Comparative Allergen Profile in the Krishna-Godavari regions
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\textbf{ABSTRACT}

Allergic diseases are amongst the most common chronic disorders worldwide. Over 20\% of the world population suffers from immunoglobulin E-mediated allergic diseases such as asthma, allergic rhinitis, eczema and anaphylaxis. In India alone, 20\% of the population suffers from allergic rhinitis and bronchial asthma. Airway allergy is now considered to be a disease which is not confined to a specific target organ, but rather a disorder of the whole respiratory tract. Epidemiological, experimental and clinical observations have suggested a link between rhinitis and asthma, leading to the definition of allergic rhinobronchitis or united airway disease and the concept of ‘one airway one disease’.

Aeroallergens play a major role in the pathogenesis of respiratory allergic diseases. Skin tests are the cornerstone for the identification of causative allergens and selection of therapy, including environmental control and immunotherapy.

The Krishna and Godavari regions are two of the nine coastal districts of Andhra Pradesh with varied environmental pollutants like cotton dust, granite dust and stone crushings, besides being a potential agricultural area. These areas have high prevalence of naso-bronchial allergies. With this background, the present study was done to study the skin sensitivity to various allergens by skin prick testing in patients of naso-bronchial allergy, visiting the Department of Pulmonology, Katuri Medical College and Hospital, Guntur, Andhra Pradesh, India, and to compare the prevalence of various allergens among the Krishna and Godavari regions.

\textbf{KEYWORDS:} Allergy, Asthma, Skin prick test (SPT), Krishna (K), Godavari (G).

\textbf{INTRODUCTION}

Allergic diseases are amongst the most common chronic disorders worldwide. Over 20\% of the world population suffers from immunoglobulin E-mediated allergic diseases such as asthma, allergic rhinitis, eczema and anaphylaxis\cite{1}. In India alone, 20\% of the population suffers from allergic rhinitis and bronchial asthma. Aeroallergens play a major role in the pathogenesis of respiratory allergic diseases we have taken up this study as Krishna and Godavari regions are the areas which have high prevalence of naso-bronchial allergies.

\textbf{AIMS AND OBJECTIVES}

The aims and objectives of the present study were as follows:

\begin{itemize}
  \item Skin prick testing (SPT) of susceptible individuals from the Krishna and Godavari regions.
  \item Compare and contrast the prevalence of various allergens and their sensitivity by SPT.
\end{itemize}

\textbf{MATERIALS AND METHODS}

This study was conducted on patients who visited the outpatient unit of the Department of Pulmonology, Katuri Medical College and Hospital, Guntur, Andhra Pradesh, India, between August 2011 and August 2012. A total of 100 (n=100) patients were evaluated on the basis of complete clinical grounds (patients with symptoms of recurrent rhinorrhea, sneezing and itching

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of eyes were studied by evaluating their medical history, clinical examination, complete blood picture, X-ray, paranasal sinus [PNS] and a detailed Ear Nose Throat [ENT] examination). Out of these 100 patients (n=100), 50 were from the Krishna (K) region and 50 from the Godavari (G) region. They were subjected to SPT with 45 standard antigens. The Krishna river terrain includes the twin towns of Vijayawada and Guntur.

The SPT was done on susceptible individuals by using the standard antigens provided by the Alcure Pharma Ltd, New Delhi, India. A total of 45 allergens were tested on each individual, depending on his/her medical history, after withdrawing them from antihistamine, antipsychotic and H-1 receptor blocker regimens 7 days prior to the procedure. Testing was done in a separate allergy room provided with all the equipments required to deal with any sort of emergencies, like anaphylaxis. The reaction in the form of wheal and flare was measured using a grading scale and the results were graded as 1+, 2+, 3+, 4+, etc.

RESULTS
Among the 100 patients tested, SPT was positive in 80 patients (K=36, G=44) for at least one antigen, when both the regions were combined.

Age Distribution
In the present study, majority of the patients suffering from allergic symptoms belonged to the age group of 20-40 years (K=60%, G=62%) in both the Krishna and Godavari regions, followed by the age groups 8-20 and 40-60 years.

Among the patients who showed positive SPT, majority had a history of bronchial asthma and allergic rhinitis. Of these, allergic rhinitis was confirmed in 30 patients (K=13, G=17), bronchial asthma in 21 patients (K=11, G=10) and rhinitis + bronchial asthma in 11 patients (K=6, G=5); whereas, 20 patients (K=20, G=18) had no history of either asthma or rhinitis.

Family History
A family history of atopy was found in the following:

- In the Krishna region, 31 (62%) patients had a family history of atopy.
- In the Godavari region, 25 (50%) patients had a family history of atopy.

Positive and Negative Results
Among the 100 patients in whom SPT was done, 80 (K=36, G=44) had a positive SPT to at least one antigen compared with 10 (K=4 (8%), G=6 (12%)) in whom there was no reaction.

Skin Prick Test Sensitivity to House Dust Mite
House dust mite was found to be the common major allergen prevalent in both the regions (K=23 (46%), G=21 (42%)).

Skin Prick Test Sensitivity to Pollens
A total of 27 pollens were tested in both the groups.

Among pollens, found in the Krishna region, B. *campestris* (24%), *A. lebbeck* (20%), *C. dactylon* (18%) and *A. indica* (18%) were the major allergens causing SPT positivity, while *A. vasica* (18%), *A. lebbeck* (16%), *A. indica* (18%) and *D. viscosa* (26%) were more prevalent in the Godavari region.

Comparing the pollen sensitivity in these two regions, *C. nurvala* sensitivity was significantly higher in the Krishna region (P-value: 0.01) compared with the Godavari region. Sensitivity to *D. viscosa* was significantly higher in the Godavari region (P-value: 0.03) compared with the Krishna region.

Skin Prick Test Sensitivity to Fungal Antigens
Three fungal antigens were tested, i.e. *Aspergillus fumigatus*, *Trichoderma* spp. and *Candida albicans*; sensitivity to fungal antigens was more in the Godavari
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region compared with the Krishna region and the major fungal antigen was found to be *A. fumigatus*, followed by Trichoderma spp. and *C. albicans*.

**Skin Prick Test Sensitivity to Insects**

Among the insects, most of the patients showed positive skin prick sensitivity to mosquito in the Krishna region (44%) compared with the Godavari region (14%). Cockroach sensitivity was more in the Godavari region (23%) compared with the Krishna region (16%).

**Skin Prick Test Sensitivity to Pollens**

Among the various dust samples tested, majority of the patients were found to be sensitive to house dust (K=13, G=16). Paper dust sensitivity was significantly higher in the Godavari region compared with the Krishna region ($P$-value: 0.0054).

**DISCUSSION**

A total of 100 patients with symptoms of allergy, asthma and rhinitis were enrolled to the study and were divided into two groups (50 in each group) based on the region to which they belong, that is either Krishna ($n=50$) or Godavari ($n=50$). Among the 100 patients tested, SPT was positive in 80 patients (K=36, G=44) for at least one antigen and majority of the patients suffering from allergy symptoms belonged to the age group of 20-40 years.

The above study is also supported by a study conducted by Prasad [2], in which it was shown that more than 80% symptomatics were in the age group of 18-40 years. In another study by Chaubey *et al*.[3], maximum number of symptomatics ranged between 13 and 48 years. Even the present study confirms the fact that naso-bronchial allergy is more common in children and young adults.

Among the patients who showed positive SPT, majority had a history of bronchial asthma and allergic rhinitis and the family history was positive for atopy. House dust mite was found to be the common major allergen prevalent in both the regions (K-46%, G-42%).

Among pollens, in the Krishna region, *B. campestris* (24%), *A. lebbeck* (20%), *C. dactylon* (18%) and *A. indica* (18%) were the major allergens causing SPT positivity, while *A. vasica* (18%), *A. lebbeck* (16%),

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Pollen allergen</th>
<th>Number of positive patients Krishna</th>
<th>Number of positive patients Godavari</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Adhatoda vasica</em></td>
<td>8 (16%) 9 (18%)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><em>Acacia Arabica</em></td>
<td>4 (8%) 4 (8%)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><em>Ageratum conyzoides</em></td>
<td>8 (16%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><em>Ailanthus excels</em></td>
<td>8 (16%) 6 (12%)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><em>Albizia lebbeck</em></td>
<td>10 (20%) 8 (16%)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><em>Amaranthus hybridus</em></td>
<td>6 (12%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><em>Amaranthus spinosus</em></td>
<td>6 (12%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><em>Argemone mexicana</em></td>
<td>8 (16%) 6 (12%)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><em>Artemesia scoparia</em></td>
<td>4 (8%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><em>Azadirachta indica</em></td>
<td>9 (18%) 9 (18%)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><em>Brassica campestris</em></td>
<td>12 (24%) 8 (16%)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><em>Broussonetia papyrifera</em></td>
<td>6 (12%) 4 (8%)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><em>Cannabis sativa</em></td>
<td>6 (12%) 6 (12%)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td><em>Cassia occidentalis</em></td>
<td>6 (12%) 7 (14%)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td><em>Cenchrus ciliaris</em></td>
<td>6 (12%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td><em>Chenopodium album</em></td>
<td>4 (8%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td><em>Crataeva nurvala</em></td>
<td>9 (18%) 1 (2%)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td><em>Cynodon dactylon</em></td>
<td>9 (18%) 6 (12%)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td><em>Cyperus rotundus</em></td>
<td>4 (8%) 5 (10%)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td><em>Cocos nucifera</em></td>
<td>4 (8%) 3 (6%)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td><em>Dodonaea viscosa</em></td>
<td>5 (10%) 13 (26%)</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td><em>Eucalyptus tereticornis</em></td>
<td>4 (8%) 3 (6%)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td><em>Gynandropsis gynandra</em></td>
<td>5 (10%) 6 (12%)</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td><em>Holoptelea integrifolia</em></td>
<td>7 (14%) 5 (10%)</td>
<td></td>
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<tr>
<td>25</td>
<td><em>Imperata cylindrica</em></td>
<td>6 (12%) 4 (8%)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td><em>Morus alba</em></td>
<td>4 (8%) 4 (8%)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td><em>Parthenium hysterophorus</em></td>
<td>3 (6%) 5 (10%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: SPT Sensitivity to pollens**

**Table 3: Comparison of representative studies in India with respect to age**
A. indica (18%) and D. viscosa (26%) were more prevalent in the Godavari region.

Comparing the pollen sensitivity in these two regions, C. nurvala sensitivity was significantly higher in the Krishna region (P-value: 0.01) compared with the Godavari region. Sensitivity to D. viscosa was significantly higher in the Godavari region (P-value: 0.03) compared with the Krishna region.

As the two regions studied in this paper, that is Krishna and Godavari, are located within South India, previous studies by Acharya[4], Agashe and Anand[5] and Subbarao et al.[6], studying the predominant pollens in South India, were studied and they described Cassia, A. conyzoides, Salvadora persica, Ricinus communis, A. lebbeck, Artemesia, P. hysterophorus as predominant allergens; however, in our study, the observation was quite different from the previous studies, as it showed a predominance of A. indica, A. vasica, B. campestris and C. dactylon, which were responsible for positive skin test. This has to be further confirmed by aerobiological surveys done at periodic intervals.

Three fungal antigens were studied, i.e. A. fumigatus, Trichoderma sp., C. albicans; sensitivity to fungal antigens was more in the Godavari region compared with the Krishna region and the major fungal antigen was found to be A. fumigatus, followed by Trichoderma spp. and C. albicans.

Among insects, most of the patients showed positive skin prick sensitivity to mosquito in the Krishna region (44%) compared with the Godavari region (14%). Cockroach sensitivity was more in the Godavari region (23%) compared with the Krishna region (16%).
Paper dust sensitivity was significantly higher in the Godavari region compared with the Krishna region ($P$-value: 0.0054).

The above-mentioned study confirms the variation in the prevalence of allergens in both these regions. Therefore, it is concluded that identification of allergens allows early intervention of the ongoing disease and modification of subsequent natural history of the disease. Due to the difference in prevalent allergens from place to place, it is strongly recommended to carry out further studies from time to time for better outcomes. Aerobiological studies and control of environmental factors can reduce the burden of allergy in human beings. More such studies in South India can help in the better understanding of the condition, which can lead to proper diagnosis and treatment.

**CONCLUSION**

- The common inhalant allergens causing naso-bronchial allergies in the Krishna and Godavari regions were assessed and compared.
- It is found that there is a variation in the prevalence of allergens in both these regions.
- This study unravels the fact that patients in the age group of 20-40 years are most susceptible to naso-bronchial allergies.
- The association between asthma, allergic rhinitis and positive SPT was highly evident.
- House dust mite is the predominant allergen causing positive SPT sensitivity in both groups.
- There is a significant variation in positivity to paper dust in both the regions, Godavari being the predominant region.
- Therefore, it is concluded that identification of allergens allows early intervention of ongoing disease and modification of subsequent natural history of the disease.
- Due to difference in prevalent allergens from place to place, it is strongly recommended to carry out further studies from time to time for better outcomes.
- Aerobiological studies and control of environmental factors can reduce the burden of allergy in human beings.
- More such studies in South India can help in the better understanding of the condition, which can lead to proper diagnosis and treatment.

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**REFERENCES**