Wet work in relation to occupational dermatitis
Chapter 9

General discussion

Management of risks to the skin from wet work

Introduction

Many occupations have an increased risk to develop a skin disease, especially hand dermatitis.[1-4,11] Although not life threatening, the symptoms are troublesome in daily life. In sectors where wet work predominates, there are many employees with skin complaints caused by their work. These employees are somehow able to continue their work and are often not known to the occupational physician. In the Netherlands occupational physicians focus on absenteeism and are losing their grip on classic occupational diseases such as occupational dermatitis.

Many patients with an occupationally relevant dermatitis do not consult their occupational physician.[34]. The general practitioner and dermatologist have a predominantly curative focus, while the occupational etiology of the skin complaints is often not recognised. Patients receive topical treatment but often little or no attention is given to the reduction of causative or contributing exposure factors and to health education on skin care and protection.

Neither employers nor employees are aware of the occupational relevance of these skin complaints, the possible risks at the work place or the necessary measures. Attention to occupational dermatoses in companies and institutions implies that the employer and the employee must be able to call on specific expertise and knowledge of the risks to the skin caused by wet work. They rely on the expertise of the occupational physician to advice on health care management. In a situation were the occupational physician is not confronted with occupational dermatitis, the expertise on this occupational health problem will be lost. This results in situations were risks for developing occupational related dermatitis are not sufficiently recognised and addressed.

The occupational physician, confronted with a contact dermatitis needs to understand its pathophysiology as well as its etiology.

Too often occupational dermatitis is considered to be an ‘allergic’ phenomenon, but only in the minority of the cases an allergic immunological process plays an essential etiologic role. Dermatitis is primarily a non-infectious inflammation of the skin and an occupational contact dermatitis is most often the result of repeated contact with weakly toxic agents: an irritant contact dermatitis.[8,32,34,42,43]. In many occupational environments different skin irritating events give a reaction in the epidermis, which is at first usually not clinically visible. The skin recovers after cessation of these exposures, but it may take several days for complete recovery. Repeated contact within the recovery period may thus result in a clinically manifest dermatitis.[44,45]. Many working circumstances come
with frequent and prolonged exposure to skin-damaging factors. Health risk management in these working conditions needs to include a reduction of these skin exposures. A care system, specifically aimed at preventing occupational dermatoses will improve the occupational physician’s performance in this respect (21;53-60). A care system aimed at managing wet work risks must focus on:
- Recognising and drawing up an inventory of the risks to the skin in work situations
- Prevention, aimed at reducing the possibility that occupational dermatoses will develop
- Monitoring health damage to the skin
Besides the duration and frequency of these skin-irritating exposures the severity of the dermatitis is also influenced by a personal predisposition. As with many diseases, not all individuals seem to be equally susceptible to the development of hand dermatitis under similar conditions of exposure. A history of atopic dermatitis predisposes for developing an irritant contact dermatitis (18;41;46-52). Therefore, a care system for occupational hand dermatitis should take this additional risk for employees with a history of atopic dermatitis into account.
The studies in this thesis contribute to the scientific substantiation of a care system focussed on reduction of occupational dermatitis.

In a follow up study 5 years after the initial diagnosis of irritant contact dermatitis, of which the vast majority was occupationally relevant, it was shown that secondary and tertiary preventative measures were not adequately implemented. The findings described in Chapter 2 make it likely that the lack of knowledge of the need for preventative measures contributes to the chronic nature of work-related skin diseases. The data highlight the difficulties of achieving permanent changes in occupational exposure levels of skin irritants. Occupations with the highest exposure level had the most difficulties in achieving appropriate reduction in exposure to skin irritants. The question rises whether these occupations, characterised by a high exposure to skin irritants, can provide appropriate working conditions for persons with a history of irritant contact dermatitis.
The outcome of this study questions the long-term effectiveness of health care education on this subject. It was noticed that, although all patients had received specialised education on skin care and protection, the use of emollients was probably more related to therapy than to prevention. Repeated education during their professional life may be necessary to achieve better results for those at risk for developing an occupational dermatitis.
This thesis describes the nature and the quantity of work-related skin complaints in two wet work sectors. The methods used in both settings to screen employees for skin complaints and for a predisposition for developing skin complaints were able to detect a substantial number of workers with occupational skin diseases who were not known to the occupational physician. The method of these cross sectional studies consisted of two steps. The first step was an overall screening with a questionnaire focussing on potential dermatitis...
complaints (actual as well season related) and on potential atopic disease. The second step was an occupational health consultation for those employees who were recognised as potentially having dermatitis and/or atopic disease. Among employees in the health care sector this two step method was successful in detecting cases of occupational contact dermatitis. Hand dermatitis is a seasonal affliction, which means that a substantial part of the complaints that are detected with a questionnaire can be missed due to the delay in access to the occupational-health clinic. The implementation of this method taught us that the questionnaire survey and the occupational-health clinic must take place in quick succession.

Wet work can cause different skin problems. Besides irritant contact dermatitis mainly mycosis on the feet was found in a cross sectional study on skin disease among paper mill workers. This study assessed the burden of wet work with a questionnaire only, instead of a more accurate observation assessment. Based on the history of the individual workers and the reported occupational exposure to wet work, all skin diseases could be related to the skin irritating working conditions at the mill. The prevalence of skin disease is in range with the occurrence of occupational skin diseases in other wet work sectors, such as in nursing.

The amount of occupational wet work in the mill (assessed with questionnaire method), can be classified as a risk occupation for occupational contact dermatitis, according the German regulation TRGS 531. An observation assessment of the wet work exposure is needed to obtain more accurate data on the characteristics of these exposures. In the absence of wet work observations in a paper mill, as is the case with the preventive measures for nurses suggested in chapter 8, the preventive measures discussed in chapter 4 are based on both the observed skin diseases and the survey on wet work exposure.

The Dutch system of occupational health regulations is based on a framework of recognising health risks, setting up preventative measures and monitoring health damage. For many (work-related) exposure risks, statutory standards have been laid down. There are stringent rules for exposure to toxic substances in particular. Unfortunately, the Netherlands do not have any regulations for exposure to the main cause of occupational dermatoses – wet (work) in conjunction with detergents, cleaning agents and solvents. This exposure to substances that are irritating to the skin occurs frequently and over a prolonged period in many working situations, causing the larger part of occupational dermatoses. For some years Germany has had a standard for exposure to wet work described in TRGS 531. This standard stipulates that work where the hands are frequently and prolonged wet, i.e. longer than 25% of working time, a prevention program must be implemented.

The Dutch system of Risk Inventory & Evaluation and Periodic Occupational Health Studies could be improved. Only sporadically the employment sectors pay attention to this risk. Methods aimed at evaluating and monitoring skin risks caused by working conditions are hardly used. The Netherlands has strict legislation in relation to pre-employment examinations that examine an
increased risk of work-related complaints – in order to protect the applicant the Dutch legislator has created obstacles that prevent the employer from recognising these groups on appointment. Yet it is important that employees with an endogenously reduced skin tolerance – mainly employees with a history of atopic dermatitis – are counselled in relation to exposure to wet work.

First risk category:

Serious atopic dermatitis with regular skin changes on the hands;
Chronic recurring hand dermatitis;
Clinically relevant allergies to substances in the profession;
Occupational illness of the skin that forces a change of profession.

This category requires clear work advice and continuous support.

Second risk category:

Atopic dermatitis without skin changes on the hands;
Minor dermatitis of the hands - dyshidrosis and metal allergies in atopic diathesis;
allergic rhinitis of allergic asthma in professions where Type-I allergies (immediate type) arise easily (e.g. in bakers);
psoriasis palmaris.

This category requires technical measures at the work place. Reassessment by the occupational physician of the skin complaints every quarter for the first year and every six months in the second year.

Third risk category:

Indications for increased skin irritability - e.g. itch when perspiring, wool intolerance;
very dry skin.

For this category technical and organisational skin-protecting measures are desirable.
Reassessment of the skin complaints by the occupational physician every 6, 12, 24 months.

Fourth risk category:

Rare hereditary skin complaints, such as serious ichthyosis, epidermolysis;
dermatoses with increased light sensitivity.

For this category consultation with an occupational dermatologist is recommended.

Table 1. Principle 24 of the German professional associations on the counselling of employees with skin problems
Germany has the G-24 regulation (Principle 24 of the German professional organisations) that prescribes various levels of monitoring and support for employees with a skin problem. Table 1 is a summary of the German regulation. Based on the studies described in this thesis, an implementation of the German regulation in the Dutch situation can be recommended.

**Predisposition to hand dermatitis, influence of atopic constitution**

The threshold value for exposure to skin-irritating conditions differs from individual to individual. The threshold value is influenced by a history of skin diseases and for a large part by endogenous factors such as an atopic constitution. The lower threshold value for skin-irritating conditions has consequences for sectors with relatively more employees with atopic dermatitis. The prevalence of an atopic constitution rises quickly in a group of young employees. In the health-care sector, with many young employees, the leeway for acceptable skin exposure becomes smaller because of the increase of employees with atopic dermatitis.

The data confirm the additional risk of hand dermatitis in the event of a predisposition for atopic dermatitis. The number of employees with an atopic constitution or manifest atopic dermatitis in a working population can be greater than expected on the basis of the prevalence in the general population. The data show that the chance of developing signs of hand dermatitis in persons with a suspected atopic constitution is greater than in those who are not atopic.

A complete assessment of the risks to the skin requires not only a quantitative and qualitative assessment of exposure risks, but also an assessment of the number of exposed atotics. It is suggested to include a screening for signs of atopic dermatitis into the first step of the occupational skin disease detection method.

**Definition of wet work**

The design of a risk evaluation method of skin complaints at the work place is focused on exposure to many different factors that could damage the skin. It is difficult to assess the threshold where frequent and long-term exposure to skin-irritating conditions starts to cause skin complaints. It is particularly difficult to determine an acceptable level of exposure to wet work, the most common cause of work-related hand dermatitis. In sectors that are characterised by wet work, employees often exceed the skin’s maximum level of exposure to irritants, with dermatitis as a result. Therefore, the definition of wet work is important in terms of the assessment. Throughout this thesis, the following definition of wet work has been used:

Work where the skin of one or both hand is exposed to:
- water or watery soap solutions
- waterproof gloves, worn for such a long period that the hands become wet due to perspiration
The nature of the exposure to irritants means that the duration and frequency of the exposure determines the risk to the skin. The problem is how to determine at which level exposure exceeds a maximally acceptable threshold. In this thesis a number of methods for assessing the exposure to skin-irritating wet work conditions were studied. The degree of exposure to wet work was assessed by means of a questionnaire and by means of observations. The results of the questionnaire were compared with the findings from the observations, whereby the continuous observation method is used as the gold standard. Apparently a questionnaire does not give accurate information on exposure to skin irritants and skin occlusions: for wet work the duration of exposure will be overestimated by a factor of approximately 2, while frequency of exposure to wet work will be underestimated by about this same factor. Accurate data on exposure to skin irritants can be obtained with an observation method, although this is more expensive and too time-consuming for routine risk assessments.

In order to come to substantiated advice on adjustments at the workplace, it is crucial to know which tasks and activities cause the exposure to wet work. As expected, the characteristics of wet work in nurses differ substantially on different wards. The longest duration of wet work was seen in the Intensive Care unit: 24% of the morning shift. In Malten’s working hypothesis, the pathogenesis of irritant contact dermatitis is based on the frequency of irritating events. Dermatitis occurs when the sequence of events that irritate the skin rises above a certain frequency for a certain period of time (45). The risk of hand dermatitis from wet work might be related to the frequency of wetting-and-drying cycles, rather than the total duration of wet work. In our population of nurses there was a high frequency of wet episodes: between 30 and 49 times accounting for 10-25% of all nursing activities. The most frequent wet activities were hand washing (with disinfectant or water and soap) and glove activities. According to the German TRGS 531, nursing would require special regulation because of the frequency of wet hands.

It seems that gloves are mainly used for infection prevention, while they should also be used as personal protection against developing irritant contact dermatitis. Although prolonged occlusion can be a risk factor for hand dermatitis, our data suggest that the use of gloves in the health care sector should be promoted. It can be issued that the skin-protective effect of glove use by preventing exposure to water and soap may be greater than its irritating effect. Decreasing the frequency of wet hands by the short-term use of protective gloves would significantly lower the burden to the skin.

Reduction in wet work exposure on regular hospital wards could focus on the reduction of the frequency of hand washing and patient washing activities. We suggest using gloves in the procedure of patient washing and activities that may cause the hands to become visibly dirty. This may reduce the frequency of exposure to water and soap by 24%, although it will increase the exposure to occlusion by gloves. First a reduction of 12% water and soap exposures could be realised, and secondly another 12% reduction could be achieved when
nurses can use a hand alcohol instead of water and soap for hand disinfection following a patient-related wet activity.

This thesis also describes wet work in cleaners on the basis of continuous observation. Office cleaners’ exposure to wet work is regarded a risk factor to the German standard for this field. The mean duration of wet work during our 3-hour observations was 90 minutes, i.e. 50% of the time, with a frequency of 70 episodes of wet hands. It was interesting to note that different cleaners who performed similar tasks, had very different levels (duration, frequency) of skin exposure. Dry work was often unnecessarily carried out using gloves, while wet work activities were often carried out without glove protection. Hands were washed with soap, whereas hand alcohol or even just water could also have been used. Based on our observations and the dermatological effects when wearing gloves (61,62) an educational program could focus on:

- Using gloves more often
- Using gloves during activities that would cause the skin to be in contact with water and cleaning substances.
- Using gloves only for short periods of time and not during dry work activities
- Washing hands with water only, using soap only when the hands are visibly dirty.

In our studies, both the observed cleaning work and the observed nursing work have a higher exposure to wet work than the German standard TRGS 531 indicates. A preventative program would be indicated on the basis of the German standard for the observed working conditions. For nursing work, the exposure is primarily exceeded because of the frequency of wet work. For cleaning work, wet work exposure is largely determined by the duration of the often unnecessary and unnecessarily long wearing of gloves.

On the basis of these findings it can be concluded that in an effective preventative program, the advice must be based on the sector’s working methods and on information about the activities that cause the wet work exposure. Generally the starting point of a prevention program is that the advice may not influence the nature and productivity of the tasks. After implementation of the prevention advice, the task-related activities must be the same where possible, but the manner in which they are carried out must be less taxing to the skin. In terms of cleaning work, attention to the use, the need and the risk of wearing gloves must be explained better to the employees. By not using gloves for work that is unnecessarily carried out with gloves, skin irritation can in theory be reduced.

For nursing work, the exposure studies have made clear that prevention may aim at adapting the hand-washing procedures and the advice to wear gloves whenever possible when carrying out work with water and soap. Two additional measures for reducing exposure to skin irritants in nursing are postulated:
- Use a handalcohol in stead of water and soap in disinfection procedures, when the hands are not visibly dirty;
- Use of gloves in wet activities such as patient washing, to prevent hands to become wet and visibly dirty.

The effectiveness of these 2 additional preventive measures were studied to find out if they would lead to a situation where the same nursing activities can be performed in a less skin irritating way. Based on the results of the experimental study described in chapter 5 and 6, it can be argued that by implementing these measures a decrease in skin irritations can be seen. Without the prevention advice an increase in skin irritation was noticed on the gloved hand compared to the contralateral bare hand. However, after being exposed without the preventive measures a tendency of increased irritation from occlusion by gloves was seen. This might be the result of the combination of occlusion with water and soap exposure. Remains of the detergent on the skin may cause the additional irritation when gloves are used. Implementation of the preventive measures will reduce the exposure to soap. The increased occlusive exposure (gloves), which is part of the prevention, may have no additional irritating effect because of the almost complete elimination of soap exposure. Because these findings are based on an experimental simulation among volunteers the differences in cumulative irritating skin effects between repeated exposure to water and soap and repeated exposure to a handalcohol, in combination to short-term occlusive glove exposure, needs further investigation. A study on ‘live’ nurses would be the final goal, because this is the only way in which one can demonstrate effects of an intervention program. First the effects on the the skin of all other elements of the prevention program can be studied with experimental simulations among volunteers. The effect of the complete prevention program, based on these experimental studies, can then be studied in a large-scale study design among ‘live’ nurses on different wards for a prolonged period of time. The problem of differences in training/education methods in such a large-scale study, that could influence the outcome, should have been resolved prior to the study.

Ever since Semmelweiss published his ideas about the need for hand hygiene in natal care in Die Ätiologie, der Begriff und die Prophylaxis des Kindbettfiebers in 1861, washing the hands with water and soap forms an integral part of the daily activities of any nurse. This thesis shows that Semmelweiss’ insight did not just bring about a spectacular progress of medical science, but that it does have a drawback when it is not applied judiciously.
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