SKIN SENSITIZATION AMONG NIGHT SHIFT AND DAYTIME HEALTHCARE WORKERS: A CROSS SECTIONAL STUDY

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SUMMARY

Objective: Allergic contact dermatitis (ACD) in the healthcare sector is a major occupational health hazard. There are many reasons for a higher frequency of ACD in healthcare personnel compared to other populations: among others, simultaneous exposure to multiple substances, use of aggressive detergents and wet work. However, studies that systematically correlate skin symptoms with the presence of sensitization investigated through patch tests in specific categories of health workers are very rare and conflicting. Although some studies have reported a correlation between skin disease and night shift, the strength of the evidence is rather limited. The purpose of our study was to investigate by means of patch testing the skin sensitization (SS) to common allergens in the hospital setting in a group of healthcare workers (HCW) reporting symptoms related to dermatitis, according to their job activity and their shift status.

Methods: 132 HCWs visiting a health surveillance centre were investigated by means of specific questionnaire for dermatitis, followed by patch test evaluation including 40 haptens of the SIDAPA 2016 series.

Results: Skin sensitization was observed in 1/3 of the subjects investigated by patch tests. The nursing job was strongly associated with cutaneous reactivity after controlling for the confounding of gender, age and other factors. Shift work was related to the prevalence of SS.

Conclusions: In our study, the nurse's role and shift work were significantly associated with the risk of cutaneous sensitization, in particular for common antigens.

Key words: contact dermatitis, health care, nursing occupation, nickel sensitization, night shift

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INTRODUCTION

Published studies have reported a higher frequency of skin diseases such as psoriasis and skin cancer among subjects with a disrupted sleep cycle, including night shift workers (1, 2). These studies however are inconclusive and do not regard the skin sensitization. Contact dermatitis in the healthcare sector is a major occupational health problem; the estimated prevalence in the sector is about 13% to 30% and includes both irritant and allergic variants (3). Healthcare workers (HCWs) are routinely exposed to a large number of chemical agents which may cause a wide spectrum of clinical manifestations including allergic contact dermatitis (ACD), irritative contact dermatitis (ICD) as well as the worsening of other skin diseases such as hydrochromic eczema, atopic dermatitis, and psoriasis. In many cases, work-related dermatitis and endogenous skin disease coexist determining complex clinical manifestations. Given the considerable diagnostic difficulties, professional contact dermatitis may be underestimated in most cases unless specifically investigated by means of targeted epidermal patches (patch tests) towards the professional haptens involved (4–6). Previous studies in literature show a positivity to the patch test in healthcare workers ranging between 17% and 63% (3, 5, 7).

Currently in hospital setting the attention is focused on some allergens more commonly implicated in skin sensitization (SS) among HCWs. Positivity to the epicutaneous tests among those workers have been reported to be common for thiuram, quaternary ammonium, formaldehyde, benzalkonium chloride, latex, and nickel (3, 8–12).

Recent evidences have reported a higher frequency of inflammatory skin diseases among rotating night shift HCWs employed in the hospital settings. The reason for this higher prevalence was considered to be related to the hormonal changes that commonly happen in workers involved in night shift rotation, such as modification of cortisol and melatonin circadian regulation (13). The dysregulation of the immune system caused by the altered circadian rhythm and by the occupational stress could be implicated in the pathogenesis of inflammatory diseases and autoimmune or allergic reactions. However, the possible synergistic effect of both skin chemical sensitization and night work in HCWs was not investigated up to now. Our study aimed to investigate the prevalence of SS in HCWs symptomatic for

contact dermatitis in relation to their risk factors, occupation and night shift status.

MATERIALS AND METHODS

The study was performed in Italy at Tor Vergata Polyclinic placed in Rome in the period from 1 November 2017 to 1 November 2018. In our retrospective study, medical records of 132 HCWs visiting a health surveillance centre for symptoms of eczematous dermatitis were evaluated. All subjects were investigated by means of a specific questionnaire followed by patch test evaluation. We applied the patches including 40 haptens of the SIDAPA 2016 series (Euromedical, Chemotechnique Diagnostic). The patch was applied on the back of the subjects (interscapular region) and removed 48 hours later. The application site was further evaluated 48 and 72 hours after the removal of the patch in accordance with the guidelines of the International Contact Dermatitis Research Group. The reactions were classified according to international recommendations (14); the +, ++, +++ reactions were considered positive. Data regarding the job activity, night shift status, smoking habits, body mass index (BMI), and presence of tattoos and/or piercings were also collected. Regarding the job schedule we divided the study population into two groups: "night shift workers" were defined as subjects working a shift schedule of two to seven 12h nights per month, whereas other subjects were classified as "daytime workers". Records of subjects who were being treated with corticosteroids or antihistamines at the time of the test were excluded from the study. Written consent was obtained from all participants. The outcomes were processed by means of the SPSS 18 databases and analysed in terms of frequency and relative risk by univariate and multivariate logistic regressions.

RESULTS

Study population was composed by 132 HCWs (24 males and 108 females). The mean age of the study subjects was 35.1 ± 11.3 years (33.17 ± 10.84 in males and 35.48 ± 11.39 in females), the study group was mainly composed of medical doctors (35/132) and nurses (33/132).

Positive patch test was found in 50 subjects (38% of the sample). Main characteristics of the population are reported in Table 1.

In general, the most common clinical presentation of the ACD was the erythemato-desquamative form (80/132, 60.6%), followed by the erythemato-microvesicular (29/132, 21.9%), hyperkeratotic-rhagadiform (18/132, 13.6%) and erythemato-bullosa (8/132, 6%) forms. The different forms sometimes coexisted in the same subject.

Regarding the results of patch test, nickel was found to be the most commonly positive substance (24.2%), followed by latex (7.6%), potassium dichromate (6.1%), methylisothiazolinone (6.1%), and formaldehyde (6.1%). Nickel and formaldehyde sensitization was more common among nurses (59.4% and 12.5%, respectively), whereas latex positivity prevalence in the general population was 7.5% higher both in nurses (12.5%) and physicians (11.4%).

The association between patch test positivity and main risk factors including night shift status was evaluated. Skin sensitization was statistically related to nurse job ($p = 0.001$) and night shift work ($p = 0.04$), also when tested in logistic regression model considering the confounding effect of age, gender, BMI, presence of tattoos/piercings, and smoking habits (Table 2).

Table 1. *Main characteristics of the study population*

Characteristics	n	%
Number of subjects	132	100.0
Mean age, years (SD)	35.1 (11.3)	
Age class (years)		
≤ 40	95	72.0
> 40	37	28.0
Gender		
Male	24	18.2
Female	108	81.8
Job task		
Nurse	33	25.0
Physician	35	26.5
Technician	18	13.6
Surgeon	7	5.3
Odontologist	6	4.5
Other*	33	25.0
Patch test outcome		
Negative	82	62.1
Positive	50	37.9

*Physiotherapists, pharmacists, technical operators, paramedics, medical students

DISCUSSION

Skin sensitization documented by positivity patch test was recorded in about 1/3 of symptomatic workers. This proportion confirms the greater frequency of sensitization of the HCW compared to the general population (3, 7, 14).

The nurse's role was strongly associated with the presence of sensitization to nickel (59.4% of symptomatic nurses). This percentage is much higher than that reported in previous studies (10). Although contact dermatitis in general and sensitization to nickel in particular are more common in the female gender that makes up a large part of the nursing population, the association of the nurse's role with the skin sensitization to common haptens in our studies was confirmed also after controlling for the possible confounding effect of gender, age, presence of piercings/tattoos through logistic regression. Although in most cases the sensitization is acquired in the pre-employment period or concerns extra-professional exposures, we can hypothesize that the damage to the skin barrier due to aggressive detergents and disinfectants and to wet work, more common among nurses, may have facilitated the penetration of metal through the skin with subsequent activation of the immune response (15–17).

Moreover, in our study night shift work was statistically related with a higher risk of cutaneous sensitization ($p = 0.04$). The role of night work in the pathogenesis of skin sensitization could be

Table 2. *Prevalence of patch test positivity by the main risk factors (n = 50)*

Factors	Patch test positivity	%	p-value (univariate)	p-value (multivariate)
Gender				
Male	8/24	33.3	0.61	
Female	42/108	38.9		
Age class (years)				
≤ 40	39/97	40.2	0.42	
> 40	11/35	31.4		
Job task				
Nurse	19/33	57.6	0.001	0.007
Physician	9/35	32.1		
Technician	6/18	33.3		
Surgeon	2/7	28.5		
Odontologist	2/6	33.3		
Other*	12/33	34.3		
Tattoo and/or piercing				
Yes	6/10	60.0	0.13	
No	44/122	36.1		
Obesity				
Yes	5/12	41.7	0.78	
No	45/120	37.5		
Smoking				
Yes	10/29	34.5	0.67	
No	40/103	38.8		
Shift				
Yes	29/61	47.5	0.02	0.04
No	21/71	29.6		

*Physiotherapists, pharmacists, technical operators, paramedics, medical students

mediated by the interference with the synthesis of melatonin and dysregulation of immune and endocrine system (18). In 2013, Wen-Qing Li et al. found an association between inflammatory skin disease (psoriasis) and night shift postulating that the increased risk could be related to a diminished ability of the pineal gland to produce melatonin (19).

Furthermore, we have to consider the possible role of occupational stress, related to the work strain of HCWs, in the development of skin disorders according to data from literature (20, 21).

Possible limitations of our study could be the cross-sectional design of the study, which prevents from inferring causality, the choice of a non-randomized convenience sample and the small sample size.

Moreover, the implementation of suitable hygienic-environmental measures designed to reduce irritative hand injuries could have an effect on containing the cases of sensitization especially in those subjects. Preventive measures should therefore take into account these observations and give priority to education, training and skin protection interventions based on the experiences reported in the literature (22–25). Further observational studies are necessary to confirm the findings of our study.

CONCLUSION

Results of our study showed that the nurse's role and night shift work are significantly associated with the risk of cutaneous sensitization among healthcare workers, in particular for common antigens. Based on the results of our study change in the work schedule should be considered for HCWs that show a worsening of skin symptoms after being involved in night shift works.

Adherence to Ethical Standards

All procedures performed in this study were approved by the Ethical Committee of Tor Vergata Polyclinic and written consent was obtained from all participants.

Availability of Data and Materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflict of Interests

None declared

Authors' Contributions

LC contributed to the study design and interpretation of the results, and was the major contributor in writing the paper; LMDZ interpreted data results and was a contributor in writing the paper; FP collected references and participated in statistical analysis; AP interpreted data results; AM contributed to study design and interpreting data results.

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