

BACTERIOLOGY OF ATOPIC DERMATITIS

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Abstract. The aerobic bacterial flora of dermatitic skin, uninvolved skin, and the anterior nares of subjects with atopic eczema was investigated. A general comparison of the bacterial flora of subjects with atopic eczema, psoriasis and from a normal population was made. The incidence of *Staphylococcus aureus* in atopics was: 93%, 76% and 79% in the lesions, non-involved skin and the anterior nares respectively. For psoriatics the incidence was: 20% on the plaques, 13% on the uninvolved skin and 30% in the anterior nares.¹ The occurrence of *S. aureus* was very low on the skin of normal population (<10%). *S. aureus* was the predominant organism in the lesion of atopics and coagulase-negative staphylococci were the major bacteria in the psoriatic plaques and on the skin of the normal population. Fifty eight percent of the *S. aureus* strains isolated from atopics belonged to group 3 and 38% were nontypable. *S. aureus* strains belonging to phage groups 2 and 4 were not detected.

Key words: *Staphylococcus aureus*; Lipophilic diphtheroids

Bacterial flora of atopic dermatitis is strikingly different from the resident flora of normal skin (2, 5). The resident flora of normal skin consists mainly of coagulase negative staphylococci, micrococci and diphtheroids. Lipophilic diphtheroids are more common in the humid areas (axilla, groin and toe webs) than the dry skin. Gram negatives are noted only in moist humid anatomical sites.

Dermatitic skin provides favorable conditions for bacterial colonization and multiplication. The overgrowth of the normal flora and the colonization by certain pathogenic microorganisms not only present a threat to the patient, but also to those who come in contact with it. High occurrence of *S. aureus* in eczematous lesions have been reported (2, 5, 8). This investigation was designed to characterize quantitatively and qualitatively the aerobic microbial flora of atopic dermatitis.

MATERIALS AND METHODS

Thirty-nine subjects with an average age of 19 years were studied (range 4 to 52 years; median 16 years). Patients

receiving antibiotics were not included. A majority (93%) of the lesions were of chronic, lichenified and non-exudative types. Subjects selected for this investigation were outpatients. The sites for sampling bacteria were the anterior nares, the inflamed skin area and the adjacent non-inflamed skin (normal skin). Forty patients with psoriasis and 20 normal subjects were included for comparison.

Skin samples were obtained by the detergent scrub technique (7). The nasal samples were collected with a calcium alginate swab. Serial dilutions were prepared and cultured on appropriate media. Organisms were identified according to their biochemical and growth characteristics (3). The Kirby-Bauer method was used for determining antibiotic sensitivity of *S. aureus* strains.

RESULTS

The incidence of bacteria on the atopics and the "normal population" is shown in Table I. The incidence of *S. aureus* was high in all the test sites of atopic patients. In the normal population this incidence was less than 10% on the skin. The occurrence of lipophilic diphtheroids was 2% on the uninvolved skin, 20% in the nose and none in the lesion; on the skin of normal population the occurrence of lipophilic diphtheroids was 47% at similar sites. The incidence of coagulase-negative staphylococci was not substantially different at the tested sites.

The mean density (39 subjects) of total aerobic flora was compared (Table II). *S. aureus* counts were higher both on the normal skin ($7.1 \times 10^3/\text{cm}^2$) and in the lesions (7.5×10^4 per cm^2). When present, the density of *S. aureus* on the skin in the normal population is extremely variable. *S. aureus* was the predominant organism in the lesion and constituted 91% of the total aerobic flora. On the uninvolved skin, coagulase-negative staphylococci were the predominant organisms (63% of the total flora). Lipophilic diphtheroids were not detected on the dermatitic skin and their counts were extremely low even on the normal skin ($6.7 \times 10/\text{cm}^2$).

Percent incidence of *S. aureus* was compared in

Table I. Percent incidence of microorganism (39 atopics)

	Anterior nares	Lesions	Normal skin	Normal population (skin) %
<i>Staphylococcus aureus</i>	79	93	76	< 10
Coagulase-negative staphylococci	77	79	82	80
Micrococci	2	13	25	40
Streptococci	2	0	2	0
Non-lipophilic diphtheroids	61	15	18	45
Lipophilic diphtheroids	20	0	2	47
<i>Bacillus</i> sp.	10	15	20	20
Gram-negative rods	2	5	5	20
Yeasts	0	0	2	< 1

atopics, in patients with psoriasis and in the normal population (Table III). The incidence of *S. aureus* was higher in all the three sites of atopics when compared with the sites of psoriatics and the normal individuals.

The antibiotic resistance of 140 strains of *S. aureus* was determined. Sixty three percent of *S. aureus* were resistant to two units and 58% to 10 units of penicillin. Resistance (20%) was also noted to 2 µg of tetracycline (14%) and 1 µg of oxacillin (8%).

Phage types of *S. aureus* are shown in Table IV. Thirty eight percent of the strains belonged to group 3, and 38% were non-typable. No phage group 2 or phage group 4 strains were detected. Different

Table II. Average microbial counts in atopic eczema patients

	Anterior nares	Lesions	Normal skin
<i>Staphylococcus aureus</i>	6.5×10^3	7.5×10^4	7.1×10^3
Coagulase negative staphylococci	1.4×10^4	7.1×10^3	1.5×10^4
Micrococci	0.8×10^3	1.6×10^2	9.5×10^2
Streptococci	3.7×10	< 10	0
Non-lipophilic diphtheroids	2.4×10^1	1×10^2	4.4×10^2
Lipophilic diphtheroids	5.4×10^3	0	6.7×10
<i>Bacillus</i> sp.	< 10	< 10	< 10
Gram-negative rods	< 10	< 10	< 10
Yeasts	0	0	10

Table III. Percent incidence of *S. aureus*

	Anterior nares	Lesion	Normal skin
Atopics (39 subjects)	79	93	76
Psoriasis (40 subjects)	30	20	13
Normal adult (30 subjects)	30	—	< 10

phage types were noted in the lesions, the non-inflamed skin and the anterior nares within the same subjects.

DISCUSSION

It was demonstrated that the incidence of *S. aureus* in the atopics was not only higher in the lesions (93%) but also in the anterior nares (79%) and non-involved skin (76%). The carriage of *S. aureus* on the skin (with the exception of perineum) of a normal population is less than 10% and in the nose ranges from 10 to 45%. Not only was the incidence of *S. aureus* higher in the lesions of atopics, but it constituted 91% of the total flora. This high density of *S. aureus* is not only hazardous to the patient but may also play an important role in the field of public health. Dispersion of *S. aureus* from inflamed skin has been noted in the hospital wards (4, 6).

The incidence (93%) and density ($7.5 \times 10^4/\text{cm}^2$) of *S. aureus* were much higher in atopic lesions than in psoriatic plaques (20% incidence and $3 \times 10^2/\text{cm}^2$ density (1)). While *S. aureus* was the major organism in the atopic lesions, coagulase-negative staphylococci were the predominant bacteria in psoriatic plaques. The nasal carriage of *S. aureus* in psoriatics was comparable to that of the normal population.

Lipophilic diphtheroids are part of the normal skin flora. No lipophilic diphtheroids were detected in the lesions of atopics, and even on the un-

Table IV. Phage types of *S. aureus*

Group	Phage types ((%)
I	13
II	0
III	38
IV	0
Not typable	38
Not allotted (94/96)	12

inflamed skin their occurrence was minimal. The scarcity of lipophilic diphtheroids had also been noted in the psoriatic plaques (4% incidence) (1).

The finding that many strains of *S. aureus* (38%) colonizing the dermatitic skin belonged to group 3 was unexpected, since most staphylococci implicated in hospital epidemics in the 1950s and 1960s belonged to group 1. It is perhaps biologically fortunate for these patients that they have been colonized by group 3 and nontypable strains. Toxic epidermal necrolysis, bullous impetigo and recurrent furunculosis are most frequently caused by other than group 3 strains of *S. aureus*. The type 71 strain (group 2) has been associated with impetigo and toxic epidermal necrolysis. Whether colonization of *S. aureus* belonging to group 3 and non-typable groups was due to patient's lack of contact with the organism or an ecological preference over other strains of *S. aureus* is not known.

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DISCUSSION

Jones (Atlanta). Q: Is there any evidence that any components of the staphylococci which are on the skin are penetrating the epidermis?

A: We don't know because we did not do any sections.

Hanifin (Portland). Q: There is a peculiar reversal of the ratio between *Staphylococcus aureus* and lipophilic diphtheroids in atopic dermatitis. Could there be any relationship between this reversal?

A: We have seen the same in other conditions too. Lipophilic diphtheroids disappear first if topical antibacterials are put on the skin. These bacteria are extremely sensitive to harsh environments.