

Comparison of the Cutaneous Autonomic and Somatic Nervous Functions in the Lesions of Leprosy¹

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Leprosy has been generally accepted as a disease involving the peripheral nerves⁽³⁾, implicating both somatic and autonomic nerve fibers⁽⁴⁾. Whereas the extent of sensory loss is routinely determined in making a clinical diagnosis of this disease, the involvement of autonomic nerves has not been investigated equally systematically. Recently Crawford⁽¹⁾ has reported a considerable loss of sweat function in anesthetic areas in cases of leprosy and diabetic neuropathy. This study is an investigation of two functions of the cutaneous autonomic nervous system i.e., sweating response and the changes in vasodilatory effect of injected cholinergic drugs, in comparison with the sensory function of the somatic nervous system.

MATERIALS AND METHODS

Thirty-four patients used in this study included 15 cases of dimorphous leprosy (intermediate), 12 cases of maculoanesthetic leprosy and seven cases of the tuberculoid variety. The duration of the disease in these patients varied from three months to 16 years and all of them, with the exception of two, were on antileprosy treatment. Only those cases were included which had macular hypopigmented lesions with at least some sensory loss. The patches were carefully tested for sensations of pain, touch and temperature by routine methods.

The sweating response was measured by giving an intradermal injection of 0.1 ml carbachol (0.025 mg carbaminoyl choline) in the center of the patch and covering the

area with a Whatman No. 1 filter paper strip impregnated with 1.0% alcoholic bromophenol blue. After 5 minutes, the paper was removed and the number of blue spots, indicative of functioning sweat glands per unit area were recorded (Fig. 1). Grading of the sweating response was done on the basis of the number and size of sweat spots in a square inch area around the point of injection, as follows:

- Nil—Indistinct sweat spots, less than 10 in number
- 1+—Distinct sweat spots, between 10 and 100 in number
- 2+—Larger sweat spots, between 100 and 200 in number
- 3+—Confluence of sweat spots, more than 200 in number
- 4+—Large smudges of sweat

The central smudge produced at the point of injection was excluded from the count.

The vasodilatory effect of carbachol was recorded by measuring the maximum diameter of the erythematous reaction developing at the end of 5 minutes following an intradermal injection of 0.1 ml carbachol.

In every patient, a corresponding normal site on the contralateral side was similarly studied for comparison. Decrease in the response was calculated by subtracting the response obtained in the lesion from the response obtained in the corresponding normal site.

RESULTS

The sweating response and the vasodilatory effect of carbachol between patients of the three types of leprosy included in this study, did not show any significant differences. Thus they will all be considered as a single group.

A comparison between the degree of

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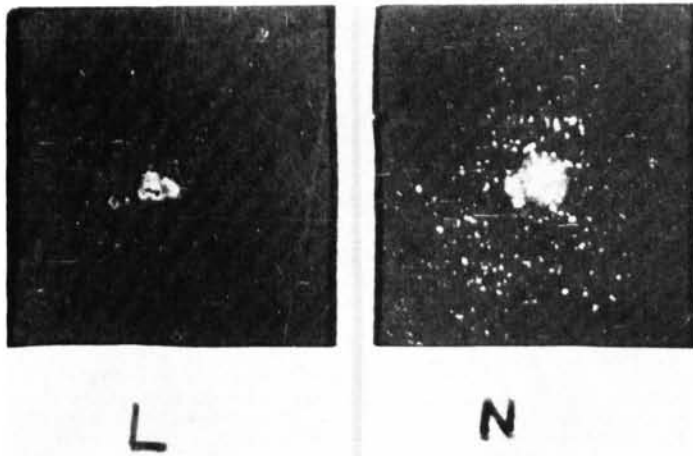


FIG. 1. Sweat response in a lesion of leprosy (L) compared to the contralateral normal skin (N). Each of the areas shown corresponds to one square inch.

sweating response of lesions and the corresponding normal sites is shown in Table 1. The lesions of nine patients did not show any sweating response, while most of the remaining lesions showed a weak (1+) response. The normal sites, by comparison, usually showed more than 2+ response. Similarly the diameter of the erythematous reaction to carbachol injection (Table 2) was usually less than 30 mm in leprosy lesions while it was more than 30 mm in most of the normal areas.

Comparison of the degree of sweat function and of vasodilatory response to the sensory status of the lesions revealed many interesting findings. Twelve patients had complete loss of all the three somatic sensa-

tions (pain, touch and temperature). Seven of them showed no sweating response while the remaining five showed only 1+ response. One patient, however, had as good a sweating response in the lesion as in the corresponding normal skin. There was no erythematous reaction in one patient while in the others it varied from 17 mm to 28 mm. There was a range of 12 mm to 38 mm less response in lesions as compared to corresponding normal sites.

TABLE 2. Grading of the vasodilatory responses obtained in lesions of leprosy and the corresponding normal skin areas.

Maximum diameter of erythematous reaction	Number of cases	
	Normal skin	Lesion
0-10 mm.	0	2
11-20 mm.	1	5
21-30 mm.	2	20
31-40 mm.	8	3
41-50 mm.	14	1
51-70 mm.	7	3
71 mm. & over	2	0

TABLE 1. Grading of the sweating response obtained in lesions of leprosy and the corresponding normal skin areas.

Sweating response	Normal skin	Lesion
Nil	0	9
1+	7	20
2+	8	4
3+	17	1
4+	2	0

TABLE 3. Correlation of the degree of loss of sweat function with the loss of sensations.

Degree of decrease ^a of the sweating response	Sensory status of the lesion								
	Temperature sensation			Pain sensation			Touch sensation		
	Absent	Im-paired	Present	Absent	Im-paired	Present	Absent	Im-paired	Present
Nil	3	3	0	3	3	0	2	3	1
1+	7	2	2	4	5	2	5	3	3
2+	7	4	0	6	4	1	3	6	2
3+	6	0	0	5	1	0	6	0	0

Figures indicate the number of cases.

^a Decrease of sweating response means difference between sweating response in the lesion and the contralateral normal skin.

Table 3 shows the degree of loss of sweat function relative to the sensory status. Although, in general, severe loss of a sensory modality corresponded to a severe loss of sweat function, there were many exceptions. Thus, three patients, each with complete loss of temperature or pain sensation, had no diminution in sweat function. The same was true of touch sensation. Further there were three patients with slight impairment of only one or more sensory modalities associated with a 2+ decrease in sweating response.

Comparison of the decrease in erythematous reaction with sensory status (Fig. 2)

led to similar conclusions. There were several patients with complete loss of a particular sensation in whom the decrease in erythematous response was very minimal. Similarly there were a few other patients with no loss of a particular sensory modality but a marked diminution of erythematous response.

A correlation between the loss of sweat function and the decrease in erythematous reaction is shown in Figure 3. A general correlation was observed but the two functions did not go hand in hand in individual cases.

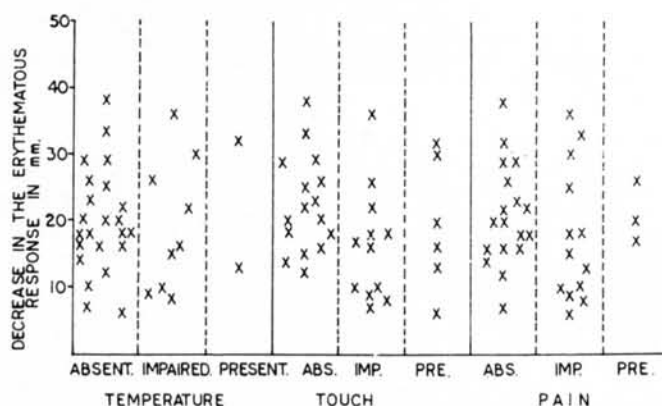


FIG. 2. Correlation of the decrease of erythematous reaction with the degree of loss of sensation in the lesions of leprosy.

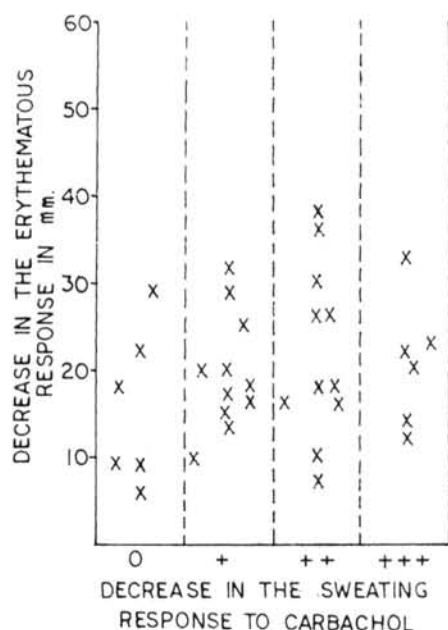


FIG. 3. Correlation of the decrease in sweating response with the decrease in erythematous reaction in the lesions of leprosy.

DISCUSSION

Apart from corroborating the well known fact that leprosy involves both autonomic and somatic nerves (⁴) the present study demonstrates that the degree of involvement of autonomic and somatic nerve fibers does not always go hand in hand. Although in most cases both these functions are severely involved, yet there are some cases in which marked loss of somatic functions is associated with very little or no impairment of autonomic functions and a few other cases show a marked impairment of autonomic functions with very little loss of somatic functions. The same is also true within the functions of the somatic and autonomic nervous systems respectively. It is well known that all the sensory modalities may not be lost to the same degree and the present study shows that there is disparity even in the two autonomic functions (sweating response and vasodilatory effect).

Thus it may be useful, as also suggested by Karat *et al.* (²), to perform tests also for the autonomic functions in cases where the

clinical features and loss of sensations are not definitive enough to determine the diagnosis.

SUMMARY

Sweating response and the vasodilatory effect of intradermally injected carbachol (cholinergic agent) was studied in the hypopigmented flat lesions of 34 leprosy patients and compared with the responses obtained from contralateral normal skin. Both these autonomic functions were impaired to a variable degree in most of the lesions. The degree of impairment of autonomic functions did not always correlate with the loss of sensations, although in severe cases both these functions tended to be markedly impaired. It is concluded that autonomic and somatic nerve fibers of skin may be independently involved and that tests for autonomic nervous functions, in addition to those for sensory functions, may help in making a diagnosis of early lesions of leprosy.

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RESUMEN

Se estudió la respuesta de sudoración y el efecto vasodilatador del Carbachol (agente colinérgico) inyectado en forma intradérmica en las lesiones planas hipopigmentadas de 34 pacientes con lepra, y se compararon las respuestas obtenidas con las de la piel normal contralateral. Ambas funciones autónomas estaban deterioradas en grado variable en la mayor parte de estas lesiones. El grado de deterioro de las funciones autónomas no estaba siempre relacionado con la pérdida de sensaciones, aunque en los casos severos ambas funciones tendían a estar notablemente deterioradas. Se concluye que las fibras nerviosas autónomas y somáticas de la piel pueden estar comprometidas en forma independiente y que las pruebas para funciones nerviosas autónomas, además de las pruebas para funciones de sensibilidad, pueden ser útiles para hacer el diagnóstico de lesiones incipientes de lepra.

RÉSUMÉ

Les résultats des épreuves de sudation et l'action vaso-dilatatrice d'un agent cholinér-

gique, le Carbachol, ont été étudiés dans les lésions planes hypopygmentées présentées par 34 malades de la lèpre. Elles ont été comparées avec les réponses obtenues dans la peau normale du côté opposé. L'une et l'autre de ces fonctions autonomiques étaient détériorées à un degré variable au niveau de la plupart des lésions. Le degré de détérioration des fonctions autonomiques n'était pas toujours en corrélation avec la perte de la sensibilité, encore que dans les cas graves ces deux fonctions marquaient une tendance à être notablement détériorées. On en conclut que les fibres nerveuses autonomes et somatiques de la peau peuvent être atteintes indépendamment, et que les épreuves destinées à étudier les fonctions nerveuses autonomiques peuvent, en supplément de celles employées pour explorer la

sensibilité, fournir des éléments utiles pour le diagnostic des lésions précoces dans la lèpre.

REFERENCES

1. CRAWFORD, C. L. Neurological lesions in leprosy. *Leprosy Rev.* **39** (1968) 9-13.
2. KARAT, A. B. A., KARAT, S. and PALLIS, C. A. Sweating under cellulose tape—a test of autonomic function. *Lancet* **1** (1969) 651-652.
3. KHANOLKAR, V. R. Studies in the histology of early lesions in leprosy. Indian Council of Medical Research, Special Report Series No. 19, 1951, pp. 18.
4. KHANOLKAR, V. R. Perspectives in pathology of leprosy. *Indian J. Med. Sci.* **9** (1955) 1-44. (Suppl. 1)