



PATCH TEST PROFILE OF AUTOMOBILE WORKERS UNDER TERTIARY CARE HOSPITAL IN NORTH INDIA, SHIMLA.

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ABSTRACT Patch tests were introduced as a diagnostic tool in the late nineteenth century. Since then, they have improved considerably becoming what they are today. Patch tests are used in the diagnostic investigation of contact dermatitis worldwide. Batteries or series previously studied and standardized should be used in patch testing. The methodology is simple, but it requires adequate training for the results to be correctly interpreted and used. Despite having been used for over a century, it needs improvement like all other diagnostic techniques in the medical field.

KEYWORDS : Dermatitis, allergic contact dermatitis, patch test, automobile workers

Introduction:

Contact dermatitis (CD) is an inflammatory skin disease characterized by pruritus, erythema, vesicles, and scale. It can present as acute, subacute, or chronic dermatitis. A total of 80% of CD cases are irritant contact dermatitis (ICD), and 20% of CD cases are allergic contact dermatitis (ACD). ICD is defined as a localized, non-immunologically driven, inflammatory reaction. ACD is a type 4 mediated hypersensitivity to a specific allergen that also results in a subsequent inflammatory reaction.[1]

Globally, the prevalence of allergic contact dermatitis (ACD) is increasing and the spectrum of its clinical patterns is expanding simultaneously. Contact dermatitis accounts for 4%–7% of all dermatological consultations[2]. An acute response is often characterized by macular erythema, papules, vesicles, or bullae, depending on the intensity of the allergic response. Chronic ACD usually manifests as fissured, scaly, and lichenified dermatitis with or without accompanying papulovesicles[3]. ACD is seen in a large number of occupational groups, with the frequency and pattern varying from one group to another. In many countries, occupational contact dermatitis ranks first among occupational diseases worldwide resulting in significant morbidity and work loss days[4].

Patch testing is a reliable method for detecting the causative antigen(s) in suspected cases. The allergens that are included in standard series vary from country to country based on the local experience. Knowledge about the responsible allergen for ACD helps a long way in reducing morbidity in such cases by identifying the incriminating allergen and can thus help minimize the impact of ACD in the affected individuals[5].

Patch tests are tools used in the identification of the etiologic agent (s) of allergic contact dermatitis. It is a scientific method of investigation, with internationally defined rules and well-established foundations, which are under continuous review and updating. The reading and interpretation of test results, whether positive or negative, are a complex process that requires training and experience, considering their relevance and associating it with the clinical history of contact dermatitis (CD).

With this background, we attempted to assess patch test profile of suspected cases of ACD among automobile workers in Urban Shimla district of Himachal Pradesh.

Materials and methods:

This study was conducted over a period of 1 year w.e.f 1st July 2018 to 30th June 2019 in Dermatology Outpatient's Department at Indira Gandhi Medical College, Shimla.

Sample Size:

Expectancy prevalence of contact dermatitis is 18% (Attwa et al[6] 2008) and absolute precision of 5%, confidence interval of 95%, non-response rate of 10%, sample size was

$$n = 4pq / L^2 = 4 \times 18 \times 82 / 5 \times 5 = 236.16 \approx 236 \text{ persons.}$$

Where p = prevalence (from previous studies), q = 100 - p, L = allowance error (5-20% of p)

Taking non response rate of 10%, sample size came out to be 260.

We enlist all the garages in all the 34 wards of Shimla city and a total of 260 automobile workers were randomly selected.

After applying inclusion and exclusion criterion, from all the 34 wards of Shimla city, a total of 256 workers were randomly selected and screened for contact dermatitis.

History and Clinical Examination:

Socio-clinical details regarding age, gender, occupation, duration and evolution of dermatitis, site of onset and progression, aggravating factors, work-relatedness of the rash, location of job when the rash began, past and present treatment taken, personal history of atopy and family history was asked from all the automobile workers included in study for screening.

- Seasonal variations, aggravation with contact and remissions when away from the inducing antigen.
- A thorough clinical examination of site and type of lesions was recorded on a designed proforma.
- After explaining the procedure and obtaining written consent patch tests were applied on upper back with Indian Standard Battery series and twelve other potential antigens.

PATCH TESTING

- Patients with acute exacerbation of their skin lesions were given treatment before undergoing patch testing.
- Patients who were on systemic corticosteroids equivalent to 20mg or more of oral prednisolone or applying potent topical steroids in preceding 14 days were included but patch test was done after 14 days off the treatment.

Patch Test Procedure:

20 antigens present in Indian Standard battery series approved by Contact and Occupation Forum of India (CODFI) along with 12 other potential antigens supplied by Systopic India limited (Delhi) India, stored at 4-8 degree Celsius were used.

Development of an additional battery of twelve antigens

There is no consensus regarding which antigens are appropriate for testing for suspected cases of ACD in automobile mechanics. We developed a battery of twelve other potential antigens which were not there in Indian standard patch test battery. These antigens were procured from Systopic India limited New Delhi (India). Out of these twelve additional antigens used, nine of these antigens are present in North American standard series. These antigens used were imidazolidinyl urea, diazolidinylurea, triethanolamine, propylene glycol, ethylenediamine, glutaraldehyde, thiomersal, Kathon CG and

bronopol.

Fin chambers supplied by Systopic India Limited, New Delhi (India) were used. These patch test chambers have 9mm internal diameter and 0.7mm depth and a volume of 43µl and were mounted on micropore tape with a distance of 2cm from centre of each other in two columns on a micropore tape 15cm×5cm. these units were covered with non-sticking release paper and stored at room temperature for ready use.

Application of Patch Test

The patch test was applied on the upper back. The site selected for patch test was non-hairy/shaved off area and free from any skin lesions. Patch test area was cleaned thoroughly with ethanol without rubbing and was dried before placing the patch. After applying the patch test, the patient was asked to come after 48 hours and 72 hours for reading the patch test results. If suspected for delayed positivity, patient was asked again to come at 96 hours for final reading.

Instructions to the Patient during Patch Test

- To leave patch test in place for 48 hours.
- Avoid bathing and washing of back during patch testing.
- Avoid exercise or heavy work that may cause sweating.
- Avoid friction or rubbing on back.
- Avoid scratching the patch test site and to report immediately if there is severe itching and burning.
- To avoid direct sunlight.
- To come after 48 hours (3rd day) and after another 24 hours (4th day) for reading. If needed the patient was asked to come after another 24 hours (5th day) for reading of late reaction.

Reading of Patch Test

- Patch test was removed after 48 hours.
- Circles around grooves were marked and patch test numbering was done.
- The patient was instructed to avoid scratching and wait for one hour for skin regains its normal colour and till non-specific skin irritation subsides. Sites were then re-examined for signs of dermatitis.
- At 72 hours second reading was taken.
- Patient was asked to come for late reaction reading at 96 hours if required.

Patch Test Results

Results were graded according to the International Contact Dermatitis Research Group criteria and recorded on designed proforma.

- Negative.

? + Doubtful reaction, faint erythema only.

+ Weak positive reaction, palpable erythema, infiltration, possibly papules.

++ Strong positive reaction, erythema, infiltration, papules, vesicles.

+++ Extreme positive reaction, intense erythema, infiltration, coalescing vesicles and ulceration.

IR Irritant reaction of different types.

Side effects of patch test reaction like reaction to adhesive tape, discomfort and development of itching, flare up of clinical dermatitis, angry back phenomenon, active sensitisation and alteration in pigment at test site when present were recorded.

Relevance of Patch Test

- Definite: if reaction is positive to patch test antigen, object or product containing the suspected antigen.
- Probable: if the substance identified by patch test could be verified as present in the known skin contactants of patient.
- Possible: if the patient is exposed to circumstances in which skin contact with material known to contain the putative antigen likely occurred.
- Past: if a positive patch test reaction could be explained by a previous and unrelated episode of contact dermatitis.
- Unknown: if there is no evidence of relevance even after extensive investigations.

OBSERVATIONS

The present study was conducted in Department of Dermatology, Venereology and Leprosy, IGMC, Shimla over a period of one-year w.e.f 1st July 2018 to 30th June 2019. A total of 256 automobile workers were screened for the occupational contact dermatitis (OCD). Patients with contact dermatitis were examined and further investigated in Outpatient clinic of Dermatology, Venereology and Leprosy department of I.G.M.C, Shimla.

Patch Test Results

A total of sixty automobile workers were clinically diagnosed with CD, out of which 45 patients were willing to undergo patch testing. These forty-five workers were patch tested. 13(28.88%) patients were patch test positive and a total of 15 patch test positive results were seen among these 13 patients. Two patients had positive patch test reactions to two antigens and eleven patients showed positivity to one antigen. Two patients who were patch test positive to two antigens, one patient showed positivity to two antigens of Indian standard patch test series and other patient to one antigen each of Indian standard patch test series and battery of twelve other antigens. So, ten (22.22%) patients showed patch test positivity by Indian standard patch test battery and four (8.88%) by battery of twelve other potential antigens for automobile workers used in our study.

Indian Standard Patch Test Battery Results

Out of thirteen patch test positive individuals, ten (76.92%) had positive patch tests to Indian standard patch test battery antigens.

Out of ten patients who were sensitized to antigens of Indian standard patch test battery, three (30%) patients were multitask workers, three (30%) patients motor mechanics, two (20%) patients of automobile body repair workers and two (20%) patients were painters.

Positive patch test results	Number of positive tests (n=13)	Percentage
Nickel sulphate	4	30.76
Cobalt sulphate	2	15.38
Potassium dichromate	2	15.38
epoxy resin	1	7.69
nitrofurazone	1	
neomycin sulphate	1	

Table 1: Indian Standard Patch Test Battery Results

One patient with patch test positive to potassium dichromate also showed positivity to thiomersal which was used in battery of twelve additional potential antigens.

Patch Test Results with Battery of Twelve Other Antigens

Beside twenty standard battery antigens, twelve other potential antigens were also applied. Out of thirteen sensitized patients, four (30.76%) had positive patch test results to thiomersal. Three patients sensitized to thiomersal were multitask workers and one was automobile electrician. No other antigens used in additional battery for patch testing are found to cause allergic sensitization in automobile repair workers.

Positive Patch Test Antigens

A total of fifteen patch test antigens were positive. Nickel sulphate and thiomersal were most common antigens found in four (30.76%) patients each. Second most common antigens were potassium dichromate and cobalt sulphate seen in two (15.38%) patients each. Neomycin sulphate, nitrofurazone and epoxy resins sensitivity were observed in one (7.69%) patient each.

FINDINGS IN PATCH TEST POSITIVE PATIENTS

Distribution of Lesions in Patch Test Positive Patients

In thirteen patch tests positive patients, involvement of both hands and forearms were most common and seen in six (46.15%) patients followed by only hand involvement in four patients. In hands, the most common parts involved were palmar aspect of hands in six patients followed by both dorsal and palmar aspect of hands in three patients. Two patients had involvement of dorsal aspect of hands and fingers and one more patient had dorsum of hands and web spaces involvement.

Body parts involved	Number of patients n=13 (%)
Hands and forearm	6 (46.15)

Only hands	4 (30.77)
Hands, forearm, face and neck	2 (15.38)
Forearms, flexures and neck	1 (7.69)

Table 2: Distribution of lesions

Patterns of hand dermatitis	Total number of CD patients n(%)=13	Patch test positive antigens (number of positivity)
Diffuse Hyperkeratotic Hand Eczema	8 (61.54)	Nickel Sulphate (3) Thiomersal (2) Neomycin (1) Nitrofurazone (1)
Patchy Vesiculosquamous Eczema	3 (23.07)	Thiomersal (2) Nickel Sulphate (1) Cobalt Sulphate (1)
Nummular Eczema Like	1 (7.69)	Cobalt Sulphate (1)
No Hand Involvement	1 (7.69)	Epoxy Resin (1)

Table 18: Patterns of hand dermatitis recorded in patch test positive patients

* one patient had positivity to two antigens (Potassium dichromate and Thiomersal). ** one patient had positivity to two antigens (Nickel sulphate and Cobalt sulphate).

Discussion:

Clinical manifestations of ACD are highly varied, depending on the degree and frequency of contact with the allergen, the nature of the putative allergen, and host-related factors. The clinical presentation varies from patient to patient, often posing a diagnostic challenge to the treating dermatologist.

Studies showed most frequent antigens associated with hand dermatitis in automobile workers are nickel sulphate, cobalt chloride, epoxy resin, colophony, potassium dichromate, fragrance mix, balsam of Peru, neomycin sulphate, para-phenylenediamine, formaldehyde, carba mix, thiuram mix and thiomersal[6-10]. In current study, nickel sulphate and thiomersal were most common antigens found in four (30.76%) patients each. Second most common antigens were potassium dichromate and cobalt sulphate seen in two (15.38%) patients each. Neomycin sulphate, nitrofurazone and epoxy resins sensitivity were observed in one (7.69%) patient each. These patch test positive results were consistent with results of studies done over automobile workers by Attwa et al[6], Meding et al[7], Donovan et al[8], Alomar et al[9] and Warshaw et al[10].

Out of thirteen patch test positive patients, five (38.46%) patients were multitask workers, three (23.07%) motor mechanics, two (15.38%) automobile body repair, two (15.38%) painters and one (7.69%) automobile electrician. All the patients had exposure to common sensitizers present in working environment. Two multitask workers and two motor mechanics were sensitized to nickel sulphate. Use of hand held nickel-plated tools and frequent contact with corroded objects containing nickel such as nickel-plated tools and several other alloys could be correlated with positive patch test results to nickel sulphate. Sensitization to thiomersal in automobile workers could be due to use of thiomersal containing topical medications, antiseptics and prophylactic vaccination with tetanus toxoid. Cobalt sulphate sensitization could be due to its presence in hard metal used for metal cutting and drilling. Also, cobalt is always present as contaminant in nickel and also found in paints and detergents. One automobile painter was sensitized to epoxy resin which is used as a primer during painting. One body repair worker had positive patch test result to neomycin sulphate and sensitization to which could be due to use of topical preparation in combination with topical steroid and neomycin. One multitask worker and one painter were also sensitized to potassium dichromate which could be due to exposure to antirust paints, sandpapering of painted metals, exposure to welding fumes and frequent use of soaps and detergents.

In thirteen patch tests positive patients, involvement of both hands and forearms were most common and seen in six (46.15%) patients followed by only hand involvement in four (30.77%) patients. The most common patterns of hand eczema recorded were diffuse hyperkeratotic hand eczema in nine (69.23%) patients followed by patchy vesiculosquamous eczema in three (23.07%) patients and nummular eczema like lesions in one (7.69%) patient which was

consistent with the findings in literature[11]. We have noted three cases of patchy vesiculosquamous eczema with thiomersal but no such reports are mentioned in literature. Apart from hands, involvement of other parts of body could be due to contact of irritants and antigens from hands to distant sites such as the face.

In current study, thirteen patients were patch test positive whereas thirty-two (71.1%) patients were patch test negative which could be due to low sensitivity of patch testing procedure or ICD or a smaller number of antigens tested. In most of studies conducted over automobile repair workers, ICD was found to be more common than ACD as reported by Attwa et al[6] and Yakut et al[12] in which 60% and 83% cases were of ICD and 40% and 17% cases were of ACD respectively supporting the findings of our study.

Conclusion:

Automobile repair workers are at high risk to develop occupational contact dermatitis attributed to exposure to various chemicals at their workplace. Atopic background, elderly age group, longer duration of work and longer working hours/day are found to be the highest risk factors for CD.

In automobile workers, a standard screening tray with or without a special antigen series (such as the Oils and Cooling Fluid Series) is often used. In our study, majority of automobile repair workers were patch test positive to antigens of Indian standard series but testing with a greater number of antigens is likely to identify a greater proportion of mechanics who have occupationally relevant ACD. Hence a larger number of offending antigens are to be included in the patch test battery to know the actual prevalence of OCD.

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