Acta Dermatovener (Stockholm) 56: 441–443, 1976

INCREASED CHLORIDE CONTENT OF SWEAT

An Additional Finding in the Klippel–Trénaunay Syndrome

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Abstract. Eight patients with at least two findings of the Klippel–Trénaunay triad (hemangioma, varices with an atypical location, and osteohypertrophy) were examined. One patient had a localized area with hypersecretion of sweat on the affected thigh. Chloride content of sweat from this brownish slightly elevated skin patch was markedly increased. This finding led the authors to measure the chloride content of sweat in all patients with a direct-reading skin chloride electrode (model 97–17) connected to an ionalyzer (model 417, Orion Research, Cambridge, Mass.). The sweat glands were stimulated by pilocarpine iontophoresis. Chloride content was expressed in mEq/l. A statistically significant increase in sweat chloride content was registered in the unaffected extremities of the patients as compared with an adult control group ($p<0.005$). In the affected limbs the chloride content was increased, although not significantly. The examined patients were completely healthy apart from their Klippel–Trénaunay syndrome. The significance of this observation is obscure.

Key words: Klippel–Trénaunay; Sweat; Chlorides; Hemangioma

In 1869, Trélat and Monod described a condition which they named partial or total unilateral hypertrophy of the body (9). This hemihypertrophy was mainly due to an increased growth of both osseous, subcutaneous and muscular tissues. These changes engaged either an arm or a leg. In the majority of their observations Trélat and Monod found vascular dilatations affecting either the cutaneous capillaries (*taches naeviformes*) or the subcutaneous veins forming real varices. The authors noted that these naevi almost exclusively engaged only one side of the body. The simultaneous appearance of osteohypertrophy, hemangiomata and varicose veins in one extremity was considered an important finding by Klippel & Trénaunay (2). They saw a distinct connection between these findings and proposed that they form a clinical entity. Since then many authors have reported additional local findings in these patients such as hypersecretion of sweat- lachrymal and sebaceous glands, hypo- and hyperpilosity, ichthyosis, gynecomastia and melanosis sclerae (4).

This study comprises 8 patients with two or more symptoms of the Klippel–Trénaunay triad. One patient with the full triad had a local hyperhidrosis of the affected extremity. Chloride concentration of sweat from that area was measured and found to be increased, which led us to measure the chloride content of sweat in all patients.

CLINICAL MATERIAL

The patients, 4 men and 4 women, ranging in age between 5 and 76 years, were seen in the out-patient clinic for peripheral vascular diseases at the Serafimer Hospital in Stockholm. Basic data of the patients including findings of the Klippel–Trénaunay triad are seen in Tables I and II.

Table I. *Basic data of the patients*

Patient	Sex	Age	Length (cm)	Weight (kg)	Involved extremity
AS	♀	76	154	58	Left arm
RJ	♂	19	176	78	Right leg
SO	♂	57	178	66	Right arm
RP	♂	24	191	84	Left leg
KL	♀	23	164	50	Left leg
AE	♂	25	167	61	Right arm
BI	♀	24	180	62	Right leg
CC	♀	5	111	18	Right leg

METHOD

Chloride content of sweat from the skin of the involved extremity and from the corresponding point on the opposite extremity was determined in all patients. For chloride determination *in situ*, the tested skin area was stimulated by pilocarpine iontophoresis for 5 minutes with a current of 1 milliampère (3). The stimulated area was washed with ion-free water. A direct-reading skin chloride electrode (model 97–17) was quickly placed on the pertinent area. Through a connected ionalyzer (model 417, Orion Research, Cambridge, Mass.) the chloride content was determined and expressed in mEq/l.

Fourteen adult healthy individuals of both sexes from the laboratory staff were used as controls.

RESULTS

All patients had been born without complications and the weights at birth were within the normal range. No patient had suffered from any previous severe diseases. Physical examination and a routine laboratory investigation of the patients did not reveal any signs of other concomitant disease. In Table III the chloride concentration of sweat in the affected and the contralateral limbs is presented. The values of the affected extremities are elevated, compared with the mean value of the controls. This difference is not statistically significant. However, in the unaffected limbs there was a significant increase in chloride concentration of sweat ($p<0.005$) as compared with the control group.

DISCUSSION

Increased chloride concentration of sweat has been regarded as a pathognomonic finding of mucoviscidosis—at least in patients under 15 years of age (1, 6, 7). In adult patients it is considered that chloride concentrations above 60 mEq/l are diagnostic of mucoviscidosis. However, Lobeck & Huebner (5) reported that 17 % of their adult control subjects had chloride concentrations of more than 70 mEq/l. Five patients in this study had chloride concentrations above 60 mEq/l in the involved extremity, and 6 patients showed higher concentrations in the unaffected extremity. All 4 patients who showed all three symptoms of the Klippel–Trénaunay triad had an increased chloride content of sweat in either or both of the extremities. However, no patients had any clinical features of mucoviscidosis.

Table II. *Findings of Klippel–Trénaunay triad*

Patient	Hemangiomata		Varicose veins	Osteo-hypertrophy (length)
	Capillary	Cavernous		
AS	+	–	+	–
RJ	+	–	+	–
SO	+	–	+	+
RP	+	–	+	+
KL	+	–	+	–
AE	–	–	+	+
BI	+	+	+	+
CC	+	+	+	–

Table III. *Chloride concentration of sweat in extremities in mEq/l*

Involved extremity in italics. R=right. L=left

Patient				
AS	L arm 92		R arm 150	
RJ	R leg 70		L leg 38	
SO	R arm 90		L arm 125	
RP	L leg 35	60.5±24.1	R leg 115	88.5±42.1
KL	L leg 28		R leg 35	
AE	R arm 74		L arm 105	
BI	R leg 52 (89)[a]		L leg 60	
CC	R leg 43		L leg 80	
Controls		44.1±16.0[b]		

[a] Area of localized hyperhidrosis on R leg.
[b] $\bar{x}$ and S.D. of $\bar{x}$ R and L legs of 14 controls.

Cortico-steroids are known to decrease Na^+ and to some extent Cl^- secretion of sweat (8). Consequently, a pronounced adrenal insufficiency would theoretically increase the chloride concentrations of sweat. As our patients were in excellent general health, adrenal cortical function was not examined specifically.

In a few patients we have measured the cutaneous blood flow of the hemangiomata which was found to be increased (unpublished findings). We do not know if an increase in cutaneous blood flow *per se* can affect secretion of sweat and electrolytes. In the present material, however, the major increase in chloride content was found in the unaffected limbs. This leaves us with a suspicion that our patients have a systemic disturbance which for unknown reasons has been accompanied by vascular symptoms in one extremity. We believe that our findings motivate further examinations of chloride content of sweat in the limbs of patients with one or more symptoms of the Klippel–Trénaunay triad.

ACKNOWLEDGEMENT

We are greatly indebted to Ass. Professor Lars Hagenfeldt, Department of Clinical Chemistry, Karolinska sjukhuset, Stockholm, Sweden, who kindly analysed sweat chlorides.

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Received November 12, 1975

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