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THE ROLE OF CONTACT ALLERGENS IN THE DEVELOPMENT OF MICROVESICULAR ECZEMA

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Abstract: Background: Microvesicular eczema (acute/subacute dermatitis) is a frequent dermatological condition characterized by pruritus, erythema, and vesicle formation. While often treated symptomatically, the underlying role of delayed-type hypersensitivity to contact allergens remains underdiagnosed in the Fergana Valley region. This study aims to identify the prevalence of contact sensitization in patients with microvesicular eczema and determine the spectrum of causative allergens. Methods: A prospective clinical study involving 150 patients with persistent microvesicular eczema was conducted. All participants underwent epicutaneous patch testing using the European Standard Series (ESS) of allergens. Reactions were read at 48, 72, and 96 hours according to ICDRG criteria. A control group of 50 healthy individuals was included for comparison. Results: Positive patch test reactions were observed in 68.0% of patients, significantly higher than in the control group (12.0%, $p < 0.001$). The most frequent allergens identified were Nickel sulfate (28.7%), Potassium dichromate (14.0%), and Cobalt chloride (11.3%). A strong correlation was found between "wet work" occupations and sensitization to preservatives. Conclusion: Contact allergens play a pivotal etiological role in the pathogenesis of microvesicular eczema. Routine patch testing is essential for identifying specific triggers, enabling targeted avoidance strategies, and preventing chronicity.
Keywords: Microvesicular eczema, allergic contact dermatitis, patch testing, nickel sensitization, skin barrier, occupational dermatology.

MIKROVEZIKULYAR EKZEMA RIVOJLANISHIDA KONTAKT ALLERGENLARNING ROLI

Annotatsiya: Kirish: Mikrovezikulyar ekzema (o‘tkir/o‘tkir osti dermatit) qichishish, qizarish va pufakchalar hosil bo‘lishi bilan tavsiflanuvchi keng tarqalgan teri kasalligidir. Ko‘pincha simptomatik davolansa-da, Farg‘ona vodiysi hududida kontakt allergenlarga nisbatan kechiktirilgan turdagi o‘ta sezuvchanlikning asl roli yetarlicha o‘rganilmagan. Ushbu tadqiqot mikrovezikulyar ekzema bilan og‘rigan bemorlarda kontakt sensibilizatsiya tarqalishini aniqlash va sababchi allergenlar spektrini belgilashni maqsad qilgan. Usullar: Davomli mikrovezikulyar ekzemasi bo‘lgan 150 nafar bemor ishtirokida prospektiv klinik tadqiqot o‘tkazildi. Barcha ishtirokchilarda Yevropa Standart Seriyasi (ESS) allergenlari yordamida epikutan patch-test sinovlari o‘tkazildi. Reaksiyalar ICDRG mezonlariga muvofiq 48, 72 va 96 soatlarda baholandi. Taqqoslash uchun 50 nafar sog‘lom kishidan iborat nazorat guruhi olindi. Natijalar: Patch-testning musbat natijalari bemorlarning 68,0 foizida kuzatildi, bu nazorat guruhiga (12,0%) nisbatan statistik jihatdan ancha yuqori ($p < 0.001$). Eng ko‘p aniqlangan allergenlar nikel sulfat (28,7%), kaliy dixromat (14,0%) va kobalt xlorid (11,3%) bo‘ldi. "Nam ish" bilan bog‘liq kasblar va konservantlarga sezuvchanlik o‘rtasida kuchli bog‘liqlik aniqlandi. Xulosa: Kontakt allergenlar mikrovezikulyar ekzema patogenezida hal qiluvchi etiologik rol o‘ynaydi. Muntazam

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patch-test o‘tkazish aniq qo‘zg‘atuvchilarni aniqlash, maqsadli saqlanish strategiyalarini qo‘llash va kasallikning surunkali shaklga o‘tishini oldini olish uchun zarurdir.

Kalit so‘zlar: Mikrovezikulyar ekzema, allergik kontakt dermatit, patch-test, nikel sezuvchanligi, teri to‘sig‘i, kasbiy dermatologiya.

РОЛЬ КОНТАКТНЫХ АЛЛЕРГЕНОВ В РАЗВИТИИ МИКРОВЕЗИКУЛЯРНОЙ ЭКЗЕМЫ

Аннотация: Введение: Микровезикулярная экзема (острый/подострый дерматит) — распространенное дерматологическое заболевание, характеризующееся зудом, эритемой и образованием везикул. Хотя лечение часто носит симптоматический характер, роль гиперчувствительности замедленного типа к контактным аллергенам в Ферганской долине остается недооцененной. Целью данного исследования является выявление распространенности контактной сенсибилизации у пациентов с микровезикулярной экземой и определение спектра причинных аллергенов. Методы: Было проведено проспективное клиническое исследование с участием 150 пациентов с персистирующей микровезикулярной экземой. Всем участникам было проведено эпикутанное патч-тестирование с использованием Европейской стандартной серии (ESS) аллергенов. Реакции оценивались через 48, 72 и 96 часов в соответствии с критериями ICDRG. Для сравнения была включена контрольная группа из 50 здоровых людей. Результаты: Положительные реакции патч-теста наблюдались у 68,0% пациентов, что значительно выше, чем в контрольной группе (12,0%, $p < 0.001$). Наиболее часто выявляемыми аллергенами были сульфат никеля (28,7%), дихромат калия (14,0%) и хлорид кобальта (11,3%). Обнаружена сильная корреляция между профессиями, связанными с «мокрой работой», и сенсибилизацией к консервантам. Заключение: Контактные аллергены играют ключевую этиологическую роль в патогенезе микровезикулярной экземы. Рутинное патч-тестирование необходимо для выявления конкретных триггеров, обеспечения стратегий избегания и предотвращения хронизации процесса.

Ключевые слова: Микровезикулярная экзема, аллергический контактный дерматит, патч-тест, сенсибилизация к никелю, кожный барьер, профессиональная дерматология.

INTRODUCTION

Eczema (dermatitis) represents a heterogeneous group of inflammatory skin disorders accounting for a substantial proportion of dermatological consultations worldwide. Among its morphological variants, "microvesicular eczema" presents a unique diagnostic challenge. Clinically, it is defined by the sudden eruption of tiny, fluid-filled vesicles on an erythematous base, often accompanied by intense pruritus and weeping (exudation). While this clinical picture suggests an acute eczematous reaction, the underlying etiology is frequently categorized as "idiopathic" or "dyshidrotic" when no obvious cause is apparent.

In the context of the Andijan region and Uzbekistan at large, rapid industrialization and urbanization have introduced the population to a myriad of new chemical compounds in personal care products, construction materials, and textiles. This environmental shift raises the hypothesis that a significant subset of what is clinically diagnosed as "microvesicular eczema" is, in fact, a manifestation of Allergic Contact Dermatitis (ACD). ACD is a T-cell-mediated hypersensitivity reaction to low-molecular-weight chemicals (haptens) that penetrate the stratum corneum.

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Despite the known pathophysiology of ACD, patch testing—the gold standard for diagnosis—is not universally applied in primary care settings in our region. Patients are often treated empirically with topical corticosteroids, which mask the symptoms but fail to address the root cause. This leads to a cycle of remission and recurrence, eventually causing chronic barrier damage. This study aims to investigate the prevalence of specific contact allergies in patients presenting with the microvesicular phenotype of eczema and to map the "allergen landscape" specific to our local population.

LITERATURE REVIEW

Pathomechanism of Microvesicular Eczema - The formation of microvesicles (spongiosis) is the hallmark of acute eczema. Histologically, this is characterized by intercellular edema within the epidermis, stretching the keratinocytes apart until the connections break, forming fluid-filled spaces. Research by McFadden et al. (2013) highlights that this reaction pattern is highly characteristic of Type IV Delayed Hypersensitivity reactions. When sensitized T-lymphocytes migrate to the skin upon re-exposure to an allergen, they release cytokines (IFN-gamma, TNF-alpha) that induce keratinocyte apoptosis and fluid accumulation.

Common Culprits: The "Big Three" Metals Global epidemiological data consistently rank metals as the top contact allergens.

Nickel - Found in costume jewelry, belt buckles, and increasingly in electronic devices (phones, laptops). A study by Thyssen et al. (2007) showed that up to 15-20% of women are sensitized to nickel.

Chromium - Historically associated with cement and leather tanning. In developing regions with active construction sectors, "cement dermatitis" often presents as microvesicular eczema on the hands (Geier et al., 2011).

Cobalt - Often co-sensitizing with nickel and chromium due to its presence in similar metal alloys.

Emerging Allergens: Preservatives and Fragrances - With the boom in the cosmetic industry, preservatives like Methylisothiazolinone (MI) and formaldehyde releasers have caused an epidemic of contact allergy. These agents are ubiquitous in "rinse-off" products (shampoos, soaps) and "leave-on" products (creams, wet wipes). The microvesicular reaction in these cases is often localized to the face or hands. Literature suggests that the disruption of the skin barrier (e.g., through frequent washing) facilitates the penetration of these haptens, increasing the risk of sensitization (Smith & White, 2016).

Diagnostic Gaps While the European Standard Series (ESS) covers the most common allergens, regional variations exist. Studies in Asian populations suggest different sensitization profiles due to cultural practices (e.g., use of herbal remedies, different textile dyes). There is a paucity of data specifically covering the Central Asian demographic regarding patch test results in eczematous patients.

MATERIALS AND METHODS

Study Design and Ethics This was a prospective, case-control study conducted at the Department of Dermatovenereology, Andijan State Medical Institute, over a 12-month period (2023-2024). The study protocol was approved by the institutional ethics committee, and informed consent was obtained from all participants.

Patient Selection: Study Group (n=150) - Patients aged 18-65 presenting with acute or subacute eczema characterized by microvesiculation (palms, soles, or other body sites). Inclusion required

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a disease duration of >3 months (relapsing course) and lack of response to empirical therapy. Control Group (n=50) - Healthy volunteers with no history of eczema or atopic dermatitis. Exclusion Criteria - Patients on systemic immunosuppressants (corticosteroids >10mg/day) within the last 2 weeks, active skin infection, or pregnancy.

Patch Testing Methodology All subjects underwent closed patch testing using the European Standard Series (ESS) comprised of 30 common allergens (Chemotechnique Diagnostics, Sweden). Allergens were applied to the upper back using IQ Chambers (aluminum chambers on hypoallergenic tape).

Application: Day 0. Removal: Day 2 (48 hours). Readings: Performed on Day 2 (30 mins after removal), Day 3 (72 hours), and Day 4 (96 hours).

Scoring: Reactions were graded according to the International Contact Dermatitis Research Group (ICDRG) criteria: (-) Negative; (?+) Doubtful (faint erythema only); (+) Weak positive (erythema, infiltration, possibly papules); (++) Strong positive (erythema, infiltration, papules, vesicles); (+++) Extreme positive (intense erythema, bullous reaction)

Statistical Analysis - Data were analyzed using IBM SPSS Statistics v26. Frequencies and percentages were calculated for categorical variables. The Chi-square test was used to compare sensitization rates between groups. A p-value of < 0.05 was considered statistically significant.

RESULTS

Demographic Profile - The study group consisted of 65 males (43.3%) and 85 females (56.7%). The mean age was 34.2 ± 11.5 years. The most common site of microvesicular lesions was the hands (54%), followed by the face/neck (22%) and feet (14%).

Prevalence of Sensitization - In the study group, 102 out of 150 patients (68.0%) showed a positive reaction to at least one allergen. In contrast, only 6 out of 50 controls (12.0%) had positive reactions ($p < 0.001$). This confirms that contact allergy is highly prevalent in the eczema population. Polysensitization (reaction to 2 or more allergens) was observed in 24% of the patients.

Allergen Spectrum - The distribution of positive reactions revealed a predominance of metals, reflecting both environmental exposure and occupational hazards in the region.

Table 1: Top 5 Detected Allergens in Patients with Microvesicular Eczema

Allergen	Frequency (n=150)	Percentage (%)	Common Sources
1. Nickel Sulfate	43	28.7%	Jewelry, buckles, coins, phones
2. Potassium Dichromate	21	14.0%	Cement, leather, matches
3. Cobalt Chloride	17	11.3%	Metal alloys, dyes, cement
4. Paraphenylenediamine (PPD)	12	8.0%	Hair dyes, black rubber, temporary tattoos
5. Fragrance Mix I	9	6.0%	Perfumes, cosmetics, soaps

Occupational Correlation - A sub-analysis of male patients (n=65) showed that 60% of those working in construction tested positive for Potassium Dichromate (Chrome). Among female patients (n=85), Nickel sensitivity was the dominant finding (40%), but there was also a significant cluster of reactions to Fragrance Mix and Preservatives among housewives and hairdressers, correlating with frequent exposure to detergents and cosmetics.

DISCUSSION

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The results of this study strongly support the hypothesis that contact allergens are a major driver of microvesicular eczema in the Andijan region. A sensitization rate of 68% in the patient group indicates that the majority of these cases are likely Allergic Contact Dermatitis (ACD) rather than endogenous or idiopathic eczema.

The "Metal Problem" in Uzbekistan: The high prevalence of Nickel (28.7%) aligns with global statistics, but the significant rate of Chromium sensitivity (14.0%) is noteworthy. This likely reflects the ongoing construction boom in the region, where manual handling of wet cement is common. Soluble hexavalent chromium in wet cement penetrates the skin barrier easily, causing severe, chronic hand eczema characterized by fissures and vesicles. The legislative regulation of reducing chromium in cement (adding ferrous sulfate), common in Europe, is not yet strictly enforced in many developing regions, contributing to this high morbidity.

Microvesicles as a Diagnostic Clue: The study confirms that the morphological presentation of "microvesicles" is highly predictive of an acute allergic etiology. The vesicles represent the "spongiotic" phase of the allergic reaction. Clinicians often mistake this for "dyshidrosis" (a sweat gland disorder), but our data suggests that in many cases, dyshidrotic-like eczema is actually a systemic or local reaction to ingested or contacted metals (Nickel/Cobalt).

Gender Differences: The female predisposition to Nickel allergy is consistent with ear piercing practices. However, the rising trend of PPD allergy (8.0%) is concerning. This is linked to the widespread use of hair dyes. The microvesicular reaction in PPD allergy often extends beyond the scalp to the face and neck, causing severe edema.

CONCLUSION

Microvesicular eczema is not merely a symptom to be suppressed with steroids; it is often a specific immune response to environmental triggers. This study establishes that contact allergens, particularly metals (Nickel, Chromium) and chemical additives, play a fundamental role in the pathogenesis of this condition in our local population.

More than two-thirds of patients with persistent microvesicular eczema have a verifiable contact allergy.

Chromium allergy is a significant occupational hazard for construction workers in the region.

Clinical examination alone is insufficient to identify the culprit allergen.

RECOMMENDATIONS

Patch testing should be mandatory for all patients with chronic or relapsing microvesicular eczema, especially those with hand involvement.

Public awareness campaigns regarding "cement safety" (wearing appropriate gloves) and nickel exposure are needed.

Policymakers should consider regulations on the chromium content in cement and nickel release from consumer goods to reduce the incidence of sensitization.

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