SKIN PRICK TEST PROFILE IN PATIENTS WITH ALLERGIC RHINITIS: A CROSS-SECTIONAL STUDY IN WESTERN NEPAL

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ABSTRACT

Aims and Objectives: Allergic rhinitis (AR) is a common health problem in Western Nepal, often underdiagnosed and mismanaged due to limited allergen identification. This study aimed to determine the common allergens causing sensitization among patients with clinically diagnosed allergic rhinitis using Skin Prick Test (SPT).

Methods: A hospital-based cross-sectional study was conducted from Feb 2014 to Feb 2020 at Nepalgunj Medical College, Nepalgunj, Banke, Nepal. Patients with symptoms suggestive of AR underwent SPT using a panel of 48 common allergens. The patients with wheal on at least one allergen during the test were included. Patients having no wheal on all tested allergens were excluded and advised for workup to rule out other diseases simulating allergic rhinitis. Results were interpreted according to standard wheal size criteria.

Results: Out of 132 patients, 79 (59.8%) were male and 53 (40.1%) were female patients. The age ranges from 14 to 54 years with average being 28.54years. The most common allergens were house dust mite (Dermatophagoidespteronyssinus) (72%), cockroach extract (42%), Parthenium hysterophorus pollen (18%), wheat (17.4%), Candida albicans (15%) and peanut (14%). Multiple allergen sensitization was seen in 103 (78.0%) of the above patients with positive result in SPT.

Conclusion: House dust mite, cockroach and Parthenium pollen are the leading allergens among AR patients in the Western region of Nepal.

Keywords: allergen, allergic rhinitis, hypersensitivity, skin prick test

INTRODUCTION

An allergy is a heightened sensitivity to a foreign substance (allergen) that causes the body's defense system to overreact when defending itself. Allergic rhinitis (AR) is an IgE-mediated hypersensitivity disorder of the nasal mucosa characterized by sneezing, nasal obstruction, rhinorrhea, and itching.[1]

Its prevalence is increasing globally, affecting up to 30% of the population.[2] In Nepal, environmental pollution, agricultural exposure, and climatic diversity contribute to its high burden. Similarly, there has been an increase in a western lifestyle, industrialization and air pollution over this period, which may have contributed to the increased prevalence of AR.[3]

Treatment of allergic rhinitis involves allergen avoidance, pharmacotherapy, immunotherapy and patient education. An allergen is an antigen capable of stimulating a type-I hypersensitivity reaction in atopic individuals through Immunoglobulin E (IgE) responses. Identification of culprit allergens is an important part of management of AR. Some conditions like non-allergic rhinitis, food allergy, infection or gastric reflux may produce symptoms identical to allergic rhinitis and can be difficult to distinguish without testing. Identification of allergen helps for better strategies for avoidance of allergen. In 1920, Skin Prick Testing (SPT) was first introduced by Lewis and Grant, since then it has been elaborated and modified,[4]. Although allergen can be identified by specific IgE estimation in serum, its clinical correlation is less than that of SPT. Blood tests are done when SPT is contraindicated like patient is on allergy medication, dermatographism, pregnancy, skin condition, etc. Skin prick test is the first step to identify patients who can benefit from Immunotherapy.

Skin prick testing measures specific IgE attached to cells in the skin. This is probably the most commonly used allergy test and is appropriate for both inhaled and ingested allergies. Allergen introduced into skin causes degranulation of IgE sensitized mast cells with mediator release and formation of a wheal and flare. It is a simple, quick, providing results within 15-20 minutes and inexpensive form of testing. Skin testing is the most reliable form of allergy testing because mast cells are located in high numbers just under the skin. The skin prick test introduces such a tiny amount of allergen

into the skin that testing is quite safe. These tests can be carried out on all age groups, including babies, although the response will be considerably smaller than in an adult.[5] Skin Prick Test is useful for different types of allergic conditions like allergic rhinitis, allergic pharyngitis, asthma, allergic contact dermatitis, food allergy, allergic conjunctivitis, etc.

SPT does have some disadvantages like complexities in their performance and interpretation, patient discomfort, intertester variability, non-standardized allergen extracts, and different interpretation scales.[6]

Although there are many studies in neighboring countries regarding allergen profile, there is limited study documented regarding allergen patterns in Nepal.[7,8,9] This study aims to identify common sensitizing allergens among AR patients attending the ENT outpatient department of Nepalgunj Medical College, which is a tertiary referral center for Western Nepal. This study aims to determine common allergens in allergic rhinitis patients using skin prick test.

METHODS

A hospital record-based data analysis from Feb 2014 to Feb 2020 was done for this cross-sectional study. Patients presenting to OPD and emergency of ENT Department of Nepalgunj Medical College, Banke and who have undergone skin prick test were included in the study. Informed consent was taken before doing the test. Patients aged more than 12 years presenting with symptoms of AR (sneezing, nasal itching, obstruction, watery rhinorrhea for >6 months) were included. Skin tests were not carried out in patients on antihistamines, steroids within 7 days, those with dermatographism, pregnancy, or skin diseases.

Skin testing was carried out on the inner forearm. It was first wiped down with alcohol. Markings done in both forearms with boxes at least 3cm apart. (Figure 1)

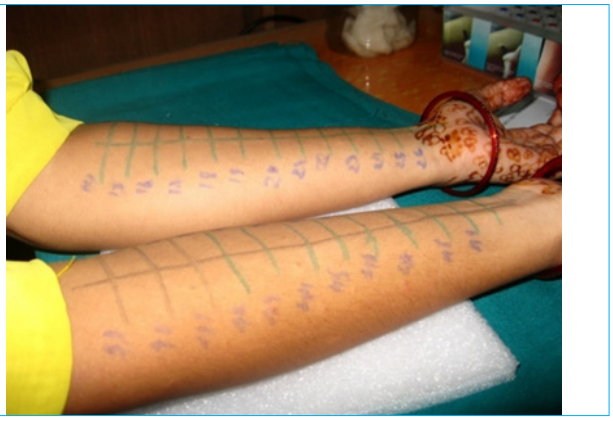

Figure 1: Preparation for SPT

A drop of the allergen (extract) solution was placed by the relevant number. The skin was then pricked through the drop using the tip of a lancet which was little uncomfortable but was not painful. (Figure 2)

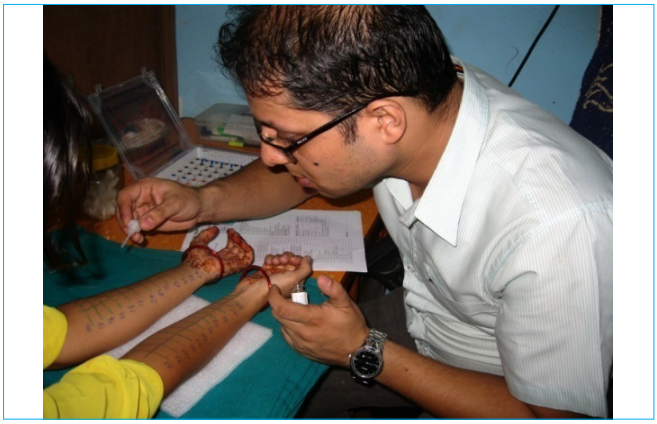

Figure 2: SPT being done

Skin Prick Test (SPT) was performed using standardized allergen extracts (Creative diagnostic, India). Histamine (10 mg/mL) served as a positive control, and saline as a negative control. Selected allergens were applied to the forearm with a dropper, and the skin gently pricked with a needle. A positive result shows as a red weal or flare on the skin within 20 minutes. The reporting was done on the basis of wheal produced and compared with histamine as shown in Figure 3 and Table 1.

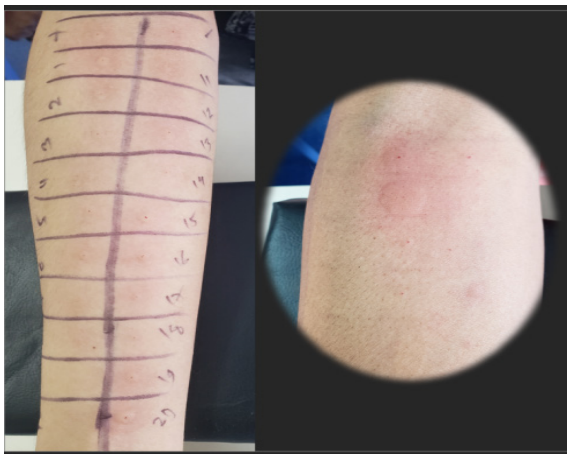

Figure 3: Wheal after skin prick

Table 1: Grading of sensitization

Grade	Description	Wheal Size (approx)	Relation to Histamine Control
+	Weakly positive reaction	>0 mm but <5 mm	Larger than negative control, but less than half the histamine reaction
++	Mildly positive reaction	5-7 mm	Half the reaction of the histamine control, or a small but clear reaction
+++	Positive reaction	7-10 mm	Equivalent to the histamine control reaction
++++	Strongly positive reaction	>10 mm, may have pseudopodia	Larger than the histamine control reaction

RESULTS

Out of 156 patients, only 132 (84.6%) patients had a positive reaction to at least one allergen and were included in the study. Out of 132 participants, there were 79 males (59.8%) and 53 females (40.1%) patients. The age ranges from 14 to 54 years with average being 28.54yrs. The geographical distribution of participants is tabulated in fig 4.

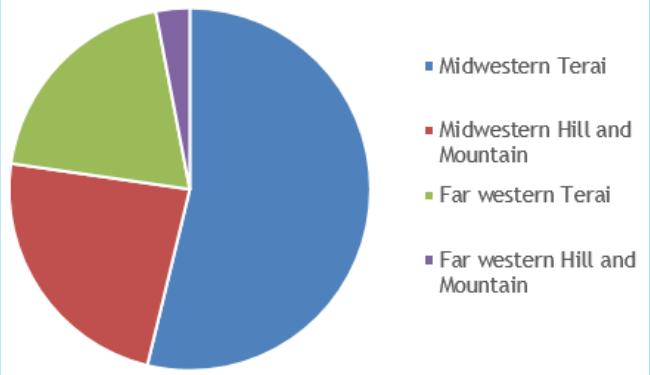

Fig 4: Geographical distribution of patients

Most of the patients were from terai region of mid-western region, probably due to road accessibility. Most of the patients were housewives and students as shown in Table 2. The majority of patients underwent SPT during the month of Ashad to Bhadra (46.2%). (Fig5)

Table 2: Occupation of participants

Occupation	Number
Business	10
Farmer	18
Office job	15
House wife	31
Student	36
Teacher	22

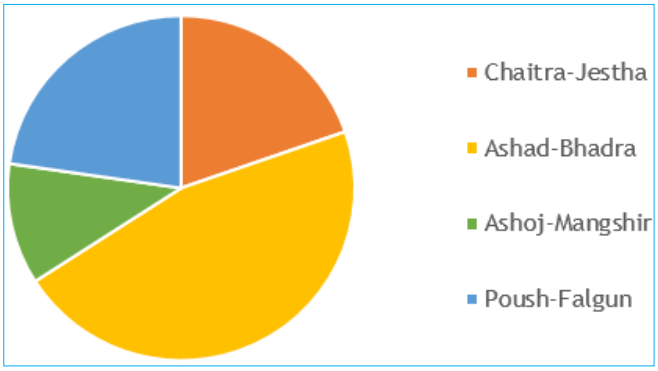

Fig 5: Skin Prick Test Performed (Month)

Multiple allergen sensitization was seen in 103 (78.0%) of SPT-positive cases as in Table 3.

One patient had sensitization to 17 allergens while 29 had only one allergen responsible. The most common allergens were house dust mite -Dermatophagoidespteronyssinus (72%), cockroach extract (42%), Parthenium hysterophorus pollen (18%), wheat (17.4%), Candida albicans (15%) and Peanut (14%). We used a single strain of house dust mite (Dermatophagoidespteronyssinus) in our study which was the commonest allergen among allergic rhinitis patients.

We tested only 4 pollen allergens with Parthenium and Xanthium being common allergens. Among different types of dust particles, house dust was the common allergen. There were 8 instances with animal epithelia as the cause of allergy. Fungi are considerably found to have caused sensitization in allergic rhinitis. Candida is the commonest one.

Cockroach, a common household insect in Nepal was found to be causing allergy in 56 (42.4%) cases. It was followed by a red ant (15.9%) in the insect group.

There were 26 food items used for skin prick test. Among food items tested, the common ones are wheat, peanut, almond, soyabean and curd. The non-vegetarian food items like chicken, egg white, fish were least involved in allergic reaction.

Table 3: Allergens with different grades of sensitization

S.N	Allergens	Number	1+	2+	3+	4+
MITES: (95)						
1	D-pteronyssinus	95 (71.9%)	37	27	22	9
POLLEN: (44)						
2	Parthenium hysterophorus	24 (18.1%)	9	8	6	1
3	Xanthium strumarium	15 (11.3%)	10	4	1	
4	Amaranthus spinosus	2 (1.5%)	2			
5	Argemonemexicana	3 (2.2%)	2	1		
DUST: (77)						
6	Saw dust (Wood Dust)	0 (0 %)				
7	Cotton Dust	8 (6.0%)	8			
8	Hay Dust	6 (4.5%)	6			
9	Grain dust	16 (12.1%)	7	7	1	1
10	House dust	47 (35.6%)	29	13	5	
EPITHELIA: (8)						
11	Cat Epithelia	4 (3.0%)	3	1		
12	Chicken feather	1(0.7%)	1			
13	Dog Epithelia	3 (2.2%)	1	1	1	
FUNGI: (31)						
14	Aspergillus flavus	11(8.3%)	5	6		
15	Candida albicans	20 (15.1%)	10	9	1	
INSECT: (78)						
16	Housefly	0 (0%)				
17	Cockroach	56 (42.4%)	30	19	7	
18	Ant (Red)	21 (15.9%)	10	11		
19	Mosquito	1(0.7%)	1			
FOOD: (239)						
20	Rice	7 (5.3%)	2	3	2	
21	Wheat	23 (17.4%)	14	9		
22	Maize	14 (10.6%)	9	5		
23	Peanut	19 (14.3%)	10	7	2	

24	Cashew nut	6 (4.5%)	6			
25	Almond	12 (6.0%)	7	3	2	
26	Masoor dal	9 (9.0%)	6	1	2	
27	Urad dal	4 (3.0%)	3	1		
28	Methi	8 (6.0%)	5	2	1	
29	Ginger	11 (8.3%)	10	1		
30	Onion	5 (3.7%)	4	1		
31	Mustard	8 (6.0%)	5	3		
32	Cauliflower	5 (3.7%)	3	2		
33	Mushroom	10 (7.5%)	5	4	1	
34	Soyabean	16 (12.1%)	12	2	2	
35	Tomato	6 (4.5%)	6			
36	Apple	7 (5.3%)	5	2		
37	Banana	8 (6.0%)	5	3		
38	Milk	8 (6.0%)	6	2		
39	Coffee	11 (8.3%)	6	5		
40	Curd	16 (12.1%)	9	7		
41	Chocolate	10 (7.5%)	6	4		
42	Chicken	1(0.7%)	1			
43	Egg white	2 (1.5%)	1	1		
44	Fish	3 (2.2%)	2	1		
45	Mutton	5 (3.7%)	4	1		
LATEX (5)						
46	LATEX	5 (3.7%)	4	1		
47	Negative Control (Saline)					
48	Positive Control (Histamine)					

DISCUSSION

Specific allergy tests are useful for patients whose history and examination suggest an inhalant allergy, especially when knowing the exact allergen will help improve their treatment. Skin prick testing (SPT) is the gold standard for finding out which substances a person is allergic to. It is simple, safe, inexpensive, gives results quickly, and is reliable when done by trained professionals.

Skin Prick Test was first described in 1959 by HelmtraudEbruster[10] and has since been widely used to diagnose type I allergic reactions. Although the basic method of SPT has remained mostly the same, different ways of performing and interpreting the test have developed over time. Because of this variation, results from different places may not always be easy to compare. It is sometimes proposed that the panel of allergens tested depends on the allergen exposure of the area. However, allergic patients are travelling across countries, new sensitizations are being found in relation to climate change.

The average age of allergic rhinitis patients in our study is 28.54yrs which is similar to the study done in India by Rasool et al[11] and Das et al[12]. In those studies, there is slight predilection for female patients while in our study it's mainly in male patients. These discrepancies may be due to female patients ignoring their allergic symptoms or avoiding due to the expenses of the test. Majority of patients underwent SPT during Ashad to Bhadra (46.2%) which indirectly indicates this season is most troublesome for allergic rhinitis patients in Western Nepal.

Polysensitization was seen in 78% patients which is similar to Indian study.[13] We used a single strain of house dust mite, Dermatophagoidespteronyssinus in our study, which showed its allergenicity at highest proportion. It shows that, in future studies, other strains of house dust mites should be incorporated as cross reactivity among other species might show an even higher proportion of sensitization in allergic rhinitis patients. HDM positivity was comparable to another study from Nepal [7] and abroad[14,15] House dust mites are the commonest allergen in most of the studies [3,7,9,13,16,17,18] while few other studies show pollen as commonest allergen [1119-22] House dust mite was not only commonest allergen in most studies for causing allergic rhinitis, but also for other atopic conditions. [8]The allergen profile depends on different allergen kits chosen. With growing knowledge in culprit allergens, more specific allergen profiles can be made. As this is the first study of its kind in this region, it will give guidance for future studies to prepare allergen profiles of Nepal.

The pollens chosen were common flora in Nepal. We tested only 4 pollens with Parthenium and Xanthium being common allergens. Parthenium was found to be the commonest pollen in a study done by Gowda et al [13] and Rao [19] Allergic rhinitis, especially seasonal types are caused by aeroallergens, hence one should include more pollen in their profile in future.

Dust is generally regarded as a common culprit of allergic rhinitis; hence we included 5 different dusts in our list. However again house dust was the common one like in another study from Nepal[7], probably having some linkage with HDM making it a common allergen. Grain dust is also of considerable proportion, however its impact on life would be greater if the allergic rhinitis patient is a farmer. Cockroaches were also found to be common insect allergen in other studies.[13]

Involvement of animals as allergen is quite less as compared to other groups. After cats we tested only two types of fungi and candida similar to study from Pokhara.[7]

Food items are subject to considerable public interest. As this is a study first of its kind, we included a variety of food items commonly used in Nepal's household. Wheat was the common food allergen similar to study from Nepal [7] and India[12]

This study showed that many patients with allergic rhinitis in western Nepal are sensitive to different allergens. House dust mites were the most common cause, similar to findings from Kathmandu and India. The warm and humid climate

of the Terai region helps mites grow easily. Parthenium hysterophorus, a common invasive weed, was the second most frequent allergen because people are regularly exposed to it in fields and along roads.

Sensitization to cockroach and grain dust suggests that everyday household conditions and farm work also play a role. Some patients reacted to mold, which may be due to poor ventilation and high indoor humidity. A large number of patients (78%) were sensitive to more than one allergen, showing that people in this region are exposed to many different triggers. This has important implications for allergy treatment, immunotherapy and environmental control measures.

This study has several limitations. First, it was a single-center hospital-based study, which may not fully represent the allergen profile of the general population of Western Nepal. Second, the allergen panel used in the study was limited and may not have covered all clinically relevant aeroallergens and food allergens prevalent in Nepal. Only one strain of house dust mite and a limited number of pollen and fungal allergens were tested. In addition, environmental exposure levels, seasonal variations, occupational exposure, and family history of allergy were not quantitatively assessed.

Larger multicenter studies involving different geographical regions of Nepal should be conducted to develop a comprehensive national allergen profile. Future studies should include a broader range of aeroallergens, pollens, fungal allergens, and region-specific occupational allergens. Seasonal monitoring of allergen exposure and correlation with clinical severity would provide better understanding of allergic rhinitis patterns in Nepal. Awareness programs regarding allergen avoidance and early diagnosis of allergic rhinitis are also recommended. The findings of this study may help clinicians in selecting appropriate allergen panels for skin prick testing and planning allergen-specific immunotherapy in Western Nepal.

CONCLUSION

Allergic rhinitis patients in Western Nepal exhibit high rates of sensitization to house dust mite, pollen, cockroach, and paddy dust. Young people usually suffer from allergic conditions. Allergic conditions usually have multiple allergens.

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