ORIGINAL ARTICLE

Prevalence of Positive Skin Prick Test in Thai Adults with Chronic Tympanic Membrane Perforation

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Objective: To find the frequency of a positive skin prick test (SPT) in patients that experienced chronic tympanic membrane perforation (TMP).

Materials and Methods: Thai patients aged 18 years or older who experienced chronic TMP and presented at the Otorhinolaryngology Outpatient Unit, Siriraj Hospital, were recruited and underwent a SPT covering 18 kinds of indoor and outdoor allergens. Patients with active middle ear disease or conditions that made them unsuitable for the SPT and pregnant patients were excluded.

Results: Forty-five participants were enrolled in the present study. The frequency of a positive SPT was 33.3%. Among the positive SPT group, 80% had polysensitization. *Dermatophagoides pteronyssinus* (mite Dp) was the most frequent positive allergen at 66.7%. The most common cause of chronic TMP in the present study was trauma. The patients' demographic profiles in the positive and negative SPT groups showed no statistically significant differences.

Conclusion: The frequency of allergy in the chronic TMP population in the present study was close to that of the normal population. Overall, the present study population had positive sensitization only to indoor allergens.

Keywords: Tympanic membrane perforation; Allergy; Skin prick test

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Tympanic membrane perforation (TMP) can occur from various causes, with the main causes being trauma and sequelae from a middle ear infection[1]. In most cases, acute TMP can spontaneously heal without any intervention[2], although surgical intervention may be needed in some patients. A previous study showed that the appearance of infection adversely affects healing in acute traumatic perforated eardrum cases[3].

Issues with the eustachian tube and the immune system can both contribute to the pathogenesis of middle ear infection[4]. For instance, impaired function of the eustachian tube can contribute to the development of chronic perforation of the tympanic membrane.

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Eustachian tube dysfunction (ETD) may be caused by endogenous or exogenous factors. Allergy and gastroesophageal reflux can contribute to ETD and may be responsible for its intermittent nature[5]. In addition, studies have shown that allergies and allergic rhinitis affect the nasal mucosa and can lead to ETD[6-8]. Khairi et al. found an association between allergy and chronic suppurative otitis media (CSOM), with statistical significance[9]. From these reports, it is clear that allergy may be associated with chronic TMP. The authors hypothesized that if this were truly the case, one should find that the frequency of allergic activity in chronic TMP cases would be higher than in the general population. Consequently, the authors performed the present study to test this hypothesis.

The skin prick test (SPT) is a well-known procedure that can be easily performed to test for an immediate immunoglobulin E-mediated allergy response[10], and thus was chosen as the present study key research tool to assess for allergic activity in patients. The specific objective of the present study was to find the rate of a positive SPT, which is reflected in allergy, in patients with chronic TMP versus a normal population.

Materials and Methods

The present study was approved by the Siriraj Institutional Review Board (COA number SI 639/2020). It was conducted between July 2020 and January 2023 at the Otorhinolaryngology Outpatient Unit, Faculty of Medicine, Siriraj Hospital, Mahidol University. Patients with chronic TMP aged 18 years or over were recruited. Patients with an active infection or inflammation of the middle ear, such as cholesteatoma, mucosal disease of the middle ear, tympanosclerosis, conditions that were not suitable for SPT, such as a history of anaphylaxis to a suspected allergen, asthma, dermatographia, patients who had taken antihistamines within seven days prior to the SPT, and pregnant patients were excluded from the study. Information on the present study and SPT was given to all patients and informed consents were obtained from all participants.

SPT was performed with various groups of allergens comprising 18 indoor and outdoor allergens. The indoor allergens used for the SPT were dander and miscellaneous such as house dust, mite Dp, *Dermatophagoides pteronyssinus*, kapok, cat, and dog, and household insects such as cockroach, mosquito, and housefly. The outdoor group included pollens such as bermuda grass, para grass, careless weed, and typha, molds such as *Cladosporium*, *Penicillium*, and *Aspergillus*, and others such as Johnson grass, Zoysia, and Borthriochloa. Histamine and buffered saline (BS) were used as the positive and negative controls, respectively (Figure 1).

The results of the SPT were evaluated 15 to 20 minutes after performing the test. A positive result was defined when the following conditions were met, 1) a wheal appeared with a diameter of 3 mm or larger, 2) patient did not show a wheal on the negative control, and 3) the wheal at the histamine site was 3 mm or larger.

Statistical analysis

Data analyses were performed using PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, such as the mean with the standard deviation or median with the minimum and maximum values, were used for the continuous variables that depended on the distribution of the data, while the frequency and percentage were used for the categorical variables. Pearson's chi-square was performed to determine the association between the descriptive data and the skin prick test results. The mean differences between groups were compared using the Mann-Whitney U test. A p-value less than 0.05 was considered statistically significant.

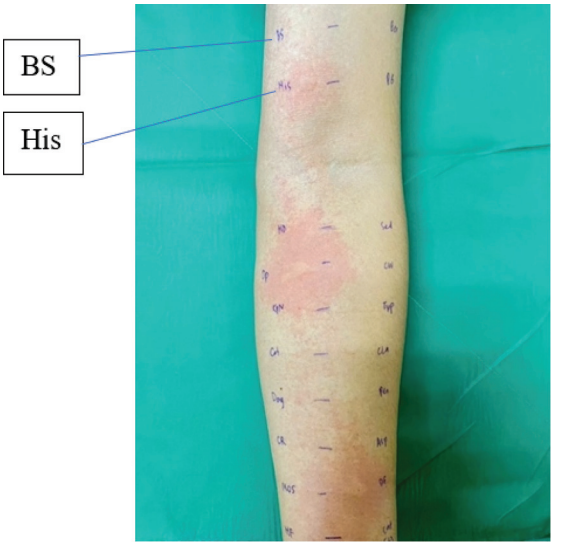

Figure 1. Skin prick test on a patients' arm showing positive results for certain allergens.

BS=buffered saline as a negative control; His=histamine as a positive control

Table 1. Skin prick test results

	n (%)
SPT result	
Positive	15 (33.3)
Negative	30 (66.7)
Polysensitization	12 (80.0)
Complication from SPT	
Yes	0 (0.0)
No	45 (100)

SPT=skin prick test

Results

Forty-five participants were recruited. Of these, 15 participants (33.3%) displayed positive results (Table 1). Among these, 12 participants (80%) displayed polysensitization, while the remaining three tested positive for one allergen alone. The allergen sensitization pattern regarding the frequency of positive tests for the tested common allergens is shown in Figure 2. The dust mite Dp was the allergen with the greatest rate of positive results at 66.7%, followed by house dust and mosquito. No participant displayed allergic sensitization to the outdoor allergens.

The demographic profiles of the participants and the correlation between the positive and negative SPT results are presented in Table 2. The participants

Table 2. Demographic profiles of the participants and correlations between the groups

Characteristics	Total (n=45)	SPT positive (n=15)	SPT negative (n=30)	p-value
Age (years); median (min, max)	57 (35, 75)	53 (39, 69)	58.5 (35, 75)	0.057
Sex; n (%)				0.153
Male	12	6 (50.0)	6 (50.0)	
Female	33	9 (27.3)	24 (72.7)	
History of ear surgery; n (%)				1.000
Yes	18	6 (33.3)	12 (66.7)	
No	27	9 (33.3)	18 (66.7)	
Comorbidity of chronic rhinitis; n (%)				0.063
Yes	13	7 (53.8)	6 (46.2)	
No	32	8 (25.0)	24 (75.0)	
Cause; n (%)				N/A
Trauma	14	5 (35.7)	9 (64.3)	
Infection	12	2 (16.7)	10 (83.3)	
Others	19	8 (42.1)	11 (57.9)	
Side of TMP; n (%)				0.429
Unilateral	36	11 (30.6)	25 (69.4)	
Bilateral	9	4 (44.4)	5 (55.6)	
Site of TMP; n (%)				0.384
Central	28	8 (28.6)	20 (71.4)	
Marginal	17	7 (41.2)	10 (58.8)	
Size of TMP; n (%)				N/A
<25%	18	6 (33.3)	12 (66.7)	
26% to 50%	16	6 (37.5)	10 (62.5)	
51% to 75%	4	1 (25.0)	3 (75.0)	
>75%	7	2 (28.6)	5 (71.4)	

SPT=skin prick test; TMP=tympanic membrane perforation; N/A=not applicable

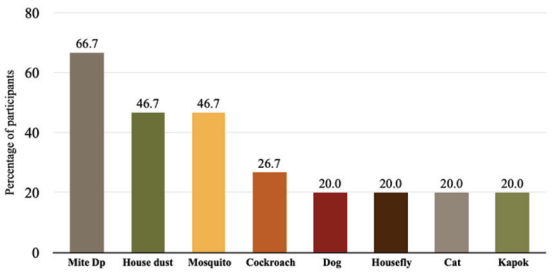

Figure 2. Frequency of allergen types.

were predominantly female, with a median age of 57 years old. Among all the participants, 40% and 28.9% had a history of ear surgery and chronic rhinitis, respectively. The most common identifiable cause of chronic TMP was trauma sequelae at 31.1%. Most of the participants had unilateral, central, and small-sized perforations. There was no difference between the number of positive and negative skin prick test results for each factor, even between patients with or without a history of chronic rhinitis.

Discussion

Chronic perforation of the tympanic membrane affects the quality of life of the patients and can lead to serious complications. The healing process of acute TMP is related to the status of the middle ear, which depends on the function of the eustachian tube. The function of the eustachian tube can be altered by endogenous or exogenous causes. Allergy is one of the endogenous factors that can cause ETD. Various studies have shown a correlation between allergy and otitis media[6,7]. Mion et al. investigated the role of allergic rhinitis in chronic otitis media and chronic TMP and found that 50% of patients presented with nasal disease and nasal eosinophilia for 33.3% of allergic patients[8].

The role of allergy in CSOM was investigated in the study by Khairi et al.[9]. That study, which was conducted in Malaysia, revealed an association between allergy and CSOM, whereby 59.7% of the participants in the CSOM group and 30.6% in the control group had positive SPT results, and there was a significant association between both groups.

In the present investigation, the authors attempted to find the frequency of allergic evidence in patients with impaired healing capacity. The authors hypothesized that an impaired eustachian tube function affected by allergy might be found more in these populations. The patients with active middle ear disease were excluded, so the study was purely focused on the frequency of allergic evidence in chronic TMP. This condition is in a steady state and is actually the sequel stage after the inflammatory process.

The frequency of allergy in the present study was 33.3%, which is lower than in the study of Khairi et al.[9]. Another study by Lasisi et al.[11] also found the frequency of allergy in children with CSOM, acute suppurative otitis media, and the control group was 80%, 47%, and 33%, respectively. A retrospective study by Tantilipikorn et al.[12] in Thailand found that 59.4% of patients with chronic rhinitis had a positive SPT.

The frequency of allergy in the present study was close to the population without active middle ear disease in the reference studies of Lasisi et al. and Khairi et al.[9,11]. Therefore, it can be assumed that chronic active inflammation in the middle ear may be related to the eustachian tube function, while the appearance of sequelae depends on a greater number of factors.

Regarding the participants with positive SPT results in the present study, nearly 50% had chronic rhinitis. This number was close to that in the study by Tantilipikorn et al.[12]. Therefore, it suggests that the present study population is not related to the allergic population. The clinician cannot apply allergy treatment in patients with chronic TMP without symptoms of chronic rhinitis.

The authors were also interested in assessing the success rate of tympanoplasty in positive and negative SPT populations. However, there were only 18 participants who had a history of tympanoplasty with six in the positive skin prick test group and 12 in the negative skin prick test group, in our study. Among the patients in the positive SPT group, 33% had re-perforation after surgery. In the negative SPT group, 25% had re-perforation. However, the number of tympanoplasty cases in the present study was too small to declare a true difference. Furthermore, the success rate of tympanoplasty depends on factors such as the size or site of perforation, the type of graft, and the technique used for graft placement[13]. On the contrary, allergy has been reported in studies as one of the main factors to define the success rate of tympanoplasty. Callioglu et al.[14] showed a graft success rate for allergic rhinitis of 89.5%, while for non-allergic rhinitis, the success rate was 80.8%. However, these results were not statistically significant. The study by Eser et al.[15] did not find significant differences between the groups based on allergic rhinitis after performing tympanoplasty.

Conclusion

The frequency of positive SPT results in chronic TMP in the present study was close to that of normal populations in reference studies in the literature. However, the present study has limitations to note, including the small sample size. The collection of data from a larger number of subjects might show more promising results. The present study population was positive for indoor allergens only. The specific focus on chronic TMP in patients with chronic rhinitis or the success rate of tympanoplasty in patients with chronic rhinitis should be further investigated.

What is already known on this topic?

There has already been reported evidence of the association between allergy and middle ear infection. Patients with acute traumatic perforated tympanic membrane have good prognosis in the self-healing process. However, infections in these patients can lessen the chance of self-healing.

What does this study add?

Healing capacity in TMP depends on many factors. Allergic activity might not be the main factor for a failure of healing TMP.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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