

THE ALLERGEN OF HUMAN DANDER

ITS RELATIVE CONCENTRATION IN SEVERAL SKIN AREAS AND IN APPENDAGES, PRODUCTS AND DERIVATIVES OF THE EPIDERMIS*

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The identification of the allergen of human dander in the scalp and also in the skin of the general body surface (1, 2) presents the problem of its relative concentration in various skin areas and in certain other substances derived from the epidermis. One of the chief reasons for undertaking this study was the hope that data so obtained might lead to information concerning the biological origin of the allergen.

EXPERIMENTS

Materials

The materials and reasons for their use are as follows:

1. *Scalp dander.* This was obtained from a normal scalp by combing and brushing. The concentration of allergen in scalp dander was used as a standard for comparison of its concentration in other materials.

2. *Thigh scrapings.* This was scraped from the anterior surface of the thighs with a sharp scalpel, the fine, pale gray, slightly flaky powder being collected in a Petri dish. The thigh was selected as fairly representative of the general hairy surface of the body and has the advantage of being protected by clothing from contamination with scalp dander. It is realized, of course, that eventually titrations will have to be made for many other skin areas. This material as well as sole scrapings and sweat, were obtained from the same subjects who furnished the scalp dander.

3. *Sole scrapings.* In a similar manner scrapings were obtained from the sole of the foot, the chief reason for choosing this area being the absence of hair follicles.

4. *Sweat.* This was obtained directly from the skin surface of the chest and axilla by aspiration of droplets with a tuberculin syringe. It was diluted for use with carbolized saline. This material was used because it seemed possible that the allergen might originate in sweat glands. Sweat collected in this manner may, of course, be contaminated with dander allergen from the skin surface or from the duct of the gland as the sweat passes through the cornified layer to the skin surface.

5. *Sebaceous cyst.* Contents expressed from two cysts of the skin having the typical butyric acid odor were used in the tests because, if the allergen arises from sebaceous glands it might be present in high concentration in such a cyst.

6. *Comedones.* For the above reason tests were made with comedones. These were obtained from the face of a 14 year old girl.

7. *Scalp hair.*

8. *Pubic hair.*

9. *Axillary hair.* The allergen may be present in hair or on the hair surface, having originated in the hair follicle or elsewhere.

10. *Scalp dander from a newborn infant.*

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TABLE 1

EXTRACT OF:	TESTS PERFORMED ON:	DILUTION			
		1-100	1-1000	1-10,000	1-100,000
1. Scalp dander	Patient 1		+++	++	-
	Patient 2		+++	++	-
	Control		±	-	-
2. Thigh dander	Patient 1	+++	++	-	-
	Patient 2	+++	+	-	-
	Control	±	-	-	-
3. Sole dander	Patient 1	++	±	-	-
	Patient 2	++	±	-	-
	Control	-	-	-	-
4. Sweat	Patient 1	+	±	-	-
	Patient 2	+	±	-	-
	Control	-	-	-	-
5. Sebaceous cyst	Patient 1	-	-	-	-
	Patient 2	-	-	-	-
	Control	-	-	-	-
6. Comedones	Patient 1		+++	++	±
	Patient 2		+++	++	-
	Control		±	-	-
7. Scalp hair	Patient 1	++	±	-	-
	Patient 2	++	-	-	-
	Control	-	-	-	-
8. Pubic hair	Patient 1	++	+	-	-
	Patient 2	++	±	-	-
	Control	-	-	-	-
9. Axillary hair	Patient 1	±	-	-	-
	Patient 2	±	-	-	-
	Control	-	-	-	-
10. Scalp dander (new born infant)	Patient 1	++	±	-	-
	Patient 2	+	-	-	-
	Control	-	-	-	-
11. Scalp hair (newborn infant)	Patient 1	±	-	-	-
	Patient 2	-	-	-	-
	Control	-	-	-	-
12. Body dander (newborn infant)	Patient 1	++	-	-	-
	Patient 2	+	-	-	-
	Control	-	-	-	-
13. Amniotic fluid	Patient 1	-	-	-	-
	Patient 2	-	-	-	-
	Control	-	-	-	-
14. Lens of eye	Patient 1	-	-	-	-
	Patient 2	-	-	-	-
	Control	-	-	-	-
15. Nail	Patient 1	-	-	-	-
	Patient 2	-	-	-	-
	Control	-	-	-	-

11. *Scalp hair from a newborn infant.*

12. *Body scrapings from a newborn infant.* Tests with these materials from a newborn infant were made with the idea of testing with substances having a minimum of contamination with bacteria and other external agents. A stillborn infant, born at term, was the source of the material.

13. *Amniotic fluid.* This substance was used because of its contact with the fetal epidermis and for the reasons just given.

14. *Lens of the eye.* A lens removed in an operation for cataract was used in the tests because the lens is a derivative of the fetal ectoderm, and for this reason might conceivably contain dander allergen.

15. *Nail.* A toe nail was used in the tests because it is a derivative of the epidermis.

Methods of preparation

Hair was cut repeatedly with a sharp scissors into lengths of a fraction of a millimeter. Fluid from the cysts was allowed to dry. The nail was scraped to a fine powder with a razor blade. These materials and also the comedones and body and scalp danders were extracted with ether, the latter being removed by decantation and discarded. (Previous tests showed the ether extract to be inactive.) The dry, fat-free material was weighed and extracted with carbolized (0.40%) normal saline, the dilutions shown in Table 1 being expressed in grams per 100 cubic centimeters. Supernatant fluid was drawn off for the dilutions without filtration because the small amounts of material involved (10 mg. in the case of the comedones) would have resulted in loss of active material by adsorption to the filter. The lens was weighed in its natural condition, crushed and extracted without preliminary ether extraction. Amniotic fluid was filtered through a Seitz filter and diluted for use. The tests were performed by the intracutaneous method in serial dilutions from 1:100 to 1:100,000, the volume injected per test being 0.02 cc. The syringes were cleansed thoroughly with concentrated sulphuric acid and potassium dichromate before use and before changing to another extract. Tests were performed on two patients known to be allergic to human dander and also on a non-sensitive control subject.

RESULTS

The results, shown in Table 1, indicate that scalp dander and comedones are good sources of the allergen and that scrapings from the thigh and sole of an adult and from the thigh and scalp of a newborn infant, sweat, hair from the scalp, pubis and axilla are relatively poor sources, these specimens having less than one tenth the amount present in scalp dander. Presence of the allergen was not detected in two sebaceous cysts, lens, nail, or amniotic fluid nor in hair from a newborn infant. (It may, however, be present in some of these substances in concentrations too low to be detected by these methods and in these dilutions).

DISCUSSION

The relatively high concentration of allergen in comedones is of interest. The cellular debris of the comedone, apparent after ether extraction, is derived from the epidermal cells of the follicle and to some extent also from the sebaceous

glands. It is analogous to dander from the scalp or other skin surface. The allergen apparently is formed in greater concentration or is retained and accumulates in these locations to a greater extent than in the other substances studied. The presence of some detectable quantity, although not great, in scrapings from the sole of the foot, and the failure to detect allergen in sebaceous cysts, suggests that the allergen is associated with the epidermis itself and that it is not necessarily connected with hair follicles or sebaceous glands. Its presence in sweat is not unexpected since the sweat passes through the cornified layer in direct contact with the epidermal cells, bathes the skin surface and would necessarily dissolve any soluble substance present. The high concentration of allergen in comedones is evidence against its origin in sweat glands. The presence of allergen in extracts of hair may result from allergen in the hair itself or from its presence on the hair surface. Its apparent absence in lens is not unexpected since different physical alterations of ectoderm are probably associated with different chemical, and hence allergenic alterations. The presence of allergenic activity in fetal epidermis is of special interest because of its bearing on the problem of the biological origin of the dander allergen.

Because of the importance of the principle of sensitivity to autogenous and homologous allergens, local *passive transfer* was attempted and was successfully accomplished in two recipients. The reagin-bearing serum was obtained from a 15 year old child with atopic dermatitis and the allergenic extract used was prepared from the epidermis of a newborn infant. This extract gave a negative reaction in control sites on the recipients. Carbolized saline injected into sensitized sites also gave negative reactions. Syringes were tested for allergenic contamination before use by doing intracutaneous tests with carbolized saline on the patient from whom the reagin-bearing serum was obtained. Only syringes which gave negative reactions were used in the experiment.

In view of these findings it is very probable that the allergen is not derived from a microorganism but rather that it arises in and from the skin itself. There are two locations in the skin in which cells are degenerating and hence locations in which there is the possibility of allergenic transformation. These are: 1. The sebaceous glands, where cells are being pushed to the gland orifice where they degenerate to form sebum, and 2. The epidermis in the region of the stratum granulosum and stratum lucidum, where cells are degenerating to form the stratum corneum. Unpublished studies of the histopathology of early lesions and the evidence presented here suggest the latter rather than the former location.

SUMMARY

Titration for the presence of human dander allergen was made by performing intracutaneous tests with serial dilutions of extracts of various substances. Scalp dander and comedones were found to be good sources of the allergen. Scrapings from the thigh and sole, sweat, hair from the scalp, pubis and axilla and scrapings from the thigh and scalp of a newborn infant were found to contain less than one tenth the amount present in scalp dander. The presence of aller-

gen was not detected in sebaceous cysts, lens, nail, amniotic fluid, nor in hair from a newborn infant.

The presence of allergen in the epidermis of a newborn infant, demonstrated by direct tests on patients and by local passive transfer experiments, is evidence that the allergen arises in the epidermis itself rather than from a microorganism or other external agent.

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