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Surgical treatment using Keystone flap for functional and aesthetic recovery of the hallux after chemical burn – case report

Tratamento cirúrgico com retalho keystone para recuperação funcional e estética do hálux após queimadura química - relato de caso

Myllena Alves Rodrigues[1] Cláudia Barbosa de Almeida Medeiros[1,2,3]
João Paulo Vieira e Silva de Albuquerque[4] André de Barros Araújo[1]
Maria Beatriz Guimarães Torres[1] Maria Eduarda Fonseca Esteves[1]
Marcelo José Borges de Miranda[2]

[1] Faculdade de Medicina de Olinda. Olinda, Pernambuco, Brazil.
[2] SOS Feridas e Queimados. Hospital São Marcos. Recife, Pernambuco, Brazil.
[3] Hospital Unimed Recife. Recife, Pernambuco, Brazil.
[4] Faculdade Pernambucana de Saúde. Recife, Pernambuco, Brazil.

Abstract

This study describes the case of a patient who suffered a chemical burn on the left hallux. The patient presented onychocryptosis, which was treated with phenol; the finger progressed to necrosis, a foul odor, and purulent discharge. After a medical assessment, the patient was diagnosed with an infected third-degree burn and was initially submitted to a non-surgical approach. Then, the Keystone flap was used to close the lesion, which presented complete recovery after two months. This study concluded that using acids may lead to severe chemical burns, impairing the function and viability of the finger. Furthermore, the Keystone flap is a good alternative for rapid recovery in deep wounds.

Keywords: Burns; Hallux; Onychocryptosis; Surgical wound.

Corresponding Author:
Cláudia Barbosa de Almeida Medeiros
E-mail: cba_medeiros@yahoo.com.br

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Resumo

O trabalho tem como objetivo descrever o caso de uma paciente que sofreu queimadura química no hálux esquerdo. Paciente com onicocriptose foi submetida a tratamento com ácido fênico, evoluindo com necrose, odor fétido e secreção purulenta. Após avaliação médica, diagnosticou-se queimadura de terceiro grau infectada, sendo submetida, a princípio a abordagem não cirúrgica, e posteriormente a realização de retalho Keystone para fechamento da lesão com recuperação completa após dois meses. Concluiu-se, com tal estudo, que o uso de ácidos pode evoluir com queimaduras químicas graves, comprometendo a função e viabilidade do dedo. Ademais, em feridas profundas, retalho Keystone mostra-se boa alternativa local com rápida recuperação.

Palavras-chave: Queimaduras; Hálux; Onicocriptose; Ferida cirúrgica.

INTRODUCTION

Burns are tissue injuries resulting from the action of agents that produce excessive heat, causing damage to body tissues and cell death. According to the causative agent, they can be classified as thermal, electrical, or chemical.[1]

Chemical burns, the level of tissue damage, and the degree of toxicity are determined by the chemical nature of the agent, its concentration, and exposure time on the skin.[2] Chemical products cause injury by destroying proteins via denaturation, oxidation, the formation of protein esters, or tissue dissection.[2]

Chemical products are frequently used for matricectomy in onychocryptosis (i.e, ingrown toenails).[3] Among the acids, phenol is the most commonly used. Due to its keratolytic properties, phenol can cause erythema and may progress to total skin necrosis.[4] Other options for this purpose are sodium hydroxide and 80% trichloroacetic acid. These acids must be handled cautiously due to the possible local or systemic complications.[3]

Onychocryptosis causes inflammation of the nail fold, leading to ingrowth into the lateral sulcus and pus formation. The pyogenic granuloma associated with the proliferation of blood vessels forms a tumorous lesion.[5] The onychocryptosis may be caused by wearing tight shoes and cutting the nails incorrectly. In addition, hyperhidrosis, circulatory insufficiency, obesity, anatomical abnormalities, and trauma may contribute to its appearance.[4]

Podiatrists are usually consulted for resolving onychocryptosis.[6] However, a trained physician is required in advanced stages because of the possible complications related to invasive methods. In this context, various surgical and non-surgical methods can be used for treatment.[7]

This study reports the case of a patient who suffered a chemical burn on the left hallux due to a substance used by a podiatrist to remove an onychocryptosis. An orthopedist with experience in wound reconstruction performed the surgical intervention.

CASE REPORT

L.R.L.S, female, 16 years old, without comorbidities, presenting recurrent onychocryptosis of the toenails for four years without significant damage. She presented a more severe episode affecting the left lateral paronychium with pain, heat, and redness in January 2022. Initially, she sought treatment with a podiatrist; however, the phenol application led to a chemical burn. After 12 days, the finger progressed to severe pain, extensive necrosis, foul odor, and purulent discharge.

Due to the clinical worsening, medical attention was sought, revealing a reduced range of movement of the dorsal flexion of the left hallux and an infected third-degree burn on the lateral side of the toe. X-rays showed erosion of the lateral cortex of the distal phalanx. Hospitalization and surgical treatment were indicated and conducted in two stages.

In the first stage, about a month after the onset of symptoms, the surgical debridement of the wound was performed; material for soft tissue and bone cultures was also collected. Intravenous antibiotic therapy (clindamycin and ciprofloxacin) was started in the immediate postoperative period. A de-escalation occurred because the lesion presented a pseudomonas culture sensitive to ciprofloxacin; therefore, the clindamycin was removed from treatment.. The wound was managed by changing dressings on alternate days using silver hydrofiber.

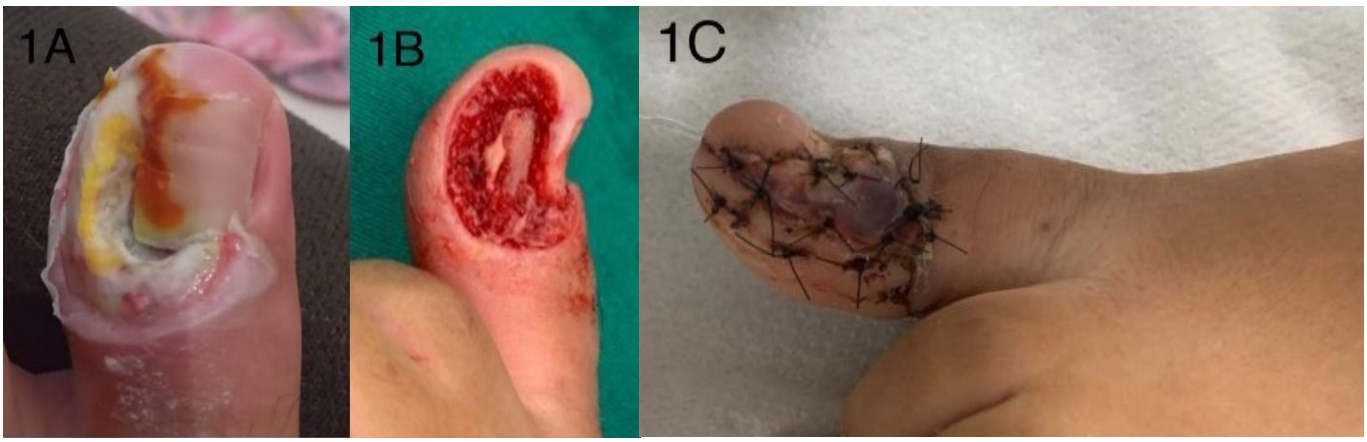

Figure 1: Evolution of onychocryptosis. **1A:** Third-degree chemical burn on the lateral aspect of the left hallux. **1B:** Immediate postoperative debridement with exposure of the distal phalanx. **1C:** Fifth postoperative day of Keystone flap reconstruction

The second stage occurred five days after the initial procedure, and a Keystone flap was chosen to close the lesion. The patient was discharged two days later, using the same oral antibiotic for 15 days. The condition resolved two months after surgery. The hallux was reconstructed and functional.

Figure 2: *two months after surgery.* **2A:** *Dorsal view,* **2B:** *Plantar view,* **2C:** *Lateral view*

As this case involved an adolescent, all the information was obtained after her legal guardian had signed an informed consent form. This case report was approved by the research ethics committee of the Olinda School of Medicine (OSM).

DISCUSSION

Burns are lesions resulting from agents that produce excessive heat, damaging body tissues and leading to cell death.[8] Acids induce thermal injuries by generating heat and damage to soft tissues. In addition, this substance induces the breakdown of proteins by hydrolysis and coagulative necrosis, resulting in a hard eschar that does not penetrate as deeply as alkalis.[2]

When treating patients with chemical burns, the initial step involves removing all chemical products by denuding the affected area and irrigating it abundantly.[2] The chemical agent cannot be neutralized due to the possible exothermic reaction that elevates the temperature and deepens the lesion.[9] In the present study, the inadequate phenol application caused product leakage beyond the desired area for matricectomy. This factor, combined with the lack of early identification, increased the extent of necrosis in the hallux.[9]

Additionally, the nature of the acid associated with other determining factors of severity (e.g., concentration, volume, and the time the substance remained in contact with the skin) directly influenced the deep tissue lesion, classified as a third-degree chemical burn.[9]

The literature supports that the infection found in this study presents a high risk of complications, including bacterial infection of the wound involving bones and joints.[2] Furthermore, the progression of this condition may lead to functional and aesthetic complications.[10]

The Keystone flap, initially described in 2003 by Behan[11], is elliptical, based on vascular, musculocutaneous, or fasciocutaneous perforators that require tissue laxity for advancement. Considering the halux, the flap was based on the subdermal plexus of the digital pulp and is considered a random skin flap for advancement. The defect is closed directly, with the midline

area presenting the greatest tension. Moreover, the isolated flap fills the defect using the V-Y advancement of each flap end, allowing the closure of the secondary defect on the opposite side.[11]

This surgical treatment is a versatile and reliable option for repairing large defects, especially in lower limbs. In addition, the flap has a high survival rate, low risk of complications, reduced pain and donor site morbidity, and a low risk of necrosis, and it is a way to avoid graft.[10]

The Keystone flap is rare in fingers and toes; however, the literature considers its use for lesions in which the usual flaps are impossible due to size or location.[10,12] Thus, the use of the Keystone flap in the present study was adequate because the lateral edge of the hallux and the extent of the lesion limited the coverage options.[11]

In this way, inappropriate use of acids for treating onychocryptosis may cause serious chemical burns, impairing function and the viability of the finger. Additionally, in deep wounds with the exposing of noble structures, the Keystone flap can be a good alternative due to low donor site morbidity and rapid recovery of the patient.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

MAR: conceptualization, data curation, visualization, research, writing of the original draft, and writing (revision and editing). **CBAM:** conceptualization, data curation, visualization, research, project management, supervision, writing of the original draf,t and writing (revision and editing)**. JPVSA:** research and writing of the original draft. **ABA**: research and writing of the original draft. **MBGT:** research and writing of the original draft. **MEFE:** research and writing of the original draft. **MJBM:** conceptualization, research, supervision, writing of the original draft, and writing (revision and editing). All the authors approved the final version.

REFERENCES

1. Zago LR, Prado K, Benedito VL, Pereira MM. The use of babosa (Aloe vera) in treating burns: a literature review. Brazilian Journal of Biology [Internet]. 2021;83:e249209. Available from: https://doi.org/10.1590/1519-6984.249209
2. Chai H, Chaudhari N, Kornhaber R, Cuttle L, Fear M, Wood F, et al. Chemical burn to the skin: A systematic review of first aid impacts on clinical outcomes. Burns. 2022;48(7):1527-43. .Available from: https://doi.org/10.1016/j.burns.2022.05.006
3. Barreiros H, Matos D, Goulão J, Serrano P, João A, Brandão FM. Using 80% trichloroacetic acid in the treatment of ingrown toenails. An Bras Dermatol [Internet]. 2013 [cited 2022 Aug 1];88(6):889–93. Available from: https://doi.org/10.1590/abd1806-4841.20132296

4. Türsen Ü, Terzi E, Guvenc U, Türsen B, Kaya T, Erdem T. The effectiveness of matrix cauterization with trichloroacetic acid in the treatment of ingrown toenails. Indian Dermatology Online Journal [Internet]. 2015 [cited 2022 Oct 23];6(1):4-8. Available from: https://doi.org/10.4103%2F2229-5178.148912

5. Kondo RN, Pontello R, Reis SG dos, Moreira CR. Nova técnica cirúrgica para tratamento de onico-criptose. Surgical & Cosmetic Dermatology [Internet]. 2019 [cited 2023 Jan 20];11(4):305–9. Available from: https://www.redalyc.org/journal/2655/265562783007/html/

6. Miola AC, Alcantara GP, Miot LDB, Miot HA. Considerations on the development of surgical techniques for the treatment of onychocryptosis. An Bras Dermatol [Internet]. 2021 [cited 2022 Oct 23];96(5):648–53. Available from: https://doi.org/10.1016/j.abd.2021.06.002

7. Ma H. Seis etapas para padronizar a abordagem cirúrgica da onicocriptose. An Bras Dermatol [Internet]. 2021 [cited 2023 Jan 20];96(1):47–50. Available from: https://www.anaisdedermatologia.org.br/en-seis-etapas-padronizar-abordagem-cirurgica-articulo-S2666275220303441

8. Sabadin I, Werneck AL, Lucio FD. Initial care to burned patients - evaluation of the knowledge of Nursing and Medical undergraduates. Research, Society and Development [Internet]. 2021 [cited 2023 Jan.20];10(12):e259101220499. Available from: http://dx.doi.org/10.33448/rsd-v10i12.20499

9. Secanho MS, Menezes Neto BFD, da-Silveira AJDCV, Fideles AAM, Chequim MM, de-Oliveira ABPM, et al. Perfil clínico-epidemiológico de queimaduras químicas em uma Unidade de Terapia de Queimados no Brasil. Rev Bras Cir Plást [Internet]. 2022;37(4):445–50. Available from: https://doi.org/10.5935/2177-1235.2022RBCP.650-pt

10. Binda G, Garbin RR, Cafrune FE. Keystone flap para defeito em membro inferior após cirurgia de Mohs. Surg Cosmet Dermatol [Internet]. 2019 [cited 2022 Oct 23];11(4):342–4. Available from: https://www.redalyc.org/journal/2655/265562783015/

11. Behan FC. The Keystone Design Perforator Island Flap in reconstructive surgery. ANZ journal of surgery [Internet]. 2003 [cited 2022 Nov 10];73(3):112–20. Available from: https://doi.org/10.1046/j.1445-2197.2003.02638.x

12. Ribeiro RDA, Pagotto VPF, Clivatti GM, Takahashi GG, Busnardo FDF, Gemperli R. A versatilidade e confiabilidade do retalho Keystone em reconstruções oncológicas. Rev Bras Cir Plást [Internet]. 2022 [cited 2022 Nov 10];37(3):308–12. Available from: https://doi.org/10.5935/2177-1235.2022RBCP.575-pt