

vidual were 0.56 to 1.01 pH units. This variation would produce large changes in the physiology of *P. acnes*. Furthermore, since the comedonal pH and adjacent skin surface pH had a low correlation coefficient, this would imply that the physiology of the resident microflora on the surface and in the follicle ought to differ.

The method for measuring follicular pH in this investigation is suitable only for open comedones. However, it is important to compare the pH of normal and acne-affected follicles and the micro-electrode would seem to be the only method left available for this type of investigation.

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### Bacteria and Fungi in Severe Foot Infection

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**Abstract.** In a study of severe foot infection in 21 miners, an attempt was made to match nine clinical parameters with both bacteriological and mycological findings. Erythema was significantly more pronounced in the presence of dermatophytes but less pronounced in the presence of Gram-negative bacilli. No other clinical parameter differed in relation to the presence of particular microorganisms.

In 1957, Marples and Bailey (3) drew attention to the apparent discrepancy, that, although many of the persons they examined had some abnormality of the skin of the toeweb, only a varying proportion yielded fungus from the lesions. Marples and Bailey proposed that bacterial infection might account for some of the symptoms. With a few exceptions bacteriologists and mycologists have ignored this work and, whilst papers on bacterial infection and on fungal infection can be found, it is rare to find both groups considered together. This paper describes clinical, bacteriological and mycological investigations on a small group of miners with severely infected feet.

#### METHODS

Men attending a clinic with severe foot infection were studied. A clinical assessment was made, scoring separately for each of the following factors; pruritis, maceration, malodour, burning, erythema, weeping, bleeding, peeling and fissuring, using a scale of 0 = absent, 1 = very mild, 2 = mild, 3 = moderate, 4 = severe, 5 = very severe.

Scrapings were collected for mycological examination and a swab for bacteriological examination (transport medium). All organisms were identified to at least the generic level, using conventional tests.

#### RESULTS

The results described here are for the first occasion only on which each of the 21 men was seen. The data are analysed in two ways. The total score for all factors for each man was set against the presence or absence of each specific organism in turn (Table I). There was no significant difference between mean scores of those with vs. without a specific organism.

Each factor was then considered in turn against each specific organism (Table II). The only diagnostic feature to emerge was erythema: in the presence of dermatophytes, erythema was significantly more severe than in the absence of dermatophytes, while in the presence of Gram-negative bacilli the trend was reversed.

The species isolated in this study were diverse. The eight dermatophytes were *T. mentagrophytes* var. *interdigitale* (2), *T. rubrum* (4), *Epidermophyton floccosum* (1) and positive microscopy only (1). No *Candida albicans* was grown, but 6 men yielded other *Candida* species. Amongst the Gram-negative bacilli were *Escherichia coli*, *Citrobacter*

Table I. Analysis of total score and standard deviation (SD) in relation to the presence or absence of specific organisms

	Organism present			Organism absent		
	Mean score	SD	Number of men	Mean score	SD	Number of men
Dermatophytes	26.6	8.8	8	22.4	6.9	13
<i>Candida</i> species	21.7	6.8	6	24.9	8.3	15
<i>Staph. aureus</i>	25.7	8.4	13	21.1	6.3	8
<i>Acinetobacter</i> sp.	24.7	9.8	12	23.4	5.9	9
Gram-neg. bacilli <sup>a</sup>	21.1	6.9	10	26.2	8.0	11

<sup>a</sup> Excluding *Acinetobacter* sp.

*freundii*, *Pseudomonas aeruginosa*, *Ps. fluorescens* and *Ps. putrificiens*, *Aeromonas hydrophila*, *Enterobacter cloacae*, *Ent. agglomerans*, *Klebsiella pneumoniae*, *Proteus mirabilis* & *P. morgani*; some men carried more than one species and this diversity may mask some important factor; there was, however, no evidence that the 4 men with *Pseudomonas* species had more severe lesions than the others.

#### DISCUSSION

This investigation forms part of a study on the therapy of foot infection. There is no real evidence emerging from this study that it is possible to distinguish clinically between those who will yield fungus, yeasts, or bacterial pathogens—except in respect of erythema, which was more severe in those with dermatophytes and less severe in those

with Gram-negative bacilli. Infection of the toeweb with Gram-negative bacilli has been described by several workers and is especially recognizable when vigorous growth of *Pseudomonas aeruginosa* results in staining of the surrounding skin by the green pigment pyocyanin (1, 2, 4). Kligman & Leyden (2) describe severe foot infection with *Ps. aeruginosa* as "frightening and the patient is immobilized". Swamp foot has also been associated with *Pseudomonas* species, especially *Ps. cepacia* (5).

Our own studies and those of others such as Kligman & Leyden point to a spectrum of disease under the general term "tinea pedis". It is the very wet toeweb which seem to carry the heaviest load of Gram-negative bacilli; drier toeweb are more likely to be infected with fungus. There is some evidence that interaction between fungi and bacteria occurs in the toeweb and elsewhere and

Table II. Analysis of mean score for each clinical factor in relation to the presence or absence of a specific organism

	Dermatophyte	<i>Candida</i> sp.	<i>St. aureus</i>	<i>Acinetobacter</i>	Gram-neg. bacilli
Number of men with/without specific organism	8/13	6/15	13/8	12/9	10/11
<i>Mean score for organism present/absent</i>					
Pruritis	3.5/3.6	4.0/3.4	3.9/3.1	3.3/4.0	3.9/3.3
Maceration	3.6/3.7	4.2/3.5	3.7/3.6	3.6/3.8	3.3/4.0
Malodour	2.0/2.5	3.3/1.9	2.4/2.3	2.7/1.9	1.7/2.9
Burning	1.6/1.1	1.7/1.1	1.4/1.1	1.7/0.8	0.9/1.6
Erythema	3.1/2.2**	2.0/2.7	2.9/1.9	3.0/1.9	1.7/3.3*
Weeping	2.5/1.2	1.3/1.9	1.9/1.4	1.7/1.8	1.1/2.3
Bleeding	1.0/0.7	0.5/0.9	0.9/0.6	1.2/0.3	0.6/1.0
Peeling	3.5/4.0	4.8/3.4	3.7/4.0	4.1/3.4	3.2/4.4*
Fissuring	3.1/3.6	3.8/3.3	3.5/3.3	3.7/3.1	3.1/3.7

\* $p < 1\%$   $t = 2.95$ , \*\* $p < 5\%$   $t = 2.20$ , + $p < 5\%$   $t = 2.51$ .

the particular components of the flora which predominate depend on that interaction and on the degree of hydration of the keratin (2, 6). The ability to distinguish between the infective agents is important in terms of therapy, but the results described here suggest that no single clinical feature, except perhaps erythema, will enable the distinction to be made easily.

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## Effect of Betamethasone Valerate on the Normal Human Facial Skin Flora

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**Abstract.** Eighteen volunteers were randomly divided into two groups and allocated either an active corticosteroid preparation (Betamethasone valerate) or the basal formulation only (placebo). The cream was applied to the face

twice daily for one month. The treated area was sampled by the scrub-wash method immediately before treatment began and after 2 and 4 weeks, and microorganisms were enumerated and identified. Application of either cream produced a very slight increase ( $\leq 0.5$  log cycle) in the skin flora during the first 2 weeks of treatment. There were no significant differences in the changes occurring between volunteers treated with placebo and those on the steroid formulation. The results are discussed in relation to theories of pathogenesis of perioral dermatitis and steroid acne.

**Key words:** Steroid; Skin microflora; Perioral dermatitis

This work was undertaken in connection with a study of patients suffering from perioral dermatitis (PD). The condition is of uncertain aetiology, but responds to tetracycline therapy, suggesting a possible role for microorganisms. No obvious pathogens have been consistently isolated from lesions of PD, but disturbances in the numbers or balance of the normal flora have not been investigated. Misuse of corticosteroid creams may be the precipitating factor for PD and we have therefore investigated the effect of steroid cream on the normal skin flora of the face in healthy volunteers. Since the aetiology of steroid acne is also poorly understood, the study may cast some light upon this clinical entity.

#### METHODS

##### *Subjects and treatment schedule*

Eighteen healthy medical students (11 male, 7 female) volunteered to participate. The study was conducted in a double-blind manner, and each student was randomly allocated to either treatment A (betamethasone valerate) or treatment B (vehicle only). Volunteers were instructed to apply a small amount of cream to the side of the face midway between the mouth and the ear at night and in the morning after washing.

##### *Microbiology*

Samples were taken by the scrub-wash method (15) before treatment commenced and after 2 and 4 weeks of treatment. Numbers of bacteria in the scrub-wash fluid were determined by the method of Miles & Misra (9). Aerobic bacteria were cultured on heated blood agar plates (Oxoid Columbia agar base +5% horse blood) at 37°C for 48 hours.

Propionibacteria were cultured on Oxoid Reinforced Clostridial Medium agar + furazolidone 6 µg/ml (RCMF) for one week at 37°C in an Oxoid anaerobic jar (80% N<sub>2</sub>+10% H<sub>2</sub>+10% CO<sub>2</sub>). Numbers of the yeast *Pityrosporum* were determined by the membrane filtration method of Mulvany (10).

Gram-positive, catalase-positive cocci were differen-