CHAPTER 1

The Epidemiology of Occupational Contact Dermatitis

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Work-related dermatoses, in particular hand dermatitis, are still among the most prevalent occupational diseases. On a visit to any manufacturing plant, one is likely to encounter workers with hand dermatitis. There is a vast literature on work-related dermatoses, particularly case reports and investigative clinical studies; their epidemiology, however, has received little attention.

Epidemiological studies play an important role in controlling outbreaks and disease trends, analyzing risk factors, and monitoring efficacy of preventive measures. Understanding the epidemiology of occupational contact dermatitis (OCD) is essential to determine etiologic factors of the disease and to make recommendations for its prevention. However, very few truly epidemiological studies of OCD have been published, and most of our knowledge about OCD is derived primarily from clinical case reports, clinical studies of groups of in- and out-patients, statistical compilations of patch-test reports, official occupational disease reports based on workers compensation agencies and state labor and health departments, or from studies of small outbreaks of skin diseases at the work place. All these data sources have their limitations and must be interpreted carefully.

In this chapter, methodological aspects of the available data on the distribution and determinants of OCD will be discussed.

What is OCD?

The vast majority of work-related dermatoses comprises contact dermatitis (90–95%); the rest are of other dermatoses such as contact urticaria, oil acne, chloracne, chemically-induced leucoderma, and infections (Hogan and Tanglerstampan 1992). A special subtype of contact allergy is mediated by immunoglobulin (Ig)E, resulting in an immediate-type contact reaction and presenting itself as contact urticaria. The clinical picture of urticaria is different from eczema/dermatitis, but after repeated episodes on the hands this contact-urticaria can eczematize, i.e., gradually progress to hand eczema (HE). Since 1989, the Finnish register of notified cases of occupational allergic contact dermatitis (ACD) has distinguished contact urticaria as a separate entity (Kanerva et al. 1996). In the past decade, this disease entity has gained increasing attention due to the increasing prevalence of contact urticaria due to latex-proteins among health care workers (Turjanmaa et al. 1996). This chapter will not be focused on contact urticaria but on studies related to contact dermatitis.

Contact dermatitis is a pattern of inflammatory response of the skin that may occur as a result of contact with external factors (allergens, irritants). The clinical picture is a polymorphic pattern of inflammation of the skin characterized by a wide range of clinical features such as itching, redness, scaling, erythema, vesiculation, and clustered papulovesicles. In chronic cases, fissuring, hyperkeratosis, and lichenification occur. The variety of morphology and natural history makes it difficult to define a widely accepted standardized definition of the disease, which is needed to compare epidemiological studies.

On etiological grounds, the two most important types of OCD are irritant contact dermatitis (ICD) and ACD. ICD results from contact with irritant substances, while ACD is a delayed-type immunological reaction in response to contact with an allergen in sensitized individuals. Primary lesions of OCD are usually found at the site of contact with the irritant or allergen; in the case of ACD, secondary lesions may occur subsequently on other sites of the body that have never been in contact with the allergen. The majority of OCD is localized on the hands, alone or in combination with other localizations (Meneghini and Angelini 1984).

Social and Economic Impact of OCD

Although contact dermatitis uncommonly leads to hospitalization, and minor degrees of contact dermatitis are often accepted as a normal hazard of life, the occupational, domestic, social, and psychological implications of OCD may be considerable. It must be
assumed that the total economic impact of OCD is very high (Table 1). OCD interacts with numerous allergens and irritants that are present in the daily household activities, in many hobbies and sports. Additionally, contact dermatitis is often localized on the hands, a highly visible area of the body, thus drawing attention and causing difficulties in social interaction. Jowett and Ryan (1985) found that, in general, 38% of patients with eczema noticed interference with social life.

In a follow-up study of 954 patients with OCD, 61% reported that they had lost time from work due to their skin disease (Wall and Gebauer 1991). About 6% of all patients had been off work for longer than 12 months continuously.

There are only a few studies that look at the costs of OCD. About 10 years ago, the total annual costs of OCD may have ranged from US $222 million to US $1 billion in the US (Mathias 1985). These estimates do not include costs of occupational retraining. In Germany, retraining costs about DM 100,000–200,000 per case; during 1993, 3150 individuals attended such a retraining program (Diepgen et al. 1995).

The Netherlands government (Ministry of Social Affairs and Employment 1997) published a report about the cost of work-related diseases and injuries. The direct medical costs, i.e., not the costs in terms of loss of income, loss of productivity etc, due to work related skin diseases was, for the year 1995, estimated to be 92 million NL guilders. This is about 42 million Euro for the Netherlands population of about 15 million inhabitants.

Despite the poor clinical prognosis of OCD, there are no recent studies regarding the costs attributable to the effects on the quality of life or activities of daily living.

### Case Ascertainment, Misclassification, and Bias

#### Clinical Diagnosis and Patch-Test Reactions

As mentioned above, in the pathogenesis of contact dermatitis, irritants and allergens are simultaneously interwoven and endogenous and environmental factors are often additionally involved. This leads to overlapping categories between ICD and ACD. In practice, the distinction is often difficult because the classifications are based upon a combination of morphological, etiological, constitutional, and other factors (Coenraads and Smit 1995).

The accuracy of the diagnosis depends on the experience, knowledge and skill level of the physician who makes the diagnosis, and on the difficulties to confirm the relationship with an exposure. Detailed patch testing or provocation tests are necessary to determine whether sensitization to certain agents had occurred, but even then it is sometimes not certain whether the contact dermatitis is of allergic origin. These patch tests or provocation tests are helpful in ACD, but are often discouraged because of high false-positive rates, irritant reactions or difficulties in interpretation. It has to be distinguished between not clinically or occupationally relevant and false-positive patch-test results. It might be often a matter of subjectivity to establish a positive patch-test result as a clinically or occupationally relevant reaction.

Additionally, false-positive reactions are also common. It was reported by Nethercott (1990), that the sensitivity and specificity of patch testing are approximately 70% with a 50% relevance for positive tests (i.e., in only half of the cases the substance inducing a patch test response be established as the cause of the patient's skin disease). In order to ascertain the validity of an instrument such as patch testing, the terms “sensitivity”, “specificity”, and “predictive value” are used. The sensitivity stands for the chance that cases with ACD are correctly diagnosed, the specificity that the non-ACD cases are correctly stated. From a statistical point of view, however, it will be more essential to calculate the positive predictive value (PPV), which is the proportion of those individuals diagnosed by the used instrument, who actually have ACD. The PPV is a function of the true prevalence of ACD in the population, the sensitivity, and the specificity (Diepgen and Coenraads 1999a,b). If, for example, the prevalence of ACD to nickel were 10% and the specificity and sensitivity of patch testing 90%, then a positive reaction results in 50% of cases diagnosed correctly. Therefore, individuals who do carry an ACD are almost always missed, while others are wrongly designated as cases of ACD. In conclusion, patch testing is less than the ideal gold standard. With ICD there are no additional confirmatory tests.

#### Case Definition and Bias

There exist further possibilities for systematic errors in samples of patients with OCD (Table 2). The lack of a standard case definition of OCD leads to difficulties in obtaining accurate epidemiological data because a precise case definition is a prerequisite for the gathering of epidemiological data. Consequently, in contact

### Table 1. The total economic impact of occupational contact dermatitis is very high according to the following costs

<table>
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<th>Description</th>
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<tr>
<td>Direct cost of medical care, workers’ compensation or disability payments</td>
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<td>Indirect costs associated with lost workdays and loss of productivity</td>
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<tr>
<td>Costs of occupational retraining</td>
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<td>Costs attributable to the effects on the quality of life</td>
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