ECOLOGICAL CONSIDERATIONS ON NICKEL DERMATITIS

BY

POUL V. MARCUSSEN

From the Department of Dermatology, the Finsen Institute, Copenhagen, Denmark

(RECEIVED FOR PUBLICATION MARCH 6, 1959)

The incidence of nickel dermatoses has shifted from the plating industry to other occupations and particularly to non-occupational causes. A Danish survey of 621 cases shows that 4% are due to nickel plating, 9.5% to other occupations, and 86.5% were not due to occupation. A primary eruption not due to occupation had occurred in 14% of the occupational cases.

The importance of preventive measures for the community more than for the adequately controlled industry is underlined.

In 1954, Banks advanced the hypothesis that industrial premises had become safer places of work than the home where industrial products are used without guidance concerning their dangers. Moreover, individual tradesmen and artisans, using certain potentially hazardous substances without safeguards, may be sensitized before entering employment in factories. Nickel dermatitis, a case in point, is found both in factory workers and in the general population.

Previous Distribution of Nickel Dermatitis

Until 1930 many cases of skin disease in nickel platers were reported from most of the large industrial centres, for example, Berlin (Blaschko, 1889), Kiel (Schittenhelm and Stockinger, 1925), Leningrad (Kolzoff, 1926), Toronto, Ontario (Bulmer and Mackenzie, 1926), Oslo (Grön, 1929), and Geneva (Du Bois, 1931). The clinical picture of the disease agreed in the main with Blaschko's description of 1889, and often 50 to 100% of the workers seemed to be affected (Kolzoff, 1926; Schittenhelm and Stockinger, 1925; Wedroff, 1935). The disease was observed to relapse (Bulmer and Mackenzie, 1926; Grön, 1929; Schittenhelm and Stockinger, 1925) and chiefly to attack workers occupied directly with the nickel baths. In some instances the picture was complicated by corrosions and pyoderma, and as the concept of allergy was then unknown as a potential industrial hazard these phenomena were often believed to result from the actions of acid or alkali and high temperature (Bulmer and Mackenzie, 1926; Girard and

Thévenard, 1923; Kolzoff, 1926). Schittenhelm and Stockinger in 1925 performed the first patch tests with nickel sulphate, but their results were criticized by Jadassohn and Schaaf in 1929 on the basis of workmen's compensation cases in Swiss industries. However, Wedroff in 1935 showed that nearly all the cases diagnosed in Moscow presented positive patch tests. Lahiri's (1957) and Lahiri and Barat's (1957) investigations in India gave similar results.

Wedroff (1935) pointed out that mechanization of the processes had rendered cases rare in factories and that single cases among self-employed artisans occurred more frequently than in factory workers. The varying standards of hygiene found in the workplaces considered may account for the contradictory observations during this period.

During the years 1930-40, when great hygienic reforms were introduced in industry, in part on an international scale, cases in workmen employed in factories seemed to disappear completely, but there were still reports of a number of carefully verified sporadic cases in industrial workers in large-scale industries (Assnin, 1933; Feit, 1930; Foster and Ball, 1935; Fuhs, 1927; Gerstein, 1927; Goldman, 1933; Gougerot, Barthélemy, and Arnaudet, 1930; Johnson, 1941; Lewith, 1928; Nékám, 1938; Riehl, 1932). The cases mentioned by Feit (1930), namely, of sensitization by nickel plating and subsequent eruption when the patient was working in a jeweller's shop, and by Johnson (1941) of a patient's sensitization by spectacle frames and eruption during work in a bicycle factory, are of special interest in relation to the present study. In 1936, Franck detected numerous cases in the

watch-making industry, the first described outside the nickel-plating industry.

Within the same period (1930-35) observations of nickel dermatitis produced by articles in everyday use were first reported. Rothman (1930), and Preininger (1934) reported it as due to coins, Lain (1931) and McAlester and McAlester (1931) to spectacle frames, Du Bois (1932) to a wrist watch, and Fox (1933) to a spectacle frame and wrist watch. Instances have since been described of sensitivity to almost any object that is nickel plated or contains a nickel alloy.

In 1939, Bonnevie, through systematic studies, demonstrated that nickel dermatitis was no rare phenomenon, constituting 5.2% of all contact dermatoses. He gave various examples from industries and trades. Skog and Thyresson (1953) found a preponderance of cases among building workers as well as in assistants in shops, stores, and offices. Finally, Calnan (1956) demonstrated that nickel dermatitis had become very frequent, a view borne out by other investigators (Fisher and Shapiro, 1956; Lahiri, 1957). Between 1936 and 1955 nickel dermatitis rose from 7.2 to 12.9% of verified sensitivities coincident with increasing imports of nickel (Marcussen, 1959). In this period the first descriptions were published of sensitivity to articles in everyday use, and from 1940 nickel dermatitis was observed to be somewhat common in the general population. From 1936, the different occupations in which workers are exposed to nickel can be traced in our records. The incidence of nickel dermatitis was found to have risen considerably during the past 20 years parallel with the increased use of the metal in everyday articles.

In the textbooks there are few comments on this problem. Mayer (1930), Blumenthal and Jaffé (1933), and Schwartz and Tulipan (1939) still regarded the existence of nickel dermatitis as doubtful or did not mention it. Schwartz, Tulipan, and Peck (1947) stated, in agreement with Wedroff (1935), that "Dermatitis . . . is common in small electroplating establishments where proper safety precautions are usually not as rigidly observed as in the large plants."

Recent Distribution of Nickel Dermatitis

The recent distribution of nickel dermatitis in the community has been studied on the basis of 621 verified* cases diagnosed during the years 1936-55 in the Department of Dermatology of the Finsen Institute. The technique of examination remained unaltered throughout this period. As nickel

dermatitis is not recognized as an occupational disease in Denmark (Danish Workmen's Compensation Act, 1949) the investigation of compensation cases cannot have influenced the composition of the series. Of 621 patients, only 24 were shown to have been sensitized in the nickel-plating industry. This group constituted only 4% of the total series, whereas the remaining 96% had been sensitized by articles containing or covered by metallic nickel. It was, however, our impression that a much larger proportion of patients had dermatoses caused or aggravated by their occupation. All patients with dermatitis of the hands were sorted out (272 or 43.8%), and classified in 12 groups (Table 1). The remaining patients were thereafter assigned to the same groups and the percentages of dermatitis of the hands calculated. In Table 1 it is seen that in certain occupations a

TABLE 1
CLASSIFICATION OF CASES

Occupation	Number of Patients	Number with Dermatitis of the Hands
Hairdressers	12	12 (100%)
Nickel platers	25	24 (96%)
Restaurant workers (including kitchen staff)	18	16 (88.9%)
The metal industries (including all work with tools and machines)	54	47 (87%)
Sewers, tailors	36	30 (83.3%)
Nurses, doctors, dentists	12	9 (75%)
Cashiers	14	10 (71.4%)
Shop assistants (especially chocolate and articles of food)	21	15 (71.4%)
Greatly exposed occupations (30.9%)	192	163 (84.9%)
Cleaning	30	9 (30%)
Office	40	12 (30%)
All other occupations and no occupation	38	10 (26.3%)
Housewives	321	78 (24.3%)
Less exposed occupations (69.1%)	429	109 (25.4%)
Total number	621	272 (100%)

disproportionately large number of patients with dermatitis of the hands were found. Men in these occupations can therefore probably be regarded as particularly exposed. As expected, the groups accord largely with the examples of nickel dermatitis quoted by Bonnevie (1939), but differ essentially from the groups affected by detergents. All groups contain instances of sensitization by articles required for various occupations, *e.g.*, typewriters. Dermatitis of the hands was by no means always the primary eruption. The patients often exhibited a primary eruption provoked by articles used in the course of everyday life. Dermatitis of the hands was primary in only 114 cases (18.4%), while in 158 cases (25.4%) it occurred after sensitization

*Verified nickel dermatitis is defined as dermatitis with a typical distribution and a positive patch test to 5% nickel sulphate.

TABLE 2
RATIOS OF PRIMARY AND SECONDARY DERMATITIS

	Number of Patients	Dermatitis of the Hands		
		Total	Primary	Secondary
Exposed occupations	192	163	75 (39.1%)	88 (45.8%)
Others	429	109	39 (9.1%)	70 (16.3%)
	621	272	114 (18.4%)	158 (25.4%)

elsewhere on the skin. This ratio was noticed in occupational as well as in non-occupational groups (Table 2).

Fig. 1 illustrates for the occupational groups the relative importance of various types of nickel-containing objects in presensitization. Women, owing to contact with nickel-containing objects in their clothing (especially suspenders), thus have a considerably greater chance of subsequently developing nickel dermatitis of the hands in certain occupations (Fig. 2).

The proposal to abolish nickel suspenders advanced by Wells (1956) is therefore well founded. Table 5 gives a survey of the aetiology of the primary eruption.

The present study (1936-55) thus showed that only 4% of patients had been sensitized in the nickel-plating industry,* 9.5% had been sensitized in other occupations, and 86.5% sensitized unconnected with

FIG. 1.—Nickel dermatitis in the greatly exposed occupations, showing the importance of presensitization.

FIG. 2.—The aetiology of nickel dermatitis of the hands in the exposed occupations. Presensitization by nickel-plated suspenders is responsible for 45% of the cases of occupational dermatitis of the hands.

their occupation. Of the last, not less than 14% of the total were later exposed occupationally to nickel and developed dermatitis of the hands. A greater number thus had a primary nickel eruption before entering an occupation entailing exposure to nickel.

TABLE 3
SOURCE OF SENSITIZATION

Sensitized in	Number
Nickel-plating industries	24 (4%)
Other occupations	59 (9.5%)
Not employed	538 (86.5%)
Total	621 (100%)

Discussion

Published work on nickel dermatitis shows that accumulated cases in the large industries were common until 1930, but single cases not of occupational origin were not published. In the following years the disease largely disappeared from the large industries owing to improved hygiene in the work-

*A considerable error in the argument would arise if numerous cases occurred in the industry but were referred to other clinics. This is not the case. The Director of the Clinic of Occupational Diseases (Frost, personal communication) has informed us that 12 cases of nickel dermatitis were recorded during the period 1948-55, and that the Workmen's Compensation Board have registered three. Of these 15 cases, nine are included in the series under review.

shops, but in the same period an increasing number of cases were reported not originating occupationally in minor industries and among tradesmen and artisans.

Of the total number of cases of nickel dermatitis seen at the Finsen Institute during the period 1936 to 1955, only 4% could be referred to work with plating, while in 9.5% it had developed in other occupations and in 86.5% it was caused by articles in everyday use. Cases reported from the nickel industry were most infrequent during this period. Thus the results of the present study support the hypothesis that the risk of sensitization has moved from the adequately controlled industry to the uncontrolled private use of industrial products. Further, it has been found that 14% of the nickel-sensitive occupational cases have been presensitized in private life and consequently handicapped in future occupations involving the use of nickel. Our prophylactic efforts should possibly consist of informing the community as a whole of the direct hazards of dermatoses from the use of nickel and preventing those presensitized from work involving exposure to nickel. Nickel-plated suspenders should be replaced by nylon suspenders.

REFERENCES

- Assnin, D. (1933). *Arch. Dermat. Syph. (Berl.)*, **169**, 451.
 Banks, A. L. (1954). In R. M. B. MacKenna *Modern Trends in Dermatology* (Second Series), p. 6. Butterworth, London.
 Blaschko, A. (1889). *Dtsch. med. Wschr.*, **15**, 925.
 Blumenthal, F., and Jaffé, K. (1933). *Ekzem und Idiosynkrasie*. Karger, Berlin.
 Bonnevie, P. (1939). *Aetiologie und Pathogenese der Ekzemkrankheiten*. Busck, Copenhagen, and Barth, Leipzig.
 Bulmer, F. M. R., and Mackenzie, E. A. (1926). *J. industr. Hyg.*, **8**, 517.
 Calnan, C. D. (1956). *Brit. J. Dermat.*, **68**, 229.
 Danish Workmen's Compensation Act No. 176 (April 12, 1949).
 Du Bois, C. (1931). *Schweiz. med. Wschr.*, **12**, 278.
 — (1932). *Ann. Derm. Syph. (Paris)*, VII ser. **3**, 209.
 Feit, H. (1930). *Arch. Derm. Syph. (Chicago)*, **21**, 481.
 Fisher, A. A., and Shapiro, A. (1956). *J. Amer. med. Ass.*, **161**, 717.
 Foster, P. D., and Ball, F. I. (1935). *Arch. Derm. Syph. (Chicago)*, **31**, 461.
 Fox, H. (1933). *J. Amer. med. Ass.*, **101**, 1066.
 Franck, G. (1936). *Schweiz. med. Wschr.*, **17**, 232.
 Fuhs, H. (1927). *Zbl. Haut.-u. Geschl.-Kr.*, **24**, 750.
 Gerstein, H. (1927). *Ibid.*, **23**, 163.
 Girard, L., and Thévenard, S. (1923). *Bull. Soc. méd. Hôp. Paris*, 3 ser., **47**, 1612.
 Goldman, L. (1933). *Arch. Derm. Syph. (Chicago)*, **28**, 688.
 Gougerot, Barthélemy, and Arnaudet (1930). *Bull. Soc. franç. dermat. syph.*, **37**, 117.
 Grön, K. (1929). *Urol. cutan. Rev.*, **33**, 606.
 Jadassohn, W., and Schaaf, F. (1929). *Arch. Derm. Syph. (Berl.)*, **157**, 572.
 Johnson, H. H., Jr. (1941). *Arch. Derm. Syph. (Chicago)*, **43**, 575.
 Kolzoff, H. (1926). *Zbl. Gew.-Hyg.*, n.s., **3**, 339.
 Lahiri, K. D. (1957). *Indian J. Derm.*, **2**, 110.
 —, and Barat, D. B. (1957). *Ibid.*, **2**, 77.
 Lain, E. S. (1931). *J. Amer. med. Ass.*, **96**, 771.
 Lewith, R. (1928). *Zbl. Haut.-u. Geschl.-Kr.*, **26**, 348.
 McAlester, A. W. Jr., and McAlester, A. W., Third (1931). *Amer. J. Ophthal.*, **14**, 925.
 Marcussen, P. V. (1959). *Brit. J. Derm.*, **71**, 97.
 Mayer, R. L. (1930). *Das Gewerbeekzem*. Springer, Berlin.
 Nékám, L. Jr. (1938). *Zbl. Haut.-u. Geschl.-Kr.*, **59**, 244.
 Preininger, T. (1934). *Derm. Wschr.*, **99**, 1082.
 Riehl, J. (1932). *Zbl. Haut.-u. Geschl.-Kr.*, **41**, 294.
 Rothman, S. (1930). *Derm. Wschr.*, **90**, 98.
 Schittenhelm, A., and Stockinger, W. (1925). *Z. ges. exp. Med.*, **45**, 58.
 Schwartz, L., and Tulipan, L. (1939). *Occupational Diseases of the Skin*. Lea and Febiger, Philadelphia.
 —, —, and Peck, S. M. (1947). *Ibid.*, 2nd edition.
 Skog, E., and Thyresson, N. (1953). *Acta dermat.-venereol. (Stockh.)*, **33**, 65.
 Stewart, S. G. (1933). *Arch. intern. Med.*, **51**, 427.
 Wedroff, N. (1935). *Arch. Gewerbepath. Gewerbehyg.*, **6**, 179.
 Wells, G. C. (1956). *Brit. J. Derm.*, **68**, 237.