DOI: 10.7860/JCDR/2023/61808.17927

Case Report

Paediatrics Section

Erythrodermic Atopic Dermatitis Associated with Dust Mite and *Alternaria alternata* in an Eight-Year-Old Child: A Case Report

PALAK P SHAH[1], RUCHI SHAH[2]

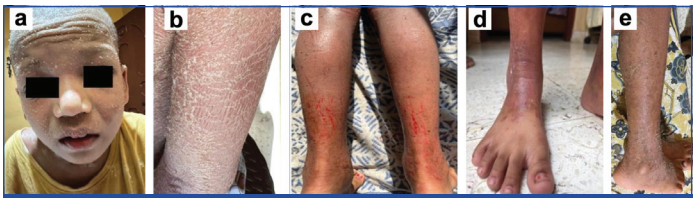
ABSTRACT

Atopic Dermatitis (AD) is a chronic inflammatory condition of the skin characterised by itching, recurrent lesions, and lichenification. Erythroderma also known as generalised exfoliative dermatitis, is characterised by erythema that covers more than 90% of the body's surface. These erythematic lesions are much more prone to infection. In present case, an eight-year-old girl presented with a chief complaint of rashes all over the body with severe itching from two years presented to the Allergy and Asthma Centre. She had positive history of atopy and multiple septicaemia-related hospitalisations since last two years. Skin biopsy leads the diagnosis of Spongiotic Dermatitis consistent with Erythroderma secondary to AD. Multiple allergies, including those to dust mites (DP der p2, p21, DF der f2) and *Alternaria alternata* (alt 1), were identified by Component-Resolved Diagnosis (CRD). Cyclosporin's, Omalizumab (a monoclonal antibody against immunoglobulin E), and allergen-specific sublingual immunotherapy were given for the management and all gave excellent results in the patient. AD can be properly diagnosed and treated in its early stages, breaking the cycle that leads to severe erythroderma. To fully comprehend the molecular and immunological genesis of these allergic types, more research is required.

Keywords: Allergic reaction, Chronic inflammation, Erythroderma, House dust mite, Immunotherapy

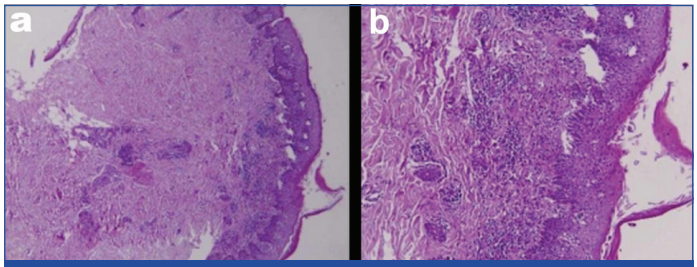
CASE REPORT

An eight-year-old girl presented to the Allergy and Asthma Centre, with a chief complaint of on and off rashes all over the body with severe itching for two years. In the family, mother had asthma and dust mite allergy from her childhood and was under medication for the same. Further, patient was living in a very old vintage home of a downtown area. Patient was relatively asymptomatic two years back then she started experiencing rashes especially on antecubital fossa, lateral regions of neck, knee joint and ankle joint. The patient took multiple treatments from dermatologists, paediatricians where steroid ointments (Omnacortil 0.1% Cream) and emollients (sebamed) were prescribed which helped in resolving the lesions but they recurred. The patient also took Ayurvedic and homoeopathic treatment for the same, but lesions recurred after their medications also. Patient also had a history of multiple hospitalisation due to septicaemia since last two years. From last one month, patient had continuous rashes and severe itching all over the body (90% of body surface area of exfoliative skin scaling, termed as erythroderma), maculopapular rash were present on the face, flexors, feet and ankle area with multiple lymphadenopathies [Table/Fig-1].



[Table/Fig-1]: Clinical picture presenting erythematous skin lesion on various parts of body before the treatment: a) Face; b) Ventral surface of the arm; c) Posterior (Dorsal) surface leg; d) Ventral surface of feet and ankle with erosions which resulted from scratching followed by fissures formation; e) Lateral surface of leg.

Further, scratching of lesions led to erosions followed by painful fissures. Histological examination showed lamellate stratum corner with parakeretosis. There was presence of epidermal acanthoses with hypogranulosis and lymphocytic exocytosis with subcorneal collection of lymphocytes. The papillary dermis showed mild oedema with superficial perivascular infiltrate consisting lymphocytes with plenty eosinophils. Histopathological features were suggestive of spongiotic dermatitis consistent with erythroderma secondary to AD [Table/Fig-2]. In blood reports, the absolute eosinophilic count was 3,000 (normal range 0 to 500 cells/µL), the total IgE count was 45011 IU/mL, and IgA, IgG, IgM, IgD levels were within the normal limits as per age.



[Table/Fig-2]: Histology of spongiotic dermatitis consistent with erythroderma secondary to atopic dermatitis with superficial perivascular infiltration of lymphocytes and plenty of eosinophil cells, (H&E,a:X100,b:X200).

Molecular diagnosis by CRD was strongly positive for house dust mites/ *Dermatophagoides pteronyssinus* (DP, Der p2, NPC2 Family >50.00 kUA/L, Der p 21, >50 kUA/L, Der p 1, cysteine protease 45.99 kUA/L), *Dermatophagoides farinae* (DF, Der f 2, NPC2 family 49.65 kUA/L, der f1, cysteine protease 47.51 kUA/L), Moulds *Alternaria alternata* (Alt a1 family 45.92 kUA/L), *Malassezia sympodialis* (Mala s 6, 35.31 kUA/L), moderately positive for chickpea lentil, peas, wheat, sesame and mildly positive for casein [Table/Fig-3]. Differential diagnosis, in this case, included other conditions that could lead to the exfoliative erythrodermic syndrome, erythrodermic psoriasis, lymphoma, leukaemia and cutaneous drug reaction, pityriasis rubra pilaris and pemphigus foliaceus which were ruled out after skin histological reports. Final diagnosis of Erythrodermic AD associated with house dust mites and *Alternaria alternata* majorly was confirmed.

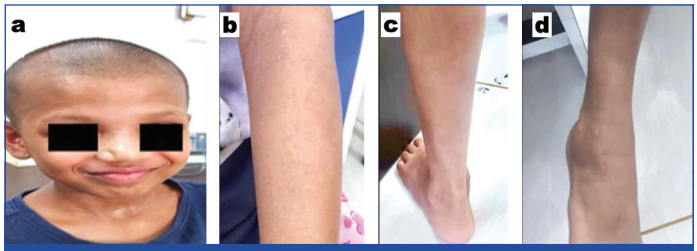
As there was an increased probability of staphylococcal infection in such erosive rashes, hospitalisation was advised, to which the parents were resistive. The patient was given symptomatic and supportive treatment to relieve the acute symptoms with emollient

S. No.	Allergen	Type	IgE levels
1	House dust mite (*Dermatophagoides farinae*)	(DF, Der f2, NPC2 family	49.65 kUA/L
	Dermatophagoides pteronyssinus	DF der f1, cysteine protease	47.51 kUA/L
		DP, Der p2, NPC2 Family	>50.00 kUA/L
		Der p21	>50.00 kUA/L
		Der p1, cysteine protease	45.99 kUA/L
2	Moulds *Alternaria alternata*	Alt al family	45.92 kUA/L
3	Yeast *Malassezia sympodialis*	Mala s 6	35.31 kUA/L
4	Storage Mite. *Blomia tropicalis*	Blo t21	31.57 kUA/L
5	Chickpea	Cic a	29.32 kUA/L
6	Pea	Pis s	29.19 kUA/L
7	Lentil	Len c	25.52 kUA/L
8	Wheat	Tria aA_TI Alpha-Amylase Trypsin-Inhibitor	23.53 kUA/L
9	Seasame	Ses i I, 2S Albumin	22.04 kUA/L

[Table/Fig-3]: Table showing highest measured IgE concentration per allergen group with higher than 15 kUA/L levels of IgE as per the CRD (component-resolved diagnosis) report.

(Emolene) and Clobetasol Propionate cream, and antibiotics (amoxicillin clavulanic acid 40 mg/Kg/day and linezolid 10 mg/Kg/dose TDS) for 21 days to reduce the chances of infection. Avoidance of food allergens was advised along with cyclosporine initially with 5 mg/Kg/day dose for three months initially and was tapered after six months to 3 mg/Kg/day, Ketotifen (H1 receptor blocker and mast cell stabiliser) (1 mg BD) for controlling the symptoms prescribed for three months initially and continued with same dose for an year. Inj.Omalizumab 150 mcg (Monoclonal anti-immunoglobulin E antibody) monthly for three months and sublingual immunotherapy for dust mite daily for four weeks initially followed by twice a week for an year, was started to stop the progression of allergy and the atopic march. Cyclosporins dose was tapered to 3 mg/kg/day and Ketotifen in same dose, that is 1 mg BD, were continued for a year. Immunotherapy is still continued after a year, will be modified depending on the symptoms of the patients.

The patient returned after a week with a complete resolution of all symptoms and rashes [Table/Fig-4]. The patient is under regular follow-ups. After one year patient was symptom free without any recurrence. The patient returned to her routine activities after the resolution.



[Table/Fig-4]: Clinical picture presenting after the treatment pictures, after complete resolution of erythematous skin lesion: a) Face; b) Ventral surface of the arm; c) Posterior (Dorsal) surface leg; d) Ventral surface of feet and ankle.

DISCUSSION

The AD is an inflammatory chronic skin condition usually associated with a family history of atopy such as allergic rhinitis, asthma etc. Erythroderma presents as redness, lichenification, and scaling of the skin, with intense pruritus which leads to erosion and painful fissures which if left untreated can become a life-threatening condition [1]. The predisposed areas affected are eyelids, face, neck, dorsa of feet and hands, flexors, wrist joint and or in severe condition can become generalised [2]. These lesions are very prone to get colonised by *Staphylococcus aureus* which worsens the skin inflammation by forming a vicious circle of releasing continuous exotoxins and stimulating the T cells and macrophages further [3]. The exact cause of this condition is yet not completely understood. The correlation between the genetic and environmental conditions, with the immunological reaction, gives an idea about their strong interaction [4]. The diagnosis of erythrodermic AD is made based on clinical criteria proposed by Hanifin JM and Rajka G in which three of the four mentioned features should be presented. Pruritus, lichenification, chronically relapsing course and atopic history. Minor characteristic features present are Immediate (type I) skin reaction, elevated serum IgE level, early age of onset, cutaneous infection, cheilitis, recurrent conjunctivitis etc., [5].

Allergy associated with house dust mites in kids was 7.8% in a study in Indian children [6], while with *Alternaria alternata* was 17.9% in kids between 5 to 18 years of age [7]. Evaluating IgE levels and skin prick test is the most common tests to determine sensitivity to allergens. Where 85% of cases show elevated IgE levels [2]. The blood findings of increased IgE and absolute eosinophilic count was the key component after the clinical criteria which helped in early diagnosis and planning the strategy of treatment. A skin biopsy confirmed the lesion type. Similar case has been reported in a 21-year-old girl in Romania, with generalised erythematous eczematous skin lesions, flexural lichenifications accompanied by intense pruritus, painful fissures and erosions resulting from scratching. The main laboratory findings were- high serum eosinophilia (2,400/µL) and very high total IgE serum (11449 UI/L). Diagnosis of Erythrodermic AD with late onset-case presentation was made in this case [2]. In a retrospective study conducted in New Delhi, India, 15% erythrodermic lesions are caused due to AD [8]. In another study on Indian kids 12% cases of erythroderma were associated by AD [9].

A nine-year-old boy from Boston, Massachusetts, USA, who had widespread eczematous dermatitis and a positive history of atopy, was reported in a case similar to this one. With extremely positive ImmunoCAP specific IgE levels to dust mite, mouse, and cockroach, as well as various tree and grass pollens, his total serum IgE level was significantly raised at 4300 IU/mL. The prospect of allergen immunotherapy was explored with his family as a potential therapeutic option, along with emollient and topical corticosteroid therapy, cyclosporine, topical tacrolimus, and several other medications [10]. In some cases of erythroderma, due to the unavailability of unaffected skin, a skin prick test cannot be perfomed. Thus, CRD or molecular diagnosis of allergy determines total serum IgE against purified native and recombinant allergic molecules. In CRD allergens are divided on basis of source (e.g., inhalant, nutritive, contact, hymenoptera venom), and the basis of protein molecules (storage proteins, profiling, a calcium-binding protein, serum albumin etc.,) [11]. In the case presented, allergens were inhalant, nutritive type with protein type of tropomyosin, defense-like proteins and storage proteins. CRD can be used in two ways singleplex and multiplex-microarray assays [11,12]. The technique used in the case presented was multiplex assay as multiple allergens-specific IgE was required to be determined. *Dermatophagoides pteronyssinus* (DP, European house dust mite) and *Dermatophagoides farinae* (DF, American house dust mite) DP DF, are most commonly found in warm and moist areas, also commonly found in beds. Currently, 23 house dust mites allergens are known (Colloff, 2009) [13].

Alternaria alternata is a fungus seen routinely in humid indoor areas. *Malassezia furfur* (*Pityrosporum ovale* in hyphal form) is a type of yeast that is naturally found on the skin surfaces of humans and some other mammals [14]. Short-term control comprises of supportive care such as fluid and electrolyte infusion, and systemic antibiotic administration [1,15].

Further sublingual and oral combination immunotherapy for dust mites was initiated. Its successful management has been discussed previously [14]. The evidence for the effectiveness of antigen specific immunotherapy for the treatment of AD was recently provided by a meta-analysis by Bae JM et al., [10]. According to this study, Specific Immunotherapy (SIT) significantly reduced the risk of developing AD, with an Odds Ratio (OR) of 5.35 and a 95% Confidence Interval (CI) of 1.61-17.77. Furthermore, SIT significantly improved the condition of patients with severe AD (OR 6.42, 95%CI 1.31-7.48) [16]. In these complicated situations, no one allergy treatment works. It's a comprehensive plan for managing the body's immunological response to enhance our patients' quality of life [17,18].

CONCLUSION(S)

Emollients combined with topical corticosteroids are an efficient way to treat AD in kids. The use of sophisticated medicines, such as immunomodulating systemic therapy, biologicals in the form of monoclonal anti-immunoglobulin E antibodies, and allergen-specific immunotherapy, as in the case described, may be necessary for severe AD. A deeper understanding of the disease's pathophysiology is necessary to identify new therapeutic targets and enhance the quality of life for AD patients.

REFERENCES

[1] Harper-Kirksey, K. (2018). Erythroderma. In: Rose, E. (eds) Life-Threatening Rashes. Springer, Cham. https://doi.org/10.1007/978-3-319-75623-3_19.
[2] Lancrajan C, Bumbacea R, Giurcaneanu C. Erythrodermic atopic dermatitis with late-onset--Case presentation. J Med Life. 2010;3(1):80-83.
[3] Freedberg IM, Eisen AZ, Wolff K, Austen KF, Goldsmith LA, Fitzpatrick TB (eds). Fitzpatrick's Dermatology in General Medicine, ed 5. Philadelphia, WB Saunders, 1999, p 534.
[4] Bouguniewicz M, Eichenfield LF. Current management of atopic dermatitis and interruption of atopic march. J Allergy Clin Immunol. 2003;112:140-49.
[5] Hanifin JM, Rajka G. Diagnostic features of atopic dermatitis. Derm Venerol. 1980;92:44-47.
[6] Raj D, Lodha R, Pandey A, Mukherjee A, Agrawal A, Kabra Sk, and New Delhi Childhood Asthma Study Group. Aeroallergen sensitization in childhood asthmatics in Northern India. Indian Paediatr. 2013;50:1113-18.
[7] Sharma R, Gaur SN, Singh VP, Singh AB. Association between indoor fungi in Delhi homes and sensitization in children with respiratory allergy. Med Mycol. 2012;50(3):281-90.
[8] Sarkar R, Garg VK. Erythroderma in children. Ind J Dermat Venere Lepro. 2010;76(4):341-43.
[9] Sarkar R, Sharma RC, Koranne RV, Sardana K. Erythroderma in children: A clinico-etiological study. J Dermatol. 1999;26(8):507-11.
[10] Bae JM, Choi YY, Park CO, Chung KY, Lee KH. Efficacy of allergen-specific immunotherapy for atopic dermatitis: A systematic review and meta-analysis of randomized controlled trials. J Allerg Clin Immu. 2013;132(1):110-17.
[11] Dodig S, Čepelak I. The potential of component-resolved diagnosis in laboratory diagnostics of allergy. Biochem Med (Zagreb). 2018;28(2):020501.
[12] Gadisseur R, Chapelle JP, Cavalier E. A new tool in the field of in-vitro diagnosis of allergy: preliminary results in the comparison of ImmunoCAP© 250 with the ImmunoCAP© ISAC. Clin Chem Lab Med. 2011;49:277-80.
[13] Chan TF, Ji KM, Yim AK, Liu XY, Zhou JW, Li RQ, et al. The draft genome, transcriptome, and microbiome of Dermatophagoides farinae reveal a broad spectrum of dust mite allergens. J Allergy Clin Immunol. 2015;135(2):539-48.
[14] Horner WE, Helbling A, Salvaggio JE, Lehrer SB. Fungal allergens. Clin Microbiol Rev. 1995;8(2):161-79.
[15] Sehgal VN, Srivastava G, Sardana K. Erythroderma/exfoliative dermatitis: A synopsis. Int J Dermatol. 2004;43:39-47.
[16] Darsow U, Lübbe J, Taïeb A. Position paper on diagnosis and treatment of atopic dermatitis. J Eur Acad Dermatol Venereol. 2005;19(3):286-95.
[17] Godse K, Mehta A, Patil S, Gautam M, Nadkarni N. Omalizumab- A review. Indian Journal of Dermatology. 2015;60(4):381-84.
[18] Kajiume T. Sublingual immunotherapy for paediatric patients with mite allergies. Medicine (Baltimore). 2022;101(4):e28690.

PARTICULARS OF CONTRIBUTORS:
1. Proprietor, Allergist and Clinical Immunologist, Amrut Asthma and Allergy Centre; Senior Resident, SBKS Medical College and Research Institute, Sumandeep Vidhyapeeth, Vadodara, Gujarat, India.
2. Reader, Department of Conservative Dentistry and Endodontics, KM Shah Dental College and Hospitals, Sumandeep Vidhyapeeth, Vadodara, Gujarat, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Ruchi Shah,
Reader, Department of Conservative Dentistry and Endodontics, KM Shah Dental College and Hospitals, Sumandeep Vidhyapeeth, Vadodara-391760, Gujarat, India.
E-mail: ruh006@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Nov 26, 2022
- Manual Googling: Feb 10, 2023
- iThenticate Software: Feb 27, 2023 (17%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Nov 23, 2022**
Date of Peer Review: **Feb 03, 2023**
Date of Acceptance: **Feb 28, 2023**
Date of Publishing: **May 01, 2023**