

OCCUPATIONAL SKIN DISEASES IN NURSES

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Abstract

Objectives: The aim of the work was to evaluate the incidence of occupational skin diseases in nurses, their morbidity rate, symptoms, possible causes and relation with occupational environment. **Materials and Methods:** The study group consisted of 706 nurses of different hospital departments. A questionnaire and collection of information about the use of disinfectants were the main investigation methods. **Results:** It was revealed that 47.3% nurses were suffering from occupational skin diseases. Allergic contact dermatitis was found to be the most frequent (28.5%) disease. Irritant contact dermatitis of non-allergic origin was diagnosed in 8.4% of nurses. The main symptoms of occupational skin diseases were itching and reddening. **Conclusion:** The risk of developing occupational dermatitis was increased by working with aldehydes and hydrogen peroxide as well as by using latex gloves and long working hours.

Key words:

Occupational skin diseases, Irritant contact dermatitis, Allergic contact dermatitis, Disinfecting materials

INTRODUCTION

Skin disorders are one of the most frequent occupation-related diseases. Work at the health care sector is regarded as a risk factor for developing occupational skin disease. Health care workers are exposed to disinfecting materials, different kinds of soap, detergents and latex [1–3]. In the USA, the highest incidence of occupational skin diseases is encountered in health care workers. The majority of occupational skin diseases take form of contact dermatitis. In Poland, the frequency of allergic contact dermatitis in health care workers accounts for 25.6% of all occupational pathologies [4], and in the former Soviet Union only 13%. According to the occupational diseases register in Lithuania, only 1.9% of health care workers were affected by this occupational pathology. Real situation in Lithuania is quite different. Health care workers are suffering from occupational skin diseases; working conditions are stress-

ful, and workers are exposed to harmful biological and chemical agents.

MATERIALS AND METHODS

The study population comprised a cohort of 706 nurses working at Kaunas Medical University Hospital. The cohort included nurses of various departments: therapeutic (305 nurses), surgical (270 nurses) and intensive care (131 nurses). The cohort was distributed by age to two large groups. Group I comprised 37.9% of women aged 20–29 years. Group II, 34.9% of women aged 30–39 years. The rest of the cohort was aged above 40 years. Length of service at medical institutions was 11.6 years. Working time was divided into intervals. The largest proportion of the study population worked 7–8 h/day. The longest working hours were at intensive care departments (Fig. 1). As

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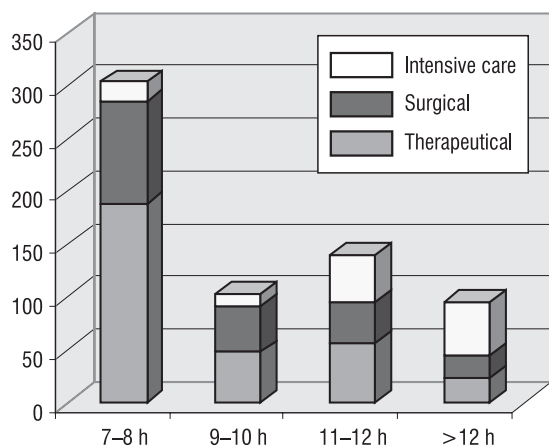


Fig. 1. Distribution of nurses by departments and workday length.

seen in Fig. 1, nurses of surgical and therapeutical departments worked 7–8 h daily whereas, nurses of intensive care departments worked 11 h and longer.

We conducted a follow-up by distributing a self-administered questionnaire within each hospital department. The rate of questionnaire responses was 89%. The data providing characteristics of the study population: age, length of service, past and present skin diseases, their localization and intensity were collected. Information concerning chemical materials and their groups was obtained from a self-administered questionnaire and chief-nurses of individual departments. The subjects were consulted by dermatologists to evaluate and diagnose skin diseases. Diagnosis was established by anamnestic, skin disease history and evaluation of data.

Statistical analysis

Odds ratio (OR) was used to measure the association between outcome and exposure. We calculated the 95% confidence intervals (CI) on the basis of the Mantel-Haenszel test and estimated adjusted odds ratios in logistic regression analysis. We assessed the role of work

environment factors, history of atopy, working hours, length of service, and individual protection measures. Exposure to chemical disinfecting materials was established individually. The prevalence of occupational skin disorders was compared with groups of nurses, with or without occupational exposure.

RESULTS AND DISCUSSION

Most hospital nurses are exposed to strong chemical disinfecting materials. The effects of these factors vary from person to person, from worksite to worksite and depend on age, pre-existing resistance and individual protection. The most intensive exposures are seen in departments with multiple medical procedures. As seen in Table 1, exposure to chemical disinfecting materials depends on the profile of individual departments.

The longest duration of contact with disinfecting materials was found for nurses of intensive care and surgical departments. Nurses working in therapeutical departments had contact with chemicals for less than 3 h or for 3–6 h. All nurses under study using chemical disinfecting materials had most frequent contact with chlorine and alcohols. Aldehydes and hydrogenium peroxide were less often used. The type of chemicals used depended on the kind of medical procedures carried out. Table 2 shows the differences between departments.

Alcohols were predominantly used at intensive therapy care units and chlorine at therapeutical and surgical departments. All departments avoided working with aldehydes and hydrogenium peroxide. Aldehydes as very aggressive chemicals are widely used for endoscopes disinfection [5].

Table 1. Distribution of nurses by time of exposure to chemical materials and departments

| Department | Contact time with chemicals | | | | Number of nurses |
|----------------|-----------------------------|-------------|------------|------------|------------------|
| | < 3 h | 3–6 h | 7–9 h | > 9 h | |
| Therapeutical | 117 (38.4%) | 106 (34.8%) | 58 (19.0%) | 24 (7.9%) | 305 (100%) |
| Surgical | 88 (32.6%) | 79 (29.3%) | 66 (24.4%) | 37 (13.7%) | 270 (100%) |
| Intensive care | 27 (20.6%) | 48 (36.6%) | 12 (9.2%) | 44 (33.6%) | 131 (100%) |

Table 2. Chemicals or group of chemicals predominantly used at clinical departments

| Department | Chemicals or chemical groups | | | | | | | |
|----------------|------------------------------|------|-----------|------|----------------------|------|----------|------|
| | Alcohols | | Aldehydes | | Hydrogenium peroxide | | Chlorine | |
| | Nurses | % | Nurses | % | Nurses | % | Nurses | % |
| Therapeutical | 241 | 65.1 | 81 | 21.9 | 145 | 39.2 | 298 | 80.5 |
| Surgical | 150 | 72.8 | 50 | 24.3 | 134 | 65.1 | 177 | 85.9 |
| Intensive care | 117 | 90 | 12 | 9.2 | 80 | 61.5 | 112 | 86.2 |

Having analyzed the data, we found that almost half of all nurses (47.5%) suffered from skin diseases. Of these nurses only 18.1% had been affected by skin diseases before starting work at health care institutions, while 81.9% nurses had no skin problems before that. It is obvious that skin diseases in nurses are of occupational origin. Skin problems are related to occupational environment and chemicals used at workplace. Repeated harmful exposures decrease the resistance of the skin. The repair capacity of the skin becomes exhausted, especially if re-exposure occurs too soon and at a time when repair from the previous exposure has not as yet been completed. Such conditions are observed in the nurses' occupational settings. Moisture and gloves double the damage to the skin. Allergic contact dermatitis was diagnosed more commonly. Irritant contact dermatitis was less often observed in our investigation. In this case, damage to the skin develops after the effect of irritant or toxic substances and depends on their chemical characteristics and concentration as well as on the properties of the epidermis. As seen in Table 3, OR for allergic contact dermatitis was 17.3 (10.4–26.8), and for irritant contact dermatitis 3.9 (2.0–7.4).

Reasons for very low diagnostic opportunities for irritant contact dermatitis may vary. Allergic contact dermatitis is considered as a more serious disease. Establishing whether a particular case is irritant contact dermatitis is complicated because of difficulties faced in differential diagnosis. Researchers all over the world agree that diagnos-

tic criteria for irritant contact dermatitis are insufficient. Identification of dermatitis type is a difficult problem in Lithuania. There is interaction between allergic and irritant contact eczema. In some occupations, allergic contact eczema prevails, whereas other occupations lead to relatively more chronic irritant contact dermatitis. Combinations are also common. In occupations with high incidence of irritant contact dermatitis, a secondary contact allergy may develop. Nurses, for example, may develop chronic irritant contact dermatitis followed by allergy to chemicals present in rubber gloves, that is why so many difficulties are faced. Diagnostic criteria for occupational origin of skin (allergic and irritant) dermatitis were:

- Significant occupational exposure to chemicals;
- Location of skin lesions corresponding to exposure;
- Improvement when exposure stops;
- Recurrence on re-exposure.

Differential diagnosis of occupational allergic contact dermatitis and irritant contact dermatitis was done by dermatologist according to the history of the disease, symptoms and type of lesions. In most cases, diagnosis is difficult and in individual cases the problem may be very complex. Differentiation between allergic and irritant dermatitis was also made by evaluating occupational vs. domestic exposure to irritants and allergens.

We found that main symptoms observed in nurses were skin redness and itching. These symptoms are characteristic of allergic contact dermatitis. Our data provided

Table 3. Odds ratio for the development of allergic contact and irritant contact dermatitis

| Dermatitis | Number of cases (%) | OR | 95% CI | P |
|------------------|---------------------|------|-----------|-------|
| Allergic contact | 161 (28.5) | 17.3 | 10.4–26.8 | <0.05 |
| Irritant contact | 41 (8.4) | 3.9 | 2.0–7.4 | <0.05 |

evidence that allergic dermatitis was manifested by rash, itching, vesicles, redness, burning and dandruff (Table 4). Non-allergic skin diseases (irritant contact dermatitis) are associated with rash and redness. As seen in Table 4, there are more symptoms related to allergic origin of the skin disease.

In 56.5% of nurses, symptoms of skin damage appeared 2 h after starting their duties, and the damage developed within 1–2 weeks. These data show that the process of skin damage progresses very quickly. A rapid skin damage is characteristic of irritant contact dermatitis. However, this is controversial, because according to the available data, one can see that there are more allergic diseases diagnosed. We were trying to establish differences in periods between being exposed and the development of allergic contact and irritant contact dermatitis. Table 5 summarizes data on each kind of dermatitis, the relation between dermatitis type and the onset of disease. As seen, both allergic and irritant dermatitis develop with the same speed.

We also collected data on nurses' working conditions, chemicals used and exposure time. Time of exposure to

Table 6. Cases of skin diseases and exposure time to chemical disinfecting materials

| Exposure time (h/day) | Nurses working with chemical disinfecting materials Cases (%) | Skin diseases Cases (%) |
|-----------------------|---|-------------------------|
| 1–2 | 219 (31.4) | 80 (36.5) |
| 3–6 | 223 (31.9) | 118 (52.9) |
| 7–9 | 126 (18.1) | 61 (48.4) |
| >9 | 97 (13.9) | 61 (62.9) |

chemical disinfecting materials was associated with the development of skin damage. The longer the exposure time the more increased the skin disease morbidity (Table 6). It was found that 62.5% of nurses who worked with chemical disinfecting materials for more than 9 h were suffering from skin damage. The proportion of nurses who were exposed for shorter (1–2 h) period and developed skin disease was smaller – 36.5% ($p < 0.05$). Nurses were working mainly with 4 groups of disinfectants: chlorine, aldehydes, hydrogenium peroxide and alcohols. Using absolute numbers, chlorine and alcohols were most dangerous for the skin, because they induced the largest amount of cases (33.5% of cases induced by chlorine and 11.4% by alco-

Table 4. Symptoms of occupational skin diseases in nurses

| Symptoms | Cases of allergic diseases | P | OR | 95% CI | Cases of non-allergic diseases | P | OR | 95% CI |
|----------|----------------------------|-------|------|----------|--------------------------------|-------|------|---------|
| Vesicles | 94 | <0.05 | 6.93 | 4.7–10.3 | 20 | <0.05 | 1.95 | 1.1–3.5 |
| Itching | 123 | <0.05 | 5.92 | 4.0–8.7 | 25 | 0.19 | 1.46 | 0.8–2.6 |
| Burning | 30 | <0.05 | 3.75 | 2.1–6.7 | 3 | 0.46 | 0.64 | 0.2–2.1 |
| Cracks | 51 | <0.05 | 3.21 | 2.1–4.9 | 11 | 0.31 | 1.44 | 0.7–2.9 |
| Dandruff | 63 | <0.05 | 2.78 | 1.9–4.1 | 23 | <0.05 | 0.73 | 0.1–5.6 |
| Redness | 124 | <0.05 | 6.03 | 4.1–8.8 | 30 | <0.05 | 2.2 | 1.2–3.9 |
| Pain | 11 | 0.07 | 5.86 | 2.0–17.1 | 1 | 0.76 | 0.76 | 0.1–5.6 |

Table 5. Dermatitis development time according to the type of disease

| Symptoms appear | Skin allergic diseases (allergic contact dermatitis) | | Skin non-allergic diseases (irritant contact dermatitis) | |
|--------------------------|--|------|--|------|
| | Cases | % | Cases | % |
| At the beginning to work | 23 | 14.1 | 3 | 7.3 |
| After 1–2 h | 85 | 52.8 | 22 | 53.7 |
| After 3–4 h | 37 | 22.7 | 9 | 21.9 |
| After 1–2 weeks | 18 | 11.0 | 7 | 17.0 |
| Total | 163 | 100 | 41 | 100 |

hols). Odds ratio for the development of occupational skin damage was highest in nurses working with aldehydes and hydrogenium peroxide. Our data do not confirm that use of alcohols is related to occupational skin diseases (OR for skin damage due to alcohols was 1.9; CI = 1.04–3.4). The risk is higher when chlorine was used (OR = 3.6; CI = 2.1–6.2). The use of aldehydes and hydrogenium peroxide increased the risk. OR for skin damage in the work environment with aldehydes was 11.3; CI = 6.2–20.08. The highest risk was observed in nurses working with hydrogenium peroxide (OR = 18.9; CI = 5.8–61.6). As depicted by our data, hydrogenium peroxide and aldehydes were the most aggressive chemicals in the hospital environment. They are not used in every workplace. Aldehydes are used for the disinfection of medical devices, which cannot be disinfected using thermal, high pressure and vapor methods. Glutaraldehyde is mainly used for the disinfection of fibroscopes at gastroenterological departments. According to R. Rietschel [6], glutaraldehyde is harmful not only to the skin, but also to whole body. The author describes nurses with skin damage, redness of eyes, headaches and bronchitis symptoms. He reports that 87% of nurses using glutaraldehyde for disinfection showed skin damage and respiratory symptoms.

Evaluating the origin of allergic contact dermatitis and its association with the work environment, it was evidenced that work with aldehydes was the most extensive risk for occupational skin damage (Table 7). The use of alcohols was not related to allergic dermatitis.

We found that some chemicals or their groups are very harmful to nurses skin. Among them aldehydes and hydrogenium peroxide were most aggressive. These chemicals cause the highest risk for the development of occupational diseases. Other materials such as alcohols and chlorine are

Table 7. Odds ratio for allergic skin diseases development in relation to chemicals used at workplaces

| Chemicals | OR | 95% CI | P |
|----------------------|------|----------|-------|
| Alcohols | 1.85 | 0.9–3.9 | >0.05 |
| Aldehydes | 12.1 | 6.2–23.6 | <0.05 |
| Hydrogenium peroxide | 7.03 | 2.4–20.5 | <0.05 |
| Chlorine | 3.56 | 1.9–6.8 | <0.05 |

less harmful. But owing to their very wide use skin damage occurs frequently.

To prevent occupational skin diseases a general approach is not essentially different from the way of preventing any other occupational disease. First, the process of work performance should be thoroughly investigated, while personal protection should be offered as a last resort. We established the relation between the frequency of hand washing and risk for occupation-related skin damage. Nurses washing hands 21 times and more per day had more problems with skin (Fig. 2).

According to the literature data, extremely intensive hand hygiene is one of the factors leading to occupational skin damage. Our results confirm this thesis as seen in Fig. 2. It is reported that intensive hand hygiene aggravates the course of the disease, and frequent hand washing, use of after-work emollients, and barrier creams can delay skin recovery.

The most effective protective measure is to reduce the frequency and duration of exposure. In the health care sector, a closer look into the infection preventing protocols may reduce the frequency of hand washing and the amount of soap and disinfectants used to clean the hands; just water or less irritant isopropylalcohol may often be sufficient [1,7]. Personal protection devices, which in practice mean usually gloves, should be given the lowest priority. The literature data on use of gloves and skin problems at the health care sector are contradictory. Some authors

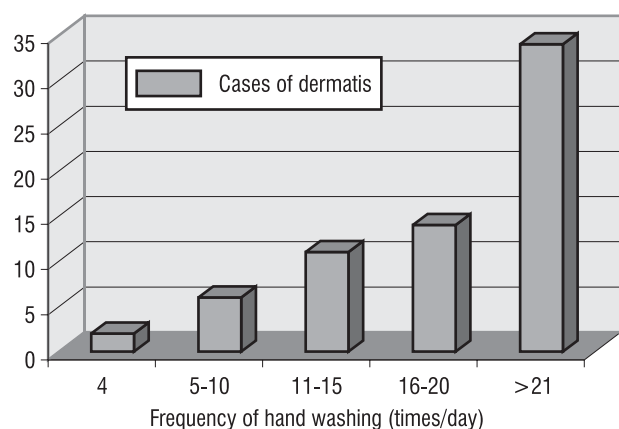


Fig. 2. Relation between hand washing frequency and prevalence of dermatitis.

Table 8. Odds ratio for skin damage development vs. gloves wearing duration

| Gloves wearing duration (h/day) | Nurses working with gloves | Cases of skin damage | OR | 95% CI | P |
|---------------------------------|----------------------------|----------------------|------|-----------------|-------|
| 0 | 65 | 16 | 1 | – | – |
| 1–2 | 147 | 57 | 1.94 | 1.01 < OR < 3.7 | <0.05 |
| 2–3 | 192 | 84 | 2.38 | 1.2 < OR < 4.5 | <0.05 |
| 4–6 | 136 | 69 | 3.12 | 1.6 < OR < 6.1 | <0.05 |
| >6 | 75 | 37 | 3.15 | 1.4 < OR < 6.2 | <0.05 |

try to convince that use of gloves decreases occupational skin problems [1,6]. Others are of the opinion that use of gloves increases possibility of skin damage. Ideal gloves do not exist. Gloves protect skin from soap, detergents, disinfectants, on the other hand, the occlusive effect on the skin creates a problem. Gloves impermeability to chemicals is not sufficient and can cause allergical skin damage. Our data confirm a significant relation between time of wearing gloves and skin damage. Odds ratio for skin damage when using latex gloves was 1.43; $p < 0.05$. We found that the relation between time of wearing latex gloves and possibility to develop dermatitis was statistically significant. The longer the use of gloves by nurses, the greater the possibility to develop skin damage. This relation is evidently indicated in Table 8.

Latex gloves are widely used in the health care sector because of the danger of blood transmitted infections, but glove rubber can give rise to skin problems: a well known example is the increase in the incidence of latex allergy in the health care workers. In the general population, the frequency of latex allergy falls within the range of 1–6%, whereas in the health care sector this proportion increases to 3–12%. Latex gloves can cause allergy. There are a lot of allergens: latex proteins, antioxidants, sensibilization materials, dyes. Risk for latex allergy development is increasing when use of latex gloves is concomitant with already existing irritant contact dermatitis.

Information about the work environment and hazards present at workplace can indirectly influence the nurses' health. The knowledge of safe work practice is a very effective preventive measure. We observed that nurses do not know much about hazardous effect of disinfectants on their health.

CONCLUSIONS

1. In the study population, 47.3% of nurses were suffering from occupational skin diseases.
2. The highest incidence of these diseases was at intensive care and surgical departments with longer working hours and more contacts with chemical disinfecting materials.
3. The highest risk for skin damage was found in work with aldehydes (OR = 11.3; CI = 6.2–20.08) and hydrogenium peroxide (OR = 18.9; CI = 5.8–61.6).
4. Main symptoms of allergic contact dermatitis were redness, rash, itching, vesicles, burning and dandruff. Non-allergic skin diseases (irritant contact dermatitis) were manifested by rash and redness.
5. Differential diagnosis between allergic contact dermatitis and irritant contact dermatitis is complicated, because of lack of data concerning skin disease history, symptoms, occupational vs. domestic exposure.
6. Aldehydes and hydrogenium peroxide were mostly responsible for the development of allergic skin diseases.
7. Intensive hand hygiene and use of latex gloves are associated with the incidence of occupational skin diseases.
8. Work at intensive care units, use of aldehydes or hydrogenium peroxyde, frequent handwashing, and long use of latex gloves are the main risk factors of the occupational dermatitis development in nurses.

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