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Original article

Extent of Allergens in Patients with Chronic Contact Dermatitis Using Patch Test in Tripoli, Libya

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ABSTRACT

Background and aims*. Occupational contact dermatitis (OCD) is one of the most common work-related cutaneous disorders in many countries. The long-term prognosis of the patients with chronic contact dermatitis (CCD) is poor, involving low health-related quality of life and negative occupational consequences. Our study was aimed to determine the common sensitizing allergens lead to allergic contact dermatitis (ACD) by using TRUE patch test (PT) and to evaluate them according to the age, sex and occupation.* ***Methods.*** *Eighty-seven patients with CCD were tested using TRUE PT Test after applied inclusion and exclusion criteria.* ***Results.*** *The most frequent detected allergen was potassium dichromate (PDC) (21.8%), and was significantly more than the other metals (P=0.022), followed by cobalt chloride (CC) (9%), and nickel sulfate (NS) (6.8%). The cleaning services including housewives (HW) considered the common occupation in our cases with metal contact dermatitis (41.6%) (P = 0.865), and 33% of them had allergic reaction to more than one metal, where 25% were significantly allergic to both PDC and CC (P = .044).* ***Conclusion****: Study concludes that metals were the most frequent allergens lead to ACD among cleaning services including HW and PDC was the most frequent.*

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INTRODUCTION

Allergic contact dermatitis (ACD) is an immunological hypersensitivity reaction type IV and is one of the most common environmental and occupational skin diseases (OSDs), caused by contact with exogenous substances, which are naturally occurring in the environment or can be synthetics. It was accounted for about 10% among all the dermatological disorders and represented about 50% of all occupational dermatosis [1-3]. However, the occupational contact dermatitis (OCD) is considered the most common and frequent dermatoses among all OSDs in many countries, accounting for up to one third of all occupational diseases [4, 5]. In UK and USA, contact dermatitis is the second most common occupational disorder, second to musculoskeletal injuries [6]. In addition; it is considered as the second most costly form of work-related cutaneous disorders in the civilian world [7].

Patch testing (PT) is an important diagnostic tool for assessment of ACD and using in clinical practice together with detailed clinical history and a complete physical examination, in the diagnostic work-up of these cases [8,9]. Establishment of the diagnosis of OCD is quite complicated since there are no specific clinical and histopathological characteristics. However; diagnosis of OCD involves two fundamental steps: recognizing the existence of an occupational exposure and assessing whether that exposure represents a cause or substantial aggravating factor in the patient's dermatitis.

To reach an accurate diagnosis, the dermatologist relies on comprehensive history taking, skin examination, skin testing, and use of Mathias criteria for establishing occupational causation and aggravation of contact dermatitis [10]. Because of limited information on this aspect our study was aimed to determine the most common allergens lead to ACD among studied cases.

METHODS

Study design and setting

A descriptive case series hospital-based study was carried out at eczema outpatient clinic of Bir Osta Milad Hospital (BOMH) for 15 months on patients clinically diagnosed as having chronic contact dermatitis (CCD). The study was approved by the research committee of department of Dermatology, Bir Osta Milad Hospital. Verbal consent was obtained from all participants.

Data collection procedure

A total of 87 cases who had a history of recurrent and/or persist contact dermatitis were enrolled, and TRUE PT Test was performed. However, any patient had active contact dermatitis or allergic to any of the allergen components of TRUE PT, or with injured or inflamed skin, or aged less than 12 years, or pregnant or breast-feeding women, or under current treatment with systemic drugs as; antihistamines, steroids or other immunosuppressive or immunomodulators were excluded. Patients on local steroid and patients with history of exposure to ultraviolet (UV) treatments or heavy sun exposure were included in the study after stopping the topical steroid for 2 weeks and after avoiding UV treatment and heavy sun exposure for at least 3 weeks.

A standard case sheet was used to collect the data and the patients were undergoing to patch testing with the TRUE PT (Manufactured by Smart Practice Denmark). The 34 allergens were arranged in 3 panels and five visits for each patient was required as follows; In visit 0 (Day 0): we informed the patients about the test and gave him pre- and during instruction form. In visit 1; we applied the PT strips in the upper back, after being cleaned with plain of water and dried. Visit 2 (after 48 hour), the PT strips were removed. Some erythema is usually present immediately after removal the strips, this usually require 15 to 30 min to be settle down, after that, the initial reading was recorded for any signs of rash, swelling, redness and blisters in the site of strips. In visit 3 (after 96 hour); we examined the patients for any signs of allergic reaction in the site of the strips and we recorded as the second reading. In visit 4 (Day 7); we examined the patients for late reaction. After the results was recorded, the patients were informed about any substances were found to be allergic to it, as well as we gave each patient that reacted positively an information sheet that explain the name, nature, source, and preventive measures of the allergen.

Positive TRUE PT result was adopted according to the International Contact Dermatitis Research Group (ICDR), while doubtful reaction (±) or irritant reactions (IR) were considered negative [11]. According to Mathias criteria for establishing occupational causation and aggravation of contact dermatitis we considered our patients contact dermatitis could be related or not related to their occupation [10, 12].

Statistical analysis

The dataset was organized and analyzed by using SPSS version 16. Descriptive statistic was used to describe the collected data including; frequency, mean median, standard deviation and chi-square used to detect the difference between categories. P value less than 0.05 is considered to be significant.

RESULTS

The age of the patients was ranged between 12 and 80 years with mean age (33 ± 13years), and the age group from 18 to 40 years was significantly more commonly affected (P = 0.001). 72.4% of the patients were females with F: M ratio 2.6:1. The study was revealed that the patients had positive reactions to 24 allergic substances out of 34 substances included in the TRUE PT.

Fifty-four (62.1%) had positive TRUE PT to either one or more allergen, 38 of them were females (P = 0.630), and the most common site involved was hands (37.9%). Out of those 54 patients had positive allergy; 24 of them (28%) had positive reaction to metals, and 30 patients (34%) were allergic to other different substances, while 33 patients (38%) were non reacting. Twenty-four (44.4 %) patients had positive reaction to one or more metal allergens, and 79% of those patients were females, however, 19 (79%) had allergic reaction to PDC, 8 (33.3%) to CC, while 6 (25%) to NS. The patients who were sensitive to PDC was significantly more than other metals (P = 0.022). Regarding to the occupations; 20 patients (83.3%) were exposed to wet work, and most of them (41.6%) were worked in the cleaning services including housewives (HW).

About nineteen patients (21.8%) out of 87 had allergic reaction to PDC. They accounted 79% of total 24 patients. Fourteen of them were females. About 84% of cases with PDC sensitization were worked in wet work, 68.4% of them were worked as cleaning service including HW, followed by builders (10.5%) and shoes dealer (5.26%). Whereas; 2

(10.5%) were worked as a (teachers and HW) and other 2 (10.5%) were worked as an (office workers and HW); we included them in group cleaning service including HW, where they exposed to wet work as home makers. According to Mathias criteria; 73.6% of our patients their contact dermatitis could be related to their occupation. However; 2 other patients (10.5%) were worked as students (dry work), and the primary site of the lesion were feet, (face and feet) respectively, as well as aggravating and relieving factors were not related to their occupation as in (table 1).

Table 1. Distribution of patients allergic to PDC.

68.4 % HW & cleaning service	**Primary site**	**Aggravating & relieving factor**
57.8%	Hand involved	Related to occupation
10.5%	Hand not involved (Face & feet)	No
Builder 10.5% Shoes dealer 5.26%	Hand & feet Hand involved	Related to occupation
73.56% could be related to the occupation		

Eight patients (9%) out of 87 had allergic reaction to CC, and they account 33.3% of the total 24 patients with allergy to the metals. Five of them were females. Regarding to the occupation; we found that; 5 (62.5%) of them were HW, two (25%) were builders, and other one (12.5%) was shoes dealer. All the patients were worked in wet work, 7 of them (87.5%) had co sensitization with other metals; 6 patients were allergic to CC and PDC, while one had positive reaction to 3 metals; PDC, NS and CC. According to Mathias criteria; we found that; 87.5% of the patient with CC sensitization their ACD could be related to their occupation as in (table 2).

Table 2. Distribution of patients allergic to CC by occupation.

62.5 % HW & cleaning service	**Site**	**Aggravating & relieving factor**
50%	Hand involved	Related to occupation
12.5%	Hand not involved (face)	No
Builder 25% Shoes dealer 12.5%	Hand & feet Hand involved	Related to occupation
87.5% could be related to the occupation		

Six patients (6.8%) out of 87 had allergic reaction to NS, which accounted 25% of the total 24 patients had allergy to the metals and all of them were females. Regarding to the occupation; two of them (33.3%) were HW, two (33.3%) were (teachers and HW), one (16.6%) was teacher, and other one (16.6%) was (office worker and HW). About 83% of those patients were exposed to wet and 2 patients had co sensitization with other metals; one of them had allergic reaction to both PDC and NS, the other one had allergy to three metals together. Depending on Mathias criteria; 83% of the patients with nickel sensitization were home maker, cleaning service linked to wet work, all of them using jewelry, 33.3% co-sensitize to other metal, all these factors; predispose to the development nickel sensitization in our patients with ACD, as in table 3.

Table 3. Distribution of patients allergic to NS by occupation.

83% hw& cleaning Service	Site	Aggravating & relieving
83% →	Hand involved →	Related to occupation
83% predispose to different factor		

DISCUSSION

This study revealed that the age group 18-40 (55.2%) was the commonest age group followed by the age group >40-60 (26.4%). The age group from 18 to 60 years was considered the most economically productive sector of the Libyan population, and mostly exposed to sensitization. These results nearly similar to Duarte et al study which revealed that, the age group 20-49 (48.5%) was the commonest [13]. A female predominance (70.4%) was evident among our patients with positive reaction to either one or more allergens of TRUE PT compared to males (29.6%). These concurred with Almogren et al study, which showed that, 73.6% were females. However; disagree with Reduta et al study, which revealed that 54% had a positive reaction with at least one allergen, and more frequently was in men 60.1% [14,15].

Our TRUE PT results revealed that most frequent allergens were metals and PDC is the commonest allergic metal (21.8%), followed by CC (9%) and NS (6.8%). Cleaning services including HW were the main reported occupation (41.6 %) in metal allergic patients. These results concurred with Yesilova et al but they found that NS (13.3%) is the commonest allergen, followed by PDC (11.3%) and CC (8.6%) and the HW were the main reported occupation [16]. Also, Duarte et al studies revealed that NS (60%) was the commonest allergen, followed by PDC (13%) and CC (8.5%), in contrast to our result and the cleaning service workers (59%) were considered the most [13].

The PDC was the most common frequent allergen reported among our cases, where, 19 patients (21.8%) had a positive reaction to this substance and was statistically significant more than the other metals (P = 0.022), and 73.6% of them were females. Regarding to the exposer to the wet work, primary site of the lesion, aggravating and relieving factors and PT result; we found that; 73.6% of those patients their ACD could be related to their occupation. The high percentage of PDC allergy was reported in female patients and the HW represents the common occupation. Whereas, uses of detergents that containing chromate, give a clue about this result. As reported by Trehan et al, and Lim et al, the chromate found in many products including detergents and bleaches agents [17,18]. Also; Duarte et al, reported that; the metals in cleaning products had a powerful triggering effect in contact dermatitis caused by metals, and cleaning workers are related to all types of metals owing to their contact with chromate, nickel and co-sensitization with cobalt [13].

Our male patients (26.30%) with PDC allergy, they worked as; builders, worker in cleaning company, and shoes dealer who was dealing with leather, this finding give other explanations of high percentage of chromate allergy in our patients. Where; Lim et al, were reported that, the leather products have been known to be the most significant source of chromate and the majority of the reports have been related to the exposure from shoe products [17]. Also; Joseph and Fowler, reported that, the chromate classically has been associated with dermatitis due to leather goods [19]. In addition; Sarma in a study was done among sixteen men construction workers with ACD, reported that the most common allergen was chromate (60%) and the cement was the most important substance that can cause OCD and chromate is the principle allergic component in the cement [4], this finding supports our results where; we found that two patients (10.5%), worked as builder and both of them had sensitization to PDC and CC. On the other hand; we found that; two patients (10.5%) with PDC allergy; one of them worked as HW and the primary site of the lesion was the face, and the other one worked in

cleaning company and the primary site of the lesions was the feet, as well as the aggravating and reliving factors for those two patients were not related to their occupation.

The CC was the second most frequent allergen in our patients, where 8 patients (9%) had positive reaction to CC, 5 (62.5%) of them were females, all of them were exposed to wet work, and 87.5% could be related to their occupation. The common occupation for this group (62.5%) was HW. Seven patients who had positive reaction to CC, had co sensitization with other metals; and 6 (25%) patients were reacting significantly to PDC and CC (P = 0.044), and presented a higher frequency of co sensitization. Three of them were worked as HW, and two of them were worked as builder, and one was worked as shoes dealer, while other one out of 7 was worked as HW and had positive reaction to 3 metals; chromate, nickel and cobalt, and only one patient was worked as HW and had positive reaction only to cobalt.

Our results concurred by Duarte et al, where they reported that, the cleaning workers are related to all types of metals owing to their contact with chromate, nickel and co sensitization with cobalt, but they disagree with our result, where they found that; the nickel was statistically significant in relation to cobalt, which presented a higher frequency of co sensitization when associated to nickel or chromate [13]. In addition; Reduta, reported that; most patients with positive reaction to cobalt also had allergies to nickel and chromate [15]. Duarte et al, and Sarma, reported that the sensitization to cobalt occurs mainly through the presence of this metal in materials that contain chromate and nickel in their consistency, and allergy to this metal is usually secondary to the chromate damaged skin, because cobalt is present in insoluble form that has very low sensitization potential [4,13], this clue may give explanation why the cobalt was the common sensitizer among our patients and ranking advanced levels compared with other chemicals. Sarma reported that the chromate, cobalt and nickel are important allergens in construction industries and cement contains nickel and cobalt, and exposure to these substances may lead to OCD. Two of our patients were worked as builder and both of them had positive reaction to both cobalt and chromate, on the other hand, the primary site of contact dermatitis for one of those patients were hand and upper limb, the other patient were hand and feet, and the aggravating and relieving factors for both patients were related to their occupation. These finding support our clue whereas the ACD could be related to their occupation.

The third common allergen reported in our study was NS, where, 6 patients (6.8%) had positive reaction to nickel, and all the patients were females. The HW included in 83%, which represent the common occupation in this group. Torres et al, reported that; homemakers deal with materials in their home that contain NS [20]. In addition; Duarte et al, reported that the cleaning workers are related to all types of metals owing to their contact with chromate, nickel and co sensitization to cobalt [13]. These finding give explanation why nickel ranking advanced level in our female patients. On the other hand; Turcic et al, and Duarte et al, reported that the reaction which happens due to the contact with these metals, generally occur in moist environment [13, 21]. Furthermore; Shah et al, reported that, the high exposure to the nickel may occur in metal workers, domestic cleaners, food handlers, and many of these workers are involved in wet-work occupations [22]. Our female patients with nickel sensitization were worked as (teachers and HW) or (office workers and HW). HW is considered their main occupation that could be related to their ACD as they dealing with metals in moist environment, as well as the aggravating and relieving factors of those patients dependent on the exposer to cleanser agent and homemaker. The hands were the primary site of the lesions of the patients with nickel allergy and this support the possible relation to their occupations. Also; Shaha mentioned that; the possible occupational nickel allergy group differed from the non-occupational nickel allergy group in having a statistically significant higher prevalence of hand dermatitis (P < .001) [22]. In addition; Torres et al, reported; generally, 30% to 40% of the patients with occupational nickel allergy develop hand eczema [20].

Involvement of the hands in a nickel-sensitized patient should raise the possibility that nickel is acting as an occupational allergen. Two patients with nickel sensitization had combined allergy; one of them had allergy to both NS and PDC, and the other patient had allergy to three metals (PDC, CC and NS), these entire multifactor may aggravate nickel sensitization. Torres, et al, reported that; the worldwide prevalence of nickel allergy is around 8.6%, and females are 3 to 10 times more affected with nickel contact dermatitis in contrast to males, which is explained by early exposure to allergen contained in jewelry, especially earrings [20]. In addition; Almogren et al, reported that; early skin contacts with nickel in earrings or pins have been implicated in the increased skin reactivity to nickel among females [14]. Attempts to decrease exposure to nickel in Denmark by legal restriction on earrings with high nickel content have resulted in 64% reduction in nickel allergy among young girls. Our female patients dealing with jewelry and exposed to earrings, as well as exposure to wet work occupation, could explained their liability to the development of nickel sensitivity in 83% of our patients with nickel allergy.

CONCLUSION

Study concludes that metals are the most frequent positive allergens lead to ACD and PDC is the most frequent allergen. Cleaning services including HW was the common occupation among patients with metals contact dermatitis. As the metals were the common cause of ACD among our cases, we recommend to do planning to reduce the exposure to these substances by taking the advantage of developed countries by reducing the chromate concentrations in the consumer products, such as detergents, to the lowest limit which does not elicits allergic reactions.

Disclaimer

The article has not been previously presented or published.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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