ORIGINAL RESEARCH PAPER

Dermatology

OBSERVATIONAL CROSS-SECTIONAL STUDY ON OCCUPATIONAL CONTACT DERMATITIS AMONG AUTOMOBILE REPAIR WORKERS IN AN URBAN AREA OF SHIMLA CITY, HIMACHAL PRADESH UNDER TERTIARY CARE CENTRE OF HIMACHAL PRADESH

KEY WORDS: Automobile workers, contact dermatitis, profile.

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ABSTRACT

INTRODUCTION: Automobile workers are at a risk of developing skin morbidity including occupational dermatosis because of their exposure to mineral oils, petroleum products and its derivatives and lubricating oil. **METHODOLOGY:** Between July 2018 to June 2019, a total of 256 workers from the automotive repair industry in Shimla were interviewed. They were active workers in the repair industry who had been employed for at least six months. The employees were examined at their workplaces and the working conditions were observed. Detailed dermatological examination was performed. **RESULTS:** A total of 60 patients had contact dermatitis. Age of person, work duration and history of atopy had statistically significant association with contact dermatitis. **CONCLUSION:** Use of protective measures would be an effective intervention to protect automobile repair workers from skin disorders.

INTRODUCTION:

The subject of contact dermatitis is old and Jadasson was the first to establish concept of allergic contact dermatitis in 1985 when he reported contact sensitivity to mercury. Contact dermatitis is one of the frequently encountered skin problem in dermatological practice and accounts for 4-7% of new cases in the outpatient clinic.[1] Contact dermatitis is defined as an inflammatory response of skin to exposure of an exogenous agent, which may be either an allergen or an irritant. The term contact eczema and contact dermatitis are often used synonymously to denote a polymorphic pattern of skin inflammation characterized at least in acute phase by erythema, edema, vesiculation and pruritus. Allergic contact dermatitis is an eczematous reaction that occurs as an immunological response following exposure to a substance to which the immune system has previously been sensitized. Irritant contact dermatitis is a non-immunological local inflammatory reaction characterized by erythema, edema, or corrosion following single or repeated applications of a substance to the identical cutaneous site.

The hands are the primary site of involvement in 80% of cases of occupational dermatitis, followed by the wrists and forearms, while 20-30% of these cases show exclusive hand involvement for which the term hand eczema or hand dermatitis is used.[2,3,4,5]

It has been suggested that the multifactorial origin of CD is responsible for the chronic course of the condition. Which is often a combination of irritant, allergic and endogenous factors mainly atopic diathesis. In India, automobile garage workers are mainly males with low-wages and low education. They perform tasks such as spray painting, repairing, cleaning, welding, servicing and general work such as washing of vehicles[6].

Several risk factors associated with dermatitis are younger age, gender, atopy, smoking, wet work and longer working times. Atopic diathesis is the best-known endogenous factor which play an important role in the aetiology of CD.

METHODOLOGY:

This was an observational cross-sectional study conducted over a period of one year i.e. from 1st July 2018 to 30th June 2019 on automobile repair workers of Shimla city.

SAMPLE SIZE: Expectancy prevalence of contact dermatitis is 18% (Attwa et al2008[7]) and absolute precision of 5%, confidence interval of 95%, non-response rate of 10%, sample size was $\eta = 4pq/e^2 = 4X18X82/5X5 = 236.16 \approx 236$ 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.

Screening for occupational contact dermatitis in automobile repair workers was done by visiting the garages in Shimla city.

SAMPLING:

We enlist all the garages in all the 34 wards of Shimla city and after applying inclusion and exclusion criterion, a total of 256 workers were randomly selected and screened for contact dermatitis.

STUDY METHODOLOGY:

DATA ASSESSMENT TOOLS: Self-designed pre-tested questionnaire was used to collect the information regarding socio- demographic profile and clinical parameters of patients.

DATA COLLECTION PROCEDURE:

The skin evaluation of enrolled patients at work place was carried out on all participants using the following:

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. A thorough clinical examination of site and type of lesions was recorded on a designed proforma.

Observations In Patients With Contact Dermatitis

All 256 automobile workers were examined for dermatological involvement. Sixty automobile workers were found to have occupational contact dermatitis. All of them were males between age group 19 to 65 years with mean age of 31.06±8.01 years. Majority of the workers i.e. 46 (76.66%) were middle aged between age group of 25-35 years.

Table 1: Socio-Demographic and occupational characteristics of patients with CD

Characteristic		Frequency(n=60)(%)
Education	Illiterate	4(6.67)
	Primary School	5(8.33)
	Secondary School	51(85)
Smoking habit	Non smoker	31(51.67)
	Smoker	29(48.33)

Marital status	Unmarried	31(51.67)
	Married	29(48.33)
Duration of work (years)	≤1	4(6.67)
	1-5	12(20)
	6-10	17(28.33)
	11-15	12(21.67)
	16-20	7(13.33)
	>20	8(10)
Working hours/day	≤6 hours/day	2(3.33)
	>6 hours/day	58(96.67)
Wet work	Yes	15(25)
	No	45(75)

Table 2:Various risk factors and their association of CD

Characteristics	Number of workers with CD n (%) = 60	Number of workers without CD n (%) = 196	p value
Age Group			
≤30 years	29(16.02)	152 (83.98)	<0.001
>30 years	31 (41.33)	44 (58.67)	
Duration of works (in years)			
≤10 years	32 (16.49)	162 (83.51)	<0.001
>10 years	28 (45.16)	34 (54.84)	
Personal history of atopy			
Positive history	7 (77.78)	2 (22.22)	<0.001
Negative history	53 (21.46)	194 (78.54)	
Working hours			
≤6 hours	2 (3.92)	49 (96.08)	<0.001
>6 hours	58 (28.29)	147 (71.71)	
Use of protective measures (masks, gloves or barrier creams)			
Yes	0	6 (100)	
No	60 (24)	190 (76)	0.098

Table 3: Sub-Occupational Groups and Their Association with CD

We divided all automobile workers into different sub-occupational groups depending on their nature of work.

Sub occupational groups	Total automobile workers n=256 (%)	Workers developing CD n(%)	p value
Body repair workers	53(20.7)	14(26.42)	0.589
Multitask workers	52(20.31)	15(28.85)	
Tire repair workers	37(14.45)	3(8.11)	
Painters	33 (12.89)	8 (24.24)	
Automobile washers	31(12.11)	6(19.35)	
Automobile electricians	26(10.16)	7(26.92)	
Motor mechanics	24(9.38)	7(29.17)	

Table 4: Various occupational exposures and their association with CD

Exposure profile of automobile workers	Total number of exposed automobile workers n(%)		p value
	Workers developing CD n(%)	Workers not developing CD n(%)	
Metals	60 (23.43)	196 (76.57)	0.292
Lubricants	54 (23.38)	177 (76.62)	0.459
Rubber	54 (25.12)	161 (74.88)	0.073
Detergents	54 (25.23)	160 (74.77)	0.061
Solvents	41 (33.06)	83 (66.94)	<0.001
Petroleum fuels	32 (31.37)	70 (68.63)	0.008
Adhesives	22 (22.45)	76 (77.55)	0.387
Soldering and welding materials	20 (25.32)	59 (74.68)	0.317
Paints and varnishes	21 (31.34)	46 (68.66)	0.041
Wet work	15 (25)	45 (75)	0.368
Coolants	12 (21.43)	44 (78.57)	0.351
Brake oil	11 (32.35)	23 (67.65)	0.101

Table 5:Various morphologies of lesions in patients with CD

Morphology of lesion	Number n=60 (%)
Hyperkeratosis	43(71.67)
Fissuring	38(63.33)
Scaling	33(55)
Erythema	25(41.67)
Papulo-plaques	22(36.67)
Hyperpigmentation	21 (35)
Papulo-vesicles	11(18.33)
Oozing and crusting	8(13.33)

Distribution of Lesions

Out of all 256 exposed workers, 118 (46.09%) workers had hands involved in the form of occupational stigmata (calluses or corns, cuts, burns etc.) in 58 workers and contact dermatitis in 60 workers. Distribution of CD lesions in most of the patients was bilaterally symmetrical over hands and forearms. Fifty-nine (98.33%) patients showed involvement of hands and other body parts, out of which forty (66.67%) patients had lesions only over the hands. Out of nineteen patients who had involvement of hands along with other parts of body, fourteen (23.33%) patients had lesions over hands and forearms and four (6.67%) patients over both hands, forearms, face and neck and one (1.67%) patient had involvement of both hands and feet. One (1.67%) patient had involvement of both forearms, flexures of extremities and neck.

Table 6:Various body parts involved in patients with CD

Body parts involved	Number of CD patients n=60 (%)
Only hands	40 (66.67)
Hand and other body parts Hands and forearm Hands, forearm, face and neck Both hands and neck	19(31.66) 14(23.33) 4(6.67) 1(1.67)
Forearms, flexures and neck	1 (1.67)
Patterns of hand dermatitis	**Number of CD patients n (%) = 60**
Diffuse hyperkeratotic hand eczema	38 (63.33)
Fingertip eczema	8 (13.33)
Patchy vesiculosquamous eczema	6(10)
Pompholyx	4(6.66)
Nummular eczema	3(5)
No hand involvement	1(1.67)

In hands, involvement of palmar aspect was most common and observed in thirty-two (53.33%) patients followed by involvement of both palmar and dorsal aspect of hands in twelve (20%) patients and exclusive involvement of fingers in eight (13.33) patients. Apart from hands, involvement of other body sites was seen in twenty (33.33%) patients with CD.

DISCUSSION:

Automotive service industry is one of the largest in the world. It is estimated that 50% of this sector is unorganized.[8] This sector is more prevalent in rural areas when compared to urban areas due to lower penetration of organized sector into this area. There has been significant increase in occupational dermatosis paralleling industrialization.

Occupational skin diseases (OSDs) constitute up to 30 % of all occupational diseases.[9,10] Occupational contact dermatitis (OCD) constitute 90-95% of OSDs[11,12,13]. It ranks, in many countries the first or the highest amongst all notified occupational diseases and cause of occupational morbidity, missed workdays and even loss of occupation.[14-17] Automobile repair work is a high risk occupation and workers during their activities are usually exposed to fuels, solvents, various oils, greases, skin cleansing agents, epoxy resins, metals, rubber, preservatives and other additives.[7,18-21]

In present study all of the employees were males. This is in agreement with the findings of studies done by Attwa et al[7], Meding et al[18] and Khalili et al[22]. Roadside mechanical activities especially in India are predominantly a masculine job, pointing towards the male gender predominance towards this occupation.

The role of age as a risk factor for occupational contact dermatitis is not well defined. In present study, CD was found more common in age group >30 years which was consistent with studies conducted by Hogan DJ[23], Yakes et al[24] and Khalili et al[22] considering their longer working hours and multiple repeated episodes of trauma to the skin increasing their susceptibility to reactions by irritants and allergens. Younger age has also been reported to be a risk factor of contact dermatitis in studies by Attwa et al[7] and Meding et al[18].

Among 256 workers, nine (3.51%) patients had personal history of atopy. Out of these nine, seven (77.78%) patients developed CD suggesting atopy as a major risk factor to develop OCD in automobile workers. This finding was consistent with studies conducted by Attwa et al[7] and Khalili et al[22]. Several studies on patients of different occupations also showed a higher risk of contact dermatitis in people with atopic diathesis.[25-28]

Total duration of work was calculated from the time of start of their job to the time of their screening. Mean duration of work in patients with CD was 10.97±7.72 years. A slightly higher mean duration of work of 13.3±10.4 and 13.29±11.97 years was noted in studies done by Yakut et al[29] and Vyas et al[6]. In our study, a positive correlation was found between the development of CD and duration of work for >10 years and work of >6 hours/day which is similar to the studies conducted by Attwa et al[7] and Joshi et al[30] and can be explained by the fact that longer the duration of work and working hours/day higher the level of exposure to affecting agents.

In studies conducted in automobile repair worker by Joshi et al and Newhouse et al, a prevalence rate of OCD as 4.3-30.2% has been reported[30,31]. In our study OCD was found with a slightly higher rate of 23.43%. Moreover, Yakut et al[29], Funke et al[11], Attwa et al[7] and Joshi et al[30] reported in their studies the prevalence rate of OCD among automobile repair workers of 5.9%, 15.3%, 18.4% and 30.2% respectively. In our study, automobile repair workers had most common contact with metallic tools followed by exposure to lubricants (like grease, engine oils, brake oil etc.), rubber, detergents used for vehicle washing and frequent washing of their hands and solvents used in paints and to coolants (antifreeze fluids). Significant association was seen between CD and exposure to paints and varnishes, solvents and petroleum fluids like diesel and petrol. These findings could be explained by the fact that solvents dissolve and remove the surface lipids, the lipid material in the stratum corneum and the fatty fraction of cell membranes. The percutaneous absorption of water and other substances is increased through this defatting action. This can diminish the protective action of skin against antigens[7]. Various studies have focused on car repair painters, since this class of workers usually suffers of long-term exposure to relatively high levels of many different solvents[32-34]. Higher prevalence of CD on exposure to paints and varnishes could be due to reason that several paints products such as epoxy resins, colophony, phenolformaldehydes used as binders, potassium dichromate used in antirust paints and exposure during sandpapering of painted metals, chloracetamide as a preservative, hydroquinone as a polymerization accelerator or inhibitor, triethylamines as a surfactant and isothiazolines such as methylchloroisothiazolines (MCI)/ methy lisothia zolinone (MI) and formaldehyde used as antiseptics can cause allergic sensitization in painters[27,28]. The exposure to petrol (gasoline) increases incidence of hand dermatitis. In addition, stratum corneum levels of ceramides, cholesterol, and fatty acids were significantly lower in the exposed group. Diesel contain enough water to support the growth of microorganisms; therefore, biocides may be added which can cause ACD.

A polymorphic patterns of skin inflammation most commonly hyperkeratosis, fissuring, scaling and erythema and in small number of patients papulo-plaques, papulo-vesicles and hyperpigmentation was noted in our study which were similar to studies done by Attwaet al[7] and Khalili et al[22].

In OCD, hands are the primary site of involvement in 80% of cases followed by the wrists and forearms[2,13,35,36]. In our study, we also observed hands as the most common site involved followed by involvement of forearms, face and neck. None of the worker with CD were using protective gloves. Diffuse hyperkeratotic hand eczema was most common morphological pattern of hand dermatitis seen in 39 (65%) patients followed by fingertip eczema in eight (13.33%) patients and patchy vesiculosquamous eczema in six (10%) patients which was similar to various studies conducted over automobile workers mentioned in the literature[7,18,36]. Repeated trauma caused by constant exposure of hands to various physical and chemical agents such as water, dust, soaps, detergents, fuels, solvents and lubricants such as greases during work may be responsible for this. In addition, antigens are more likely to induce sensitivity when applied over previously damaged skin[11].

CONCLUSION:

Automobile repair workers during their activities at workplace are exposed to paints, varnishes, metallic tools, solvents, soldering and welding materials, adhesives, coolants, rubber, petroleum fuels, lubricants, detergents and wet work. 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 this occupational group where a very few numbers of workers are using protective measures, an effective intervention would be the introduction of personal protective measures such as gloves, barrier creams etc. in combination with effective worker safety training.

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