

# Patch Testing in Allergic Contact Dermatitis

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## ABSTRACT

**Background:** Allergic contact dermatitis is one of the most common forms of skin diseases that require medical intervention. Appropriate detection of allergens by patch test and accurate avoidance of them is the key to management. The objective of this study is to determine the types and frequency of allergens responsible for Allergic contact dermatitis in a tertiary hospital of Nepal.

**Methods:** Altogether 120 patients with Allergic contact dermatitis were enrolled in the study. Patch test was performed to find out the most common inciting allergen, utilizing the Indian Standard Series of allergens approved by The Contact and Occupational Dermatoses Forum of India. Results were read at 48 and 96 hours. Grading of the reactions was done based on the criteria of the International Contact Dermatitis Research Group. Pattern of reactivity of different allergens was assessed.

**Results:** Of all the patients, 63 (53%) showed positivity to at least one allergen. Nickel sulfate was the most frequent sensitizing agent in 22 (18%) cases, followed by Fragrance mix in 11(9%) and Paraphenylenediamine in 7 (6%) cases. Out of all positive results, Grade 1 positivity was seen in 44 (51%), Grade 2 positivity in 41(47%) and only 2 (2%) cases showed Grade 3 positivity. Mercaptobenzothiazole, Balsam of Peru, Nitrofurazone and Wool Alcohol did not show positive results in any of our patients.

**Conclusions:** Patch testing helps in the treatment, long term remission, and patient counseling for prevention. Larger scale studies are required to know the sensitivity to allergens in Nepalese population.

**Keywords:** Allergens; allergic contact dermatitis; nickel; patch test.

## INTRODUCTION

Allergic contact dermatitis (ACD) is a common dermatological problem in Nepal with a prevalence of 1.8% according to a community-based study.<sup>1</sup> Patch test is gold standard in the diagnosis and helps in identification and avoidance of allergen. Patch test has also been found to be beneficial in improving patients' quality of life.<sup>2, 3</sup> There are no standard series of patch test in Nepal and studies on patch test are also limited. The present study was performed to determine the type of allergens implicated in patients with ACD in a tertiary hospital in Nepal.

## METHODS

This is a hospital based descriptive study conducted at Tribhuvan University Teaching Hospital in Kathmandu,

Nepal. It was completed over a period of one year from October 2017 to September 2018. Informed written consent was taken from all the patients enrolled in the study. Approval from Institutional Review Board was obtained.

Patients with a diagnosis of ACD were included in the study. Patch testing was done using Indian standard series of allergens as approved by the Contact and Occupational Dermatoses Forum of India, consisting of 19 allergens. The allergens that were used for patch testing were: Wool alcohol (Lanolin), Balsam of Peru, Formaldehyde, Mercaptobenzothiazole, Potassium bichromate, Nickel sulfate, Cobalt sulfate, Colophony, Epoxy resin, Parabens mix, Paraphenylenediamine, Parthenium, Neomycin sulfate, Benzocaine, Chlorocresol, Fragrance mix, Thiuram mix, Nitrofurazone and Black rubber mix.

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Vaseline petrolatum was used as control. After cleaning the upper back with spirit swab, patch test strips were applied and results read at 48 and 96 hours. Grading of the reaction was done according to the criteria of the International Contact Dermatitis Research Group.<sup>4</sup>

## RESULTS

A total of 120 patients were included in the study, out of which 73 (61%) were females. Most of the patients 80 (67%) were in the age group 18-40 years. The most common occupation among females was housewife in 38 (52%) whereas maximum males were office workers in 10 (21%). Similar past episodes was present in 37 (31%) patients. Predominant symptom was pruritis in 108 (90%).

Anatomic sites of involvement shows that patients presented with involvement of multiple sites in 36 (30%) cases most frequently followed by involvement of hands in 32 (27%) cases. In females, involvement of multiple sites in 23 (32%) is most frequent followed by the involvement of face in 22(30%), whereas hands are the most frequently involved sites in males in 17 (36%) cases.

Positive patch test reaction to at least one allergen was seen in 63 (53%) cases. The most common inciting allergens in our series were Nickel sulfate, Fragrance mix, Paraphenylenediamine, Formaldehyde, Potassium bichromate, Cobalt, Parthenium, Colophony and Chlorocresol, as shown in figure 1. There was no statistically significant difference in positivity to at least one allergen among females and males. (p value=0.8)

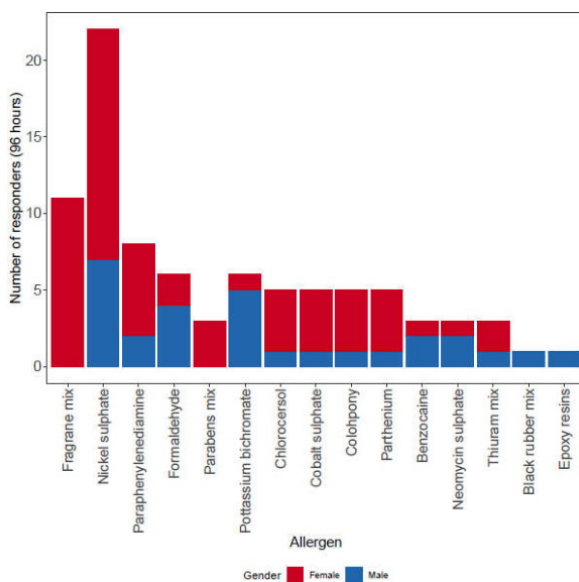


Figure 1. Positivity to different allergens.

Out of all allergens, sensitization to Fragrance mix was statistically more significant in females (p-value=0.003) and to Potassium bichromate in males (p-value= 0.034).

Soap, cosmetics, jewellery, mud and hair dye were identified as the most commonly reported aggravating factors. Factors such as soap and jewellery were exclusively reported by female participants whereas cement and polish were mentioned exclusively by males.

For factors where number of sample was at least 5, a correlation test was performed to identify relationship between aggravating factor and the allergen for which response was observed. Aggravating factors correlates highly to metals in Nickel sensitization, hair dye in Paraphenylenediamine sensitization and to mud in Formaldehyde and Parthenium sensitization as shown in figure 2.

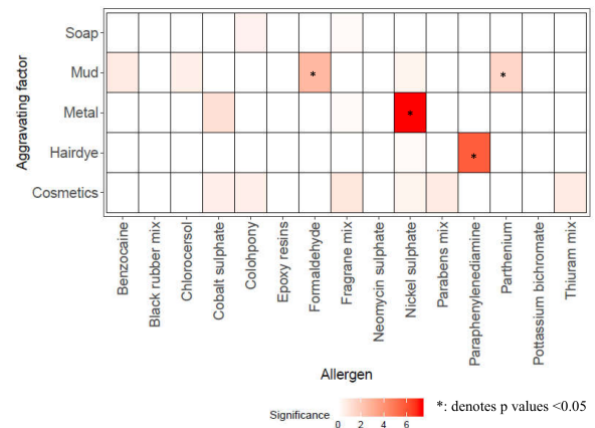
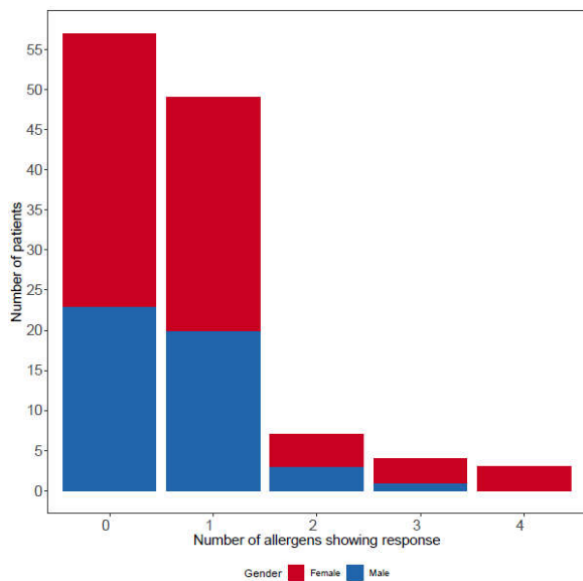


Figure 2. Correlation between aggravating factor and allergens.

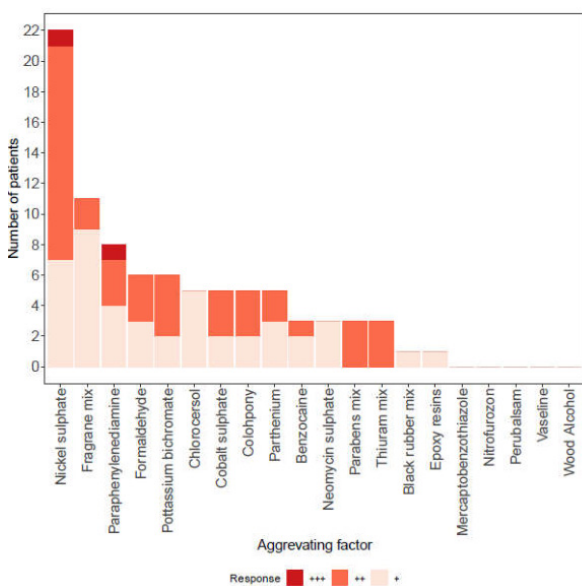
Of the 63 patients who showed positive results, 49 (78%) had positive reaction to only one allergen whereas 14 (22%) were polysensitized with two or more allergens as shown in figure 3.



**Figure 3. Patch test reactivity to number of allergens.**

Positive reactions were not noted to all the allergens tested. Allergens Mercaptobenzothiazole, Balsam of Peru, Nitrofurazone and Wool Alcohol did not show positive results in any patients, whereas allergens Black rubber mix and Epoxy resins showed positivity in less than 1% patients as shown in figure 4.

Regarding the pattern of reactivity, out of all positive reactions, 44 (51%) showed 1+ positivity, 41 (47%) showed 2+ positivity and 2 (2%) showed 3+ positivity to different allergens as shown in figure 4



**Figure 4. Pattern of reactivity.**

## DISCUSSION

Allergic contact dermatitis (ACD) may have significant negative impact on patient's quality of life. Since hands are involved in everyday work, hand eczema causes significant physical and emotional distress as well as social stigmatization. Patch testing is the only practical scientific procedure for the diagnosis of ACD. <sup>5</sup> It helps in detecting the contact allergen exposure in each population. Dermatology specific quality of life has been shown to improve significantly in those who are patch tested because of more accurate diagnosis and earlier intervention. <sup>3</sup>

Our study had statistically insignificant more female patients (61%) in contrast to a study done in India. <sup>6</sup> Preponderance of female patients may be partly due to the occupation of household workers who are exposed to allergens. Multiple site involvement was the most common in our study (30%), followed by the involvement of hands. In males, the predominant site was hand which is similar to a study done in Nepal. <sup>7</sup> Multiple site involvement may be due to delayed presentation after trying all over-the-counter medications when it is already late. The most frequent symptom was pruritus (90%). Study done in India also shows pruritus to be the most frequent symptom. <sup>8</sup> Almost 40% patients had the aggravation of lesions following contact with the specific substance, which is lower than a study done in India in 62% patients. <sup>8</sup>

The detection rate of contact sensitization in our study is 53% which is lower than a study done in Malaysia. <sup>9</sup> Additional testing with extended series can increase the detection rate of sensitization which was not done in our case. Our study is comparable to a study done in India which shows 45% positivity in patch test. <sup>10</sup> Study done in Nepal among patients with hand eczema only showed positive reaction in patch testing to at least one allergen in 56% cases. <sup>11</sup> There is no statistically significant difference in the sensitization rates between males and females in our study. In contrast, few prior studies have reported higher rates of patch test positivity in females. <sup>12</sup>

Like in most previous studies, <sup>11,12, 13</sup> we found Nickel sulfate to be the most common agent causing allergic contact dermatitis, with a rate of 18% of cases, comparable with the worldwide incidence. <sup>14</sup> Ear piercing has been considered as the most common cause of Nickel sensitization; and the risk of Nickel allergy rises as the number of piercings increase. <sup>12</sup>

Fragrance mix is the second most frequent allergen

identified in our study in 9% cases which is slightly lower than a study performed in Nepal among patients with hand eczema.<sup>11</sup> Fragrance is frequently found in cosmetics, perfumes, toiletries and also food additives. It is seen exclusively in females in our study and is statistically significant. Study done in Malaysia also shows females to be significantly more sensitized to this allergen.<sup>9</sup>

In our study, 6% patients showed sensitization to PPD and it was the third most common allergen. The sensitization prevalence to PPD in Asia range between 2% and 12%, with an average of 4.4%.<sup>15</sup> Although studies showed that the prevalence of PPD sensitization was higher in Asian men than in women<sup>15</sup> our study revealed more females sensitized to PPD but without a statistical significance.

The fourth most common allergens in our study were Potassium bichromate and Formaldehyde, positive in 5% patients. In accordance to studies reporting more potassium bichromate reactivity in adult males, we also found significant male predominance for this allergen. In contrast to few studies in which the main source of chromate was leather footwear, in our study the main source of chromate was from cement. Western countries have reported a sharp decline in chromate positivity since the addition of Ferrous sulfate to cement, which converts the easily absorbable hexavalent chromium to the less-sensitizing trivalent state.<sup>16</sup> In our study, 5% patients have shown positivity to formaldehyde, which is comparable to North American study.<sup>14</sup> Patch test reactivity to Parthenium has been seen in around 15 to 20% patients in various studies from India,<sup>8,13</sup> whereas it is less than 5% in our study.

Positive reactions were not noted to all the allergens tested. Allergens Mercaptobenzothiazole, Balsam of Peru, Nitrofurazone and Wool Alcohol did not show positive results in any patients, whereas allergens Black rubber mix and Epoxy resins showed positivity in less than 1% patients. This is in contrast to a study performed in Belgium to analyze reactions to herbal medicines, where Balsam of Peru was the most frequent sensitizer among 21 botanical allergens.<sup>17</sup> Polysensitization with two or more allergens were noted in 22% of the patients with positive reactions, which is lower than a study done in India where 55% patients were positive for multiple allergens.<sup>8</sup> In a study conducted in Israel among patients with contact dermatitis, 43% showed two or more positive reactions with statistically significant associations between 12 pairs of allergens.<sup>12</sup> However, statistically significant association between any pairs of allergens could not be assessed in our study due to

smaller number of samples. Out of all positive results, 51% showed 1+ positivity, 47% showed 2+ positivity and 2% showed 3+ positivity to different allergens. In a study done in India, most of the reactions (74%) were 1+ positive.<sup>8</sup> No association was found between the allergen and pattern of reactivity in our study, whereas in a study conducted in Australia among healthy volunteers, 78% of the reactions to Nickel sulfate were strong (++ or +++), while 70% of reactions to potassium bichromate were weak (+).<sup>18</sup>

## CONCLUSIONS

The mainstay of management of allergic contact dermatitis includes correlation of positive patch test reactions with environmental exposure which helps in prompt avoidance of allergens. The allergens are identified by patch testing, which is considered gold standard for the diagnosis of ACD. Nickel sulfate, Fragrance mix, Paraphenylenediamine, Potassium bichromate and Formaldehyde are the most common inciting allergens in our study.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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