Responsiveness of Sweat Glands to Adrenaline in Skin Diseases. III

By

Yoshio Saito

(齋藤 佳雄)

*From the Department of Dermatology, Faculty of Medicine,
Tohoku University, Sendai; Director: Prof. M. Itô*

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I. Change of A.S.T. accompanying the Progress of the Malady (See Table I)

Wada-Takagaki's A.S.T. (adrenaline sweating threshold) tests were conducted on 57 skin and urogenital disease patients before and during their treatments and after recovery for the purpose of following up the change in their A.S.T. According to Wada¹⁾, the A.S.T. values in healthy adults showed no change throughout the year, but Kimura²⁾ and Ôtsuji³⁾ admitted some seasonal variation in A.S.T. values in patients and reported that the change in A.S.T. values may be serviceable in prognostication in some cases of diseases such as tuberculosis. In my findings, normalization of A.S.T. means the approximation to the value of 10^{-6} and 10^{-7} either by rising from a lower or falling from a higher A.S.T., and 22 cases that showed such a normalization presented simultaneous improvement in their situation without exception. On the other hand, denormalization means further deviation from the normal values of 10^{-6} and 10^{-7} , either by rise or fall of A.S.T., and 3 cases showing such denormalization by rise of A.S.T. showed aggravation in their progress, but no such aggravation was observed in denormalized cases by the fall of A.S.T., cases showing no change in A.S.T. generally showed little change in their progress either. Such minor surgical operations as extirpation of affected site in Osmidrosis axillae, epididymectomy and implantation of cow's pituitary gland did not affect the A.S.T., but one tuberculosis renalis patient retained a high A.S.T. even three weeks after nephrectomy, without coming down to the normal value. The alopecia areata multiplex patients who had improved in their situation by implantation of cow's pituitary gland usually showed normal A.S.T. values in affected areas and negative in Thorn's tests. From these facts it is suggested that the function of vegetative nerves was adjusted by that treatment.

TABLE I
Change of A.S.T. Value accompanying the
Progress of the Malady

Diagnosis	Total cases	Normali- zation	Denormali- zation	No change
Eczema chronicum	3			3
Neurodermitis disseminata	2	2		
Erythema exsudat. multiforme	2	1	1*	
Erythema annulare centrifugum	1			3
Erythematodes	3	1	2*	
Toxicodermie	1	1		
Prurigo nodularis	1	1		
Purpura rheumatica	1		1	
Erythrodermia desquamativa	2	1	1	
Urticaria acuta	1	1		
Eczema seborrhoicum	1	1		
Acne rosacea	1	1		
Psoriasis	2	2		
Parapsoriasis guttata	1	1		
Tuberculosis cutis	9	1	2	6
Vitiligo	1	1		
Alopecia areata	9	2	4	3
Pityriasis rubra pilaris	1		1	
Fungus poisoning	1		1	
Mycosis fungoides	1		1	
Syphilis II latens	1		1	
Diabetes insipidus	1	1		
Osmidrosis axillae	2			2
Epididymitis tuberculosa	5	3	2	
Tuberculosis renalis	3		1	2

Gothic type: Recovery or improvement. *: Aggravation. Other cases: No improvement.

II. Variation of A.S.T. by Sites of the Body

The difference, if any, in the A.S.T. values of skin areas in the extensor surface of the forearm and the bend of elbow, the extensor and flexor surfaces of the forearm, the flexor surface of the leg and the popliteal space in undiseased conditions were measured by 121 skin disease patients and 30 healthy controls (Table II). Kuno⁴⁾ had reported that the quantity of sweating was different according to the bodily positions, but Arai⁵⁾ reported that the excitability of sweat glands was individually constant in any part of the skin, except the face and the backs of the hands and

feet, in his tests with adrenaline and acetylcholine. In my tests on 30 subjects in normal health, the results showed no difference in the A.S.T. on the extensor side of the forearm and the bend of elbow, and in the extensor and flexor surfaces of the forearm. Similarly, the tests on 6 healthy subjects revealed that the A.S.T. values on the flexor side of the leg and the popliteal space were of the same. No difference of A.S.T. value by sites was observed among about 30 kinds of dermatoses patients (78 cases) but some dermatoses that presented different values by sites were shown in Table II. Namely, 28 of 39 tested cases showed difference, and it is noteworthy that in many cases of neurodermitis, atopic dermatitis and eczema seborrhoicum the A.S.T. at the bend of elbow, the predisposing area of these diseases, was found to be higher value than that on the extensor side of the forearm. 14 out of the 29 tested cases showed no differ-

TABLE II
Differences of Sweat Glands Excitability to
Adrenaline by Sites

Diagnosis	Comparison of A.S.T. values						
	Cases	a* < b†	a > b	a = b	Cases	b < c‡	b > c b = c
Neurodermitis	10	7	1	2	7	3	4
Atopic dermatitis	3	1					
Eczema seborrhoicum	9	7	1	1	10	3	1 6
Prurigo nodularis	1	1		0	1	1	0
Eczema chronicum	3	2		1			
Ichthyosis vulgaris	3	1		2	3	1	2
Erythematodes	3	2		1	4	1	2 1
Perniosis	1	1		0	2	1	1
Keratosis palmoplant. hered.	1	1		0			
Pityriasis rubra pilaris	1		1	0			
Erythema scalatinif. recid.					1		1 0
Acne rosacea	4	2		2			
Acne vulgaris					1		1 0
	39	25	3	11	29	10	5 14

*, A.S.T. value in bend of elbow, †, the value in extensor surface of forearm, ‡, the value in flexor surface of forearm, > the former shows lower A.S.T. value than the latter, <, the former shows higher value than the latter, =, both areas show equal value.

ence in the excitability in the extensor and the flexor sides of the forearm. But 15 showed some difference, the neurodermitis, eczema seborrhoicum, ichthyosis vulgaris and prurigo nodularis cases showed decreased excitability in the extensor side, the side preferred by the diseases to the

other. Only 2 out of the tested 11 cases showed any difference in the A.S.T. in the leg and the popliteal space.

III. Relation of A.S.T. to Aschner's Phenomenon

Before testing 585 subjects with skin diseases for their A.S.T., the change in their pulsation by eyeball pressure was measured, those with decrease of more than 20 pulses per minute being classed as positive and those with decrease of below 20 per minute as negative. This Aschner's test is used as an auxiliary method in diagnosing hypertony of parasympathetic nerves, of which the resultant decrease of pulse frequency is an index. As shown in Table III, no relationship between the A.S.T. and the results of Aschner's tests was found so that it became clear that the A.S.T. is no index to the degree of parasympathetic nervous tension.

TABLE III
Relation of A.S.T. Value to Aschner's Phenomenon

Aschner's p.	Cases	A. S. T.									
		Concentration of adrenaline in 0.9% saline solution								Percentage by groups	
		10 ⁻¹⁰	10 ⁻⁹	10 ⁻⁸	10 ⁻⁷	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴	Negative	10 ⁻¹⁰ ~10 ⁻⁸	10 ⁻⁷ ~10 ⁻⁶ 10 ⁻⁵ ~negative
Positive	142	5		18	29	56	15	9	10	16.3	59.9
Negative	443	10	2	63	147	129	45	27	20	16.9	62.3

Subjects with decrease of more than 20 pulses per minute are classed as positive, and those with decreases less than 20 per minute as negative.

IV. Comparative Tests of Adrenaline and Acetylcholine for their Excitation of Sweat Glands

The tests were conducted in the same manner as described in the first report on the undiseased parts of extensor surface of forearms with 52 skin disease patients, using adrenaline in one side and acetylcholine in other side.

Kimura⁶⁾ had tested the excitability of sweat glands of 366 healthy subjects with adrenaline and acetylcholine and found a positive relation between the values obtained with the two agents, giving the normal values of 10⁻⁷ for adrenaline and 10⁻¹³ for acetylcholine. Ôki⁷⁾ had reported that the high-aged subjects with high A.S.T. showed also high threshold of sweating with acetylcholine. Akasaka⁸⁾ has measured the time taken for incipient sweating after injection of adrenaline, acetylcholine and pilocarpine in a certain concentration in the diseased areas of skin disease patients and in control healthy parts, and found that the three formers presented parallel effects each other. In my tests, I found that the sub-

TABLE IV
Comparative Tests of Adrenaline- and Acetylcholine-
Sweating Threshold Values

Concentration of adrenaline	Concentration of acetylcholine								
	10 ⁻¹⁹	10 ⁻¹⁸	10 ⁻¹⁷	10 ⁻¹⁶	10 ⁻¹⁵	10 ⁻¹⁴	10 ⁻¹³	10 ⁻¹¹	*Negative
10 ⁻¹⁰	1		2	5					
10 ⁻⁹				1					
10 ⁻⁸		1	4	5	1	8	3		
10 ⁻⁷						1	6		
10 ⁻⁶			1	1		2	5		
10 ⁻⁵								1	
Negative†									4

*; No response to 10⁻¹⁰ concentration, †, No response to 10⁻⁴ concentration.

jects with A.S.T. of 10⁻⁷ or 10⁻⁶ showed the threshold value of 10⁻¹³ with acetylcholine, which I take for the normal values, and also found a parallelism between the higher and lower A.S.T. values and the higher and lower acetylcholine threshold values.

Kimura²⁾ and Ôtsuji³⁾ have assumed that the A.S.T. values obtained by the tests in the manner I have adopted express the individual reaction to adrenaline and can be used as an index of his vegetative nerve tension, but Kuno⁴⁾ has countered them in pointing out the indecisiveness of any attempt as distinguishing the nerve systems through the actions of adrenaline and acetylcholine, seeing that these two chemicals exert similar effects upon the same sweat glands. My results also showed that A.S.T. values have no definite relation with the results of Aschner's tests as mentioned above and that adrenaline and acetylcholine show similar tendency in their actions against the sweat glands. Abe's⁹⁾ adrenaline tests with the blood pressure as index also failed to establish a specific relation between their results and A.S.T. values. In summary, it is impossible to assert that the A.S.T. value commensurates with the reaction against adrenaline of the individuum, or in other words, that A.S.T. can be used as an index to the degree of his vegetative nerve tension.

CONCLUSION

From what mentioned above it have been established that,

1. The skin disease patients who showed normalizing tendency in their A.S.T. showed improvement in their situation, while those who showed no variation of A.S.T. value presented no improvement in their progress.

2. The neurodermitis, the atopic dermatitis and the eczema seborrhoicum cases showed a tendency to higher A.S.T. on the bend of elbow rather than on the extensor side of the forearm, and on the extensor side rather than on the flexor side of the forearm.

3. It was inadmissible to infer the individual reaction against adrenaline from the results of these tests, judging from the points as follows (i) the A.S.T. values showed no definite relation with the results of Aschner's tests, (ii) adrenaline and acetylcholine showed similar tendency in their action on the sweat glands, (iii) and the results of adrenaline tests with the blood pressure of the subject as index stood in no apparent relation with the A.S.T. values.

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