

From the pediatric department, Sundby hospital, Copenhagen, Denmark.
Chief: C. Friderichsen, M.D.

ON THE ABILITY OF THE SKIN
OF INFANTS AND YOUNG CHILDREN TO FIX
SKIN SENSITIZING ANTIBODIES

*Passive Transfer by the Method of
Prausnitz-Küstner*

By

TAGE SAMSØE-JENSEN and KRISTINE HAUGE KRISTENSEN

Passive transfer by the method of Prausnitz-Küstner presumably involves the fixation of skin sensitizing antibodies to the endothel-cells of the cutaneous vessels. The presence of a normal functioning capillary network is necessary for the appearance of the wheals, which are characteristic of a positive Prausnitz-Küstner reaction.

Most normal, non-allergic persons will be sensitized very easily by passive transfer. Now and then the antibody does not confine itself to the local site, and the entire skin may even be sensitized in this way. (*Feinberg*) (5).

A small percentage of individuals are considered to be "poor receptors", whose skin apparently does not possess the ability to fix the antibody and react with the corresponding antigen (*Walzer*) (13). *Coca & Grove* (4) found that a positive Prausnitz-Küstner reaction could only be elicited in 86 (84 %) of 103 normal subjects. *Urbach* (12) states that

Aided by a grant from King Christian X Fond.

We are greatly indebted to Michael Schwartz, M.D. who kindly supplied us with the dried serum and to Carl Lund, Pharm. Dr. for technical assistance.

the skin of elderly or weak individuals is not suitable for passive transfer.

On the other hand *Schwartz* (9, 10) using an antibody with a high titer found no "poor receptors" among 130 persons from 18 to 96 years old.

The ability of the skin of children to accept atopic reagins does not seem to have been investigated before, especially not in premature and fullterm, newborn infants.

Such a study will be reported below.

MATERIALS AND METHODS

The serum used for passive transfer was produced in 1945 by the State Serum Institute, Copenhagen from the pooled sera of 14 grass hay fever patients. Despite 12 years of storage the activity of the grass-pollen antibody does not seem to have diminished.

A ten per cent serum solution was made with 0.9 per cent saline and dispersed in 2 ml. vials. In all cases sensitized skin sites were prepared on the anterior aspect of the forearm with 0.1 ml. of the serum solution.

The antigen used throughout was an extract of Timothy, 1 per cent solution, 0.03 ml. being injected for the elicitation of the Prausnitz-Küstner reactions.

The subjects totalled 105 children, 59 boys and 46 girls. The weights of the children ranged from 1380 to 14980 gr., comprising premature and fullterm babies and young children below 2 years of age. The diameters of the wheals, measured by means of a plastic ruler, are recorded related to the weights. Girls and boys are considered separately.

RESULTS

From table 1 it will be seen that the individual reactions are rather marked and too that no subject failed to react. *Walzer* (13) who supposed the existence of "poor receptors" administered the allergen by mouth. It is well known, however, that this indirect way of eliciting the Prausnitz-Küstner tests (distant reaction) cannot wholly be compared with the direct one, which we used, as several factors influence the passage of the allergen to the sensitized skin cells e.g. the condition of the intestinal mucous membrane and the permeability of the skin vessels.

TABLE I

The size of the individual skin reactions related to the weights.

Weight-groups in grams	Weight in grams girls	Diameter of wheals in mm	Weight in grams boys	Diameter of wheals in mm
1000-2500	1380	12	1400	8
	2030	11	1920	13
	2260	9	1920	9
	2310	10	2090	13
	2380	11	2350	8
	2410	12	—	—
2501-4500	2550	10	2650	10
	2700	17	2720	11
	2800	15	2730	15
	3000	11	3520	12
	3020	10	4020	12
	3100	10	4150	9
	3330	11	4250	11
	3760	13	4260	14
	4300	17	4350	11
	—	—	4510	18
4501-15000	4670	18	4600	14
	5700	12	5430	15
	5850	15	6020	12
	5850	15	6050	15
	6070	16	6750	17
	6160	15	6760	12
	6390	12	7010	12
	6990	15	7050	15
	7500	16	7090	14
	7500	13	7120	16
	7730	10	7470	15
	7950	13	7500	14
	8140	13	7520	13
	8300	17	7520	17
	9000	12	7550	13
	9120	13	7900	16
	9500	14	7950	12
	9500	13	8250	13
	9550	14	8380	15
	9550	16	8400	15
	9650	13	8500	16
	10000	14	8540	14
	10050	16	8750	13

TABLE 1 (cont.)

Weight-groups in grams	Weight in grams girls	Diameter of wheals in mm	Weight in grams boys	Diameter of wheals in mm
	10150	11	8870	14
	10330	18	8950	16
	10350	16	9060	11
	10600	14	9170	15
	11060	12	9650	12
	11250	20	10350	16
	11580	14	10520	13
	11800	14	10650	17
			10990	12
			11150	18
			11200	14
			11250	14
			11250	12
			11350	12
			11580	18
			12200	12
			12550	11
			13100	12
			13550	11
			13670	12
			14980	18

Our findings so corroborate those of *Schwartz* (9) who concluded that "poor receptors" probably are very scarce, when a skin sensitizing antibody with a high titer is used.

Schwartz (9) found too that old people (both women and men) had significantly stronger skin reactions than younger ones and that women had larger wheals than men. He suggested that the larger wheals in old people might be due to the diminishing blood circulation of old skin, with the consequent possibility for histamine (or H-substance), released by the antigen-antibody reaction, to act for a longer time, before it is carried away by the blood stream. A larger wheal should be the result. In another study (10) he admits, however, that the cause is quite obscure and may be something quite different from circulatory changes in the skin.

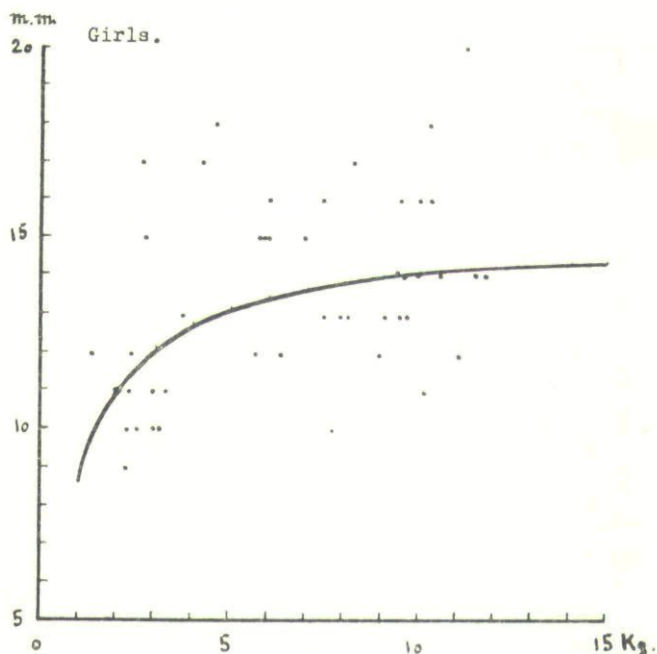


Fig. 1.

Connection between the size of the wheals and the weight of the children (girls).

From a statistical calculation of the present skin reactions it will be seen (figs. 1, 2 and 3), despite a great variation, that the size of the wheals increases with increasing weight, equal for girls and boys. This phenomenon has not been described previously, as far as we know.

DISCUSSION

It is a well-known fact that the skin of children in the first few years of life is an unfinished organ. It is in development into the adult form anatomically and physiologically (*Becker*) (3).

This development too affects the capillary networks. By means of capillary microscopy the gradual change of the capillaries from a predominantly horizontal plexus structure

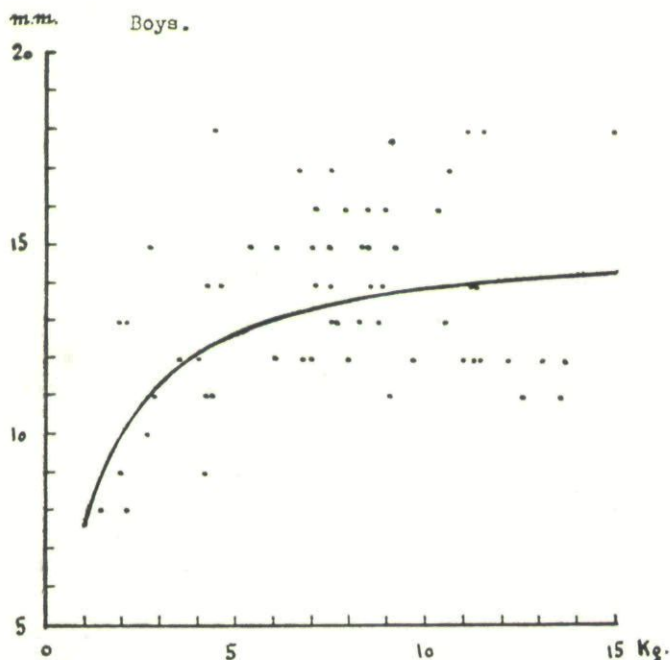


Fig. 2.

Connection between the size of the wheals and the weight of the children (boys).

to that of an end loop structure has been observed. Opinions differ widely, however, on the time the capillary networks require to reach the adult form. *Mayer* (7) set the age limit at 3 years and *Andreew* (1) at 2. *Arajärvi* (2) concluded that the capillaries—at any rate in the conjunctivae—have reached their definitive form, when the children are from 6 to 8 months old. She showed too that the capillaries in premature infants under a certain weight reacted more slowly to adrenalin than did the capillaries of infants with a larger birth weight.

It is an obvious possibility, which suggests itself, that the increasing intensity of the cutaneous reactions, which we have demonstrated may be due to the increasing "maturation" of the skin, perhaps especially of the capillary networks.

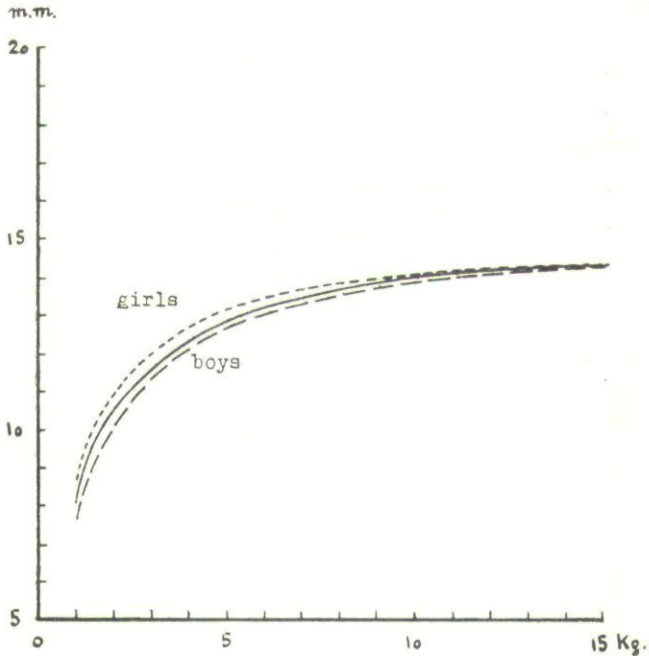


Fig. 3.

Connection between the size of the wheals and the weight of the children (total material).

This point of view, though hypothetical, seems justified. The shape of the curves, presented above, is quite similar to those, which have been found as expression of the function of other organs, investigated during prematurity and infancy e.g. the function of the stomach (*Flensborg*) (6) and of the kidneys (*Tudvad*) (11).

EXTRACT FROM STATISTICAL REPORT

By introducing the reciprocal values instead of respectively the weights of the children and the diameters of the cutaneous reactions a normal distribution of the observations about a straight regression-line is obtained.

The statistical analysis and report have been made by Poul Aarøe-Jensen, Lic. Act.

A comparison of the reactions in girls and boys nearly shows the same variance ($v^2 = 1.041$, $f_1 = 57$, $f_2 = 44$).

No difference can be demonstrated neither in the slope of the lines ($t = 0.90$, $f = 101$), which is significantly different from 0 ($t = 6.38$, $f = 101$), nor in their mutual position ($t = \div 0.95$, $f = 101$).

The curves in fig. 1 and 2 show the connection between the intensity of the cutaneous reactions and the children's weights and the variation of the single measurements. In fig. 3 the curve for the total material will be seen in addition.

SUMMARY

Passive transfer by the method of Prausnitz-Küstner was made into the skin of 105 children with the weights ranging from 1380 to 14980 gr. A 10 per cent solution of a dried serum, containing grass-pollen antibodies, was used. No "poor receptors" were demonstrated. The size of the urticarial wheals was the same in girls and boys. From a statistical computation an increasing cutaneous reactivity with increasing weight was demonstrated. It is suggested that this phenomenon may be due to the gradual anatomical and physiological maturation of the skin.

REFERENCES

- 1) *Andreev, J.*: Capillaroskopische Studien an sofioter Kindern. Zschr. f. Kinderheilk. 49, 600-604, 1930.
- 2) *Arajärvi, T.*: Microscopic investigations into the capillaries of newborn, especially premature infants. Thesis. Helsinki 1953.
- 3) *Becker, J.*: Anatomische Aufbau der Haut im Kindesalter. In Pfaundler und Schlossmann: Handbuch d. Kinderheilk. Berlin 1935.
- 4) *Coca, A. F. & Grove, E. F.*: Studies in Hypersensitiveness. XIII. A Study of the Atopic Reagins. J. Immunol. 10, 445-464, 1925.
- 5) *Feinberg, S. M.*: Allergy in Practice. Chicago 1946, pp. 838.
- 6) *Flensburg, E. W.*: The gastric secretion in normal and ill infants and small children. Thesis. Roskilde 1944.
- 7) *Mayer, K. M.*: Observations on the Capillaries of the Normal Infant. Am. J. Dis. Child. 22, 381-387, 1921.
- 8) *Prausnitz, C. & Küstner, H.*: Studien über die Überempfindlichkeit. Zentralbl. f. Bakt. 86, 160-163, 1921.
- 9) *Schwartz, M.*: Studies in Passive Transfer of Skin Sensitizing Antibodies (Atopic Reagins) to the Skin of Young and Old Individuals. J. Gerontol. 9, 36-42, 1954.

- 10) *Schwartz, M.*: Studies in passive transfer of skin sensitizing antibodies (atopic reagins). The effects of topical administration of steroids on the skin of old individuals. *Acta Allergol.* 7, 403-408, 1954.
- 11) *Tudvad, F.*: Blodsukker og sukkerudskillelse hos præmature. Thesis. København 1955.
- 12) *Urbach, E.*: Allergy. New York 1946, pp. 968.
- 13) *Walzer, M.*: Studies in Absorption of Undigested Proteins in Human Beings. *J. Immunol.* 14, 143-174, 1927.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.