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THE COLD SCIATIC LEG

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Pain is the predominant symptom in sciatica, which may also involve paresthesia and/or pareses. Less attention has been paid to the sensation of cold that is sometimes experienced in the lower leg and foot on the affected side. Although the patient may wear a thick extra sock to counter this discomfort, it is seldom reported spontaneously. When questioned on the subject, however, nearly all patients state that they suffer from cold in the lower leg and foot on the affected side.

The peripheral cold is mentioned only occasionally and in passing in the voluminous literature on the sciatic syndrome. No detailed analysis of this symptom has been published. *Berquet* (1963) admittedly mentioned in a short report that a difference between the sciatic and the healthy leg was found in measurements of the skin temperature, though not at oscillography, but no data were published and the finding has not been followed up.

The aims of the present study were:

1. To investigate whether there is an objectively measurable temperature difference between the sciatic and the healthy leg in subjects with symptoms of pressure on lumbar nerve roots.
2. To investigate whether this difference between the legs changes after the pressure on the nerve roots has been relieved by conservative or surgical measures.

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Table 1. Clinical data in 28 patients with sciatica.

Case No.	Sex	Age	Duration of sciatic symptoms	Nerve-root affected according to Neurol. findings	Myelography	Op. findings
1.	♀	43	3 months	LV + SI	SI	SI
2.	♂	52	6 „	SI	SI	SI
3.	♂	37	6 „	LV	LV	LV
4.	♂	42	7 „	SI	SI	SI
5.	♀	25	9 „	No neurol. findings	Neg. myelography	No disc herniation
6.	♀	33	8 „	LV	LV	LV
7.	♂	21	4 „	No neurol. findings	SI	SI
8.	♀	34	13 „	No neurol. findings	LV	LV
9.	♀	33	3 weeks	SI	SI	SI
10.	♀	45	2 months	SI	SI	SI
11.	♂	34	5 „	No neurol. findings	SI	SI
12.	♂	39	6 „	No neurol. findings	LV	LV
13.	♂	29	1 „	LV + SI	LV	LV
14.	♀	35	2 weeks	SI	SI	SI
15.	♀	37	13 months	No neurol. findings	Neg. myelography	SI
16.	♀	51	2 „	LV + SI	SI	SI
17.	♀	33	2 „	SI	SI	SI
18.	♂	22	6 „	SI	SI	SI
19.	♀	38	2 „	LIV + LV + SI	Total block LV	SI
20.	♀	47	12 „	LV	LV (?)	LV
21.	♀	36	3 „	SI	SI	SI
22.	♂	32	6 „	LV	LV (?)	No operation
23.	♂	19	5 „	LV	LV	No operation
24.	♂	49	14 „	LIV + SI	LV	No operation
25.	♀	38	24 „	SI	SI	No operation
26.	♂	21	12 „	LIV + LV	Neg. myelography	No operation
27.	♂	39	2 „	LV	SI	No operation
28.	♂	50	2 „	No neurol. findings	Myelography not performed	No operation

MATERIAL

The study was made on 28 patients (see Table 1), 14 males and 14 females, mean age 35.5 years (range 19–52 years). Only persons below 55 years of age were included, in an attempt to avoid cases with obliterative vascular disease. No clinical signs of stenotic vascular disease were detected in any of the subjects. All the patients had typical, unilateral sciatics with symptoms that had lasted from a fortnight up to two years.

The first part of the examination concerned the patients' skin temperature and the arterial and venous blood flow at rest in both the lower extremities (see Methods below). In all but one case, the clinical diagnosis was then verified roentgenologically by lumbar myelography with a positive contrast medium (Perabrodil®). Twenty-one patients were treated surgically, twenty of them with resection of a herniated disc; in six of these cases the herniation lay between L IV and L V, in fourteen between L V and S I. In the remaining operated case, there was no disc herniation. Seven patients received conservative treatment with physiotherapy and/or a brace. The examination of the circulation was repeated at an average of 9 months after the end of treatment in fourteen of the operated cases and four of those treated conservatively.

PROCEDURE AND METHODS

The examinations were conducted with the subject supine and the legs bare. Before the examination, the subject spent 30 minutes resting in order to adapt to the room temperature, which was 18–22° C.

The *skin temperature* was measured with thermocouples taped to the skin and registered on a mirror galvanometer (TE3, Ellab, Denmark). Bilateral measurements were made on the following points: (*a*) underneath the big toe, (*b*) the outside of the foot on a level with the head of the fifth metatarsal, (*c*) the sole of the foot 2 cm proximal of the third toe, (*d*) the dorsum of the foot 2 cm proximal of the third toe, (*e*) 5 cm proximal of the medial malleolus, and (*f*) 20 cm proximal of the lateral malleolus.

The measurements were performed before and during sympathicolysis (*Lewis & Pickering* 1931), elicited by heating the trunk with a thermostatic heating-box set at 40° C. Before this heat treatment, the patient received 50 ml of a lytic cocktail containing 50 per cent alcohol. In two cases, the skin temperature was also measured 20 minutes after the posterior tibial nerve had been blocked with 5 ml 1 per cent Xylocain®.

Digital plethysmography was performed according to *Lund* (1949) after indirect heating for 40 minutes. Arterial toe pulse curves were obtained via a closely-fitting plastic hood and piezoelectric pressure receptor on the second toe, coupled to a Mingograph (Elema-Schönander). The average propagation time, inclination time and amplitude were calculated bilaterally from three consecutive curves.

Venous occlusion plethysmography was undertaken in four patients, using a modified Dohn plethysmograph (*Graf & Westersten* 1959). The resting circulation was determined in a segment of the maximal part of the calf on either leg by calculating the mean of five consecutive recordings.

RESULTS

A. *Preoperative Studies*

1. *Skin temperature* (Table 2). The basal skin temperature was generally lower on the affected leg than on the contralateral one. The measured difference was significant over the medial malleolus and the sole of the foot ($p < 0.001$–0.01). The differences obtained during

Table 2. Skin temperature before and during indirect (body) heating in the acute phase of sciatica in 28 patients. A indicates the affected leg and C the control leg.

Time after body heating in min	Leg	Skin area: Big toe Mean	SD	P	Fifth metatarsal Mean	SD	P	Sole of foot Mean	SD	P
0	A	24.3	4.7	> 0.1	25.9	3.4	< 0.05	24.9	4.1	< 0.01
	C	24.9	4.8		26.6	3.1			4.0	
20	A	30.2	4.9	< 0.01	29.1	4.3	< 0.02	29.8	4.7	< 0.01
	C	31.3	4.5		30.1	4.1		30.8	4.3	
30	A	32.2	3.2	< 0.02	30.6	3.7	< 0.02	31.2	4.3	< 0.02
	C	32.9	2.8		31.4	3.5		32.2	3.4	
40	A	33.0	2.3	< 0.05	31.1	3.6	< 0.05	31.9	3.6	< 0.01
	C	33.5	1.6		31.7	3.4		32.9	2.5	

Time after body heating in min	Leg	Skin area: Dorsum of foot Mean	SD	P	Medial malleolus Mean	SD	P	Lateral side of calf Mean	SD	P
0	A	26.9	3.5	< 0.05	29.8	2.0	< 0.001	31.5	1.3	< 0.02
	C	27.5	3.4		30.7	1.8		32.0	1.0	
20	A	29.8	3.8	< 0.01	30.4	1.7	< 0.01	31.1	1.2	> 0.2
	C	30.8	3.6		31.2	1.9		31.2	1.1	
30	A	31.6	3.2	< 0.05	31.0	1.6	< 0.001	30.9	1.0	> 0.2
	C	32.3	2.6		31.8	1.8		31.0	1.1	
40	A	32.4	2.5	< 0.01	31.6	1.4	< 0.01	30.9	1.0	> 0.2
	C	33.1	1.9		32.2	1.6		31.0	1.0	

The p-values refer to the significance of the differences between paired observations.

indirect heating were still more pronounced, being significant between the majority of the bilaterally identical measuring points within 20–30 minutes.

The posterior tibial nerve was blocked on the affected side in two cases once indirect heating had produced an optimal effect. One of these cases is illustrated in Figure 1, which shows the very marked differences between the two legs after indirect heating and the almost complete elimination of these after the blockade.

It was found that the patients with an S I syndrome had greater temperature differences on the average between the affected and the

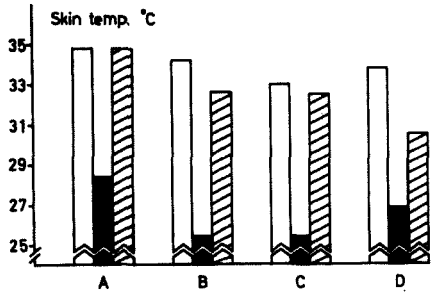

Figure 1. Skin temperatures at different points (A, big toe; B, head of 5th metatarsal; C, sole of foot; D, dorsum of foot) on the foot of a patient with a left-sided sciatica syndrome, as measured after 40 minutes body heating (filled bars) and 20 minutes after posterior tibial nerve block (shaded bars). The unfilled bars represent the right control leg.

healthy leg than those with an L V syndrome. No correlation was found between the level of nerve root compression and the site of the maximal difference in skin temperature between the two legs.

2. *Digital plethysmography.* The arterial toe pulse curves had a normal configuration in all cases and no differences were found between healthy and affected legs concerning propagation time, inclination time or amplitude. Peripheral obliterative arterial disease could thus be ruled out as a cause of the differences in skin temperature.

3. *Venous occlusion plethysmagraphy.* The average resting blood flow of the calf amounted to 2.1 ml/100 ml · min (range 0.5–2.9) on the affected side, which is practically identical to the average for the contralateral side (2.2, range 0.6–2.9).

B. *Postoperative Studies*

The measurements of skin temperature under basal conditions and during indirect heating were repeated 2–12 months after the operation in 14 cases. None of these patients had any back trouble or sciatica at the time of this examination. As will be seen from Figure 2, the previous differences in skin temperature between the two legs in these patients were substantially greater than at the postoperative examination. This applies to the basal temperatures as well as to the values obtained during body heating. The postoperative differences were most pronounced after 20–30 minutes heating, when they were significant for all the measuring points on the foot.

Cases with an S I syndrome displayed a more marked postoperative improvement in skin temperature than those with a syndrome from

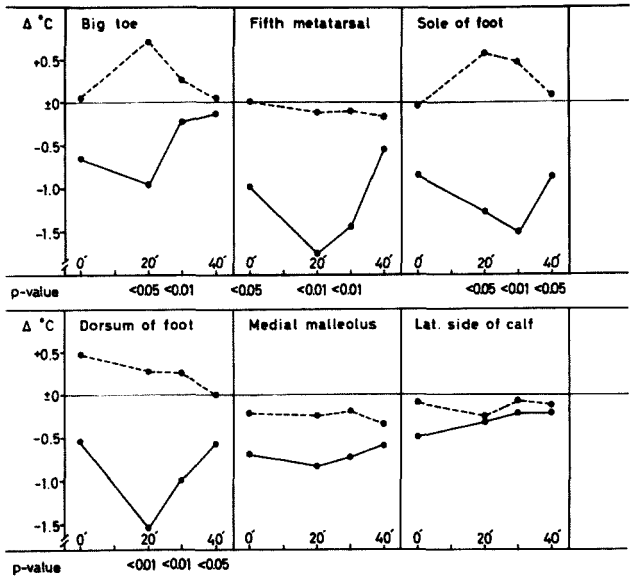

Figure 2. Mean difference in skin temperature between the affected and the healthy leg in 14 patients before (————) and after (– – – –) excision of a prolapsed disc. The difference between the legs was calculated separately for each of four sets of measurements from six different points during indirect body heating. The values of p *indicate the statistical effect of the operation on these differences.*

other segments. This difference was not significant owing to the small number of cases.

C. *Patients Receiving Conservative Treatment*

The changes in skin temperature after conservative treatment of the sciatica were of the same magnitude as in the surgical cases. There were too few patients for a statistical analysis of this group (4 cases).

DISCUSSION

The comparatively low skin temperatures, particularly in the distal part of the leg, in acute sciatica indicate a reduced skin blood flow. The simultaneous finding of normal arterial toe pulse curves in these cases rules out obliterative arterial disease as a cause of the peripheral circulatory disturbance. Moreover, the absence of any effect on the calf blood flow at rest points to a selective disturbance of the skin circulation. On the other hand, the fact that peripheral nerve block

in the affected leg entirely eliminates the difference in skin temperature between this and the contralateral leg in unilateral sciatica (Figure 1) suggests that the difference is conditioned by a regionally enhanced vasoconstrictor activity. This is also indicated by the slow appearance and incomplete nature of the effect of indirect (body) heating on the skin temperature in the affected leg. Normally this procedure, which diminishes the sympathetic vasoconstrictor tone, causes the skin blood flow and hence the skin temperature to rise rapidly to an optimal level (*Lewis & Pickering* 1931, *Roddie, Shepherd & Whelan* 1956).

The sympathetic nervous system is chiefly an afferent system. Its preganglionic fibres are said to emerge from the spinal cord via the ventral nerve roots in the segment T I-L (*Brain* 1962), T I-L II (*Broman* 1934, *White & Smithwick* 1948, *Bonica* 1954), or T I-L III (*MacDonald & Chusid* 1952). There would thus appear to be some uncertainty as to which is the most caudal segment containing elements from the sympathetic nervous system. There can be no doubt, on the other hand, that the nerve roots L IV, L V and S I, which are the ones commonly engaged in rupture of a lumbar disc, do not contain efferent sympathetic nerve fibres. The parasympathetic nervous system, which probably has no influence over vascular tonus in the leg, is incorporated in the nerve roots S II-S IV, *i.e.* below the levels involved in rupture of a lumbar disc. It follow that the augmented vasoconstrictor activity in the acute phase of sciatica cannot be ascribed to a mechanical effect from a ruptured disc on efferent pathways in the autonomic nervous system.

There are, however, several observations to the effect that increased activity in the sympathetic vasoconstrictor tone can be reflexly elicited by pain, resulting in a diffuse efferent outflow. *Adams-Ray & Pernow* (1949) demonstrated, for instance, that an inflamed area is frequently surrounded by a pale zone and that this pallor syndrome can be eliminated by sympathetic block. Pain in visceral organs also elicits vasoconstriction in the corresponding dermatome as a result of a reflexly increased flow of impulses from vasoconstrictor fibres (*Wernoe* 1920, *Adams-Ray* 1953). The pains in the leg elicited by compression of the nerve root in the present cases might similarly give rise to reflexly increased vasoconstrictor tone and hence a reduced skin circulation, particularly in the distal parts of the leg where the autonomic innervation is extensive. Such a hypothesis would also explain why the effect on the skin temperature apparently did not coincide with the

dermatomes for the affected nerve roots. The theory is also supported by the finding that the low skin temperature seems to have normalized with the cessation of the pain, regardless of whether this occurred after conservative treatment or after surgical correction of the pressure on the nerve root.

The results explain why sciatic patients frequently experience peripheral cold in the affected leg. This phenomenon does not seem to have been verified objectively before, nor has it been analyzed in relation to the effect of the treatment given. The results also suggest that measurements of skin temperature may be valuable for an objective assessment of clinically indefinite cases of sciatica.

SUMMARY

The skin temperature of the foot and lower leg was measured bilaterally in 28 patients with typical unilateral sciatica and symptoms that had lasted from a fortnight up to two years. The examination was conducted before and after surgical or conservative treatment.

The basal skin temperature on the medial malleolus and the sole of the foot on the affected side was significantly lower compared with the corresponding contralateral points. The difference was still more marked after indirect body heating for 20–30 minutes. The difference in temperature, which was greater in patients with an S I syndrome than in those with an L V syndrome, was eliminated after posterior tibial nerve block. The basal calf blood flow did not differ between the two legs.

After the surgical or conservative treatment, when the patients were free from symptoms, the difference in skin temperature between the legs was substantially smaller. This applies both to the basal temperatures and to the temperatures during indirect heating. The improvement was most marked in cases with an S I syndrome.

The results indicate that measurements of skin temperature are of practical value for an objective assessment of clinically indefinite cases of sciatica.

RESUME

La température de la peau du pied et de la jambe inférieure a été mesurée bilatéralement sur 28 patients souffrant d'une sciatique typiquement unilatérale et dont les symptomes s'étaient étendus sur une période de 2 semaines à 2 ans.

L'examen a eu lieu avant et après un traitement chirurgical ou conservatif.

La température de base de la peau de la malléole interne et de la plante du pied du côté malade était significativement plus basse comparée aux points correspondant de l'autre membre.

La différence était encore plus marquée après réchauffement indirect du corps durant 20 à 30 minutes.

La différence de température qui était plus grande chez les patients ayant un syndrome SI que ceux ayant un syndrome LV a été éliminée après blocage du nerf tibial postérieur.

Le flux sanguin de base dans le mollet ne différait pas dans les deux jambes.

Après traitement chirurgical ou conservatif, lorsque les patients ne souffraient plus de symptomes, les différences de température de la peau étaient substantiellement plus petites.

Ceci s'applique à la fois aux températures de base et aux températures durant l'échauffement indirect.

L'amélioration a été la plus marquée dans les cas à syndrome SI.

Les résultats indiquent que les mesures de température de la peau sont d'un intérêt pratique pour une évaluation objective de cas cliniques indéterminés de sciatique.

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