

## SMALL VESSEL REACTIVITY IN ATOPIC DERMATITIS

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**Abstract.** The vascular reaction following local application of thurfyl nicotinate and i.d. injection of  $10^{-2}$  mg metacholine were studied. Temporal variations in response and multiple patterns were found. Erythematous skin (increased amount of blood in the subpapillary venous plexus) always corresponded to arteriolar dilatation, but in blanched skin an arteriolar fluctuation between dilatation and constriction could easily be followed. A stronger tendency to vasoconstriction was recorded in involved vis-à-vis uninvolved skin.

**Key words:** Vascular reactivity; Reflectometry; Photoelectric plethysmography

Several authors have investigated and described altered vascular responses to acetylcholine and nicotinic acid esters, especially thurfyl nicotinate in atopic dermatitis (1, 2, 3, 4, 5). In almost all instances the reactions were evaluated visually and the delayed blanch response was generally interpreted as a tendency to vasoconstriction. It was not until 1969 when Ramsay (6) performed objective measurements by means of plethysmography that this theory was challenged.

In the present study we have performed continuous reflectometric measurements of the state of the subpapillary venous plexus, while the arteriolar response was evaluated plethysmographically.

### MATERIAL AND METHODS

Twenty patients of both sexes aged 11 to 30 years and suffering from atopic dermatitis, were studied. Only those who had not been treated with fluorinated steroid creams were admitted.

**Reflectometry.** Changes in skin colour on the volar aspect of the forearms were registered by photoelectric reflection meter (Photowolt 670). Preliminary, comparative measurements by this method have proven a high degree of reproducibility, superior to visual evaluation. The skin colour as measured by reflectometry depends on the amount and distribution of pigment, the colour of the surface layers of the epidermis, and filling of the subpapillary venous plexus. Only the latter is of significance in comparative short measurements. An increased reflection on the photometer is

produced by a blanching which is a sign of decreased blood flow in the subpapillary venous plexus. The red tinge is caused by a dilatation of these vessels and lower values are registered reflectometrically.

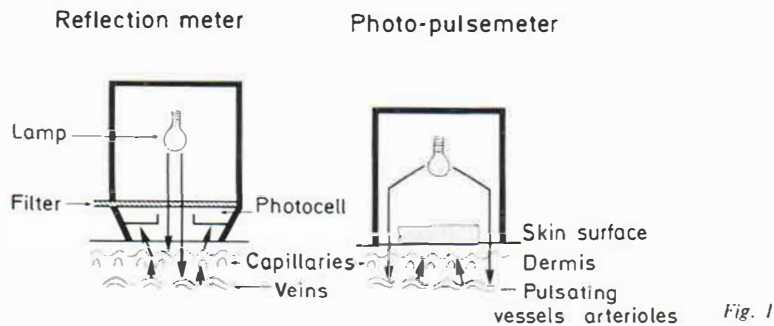
**Photoelectric plethysmography.** This is actually a pulse meter which measures the pulsating arteriolar blood flow (7). An increased pulse amplitude corresponds to an arteriolar dilatation in the dermis, and vice versa. Fig. 1 represents a schematic drawing of the two instruments. Reflectometric and plethysmographic registrations were performed on uninvolved and involved skin of the forearms. Metacholine (acetyl-beta-methylcholine)  $10^{-2}$  mg in 0.1 ml of physiologic saline, was injected intradermally in one arm. Thurfyl nicotinate (Trafuril® ointment 5%) was gently rubbed into a measured area of the contralateral arm for 30 sec and wiped off with alcohol on cotton. Registrations with both methods were repeatedly performed for 30-60 min.

### RESULTS

The findings are illustrated in Table I.

**Uninvolved skin.** With reflectometry, varying data were recorded: 8 out of 14 patients showed either increased (5 patients) or almost unchanged (3 patients) values following thurfyl nicotinate application. These patients with delayed blanch or visually unchanged (pale) skin, represent the paradoxical reaction characteristic of atopic dermatitis. Increased pulsation, i.e. arteriolar vasodilatation, was observed in 13 of the 14 patients. In one patient the pulse amplitude varied, but with a tendency to increased values after 15 minutes.

**Involved skin.** A higher reflection percentage occurred in 4 out of 6 patients following application of thurfyl nicotinate and in 3 patients following methacholine injections. This corresponded to a visually observed blanching. In the other cases varying degrees of erythema and decreased amounts of reflection were noted. In 3 out of 6 patients a clear decrease in pulsations (arteriolar vasoconstriction) occurred following thurfyl nicotinate and methacholine. In the others the pulse amplitudes were either unchanged or alternately decreased or increased.



## DISCUSSION

The usual cutaneous reactions in normal persons to thurfyl nicotinate and metacholine are dilatation of the pulsating arterioles in the dermis and of all the other vessels governing the colour of the skin, in particular the subpapillary venous plexus. In the present study some patients reacted in both involved and uninvolved skin of the forearms, as do normals. But particularly in involved skin a variability of vascular changes was observed by both methods. This lability of vascular tonus or dynamic course of the reaction might be dependent upon the skin area studied (regional variations in vascular pattern) and the degree of inflammation in this area.

Although the reactions to thurfyl nicotinate and methacholine differed in a few patients, the similarity in vascular pattern points to some common or related vasoactive substances, although different mechanisms have been suggested (2).

Our results differ somewhat from those obtained by Ramsay (6) (see Table I) and indicate a more fluctuating vascular reaction, in particular of the deeper vessels. It seems important to distinguish

between the reactions in these vessels and the more superficial vascular patterns, as they may react quite differently. This phenomenon is quite typical in urticarial wheals where the oedema can compress the superficial vessels, giving rise to blue, red, or white areas. But despite these colour changes there is considerable vasodilatation of the deeper dermal vessels (personal observations). This vasodilatation in urticaria is far more prominent than in atopic dermatitis.

Altered vascular reactions to methacholine and nicotinic acid esters have recently also been described in dermatitic changes of allergic contact type (8). This report suggests that the abnormal vascular reactions in atopic dermatitis are secondary phenomena. Further studies are needed to elucidate this problem.

## REFERENCES

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Table I. Results of present study and of Ramsay (6) on paradox vascular reaction in atopic dermatitis

<i>Uninvolved skin</i>		
Trafuril (1-15 min)	8/14: blanching/increased pulsation	6/14 (as normals): redness/increased pulsation
<i>Involved skin</i>		
Trafuril (1-15 min)	3/6: blanching/decreased pulsation 1/6: blanching/increased pulsation	2/6 (as normals): redness/increased pulsation <sup>a</sup>
Methacholine (5-25 min)	1/6: blanching/unchanged pulsation <sup>a</sup> 3/6: blanching/decreased pulsation <sup>a</sup>	2/6 (as normals): redness/increased pulsation <sup>a</sup>
Ramsay (6)	7/8: blanching/increased pulsation	
White dermographism	2/7: blanching/decreased pulsation 5/7: blanching/unchanged-slightly increased pulsation	

<sup>a</sup> Somewhat varying values.

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## DISCUSSION

*Soter (Boston)*. Q: Were morphologic studies done to look at the state of vessels?

A: No such investigations were performed.

*Voorhees (Ann Arbor)*. Q: Are there any differences between patients with and without cold fingers, by these methods?

A: By pulse plethysmography, earlier data on depressed temperature/blood flow could not be confirmed, though these data are preliminary, and I would be glad if you have found differences in your laboratory.

*Soter (Boston)*. Q: Have you looked at variations on the same subjects?

A: Yes, the same patients may not react every time in the same manner. Instead of vasodilatation/constriction, lability of vessels may be stressed.