and MAMH visited the patient and were in charge of clinical follow-up. IDE and YSMG confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The present study (registered 2020-04-07) was approved by the Ethics Committee of the School of Medicine of the Universidad de Colima, Mexico, and written informed consent was obtained from the participant. All procedures performed in the present protocol were in accordance with the Declaration of Helsinki.

Patient consent for publication

The patient provided his written informed consent for the publication of his clinical case, keeping his identifying information hidden.

Competing interests

The authors declare that they have no competing interests.

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