

Review Article

The prognosis of occupational contact dermatitis in 2004

JENNIFER CAHILL¹, TESSA KEEGEL^{1,2} AND ROSEMARY NIXON^{1,3}

¹Occupational Dermatology Research and Education Centre, Skin and Cancer Foundation Inc., Melbourne, Australia,

²Department of Public Health, and ³Department of Medicine, The University of Melbourne, Victoria, Australia

The prognosis of occupational contact dermatitis (OCD) takes into account the extent of healing, effect on quality of life and employment, and financial costs for both the individual and the wider community. We reviewed 15 studies published between 1958 and 2002, reporting the complete clearance of dermatitis (range of 18–72%). 9 of the 15 studies reported a clearance rate of between 18 and 40%. Improvement was reported as an outcome in 3 studies between 1991 and 2002 (range of 70–84%). A number of common variables were identified as of possible influence. These include age, sex, atopy, patient knowledge, disease aetiology, duration of symptoms and job change; clinical, financial and social issues are also described. All of these factors need to be considered when managing a patient with OCD. Improved patient knowledge and early diagnosis may be associated with improved prognosis, whereas job change does not make a significant difference. Some patients will develop persistent post-occupational dermatitis, which has important implications for prognosis and workers' compensation. Only a small proportion of eligible patients receive workers' compensation, even though financially supported healing time soon after diagnosis may result in an improved prognosis.

Key words: allergic contact dermatitis; irritant contact dermatitis; occupational skin disease; persistent post-occupational dermatitis; prognosis. © Blackwell Munksgaard, 2004.

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Prognosis refers to the forecast of a disease over time with and without intervention (1). The prognosis of occupational contact dermatitis (OCD) takes into account the extent of healing, the effect on quality of life (QOL) and employment, and financial costs for both the individual and the wider community. Information about prognosis is useful for both medical practitioners and health or regulatory authorities, to help implement risk management of patients exposed to potential irritants and allergens, and to plan and prioritize preventative and protective measures (1).

Prognosis of OCD is difficult to quantify and compare between individuals and across clinical centres. Some individuals may be prepared to endure a certain level of ongoing dermatitis, as their continuing employment in a chosen field may outweigh the burden of physical symptoms. In clinical terms, the measurement of prognosis is inconsistent across different centres. Some studies utilize complete clearance of dermatitis as their endpoint, whereas others use improvement. Com-

parison is further complicated as measurements may vary from patient-administered postal questionnaires to clinical review by a dermatologist. The aim of this review is to look at trends over time, to identify common variables influencing the prognosis of OCD and to describe clinical, social and financial outcomes. Analysis of these factors may have the potential to improve an individual's working future and limit costs to the worker, the employer and the community. A review of the literature is timely in the light of renewed interest regarding persistent post-occupational dermatitis (PPOD) (2, 3).

Materials and Methods

The databases Medline and Web of Science were searched between 1966 and February 2004, using the terms OCD, occupational skin disease, prognosis, allergic and irritant contact dermatitis (ICD). The search was limited to articles in English. In addition, a hand search was conducted using

references from the available literature dating back to 1958. We report articles on OCD and occupational skin disease, as OCD has been estimated to comprise over 90% of occupational skin disease cases (4). More than 70 articles, including follow-up studies, case series, analyses of workers' compensation and QOL data sets, and review articles, were found and analysed for common themes. 8 major factors influencing prognosis were identified and reported. 17 studies looking at the prognosis of OCD in a group of more than 25 patients, where clearance and/or improvement were reported, were specifically reviewed. The graph was generated using STATA 7 (5).

Limitations

There are some common problems that arise in studies of dermatological populations, which limit the comparison of the literature. Diepgen (6) lists misclassification, information and selection bias as reasons for systematic error in samples of patients with OCD. Misclassification bias results from the lack of a standard definition of OCD, and the common occurrence of patients having multiple diagnoses, often including both ICD and allergic contact dermatitis (ACD) (6). It has been reported that the sensitivity and specificity of patch testing is approximately 70% (7). These figures impact significantly on the positive predictive value in a patch test population (8).

Information bias is caused by ascertainment of cases from a variety of sources, ranging from self-administered questionnaires to clinical examination (Table 1). Another factor is the use of instruments that have not been standardized or evaluated. Selection bias is also a common problem, as most studies investigate patients attend-

ing tertiary referral clinics rather than individuals randomly selected from the general population. Not all cases of work-related skin problems result in medical attention. In one workplace-based study of 234 epoxy resin workers, 17 of the 24 workers with ACD had consulted a doctor about their skin problem, and only 3 had seen a dermatologist (9). The more severe cases are generally those seen at dermatology clinics, and therefore, tend to be overrepresented in studies. Patients with ongoing skin problems are also more likely to participate in follow-up studies, as they may be seeking further medical advice and treatment. These factors lead to an overestimation of severity in studies of prognosis.

Outcomes

The majority of studies use either clearance or improvement as measurements of prognosis, where clearance represents complete resolution of dermatitis. Another outcome is persistent dermatitis in those without present occupational exposure; this condition has been termed PPOD (10).

Between 1958 and 2002, 15 studies reported the complete clearance of dermatitis as an outcome, a summary being shown in Table 1 (11–24). Clearance values ranged between 18 and 72%, 9 of the 15 studies reporting a clearance rate between 18 and 40%. Up to 1983, 4 studies reported rates below 31%. From 1989 to 2002, 11 studies reported a wide range of rates. A fitted line was generated using Lowess (robust, locally weighted) smoothing, a slight trend towards better prognosis in later studies being detected (Fig. 1). Improvement of dermatitis was reported as an outcome in 3 studies between 1991 and 2002

Table 1. Clearance rates of occupational contact dermatitis reported in studies from 1958 to 2002

Reference number	Location	Year	Number of patients (clearance rate percentage)	Follow-up time (years)	Study method	Change of work effect
11	Leeds, UK	1958	124 (23)	4–6	Q	ND
12	Northern Ireland	1972	113 (21)	10–13	CR	NA
13	Lund, Sweden	1975	555 (25)	2–3	Q	ND
14	Hull, UK	1983	188 (31)	1–6	Q	ND
15	Copenhagen, Denmark	1989	28 (50)	6	CR	NA
16	London, UK	1989	100 (25)	>2	Q	ND
17	Singapore	1991	112 (72)	1	Q/CR	NA
10	Perth, Australia	1991	954 (45)	1–8	CR	NA
18	Sydney, Australia	1993	336 (34)	1–5	Q	Beneficial
19	USA/Canada	1994	201 (63)	>2	Q	NA
20	Finland	1995	896 (59)	12	Q	Beneficial
21	Zurich, Switzerland	1996	88 (72)	1–5	Review of records	All ceased work
22	Sheffield, UK	1996	51 (18)	1–5	Q	ND
23	Turku, Finland	1999	424 (35)	2–10	Q	NA
24	Singapore	2002	45 (40)	1	Q or CR	NA

Q = Questionnaire; ND = No difference; CR = Clinical review; NA = Not assessed.

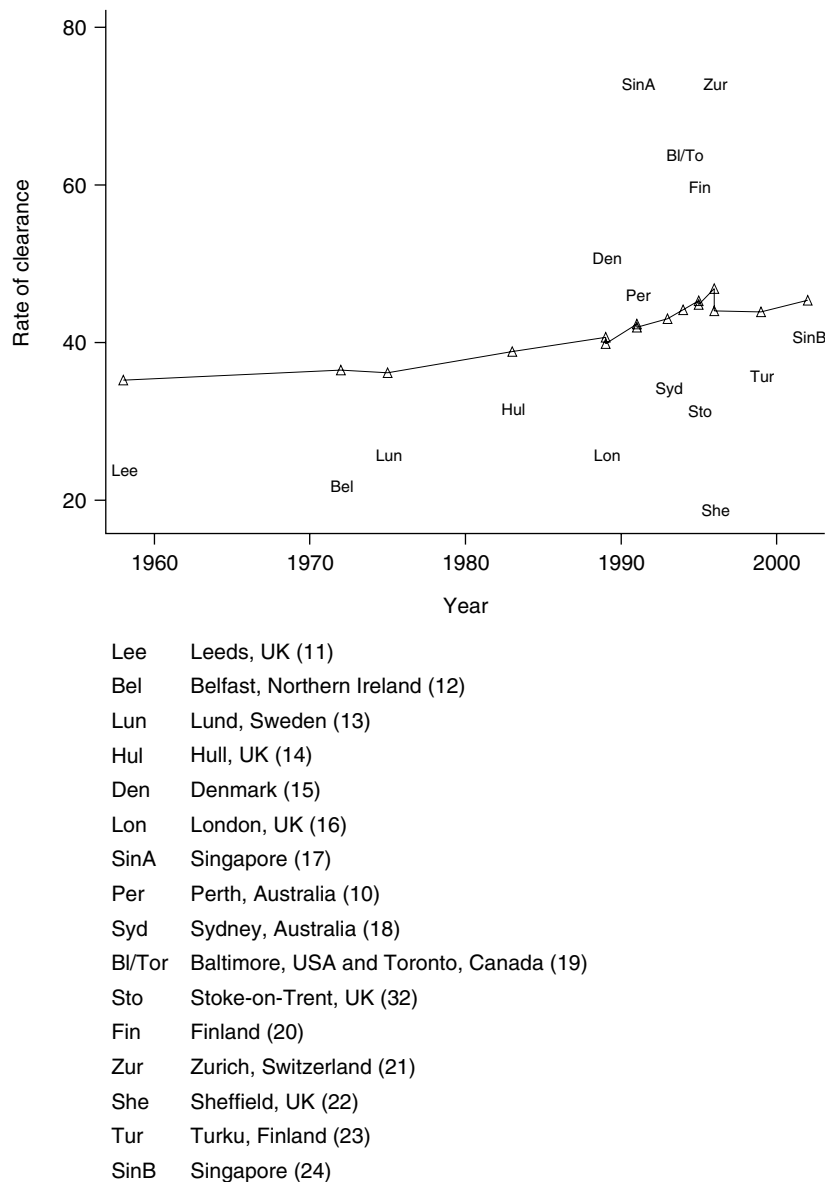


Fig. 1. Clearance rates of occupational contact dermatitis between 1958 and 2002.

(Table 2) (18, 25, 26). Improvement values ranged between 70 and 84%.

Factors Influencing Prognosis

Age

6 centres have reported the effect of age at time of diagnosis on the prognosis of OCD (11, 12, 16, 17, 19, 26, 27). In a 1958 study of 124 workers, Hellier (11) reported that 68% of workers aged over 50 years reported a diminished earning capacity compared to 53% of workers under 50. Nethercott and Holness performed a study of 201 workers from 2 clinic populations that was published in 1994. This study found that 60% of those aged over 55 reported improvement of

their skin condition since diagnosis compared to 78% aged 35–55 and 84% aged less than 35 years ($P=0.046$) (19). A second report by Holness and Nethercott on 230 workers from the same clinic populations in 1995, ascertained that workers aged over 40 were less likely to be working 2 years after diagnosis (65%) than those under 40 (90%). Older workers were also more likely to have applied for workers' compensation than those under 40 (52 and 36%, respectively, $P=0.014$), although, they were no more likely than younger workers to have a successful claim (90 and 86%, $P=0.533$) (27). In a 2002 review of 510 patients from the EPIDERM surveillance scheme, Adisesh et al. (26) reported that increasing age independently predicted time off work,

Table 2. Improvement rates of occupational contact dermatitis reported in studies from 1991 to 2002

Reference number	Location	Year	Number of patients (improvement rate percentage)	Follow-up time (years)	Study method	Change of work effect
25	Canada/USA	1991	230 (76)	2–9	Q	NA
18	Sydney, Australia	1993	336 (70.3)	1–5	Q	Beneficial
26	UK	2002	510 (84.2)	2–3	Q	NA

Q = Questionnaire; NA = Not assessed.

with the likelihood of time off work estimated to increase by 25% for each 10 years of age increase (OR 1.25).

In contrast, 3 studies suggested that age of onset did not significantly influence the prognosis of OCD (12, 16, 17). In 1972, Burrows (12) investigated a group of 113 patients in Northern Ireland and reported that 78% of those aged less than 40 had persistent dermatitis compared to 79% of those over 40. A 1989 study of 100 machine operators found that there was no significant difference in prognosis between those aged less than 50 and those aged 50 years and over ($P=0.49$) (16). Chia and Goh (17) investigated 112 patients in Singapore in 1991 and found no significant difference between the reported age groups, however, the majority of patients were in the 20–29 and 30–39 age groups, with only 20 patients aged 40 and over.

Sex

Chia reported complete clearance in 90% of males with ACD compared to 50% of women ($P<0.02$). No significant difference was seen between the sexes in the group with ICD (17). In contrast, the 1994 Nethercott and Holness (19) study found that 87% of women reported improvement from initial assessment compared to 74% of men ($P=0.04$). A 1995 study by Susitaival and Hannuksela (20) followed up 77% (896) of 1164 Finnish farmers in 1995, 12 years after they reported hand or forearm dermatoses in a questionnaire survey. No difference was found in clearance rates between men and women (56 and 61%, respectively).

Atopy

In 1993 a study of 336 patients in New South Wales, Australia, found that nonatopic individuals were more likely to report improvement in symptoms than atopic individuals 1–5 years after diagnosis (80 and 62.4%, respectively, $P<0.01$) (18). Susitaival and Hannuksela (20) reported skin atopy to be a risk factor for persistent dermatitis, with 63% of nonatopic farmers

reporting healing, compared to 47% of those with a history of skin atopy ($P<0.001$). Younger patients (<45 years) in the EPIDERM group who were nonatopic were less likely to report no improvement (13.4%) than those with a history of atopy (13.4 versus 25.4%, $P=0.04$) (26).

In contrast, a slightly better outlook was reported for atopic patients in the 1995 Holness and Nethercott study of 230 Canadian workers. Atopic individuals had lost less time from work than nonatopic individuals (27 versus 42%, $P=0.04$) and were less likely to apply for workers' compensation (29 versus 54%, $P=0.001$) (27).

ACD and ICD

In general, the evidence suggested that a poor prognosis was more likely for those with ACD (6, 13, 15, 24, 26, 28). The allergens that are more likely to cause persistent symptoms are reported to be nickel in women (rate of clearance range 7–30%) (13, 18) and chromate in men (rate of clearance range 10–72%) (13, 15, 18, 21, 24, 29). Lips et al. reported a clearance rate of 72% in 1996, in a group of 88 Swiss construction workers with occupational chromate dermatitis. These workers were all excluded from their workplace by law and given financial support after their diagnosis, which ensured strict avoidance of occupational chromate exposure (21).

In a 1990 population based study of 1238 individuals with hand eczema in Gothenburg, Meding found that 167 had ACD compared to 370 with ICD. Those with ACD had a greater number of medical consultations ($P<0.001$) and were more likely to have had sick leave because of their dermatitis, with an average mean total sick-leave time of 28.6 weeks compared to 13 weeks for individuals with ICD ($P<0.01$) (30). Avnstorp followed up 143 cement workers in 1987; 6 years after 28 of them had been diagnosed with OCD due to cement. Those with ACD ($n=17$) were more likely to have persistent symptoms and more doctors' visits in the preceding 12 months, compared to the ICD group ($n=11$) (15). A 2002 study of 45 patients with a single diagnosis of

either ICD or ACD reported that 43% of those with ACD ($n = 10$) had complete clearance of their dermatitis at 1 year, compared to 77% of those with ICD ($n = 17$) ($P = 0.022$) (24).

Other studies suggested that those with ICD tend to do worse (1, 11, 19, 27). In Hellier's (11) study, 14% of patients with ICD reported clearance compared to 32% of patients with ACD. In the 1994 Nethercott and Holness study (19), 45% of patients with ICD reported persistent symptoms compared to 29% of those with ACD ($P = 0.022$), though similar numbers of patients from each group reported improvement (77% of ICD and 79% of ACD, $P = 0.0729$).

Some studies have reported that there is no difference in prognosis between ICD and ACD (17, 18, 22). Chia and Goh (17) reported clearance rates of 70% for ICD ($n = 57$) and 77% for ACD ($n = 24$). A clearance rate of 30.3% for ICD and 38.1% for ACD was reported in New South Wales (18).

Patient knowledge

In 1991 Holness and Nethercott reported a study of 230 patients, which found that only 33% could correctly identify their diagnosis 2–9 years after initial assessment. These patients were more likely to report clearance (OR 1.95, $P = 0.03$) or improvement (OR 2.14, $P = 0.04$) of their symptoms (25). Kalimo et al. reported a trial of 424 patients in 1999, 172 of whom received extra education at the time of their diagnosis from a specially trained nurse. At follow up, prognosis was improved in the patients with ICD who received extra education ($P < 0.003$), but no difference was seen in those with ACD (23).

Duration of symptoms before diagnosis

In 1991, Wall and Gebauer (31) reported that 29% of 954 patients in Western Australia had suffered from occupational skin disease for at least 2 years before their diagnosis. A poor overall clearance rate of 45.3% was found in the follow-up report of this study (10). In a 1992 study of 120 individuals with chromate dermatitis, 33 had persistent dermatitis despite no obvious cause for the continuing eruption. These individuals had been symptomatic for more than 12 months before their chromate sensitivity was diagnosed and advice given regarding allergen avoidance ($P = 0.02$) (29). An analysis of a group of patients from EPIDERM showed that patients with persistent dermatitis had been exposed to the causative agent longer (mean 7.6 years) than those who improved (mean 5.3 years) (26).

Effect of job change

The majority of studies suggest that a change of work does not make a significant difference to prognosis (11, 13, 14, 16, 22, 27, 32). Fregert (13) investigated a group of 555 workers in 1975, 2–3 years after they were diagnosed with occupational skin disease. 26.8% of the 239 workers who had changed their job reported clearance of their dermatitis compared to 20.6% of workers who had not changed ($n = 316$). In 1995, Holness and Nethercott (27) found that 35% of individuals who had changed work still had active dermatitis compared to 46% of those who had not changed ($P = 0.09$).

In contrast, some authors report that a change of work improves prognosis (18, 20, 33, 34). Susitaival and Hannuksela reported that 50% of those with a history of dermatitis had changed their job or retired from farming. This group was significantly more likely to have clearance of symptoms than those still farming ($P < 0.001$) (20).

PPOD

In Wall and Gebauer's study, 11.5% of patients ($n = 110$) had ongoing dermatitis precipitated by prior OCD, for which there was no obvious present cause. This condition was termed PPOD (10). Lips et al. (21) reported that 28% of chromate-sensitized patients had persistent dermatitis after strict avoidance of chromate. Other persistent occupational dermatoses that have been described include post-traumatic eczema (35) and chronic occupational hand eczema in atopic individuals (36).

QOL

Since the 1990s, QOL assessment has become an increasingly used measurement of prognosis. In Meding and Swanbeck's (28) 1990 Gothenburg study 80% of patients experienced a disturbance in their social and emotional lives, considered to be due to their condition. In 2001, Hutchings et al. administered the Dermatology Life Quality Index (DLQI) (37) to 70 patients who had been diagnosed with OCD over the previous 4 years. OCD was ranked 7th most severe on a list of 15 skin conditions, which rated delayed pressure urticaria as most severe and melanocytic naevus as least severe (38). In 2001, Holness investigated QOL in 339 patients at a patch-testing clinic. It was reported that patients with OCD (39%) were more likely than those with non-work-related dermatitis to report that their skin condition interfered with sleep ($P < 0.05$), social or leisure

activities ($P < 0.05$), housekeeping ($P < 0.05$) and caused problems with partner/friends ($P < 0.05$) (39). In a 2003 review of 149 patients with ACD, 13% had changed job because of their skin condition. This group reported a significantly worse QOL than those who stayed in the same job (40).

Financial Implications

Financial costs of OCD encompass medical and treatment expenses, lost workdays and productivity, workers' compensation and retraining. There are also the economic costs attributable to effects on QOL and activities of daily living (6).

In terms of individual costs, 59% of patients in Hellier's (11) study self-reported a diminished earning capacity. Burrows (12) reported similar findings, with 58% of workers suffering financial loss, even with court awards taken into account.

In 1985, Mathias (41) estimated annual costs of occupational skin disease in the USA at approximately \$222 million to 1 billion. In 1993, Freeman (42) estimated that the annual cost of OCD in New South Wales, Australia, was at least \$12 million, including loss of productivity and workers' compensation. In Germany 3150 individuals underwent retraining because of OCD in 1993, at a cost of approximately 100 000–200 000 DM per case (6). Direct medical costs alone of work-related skin disorders in the Netherlands were estimated at €42 million in 1995 (6).

In 1983, Shmunis and Keil reported an analysis of cost variables for 958 cases of occupational skin disease in South Carolina. The most costly 5% of cases (based on medical fees, hospitalization and medication costs, compensation payments and lost work time) accounted for 68% of total expenses. Patients with a delayed referral time (longer than 1 month after employer awareness) had significantly more doctors' visits ($P = 0.002$), higher total fees ($P = 0.001$), physician costs ($P = 0.002$) and compensation costs ($P = 0.0002$) (43).

Workers' Compensation

Occupational contact dermatitis is frequently under-reported in workers' compensation data (41). Holness and Nethercott reported that only 43% of patients had applied for workers' compensation and 87% of these had successful claims (37% of the entire group). All patients were deemed to have work-related dermatitis at the time of diagnosis (27). Kalimo et al. (23) reported that 60% of patients were not aware of the outcome of their claim and had not received compensation, although, the insurance companies

had accepted 94% of the workers' skin diseases as occupational dermatoses.

Lips et al. (21) reported that prognosis was improved in chromate-sensitive patients who received financial support to enable them to cease work and avoid exposure.

Adishes et al. (26) found that medicolegal assessment was an independent predictor for length of time off work for patients reported to EPIDERM, where individuals assessed for medicolegal purposes were more than $\times 4$ as likely to have been off work (OR 4.42, 95% CI 2.20–8.89).

Persistent post-occupational dermatitis has important implications for workers' compensation, especially in the long term (3). Of 110 PPOD cases reported by Wall and Gebauer (10), 25.5% had never sought compensation and 32% had received initial compensation but subsequently no longer received assistance, despite their ongoing problems.

Discussion

Factors that have the potential to improve the prognosis and reduce the cost of OCD include improved patient knowledge of their condition, and early diagnosis and treatment. It is difficult to assess how much of the information given to a patient at diagnosis is understood and remembered, and how this influences compliance with their management plan. However, it is generally acknowledged that the more a patient knows about relevant irritants and allergens, the better the prognosis (44). Patients and employers who are aware of optimal working conditions may be better equipped to take an active role in implementation of substitution and avoidance measures, and use of personal protective equipment. Because job change is not always associated with improved prognosis, all attempts should be made to minimize current workplace exposures, and maximize patient knowledge, prior to a change of employment (45). Delayed referral time, as seen in the Shmunis study (43), was associated with significantly higher costs. This highlights the need for early diagnosis and treatment, and represents a potential area for significant cost saving if this particular group is targeted.

A relatively small proportion of eligible patients with OCD apply for workers' compensation, an even smaller proportion receiving it. The relationship between workers' compensation and prognosis has not been fully investigated. Lips et al. (21) reported improved prognosis in patients who were given financial support to cease working with chromate. Financially supported healing

time, soon after initial diagnosis, may result in an improved prognosis.

Although the majority of patients with OCD will improve over time, many will suffer from some degree of persistent dermatitis. In some cases this may be caused by failure to avoid relevant irritants or allergens, or the dermatitis may develop into PPOD, becoming self-perpetuating for reasons that are not yet entirely clear (3). In the absence of ongoing irritant or allergen exposure at work, a patient with OCD may have their workers' compensation case reviewed 6–12 months after original diagnosis. If they are incorrectly reclassified as having endogenous eczema, their workers' compensation is likely to be suspended (46).

Consideration of all aspects of prognosis in OCD, and of how they relate to each individual, will help when advising patients regarding treatment and outcome, and in the implementation of an appropriate management plan. OCD is a significant problem for workers, employers and the community, and there is a need for large, prospective and standardized studies to describe more accurately the prognosis of OCD and better to define predictive factors.

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Address:

Rosemary Nixon
Occupational Dermatology
Research and Education Centre
Skin and Cancer Foundation Inc.
Melbourne
P O Box 132
Carlton South
VIC 3053
Australia
Tel: +61 3 96399633
Fax: +61 3 96399644
e-mail: rnixon@occdern.asn.au