


Case report

DOI: 10.32415/jscientia_2023_9_1_54-60
EDN: GUUZDF**ALLERGIC CONTACT DERMATITIS: SENSITIZATION TO 2-HYDROXYETHYL METHACRYLATE****M. R. Izmailovich** ^{1,2}, **S. R. Valiyeva** ¹, **D. N. Sarbasova** ^{1,2},
O. Yu. Dedova ^{1,2}, **B. S. Koshkarbaeva** ¹, **A. A. Knaus** ^{1,2}¹ Karaganda State Medical University, Karaganda, Kazakhstan² Regional Allergological Center “Divera”, Karaganda, Kazakhstan Valiyeva Sabina — svalieva52@gmail.com







Acrylate polymers are an important cause of allergic contact dermatitis. Over the last decades, the vector of allergy to methacrylic acid esters has shifted from industrial products to the beauty and medical industries. In the described clinical case, the potential risk of sensitization to 2-hydroxyethyl methacrylate, a component of medical products, is emphasized, particularly in patients working in the cosmetology field. The authors present a clinical case of allergic contact dermatitis caused by 2-hydroxyethyl methacrylate, a component of the adhesive in a medical plaster. Basic diagnostic measures, including allergodiagnosics using a patch test, were conducted. Based on the collected data, the diagnosis was verified, and therapy for allergic contact dermatitis was prescribed according to the international clinical treatment protocol. The increasing number of cases of allergic contact dermatitis caused by acrylate compounds in medical materials requires further investigation and the implementation of effective preventive measures to ensure patient safety.

KEYWORDS: allergic contact dermatitis, patch test, 2-hydroxyethyl methacrylate, acrylates, medical plasters, sensitization, methacrylic acid esters, adhesive, diagnosis, therapy, preventive measures

FOR CITATION: Izmailovich MR, Valiyeva SR, Sarbasova DN, Dedova OYu, Koshkarbaeva BS, Knaus AA. Allergic Contact Dermatitis: Sensitization to 2-Hydroxyethyl Methacrylate. *Juvenis scientia*. 2023;9(1):54-60. DOI: 10.32415/jscientia_2023_9_1_54-60.



Клинический случай

DOI: 10.32415/jscientia_2023_9_1_54-60
EDN: GUUZDF**АЛЛЕРГИЧЕСКИЙ КОНТАКТНЫЙ ДЕРМАТИТ: СЕНСИБИЛИЗАЦИЯ К 2-ГИДРОКСИЭТИЛМЕТАКРИЛАТУ****М. Р. Измайлович** ^{1,2}, **С. Р. Валиева** ¹, **Д. Н. Сарбасова** ^{1,2},
О. Ю. Дедова ^{1,2}, **Б. С. Кошкарбаева** ¹, **А. А. Кнаус** ^{1,2}¹ Карагандинский государственный медицинский университет, Караганда, Казахстан² Областной аллергологический центр «Divera», Караганда, Казахстан Валиева Сабина Радиковна — svalieva52@gmail.com

Акрилатные полимеры являются важной причиной развития аллергического контактного дерматита. За последние десятилетия вектор аллергии на эфиры метакриловой кислоты переместился от продуктов химической промышленности в индустрию красоты и медицинские материалы. В описанном клиническом примере подчеркивается потенциальный риск развития сенсibilизации к содержащемуся в составе медицинских изделий 2-гидроксиэтилметакрилату, в частности у пациентов, работающих в косметологической сфере. Авторы представили клинический случай развития аллергического контактного дерматита, вызванного 2-гидроксиэтилметакрилатом — компонентом клеящего вещества в составе медицинского пластыря. Проведены основные диагностические мероприятия, включая алергодиагностику с использованием патч-теста. На основании собранных данных верифицирован диагноз и назначена терапия аллергического контактного дерматита согласно международному клиническому протоколу лечения. Рост количества случаев аллергического контактного дерматита, вызванных акрилатными соединениями в составе медицинских материалов, требует дальнейшего исследования и внедрения эффективных профилактических мер для обеспечения безопасности пациентов.

КЛЮЧЕВЫЕ СЛОВА: аллергический контактный дерматит, патч-тест, 2-гидроксиэтилметакрилат, акрилаты, медицинские пластыри, сенсibilизация, эфиры метакриловой кислоты, адгезив, диагностика, терапия, профилактика

ДЛЯ ЦИТИРОВАНИЯ: Измайлович М.Р., Валиева С.Р., Сарбасова Д.Н., Дедова О.Ю., Кошкарбаева Б.С., Кнаус А.А. Аллергический контактный дерматит: сенсibilизация к 2-гидроксиэтилметакрилату // *Juvenis scientia*. 2023. Том 9. № 1. С. 54-60. DOI: 10.32415/jscientia_2023_9_1_54-60. EDN: GUUZDF.



INTRODUCTION

Contact dermatitis is an inflammatory eczematous skin disease. Typical forms of contact dermatitis include irritant contact dermatitis and allergic contact dermatitis. Irritant contact dermatitis is a non-specific skin reaction to direct chemical exposure by releasing inflammatory mediators from epidermal cells. Allergic contact dermatitis (ACD) is a type IV (delayed-acting) hypersensitivity reaction to a small molecule of fewer than 500 daltons or a hapten that comes into contact with the skin of a sensitized person [1].

According to the latest data, ACD accounts for 20% of contact dermatitis, while allergens vary greatly depending on geographic location, age, gender, different preferences, and comorbidities of the population [2]. For example, women are at greater risk of developing ACD because they are more likely to encounter household irritants and beauty products [3].

The incidence of allergic contact dermatitis is currently growing. The increase in morbidity is due to various social and medical aspects, particularly the development of the chemical industry [4]. Nowadays, acrylates are a considerable part of the thriving chemical industry. Acrylate monomers containing an acrylic group, obtained from acrylic and methacrylic acids, are increasingly being used [5, 6]. The development of 2-hydroxyethyl methacrylate (HEMA) and other acrylate compounds began in the 1930s. In a short time, scientists have found applications in producing varnishes, plastics, adhesives, latex paints, and surface coatings [7]. Acrylate monomers released from the polymer structure act as haptens, have a high allergenic potential, and can often cause allergic contact dermatitis [8].

CASE REPORT

A 32-year-old patient, female applied to the Allergy Centre "DiVera" in Karaganda city with complaints of severe itching, burning, and rashes on the skin. According to anamnesis morbi, the patient underwent a planned operation for delivery by cesarean section according to Joel-Cohen. During hospitalization, the sutures were treated with a chlorhexidine solution and medical patches. 48 hours after using medical bactericidal polymer-based adhesive plasters (Bioplaster), itchy rashes and bumps were observed on the

abdomen skin next to postoperative sutures and the chest skin. Skin redness, itching, and weeping were noted on the surface of both arms in the area where the intravenous catheter was applied. According to the examination, except for the chest rashes, inflammation and redness had clear boundaries corresponding to the areas of application of the medical plaster. The patient did not take any treatment independently and consulted an allergist-immunologist.

According to *anamnesis vitae*, she has worked as a nail service master for 3.5 years.

Allergy anamnesis: a previous triple reaction to medical patches (within two years) manifested by urticaria. The condition resolved quickly by taking the antihistamines — Chloropyramine 25 mg *per os*. In November 2022, while performing a beauty procedure using gel polish, onycholysis and eczematous rashes appeared. The patient's condition improved by taking the corticosteroid Dexamethasone and the antihistamine drug Fexofenadine *per os*. Previously, the patient rarely used this procedure for herself. Her work process was always carried out with gloves.

Physical examination

The patient's condition is of moderate severity due to skin lesions. The tongue is covered with a white coating. Skin examination: on the anterior surface of the chest, the lower third of the neck skin (Fig. 1), and the anterior surface of the abdomen (Fig. 2), pinkish-red hyperemia is observed. There is a bright red hyperemia with clear boundaries, crusts, and peeling elements on the right and left-hand inner and outer surfaces (Fig. 3, 4). There are no auscultatory changes in the heart and lungs. The abdomen is soft and painless during the palpation.

Laboratory results

The following results were obtained: eosinophilia ($9.2 \times 10^9/l$), an elevated total IgE in the blood serum by ELISA method (310 IU/ml).

Allergy skin tests

Considering the history of the disease and allergy anamnesis, the patient was recommended a diagnostic patch test IQ Ultimate™ using MA-1000 Acrylate Series (Adhesives).



Figure 1. Hyperemia on the chest and lower third of the neck



Figure 2. Hyperemia and swelling on the abdomen surface



Figure 3. Bright red hyperemia with clear boundaries on left hand



Figure 4. Hyperemia, crusts and peeling elements on the right hand

Patch test results revealed a strongly positive reaction (++) to 2-hydroxyethyl methacrylate hapten with the formation of discrete vesicles.

The patient was diagnosed with allergic contact dermatitis, sensitization to 2-hydroxyethyl methacrylate (in the composition of varnish and medical plasters). The diagnosis was made based on the patient's symptoms, past and present illness history, physical examination, laboratory and allergy skin tests.

Treatment

The outpatient therapy included:

- 1) topical soaks with Burow solution (1:40 dilution);
- 2) hypoallergenic diet;
- 3) elimination measures: restriction of synthetic detergents and excluding gel polishes and medical patches, replacement of patches with a protective film for the skin and hypoallergenic surgical fabric tapes;

4) medications: loratadine 10 mg once daily for 14 days *per os*; topical steroids — mometasone furoate, 0.1%, 1–2 times a day for 10 days.

Further management: use of emollients in order to restore the barrier properties of the skin.

Treatment outcomes

After the treatment, there was a gradual decrease in hyperemia and rashes on the skin. The symptoms completely resolved within 10 days. The total level of IgE normalized to 70 IU/ml.

DISCUSSION

Describing this clinical case, we emphasize the increasing importance of 2-hydroxyethyl methacrylate (HEMA) compounds in developing allergic contact dermatitis. The growing use of long-lasting chemical nail products leads to sensitization and increased chances of allergic contact dermatitis [8]. Nail masters and beauticians account for most of occupational

cases of HEMA-induced allergic contact dermatitis and are considered the subgroup most susceptible to developing ACD [9]. All types of artificial nails contain acrylates and may cause sensitization. This applies to cosmetologists who work directly with such materials and people receiving nail services [10].

Sensitization can develop after months or even years of using gel nail polish [11]. Clinical manifestations of skin allergy include periungual eczematous lesions, nail dystrophy, sometimes with concomitant atypical localizations such as abdominal or neck dermatitis [12].

In our case report, the patient's allergic history indicated a previous reaction to the gel polish procedure. Afterward, typical clinical manifestations of ACD appeared. One month after the allergic reaction to the nail procedure, the patient had a surgery operation and was recommended to use medical patches containing HEMA as an adhesive substance [13].

According to disease anamnesis, authors assumed that the patient was explicitly sensitized to the medical patch component, given the nature of the rash with clear boundaries. The authors' assumption was confirmed by laboratory and specific skin allergy examinations. The laboratory tests revealed eosinophilia and a high level of total Ig E. The total IgE level was apparently associated with repeated exposure to an allergen [14]. The increase in the level of blood eosinophils was due to the allergic component of the immune response, accompanied by hyperproduction of IgE [15].

Furthermore, we observed a strongly positive reaction with the formation of discrete vesicles during the patch-test with HEMA, which was a part of the general panel of specific haptens. Considering the symptoms, allergic anamnesis and *anamnesis vitae*, the patient was diagnosed with allergic contact dermatitis and sensitization to 2-hydroxyethyl methacrylate.

Some studies on allergic reactions also confirm the possibility of sensitization to other acrylates in

medical materials using an adhesive substance. For instance, there are cases of ACD after the use of hair prosthesis fixators [12] and popular medical devices for express glucose monitoring, where the device is fixed on the skin for 14 days using an adhesive including acrylates [16].

CONCLUSION

Nowadays, 2-hydroxyethyl methacrylate has become a common cause of allergic contact dermatitis. Acrylates are most frequently used by the beauty industry, including nail service, but a new significant trend is allergic contact dermatitis caused by medical products. Our case report demonstrated long-term sensitization to 2-hydroxyethyl methacrylate in connection with professional activities. Sensitization led to a pronounced allergic reaction due to exposure to another material — a medical patch that included an identical chemical polymer in its composition. In most cases, contact dermatitis resolves on its own and is treated with simple, supportive measures. However, in some patients, the disease has a chronic course and can significantly affect the quality of life. The growing number of ACD cases caused by HEMA in medical materials certainly requires more effective preventive measures and particular regulations in the patient safety area.

Funding: The authors declare no funding.

Conflict of interest: The authors declare no conflict of interest.

Compliance with ethical principles: All participants in the study provided informed consent for publication of their data.

Author contributions: All authors confirm the authorship according to the international criteria of ICMJE (all authors have made substantial contributions to the conception, design, conduct of the study, and preparation of the manuscript, have read and approved the final version for publication).

REFERENCES [ЛИТЕРАТУРА]

1. Divkovic M, Pease CK, Gerberick GF, Basketter DA. *Hapten-protein binding: from theory to practical application in the in vitro prediction of skin sensitization*. Contact Dermatitis. **2005**;53(4):189-200. DOI: 10.1111/j.0105-1873.2005.00683.x.

2. Novak-Bilić G, Vučić M, Japundžić I, et al. *Irritant and allergic contact dermatitis - skin lesion characteristics*. Acta Clin Croat. **2018**;57(4):713-720. DOI: 10.20471/acc.2018.57.04.13.
3. Peiser M, Tralau T, Heidler J, et al. *Allergic contact dermatitis: epidemiology, molecular mechanisms, in vitro methods and regulatory aspects. Current knowledge assembled at an international workshop at BfR, Germany*. Cell Mol Life Sci. **2012**;69(5):763-781. DOI: 10.1007/s00018-011-0846-8.
4. Starokozhko LE, Gaidamaka II, Tishaeva AV. *Otsenka effektivnosti pennogo intragastral'nogo kokteilya s azotom u bol'nykh atopicheskim dermatitom (Evaluation of the effectiveness of a foam intragastric cocktail with nitrogen in patients with atopic dermatitis)*. Medical News of North Caucasus. **2012**;(2):69-71. (in Russ.). [Старокожко Л.Е., Гайдамака И.И., Тишаева А.В. Оценка эффективности пенного интрагастрального коктейля с азотом у больных atopическим дерматитом // Медицинский вестник Северного Кавказа. **2012**. № 2. С. 69-71]. EDN: PACPVL.
5. Spencer A, Gazzani P, Thompson DA. *Acrylate and methacrylate contact allergy and allergic contact disease: a 13-year review*. Contact Dermatitis. **2016**;75(3):157-164. DOI: 10.1111/cod.12647.
6. van der Voort EA, van Neer FJ, Neumann HA. *Acrylate-induced nail contact allergy*. Int J Dermatol. **2014**;53(9):e390-e392. DOI: 10.1111/ijd.12378.
7. Piirilä P, Kanerva L, Keskinen H, et al. *Occupational respiratory hypersensitivity caused by preparations containing acrylates in dental personnel*. Clin Exp Allergy. **1998**;28(11):1404-1411. DOI: 10.1046/j.1365-2222.1998.00400.x.
8. Raposo I, Lobo I, Amaro C, et al. *Allergic contact dermatitis caused by (meth)acrylates in nail cosmetic products in users and nail technicians - a 5-year study*. Contact Dermatitis. **2017**;77(6):356-359. DOI: 10.1111/cod.12817.
9. Symanzik C, Weinert P, Babić Ž, et al. *Allergic contact dermatitis caused by 2-hydroxyethyl methacrylate and ethyl cyanoacrylate contained in cosmetic glues among hairdressers and beauticians who perform nail treatments and eyelash extension as well as hair extension applications: A systematic review*. Contact Dermatitis. **2022**;86(6):480-492. DOI: 10.1111/cod.14056.
10. Gonçalo M, Pinho A, Agner T, et al. *Allergic contact dermatitis caused by nail acrylates in Europe. An EECDRG study*. Contact Dermatitis. **2018**;78(4):254-260. DOI: 10.1111/cod.12942.
11. Gatica-Ortega ME, Pastor-Nieto MA, Silvestre-Salvador JF. *Dermatitis alérgica de contacto por acrilatos en esmaltes permanentes (Allergic Contact Dermatitis Caused by Acrylates in Long-Lasting Nail Polish)*. Actas Dermosifiliogr (Engl Ed). **2018**;109(6):508-514. DOI: 10.1016/j.ad.2017.08.010.
12. Marrero-Alemán G, Sabater-Abad J, Miquel FJ, et al. *Allergic contact dermatitis to (meth)acrylates involving nail technicians and users: Prognosis and differential diagnosis*. Allergy. **2019**;74(7):1386-1389. DOI: 10.1111/all.13736.
13. Spencer A, Gazzani P, Thompson DA. *Acrylate and methacrylate contact allergy and allergic contact disease: a 13-year review*. Contact Dermatitis. **2016**;75(3):157-164. DOI: 10.1111/cod.12647.
14. Novitskii VV, Ryazantseva NV, Litvinova LS, et al. *Mekhanizmy narusheniya kooperatsii eozinofilov i immunotsitov pri formirovani bol'shikh eozinofilii krovi (Mechanisms of impaired cooperation of eosinophils and immunocytes during the formation of large blood eosinophilia)*. Bulletin of Siberian Medicine. **2006**;5(2):52-61. (in Russ.). [Новицкий В.В., Рязанцева Н.В., Литвинова Л.С., и др. Механизмы нарушения кооперации эозинофилов и иммуноцитов при формировании больших эозинофилий крови // Бюллетень сибирской медицины. **2006**. Т. 5. № 2. С. 52-61]. EDN: HVEVPL.
15. Long H, Zhang G, Wang L, Lu Q. *Eosinophilic Skin Diseases: A Comprehensive Review*. Clin Rev Allergy Immunol. **2016**;50(2):189-213. DOI: 10.1007/s12016-015-8485-8.
16. Herman A, Aerts O, Baeck M, et al. *Allergic contact dermatitis caused by isobornyl acrylate in Freestyle® Libre, a newly introduced glucose sensor*. Contact Dermatitis. **2017**;77(6):367-373. DOI: 10.1111/cod.12866.

AUTHORS [АВТОРЫ]

Izmailovich Marina Rashidovna, assistant of the Department of Internal Diseases, Karaganda State Medical University; ORCID: 0000-0001-8128-4356.

✉ *Valiyeva Sabina Radikovna*, Resident of the 2nd year of training in adult and pediatric allergology, Department of Internal Diseases of the Karaganda State Medical University; ORCID: 0000-0003-0767-1993; email: svalieva52@gmail.com.

Sarbasova Dina Nurkenovna, Resident of the 2nd year of training in adult and pediatric allergology, Department of Internal Diseases of the Karaganda State Medical University; ORCID: 0000-0002-2853-9150.

Dedova Olga Yuryevna, Lecturer at the Department of Internal Diseases of the Karaganda State Medical University; ORCID: 0000-0002-5041-969X.

Koshkarbayeva Bibigul Sabitkyzy, Lecturer at the Department of Internal Diseases, Karaganda State Medical University; ORCID: 0000-0001-5509-1040.

Knaus Anna Alexandrovna, Associate Professor of the Department of Internal Medicine, Karaganda State Medical University; ORCID: 0000-0002-5289-7126.

Измайлович Марина Рашидовна, ассистент кафедры внутренних болезней Карагандинского государственного медицинского университета; ORCID: 0000-0001-8128-4356.

✉ *Валиева Сабина Радиковна*, резидент 2-го курса обучения по специальности аллергология взрослая, детская кафедры внутренних болезней Карагандинского государственного медицинского университета; ORCID: 0000-0003-0767-1993; email: svalieva52@gmail.com.

Сарбасова Дина Нуркеновна, резидент 2-го курса обучения по специальности аллергология взрослая, детская кафедры внутренних болезней Карагандинского государственного медицинского университета; ORCID: 0000-0002-2853-9150.

Дедова Ольга Юрьевна, преподаватель кафедры внутренних болезней Карагандинского государственного медицинского университета; ORCID: 0000-0002-5041-969X.

Кошкарбаева Бибигуль Сабиткызы, преподаватель кафедры внутренних болезней Карагандинского государственного медицинского университета; ORCID: 0000-0001-5509-1040.

Кнаус Анна Александровна, ассоциированный профессор кафедры внутренних болезней Карагандинского государственного медицинского университета; ORCID: 0000-0002-5289-7126.

Received: 24.01.2023

Accepted: 20.02.2023

Published: 28.02.2023