Occupational Medicine

Occupational skin disease

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Introduction

It is opportune to discuss occupational skin disorders since recently a 'Save your Skin' Campaign has been undertaken in the United Kingdom by the Employment Advisory Service of the Health and Safety Executive to increase the awareness of employers and employees of the need to prevent skin problems in industry.¹ This was justified because skin disorders caused by substances at work are the most common occupational health problem.

Contact dermatitis (eczematous dermatitis of predominantly exogenous aetiology) is the commonest form of occupational skin disease. However, other occupational skin disorders occur, often presenting to physicians of different disciplines, for example infectious conditions, occupational skin cancer, occupational vitiligo, vibration white finger. The purpose of this article is to outline the major occupational skin disorders and to give references to sources of information in greater depth.

Since 1986 certain skin diseases linked to specified types of work must be reported in the United Kingdom.² These include chrome ulceration of the nose or throat, or of the skin of the hands or forearms, in persons in work involving exposure to chromic acid or to any other chromium compound; folliculitis, acne, and skin cancer, in those whose work involves exposure to mineral oil, tar, pitch or arsenic; inflammation, ulceration or malignant disease of the skin is also reportable in those working with ionizing radiation. In addition to these listed skin diseases, anthrax is reportable whatever the person's occupation and vibration white finger is reportable in those exposed to a specified list of tools or processes in which vibration or percussive features occur. It is of interest that the most common dermatosis, contact dermatitis, is not a reportable disease under the present regulations.

Diagnosis of occupational skin disease

Early diagnosis depends upon awareness of the possibility that a presenting dermatosis can be occupational in origin. Sometimes the dermatosis is quite specific for exposure to a chemical, for example the lichenoid dermatosis seen in persons working with colour developers.³ Sometimes the dermatosis is lookalike of a non-occupational disorder, such as vitiligo, and sometimes we are faced with contact dermatitis which could equally well be due to an offending substance in the domestic environment. It is important to realise that the environment is constantly changing and new processes are being introduced. For example, grass cutting by strimmers is now known to cause a distinctive phytophotodermatitis in some individuals.⁴

A high index of suspicion arises when multiple cases of similar dermatoses occur amongst workers. However, it is important to realise that once a process is suspected as a cause of dermatitis individuals may present with their non-industrial skin complaints such as rosacea, acne, psoriasis and other common disorders in the belief that they are work-related.

Sources of information

When a dermatosis occurs, information can usually be obtained from the employers through health and safety leaflets concerning their products. Further information may be obtained by reference to the Employment Medical Advisory Service of the Health and Safety Executive. A general textbook such as *Hunter's Diseases of Occupations*⁵ can be helpful but in greater depth, *Occupational Skin Disease* by Robert Adams,⁶ *Contact Dermatitis* by Alexander Fisher⁷ and *Contact Dermatitis* by Etain Cronin⁸ are firmly established sources of reference. The journal *Contact Dermatitis*⁹ is a valuable source of current contributions to the literature. In the majority of cases referral to a consultant dermatologist is advisable. Firstly, non-occupational dermatoses can be excluded and secondly, in the case of contact dermatitis, investigation by patch testing is likely to be required and can

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only be done efficiently in a clinic organized for this purpose. The dermatologist will probably need in many cases to visit the workplace to see the process for himself.

Non-eczematous dermatitis

Animal parasites

Animal parasites as a cause of dermatoses in industry are frequently overlooked. Fleas can present with papular urticaria or even bullae in susceptible individuals; mites typically occur in grain and may affect poultry workers. Scabies is a particular hazard amongst nurses and care attendants. In geriatric and psychiatric institutions some patients have a low threshold to itching and develop an atypical crusted form of scabies which is not clinically recognized and these highly infested individuals can transfer the acarus to the attendant staff.

Some occupations demand that the worker lives in the tropics where infestations with parasites in the environment may be acquired, such as leishmaniasis seen in troops in South America and bizarre eruptions such as larva migrans.

Dermatoses due to micro-organisms

Orf is caused by a pox virus which can be identified by electron microscopy of scrapings from the lesion. This appears about 5 days after exposure to the virus as a firm, reddish-blue papule later becoming a haemorrhagic pustule, with a depressed umbilicated centre. The lesion may be associated with lymphangitis and in some cases with the appearance of a widespread rash of the erythema multiforme type. Orf particularly occurs at the lambing season, when the infection is acquired from lambs particularly those requiring hand-feeding or dosing. Treatment is to control secondary infection.

Cows suffer mild infections of the mouth and sometimes of the teats due to the parapox virus which can cause milker's nodules on the hands of attendant workers. The lesions are less acute than those of orf, but may be followed after an interval of about 10 days by a papulovesicular eruption mainly on the upper limbs. Electron microscopy of biopsy fragments is diagnostic.

Virus warts, common in the population, are much more prevalent amongst meat handlers¹⁰ and amongst workers in modern poultry packing stations.¹¹ Important factors in the latter appear to be prolonged exposure to cold and the occurrence of minor trauma to the skin from scratches and maceration. The infecting virus is always of the human papilloma virus (HPV) type. In one investigation amongst a group of

butchers, 4 different types of HPV virus were involved.

Bacterial infection of the skin with haemolytic streptococcus occurs in the slaughterhouse industry. It is also important to realise that anthrax still occurs, although very rarely in Europe, in those handling imported meat, hides or wool. Presentation is with multiple pustules on the exposed parts of the skin followed by constitutional symptoms 3 or 4 days later. Erysipeloid due to infection with *Erysipelothrix insidiosa* is seen following scratches in fishermen and butchers. Typically about 3 days after infection a sharply demarcated purplish erythema develops, usually on a finger, and spreads to the adjacent hand and can be associated with small vesicles. A minority of patients have fever and feel unwell. Sometimes a chronic form can occur. The condition is responsive to penicillin.

Folliculitis progressing to pustule formation can occur from *Pseudomonas aeruginosa* amongst divers and others wearing wet suits and can also afflict those sharing whirlpools and swimming baths.

Persons working with tropical fish can acquire an infection due to *Mycobacterium marinum*. Known as swimming-pool granuloma or fish tank granuloma, the histology is tuberculoid. The incubation period is of the order of 3 weeks and a typical lesion is a nodule present often on the back of the hands and gradually forming a superficial ulcer or pustule. The lesion can resemble an abscess. Regional adenitis is minimal. The condition responds to a combination of curettage and treatment for 6 weeks with co-trimoxazole, or with rifampicin if response to treatment is slow. The infection is often misdiagnosed and the occupation of the individual is a pointer to the correct diagnosis. Amongst farmers, infection with *Trichophyton verrucosum* from cattle can give rise to severe ringworm lesions or to a carbuncle-like lesion on the scalp known as kerion. The source of infection is not normally from the animals themselves, but more commonly from posts, gates and other surfaces against which the animals have rubbed.

Occupational vitiligo

Depigmentation of the skin can result from exposure to certain substituted phenols and catechols.¹² The depigmentation can be confined to the source of skin contact, for example in shoemakers handling an adhesive containing paratertiary-butyl-phenol, or the condition may be symmetrical and clinically identical with naturally occurring vitiligo and indistinguishable both histologically and on electron microscopy. Such cases are due to the absorption of a chemical through the skin or by inhalation.

The condition is well recorded, but owing to its resemblance to natural vitiligo outbreaks of chemically-induced vitiligo have been missed on

several occasions.¹³ If a person presents with vitiligo and there are other cases in the working environment, it is necessary to screen the workforce with Wood's lamp, since cases can be detected before they are clinically apparent by this means.¹³ There seems to be no confirmed evidence that autoimmune antibodies and autoimmune disease are associated with chemically-induced vitiligo, but in those taking a substantial amount of alcohol, liver disease is likely to be more common in the presence of some of these depigmenting agents.

Occupational scleroderma

A form of scleroderma known as vinyl chloride disease occurred in workers cleaning chemical reactors, in which they inhaled the vapour of vinyl chloride.¹⁴ The men developed symptoms resembling drunkenness from inhaling vapour in the confined space of a vat and this was followed after a long interval by sclerodermatous changes in the hands and feet with Raynaud's phenomenon and, on X-ray, erosions in the phalanges (acro-osteolysis). Hepatic damage with fibrosis and in some men angiosarcoma of the liver also occurs. Scleroderma has also been reported from solvents used for dry cleaning.

Vibration white finger

Episodic blanching of the fingers associated with Raynaud's phenomenon has recently been recognized in the United Kingdom as a prescribed occupational disease known as vibration white finger.¹⁵ In addition to blanching of the fingers on exposure to cold or on exposure to vibration if still working, tingling of the fingers, numbness and clumsiness together with interference with leisure activities such as playing darts, gardening etc, can be a severe handicap. The condition follows working with chainsaws and other percussive tools, but particularly with pneumatically driven percussive tools. Many cases have been seen in the shipbuilding industry and these men also frequently suffer from occupationally induced deafness. Unfortunately there is no clear cut diagnostic method of differentiating episodic blanching due to vibration white finger from idiopathic Raynaud's phenomenon and the history is all important, together with the exclusion of other conditions such as systemic sclerosis which can present with similar symptoms.

Acne and folliculitis

Follicular papule and pustule formation from oils, common particularly on the thighs and forearms under modern conditions, should be avoidable especially in view of the carcinogenic effects of some oils. Chloracne in which comedones occur particularly

on the cheeks, forehead, neck and behind the ears, has been reported due to chlorinated naphthalenes and more recently, chlorinated biphenyls used in the electrical industry. Chloracne occurring in a plant manufacturing trichlorophenol due to the accidental production of dioxin, and associated with severe systemic toxic manifestations occurred in Italy in 1976.¹⁶

Dermatoses due to physical agents

Repeated exposure to radiant heat can damage the skin.¹⁷ Heat can also induce disorders of sweating, e.g. prickly heat (miliaria) and dishidrotic eczema (pompholyx). In mild climates similar overheating can occur from the wearing of occlusive garments such as wet suits. Extreme cold can induce chillblains and in certain individuals the condition cold urticaria, in which an acute localized urticarial swelling develops in the area exposed to cold.

Exposure to man-made fibres such as fibre glass, rockwool and slagwool can produce itching and sometimes a scabies-like rash due to sharp particles embedding in the skin, but many workers become hardened to these after an initial susceptible period. Occasionally true immunological contact dermatitis occurs in persons exposed to fibre glass if it has been coated with a resin to which they become sensitized.

Low humidity can cause chapping and fissuring of the skin aggravated by the use of harsh cleansers. Similarly, with exposure to high humidity aggravation of existing acne and the prevalence of staphylococcal skin conditions occur.

Contact urticaria

This is an immediate-type reaction with weal and flare and can be non-immunological, immunological or due to uncertain aetiology. Non-immunological contact urticaria can occur from handling certain seaweeds, coral and algae or exposure to alcohols and preservatives. Immunological contact urticaria is particularly seen in those handling meat proteins in the catering industry including milk and raw prawns.¹⁸ Contact urticaria in the acute form can be associated with eye and throat irritation and inflammation leading to airway obstruction.

Occupational skin cancer

Skin malignancy is discussed in another article in this series, but from a dermatologist's point of view skin cancer is seen in those exposed to pitch and tar, to mineral oils and also in those who have in the past been exposed to ionizing radiation or to excessive sunlight.

The importance of exposure to ultraviolet light is paramount and skin cancers may be due to a combina-

tion of the presence of carcinogens and exposure to ultraviolet light. Workers in agriculture and other outdoor occupations in sunny climates, especially in Africa, present with numerous keratoses followed by basal cell epitheliomata and less commonly squamous cell epitheliomata. It is now being realized that the use of sunscreens, especially in childhood, in Caucasians in sunny climates, is an important prophylactic measure. In Scotland skin cancers were commonly seen amongst jute workers exposed to oil and in those working with oil shale. The shale industry has been revived and further cases are liable to occur.

Welders who may get considerable ultraviolet exposure from flashburns in the unprotected area of the sides of the face and neck and from the radiation from adjoining welders, should be protected from such scattered radiation.

Eczematous occupational skin disease

Non-immunological contact dermatitis (NICD)

The term dermatitis is in this context used synonymously with eczema. The oedema present in the epidermis gives rise histologically to the characteristic appearance of spongiosis. Acute dermatitis presents with severe redness, swelling, weeping and crusting of the skin at the site exposed to the irritant. If unchecked the dermatitis can spread to other non-affected areas and the situation may be complicated by the application of medicaments which are either irritant or to which the patient is allergic.

More commonly, the condition starts insidiously where low grade irritants are encountered. In the initial stage chapping and dryness of the skin is followed by fissuring, redness and scaling. Assuming that the hands are affected the fingerwebs and sides of the fingers and the backs of the hands tend to be affected and later the hornier skin of the palms. Such changes are seen in apprentice hairdressers who have to do large numbers of shampoos without wearing gloves. In industry a common cause of subacute non-immunological contact dermatitis (NICD) is exposure to coolant oils in light industry. Predisposing factors to NICD are the physical conditions discussed, but even more important a previous history of atopic eczema in childhood. Persons with an atopic history should be advised against taking up occupations such as hairdressing or working in the building industry where irritant cement is bound to be encountered.

Immunological contact dermatitis (ICD)

ICD is an example of a type IV delayed or cell-mediated reaction in which T-lymphocytes are involved. It is less common but very important to

diagnose as avoidance of the offending allergen may well result in recovery. Sometimes it follows irritant dermatitis, for example cement workers initially may get an irritant dermatitis and later develop allergic sensitivity to chromate. Sensitization usually requires a matter of 2–3 weeks, but often much longer, before clinical symptoms occur which often localize to the site of contact initially. Oedema of the eyelids and, in men, of the penis is very characteristic in ICD. The majority of agents causing ICD are identifiable compounds of low molecular weight which combine with protein to form haptens. The sensitizing capacity of chemicals is extremely variable. In practical terms in industry ICD can be caused by an enormous variety of sources varying from plants, such as primula, photosensitizing plants,¹⁹ nickel, cobalt, chromate, rubber compounds, epoxy resins, formaldehyde and new biocides present in detergents and cooling oils. The situation may be compounded by secondary immunological contact dermatitis to medicaments used to treat the original condition.

It is rarely possible to distinguish clinically for certain between NICD and ICD and investigation by patch testing is mandatory if cases of ICD are not to be missed. Patch testing is a skilled procedure and should only be carried out in properly organized dermatological clinics. It is very easy to produce chemical burns and false positive results by applying substances in irritant concentrations and alternatively to miss diagnosing ICD when the concentration used is too dilute.

The chosen site for patch testing is the back and the procedure should be carried out when the ICD is quiescent or preferably clear, otherwise false positive reactions can occur. Most patch test materials can be made up in soft yellow paraffin and are available for purchase from commercial firms specializing in this.

Usually it is wise to test with a standard battery of common substances causing ICD and such a battery can be based with modifications on the current recommendations of the International Contact Dermatitis Research Group (Figure 1, Table I). Having checked with a standard battery one can proceed further by testing with batteries of substances relevant to the occupation, for example, hairdressing, nursing etc, not already included in the standard battery. In addition it may be necessary to have specially made up dilutions of substances such as new resins with which the person is in contact and then tested on volunteer controls to check that the findings are meaningful, that is that the concentrations used are not irritant. All countries now have experts in patch testing to investigate ICD and sporadic patch testing by general physicians is not to be recommended, as occasionally exacerbation of existing ICD and rarely sensitization can be induced by patch testing.

The important message is that any person suffering

Figure 1 (a) Two types of 'patch test'; (b) 'Patch tests' applied to the back; (c) Positive response to cobalt and nickel.

from eczematous dermatitis must be investigated at a suitable quiescent stage by patch testing, otherwise ICD, whether due to substances at work or substances in the home or to medicaments, can readily be missed.

Reviewing the standard patch test battery (Table I), some of the important causes of ICD from the test agents used are as follows: potassium dichromate is found in cement, paint manufacture, electroplating, the printing industry, milk analysis, wood preserving and in the manufacture of colour television sets. Non-industrial sources include chrome-tanned leather, matches and wood ash. Paraphenylenediamine (PPD) is encountered in furriers, printers and laboratory workers and in non-occupational exposure to hair dye.

PPD is similar chemically to sulphonamides and may cross-sensitize also with some PPD derivatives which are used in rubber, particularly black rubber used for tyres.

Thiuram mix contains thiuram derivatives which are found in rubber, timber preservatives, paint and pesticides as well as fungicides. Persons sensitive to tetramethylthiuramdisulphide can experience worsening of their rash when taking alcohol. Neomycin sulphate is present in many medicaments and cross-reacts with other chemically similar antibiotics used topically. Mercapto mix, MBT, PPD mix and carba mix are used in detecting sensitivity to rubber compounds. Sensitivity to nickel is very common; in men it is most commonly due to occupational exposure, in women more commonly due to sensitization from clothing and jewellery. Sensitivity to ethylene diamine is of interest since persons encountering this in Triad-cortyl cream and sensitized may develop a severe rash if given aminophyllin. Epoxy resins are a potent source of ICD in industry. Balsam of Peru can be encountered from medicaments, but also from the peel of citrus fruits. Formaldehyde has caused problems in renal dialysis units. It is still widely used in industry and also occurs in deodorants. Amongst biocides used both for cosmetics and in coolant oils, kathon, dowicil and germal 115 must be considered, but sensitization from these substances is comparatively uncommon. PTBP resin used to be a problem in the shoe manufacturing industry where it is used in certain adhesives. Clearly this type of standard battery requires revision in the patch test clinic on an annual basis following a study of the incidence of positive patch tests and the occurrence of new commoner hazards in the environment.

The prevention of contact dermatitis

Persons with atopic eczema in childhood of any major degree should be counselled to avoid employment in industries where irritants are likely to be encountered, such as hairdressing. It is now recognized that some individuals have a greater susceptibility to sensitizers and an amplification of sensitivity.²⁰ In view of this, persons who have already been sensitized to one chemical should not be employed in an occupation where sensitization is a major hazard, for example, where epoxy resins are used. It is vital that management should be aware of the dangers of the workplace and devise a safe and satisfactory system of working and ensure that the workers are instructed in methods to minimise the risk of dermatitis. In particular protective clothing should be of a suitable type. It has recently been shown that gloves can readily be penetrated by certain chemicals²¹ and there is now a range of glove materials to combat this hazard. The provision of barrier creams is a useful reminder of the

Table I A standard patch test battery

1	Pot Dichrom	0.5%	16	Epoxy resins	1%
2	PPD	0.5%	17	Balsam of Peru	25.0%
3	Thiuram-Mix	1%	18	PPD Mix	0.6%
4	Neomycin Sulph	20.0%	19	Carba Mix	3%
5	Cobalt Chlor	1.0%	20	Formaldehyde	1%
6	Benzocaine	5.0%	21	Bronopol	0.5%
7	Nickel Sulph	5%	22	Kathon	100 ppm
8	Quinoline Mix	6%	23	Chlorocresol	1%
9	Colophony	20%	24	Primin	0.01%
10	Parabens	15%	25	Dowicil 200	1%
11	Mercapto Mix	2%	26	PTBP Form Resin	1%
12	Fragrance Mix	8%	27	Germall 115	2%
13	Wool Alcohols	30.0%	28		
14	MBT	2.0%	29		
15	Ethylene Diamine	1%	30		

PPD – paraphenylenediamine; MBT – mercapto benzthiazole; PTBP Form – paratertiary butyl phenol formaldehyde.

possibility of skin damage, but the efficacy of barrier creams is still a matter of controversy. Washing facilities should be such that harsh and harmful cleansers are avoided and it is particularly important

to provide an afterwork cream to prevent the damaging effect of defatting of the skin either by chemicals or by the washing process.

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