

# Cardiac Dysautonomia in Leprosy<sup>1</sup>

H. N. Khattri, K. Radhakrishnan, S. Kaur, B. Kumar and P. L. Wahi<sup>2</sup>

The autonomic nervous system in various neuropathies has been subjected to extensive studies. The peripheral autonomic fibers are commonly involved simultaneously with the sensory fibers quite early in leprosy, as shown by the characteristic dryness and roughness of the skin and anhydrosis<sup>(10)</sup>. As far as we are aware, no detailed study of cardiovascular reflexes in leprosy is available. The present study was planned to provide information about the involvement of the cardiac autonomic system in a group of patients with leprosy.

## PATIENTS AND METHODS

Fifteen patients with leprosy and ten age and sex matched normal controls were the subjects. Jopling's classification was used for the selection of patients. Five patients each belonging to the lepromatous (LL), borderline lepromatous (BL), and tuberculoid (TT) varieties of leprosy were included. The following criteria for inclusion in the study were used: a) age below 45 years; b) absence of symptoms of ischemic heart disease and normal resting electrocardiogram; c) other causes of autonomic neuropathy such as diabetes mellitus, amyloidosis, porphyria and syphilis were excluded by relevant investigations; and d) none of the patients were on any drugs likely to affect autonomic nervous system functions.

Apart from one patient (LL-1) who gave a history of postural syncopal attacks, none had symptoms referable to cardiovascular, urinary bladder or bowel dysautonomia. All patients were males. None of the patients had *erythema nodosum leprosum* (ENL) or lepra reaction at the time of investigation.

The plan of the study was similar to that

described by Bennett *et al*<sup>(1)</sup> and Martin *et al*<sup>(11)</sup>, with necessary modifications. Heart rate was continuously monitored electrocardiographically throughout the procedure. Blood pressure was recorded by sphygmomanometer in a lying position after 20 minutes of bed rest, at heart level at 15 seconds, at one minute, and at five minutes of standing. Sympathetic functions were studied by noting orthostatic adaptation of blood pressure<sup>(8)</sup>, tachycardia response to standing<sup>(4)</sup>, hand immersion in ice water<sup>(11)</sup>, and mental stress<sup>(12)</sup>. Parasympathetic functions were assessed by noting the presence or absence of sinus arrhythmia to deep breathing<sup>(13)</sup>, bradycardia response to carotid massage<sup>(2)</sup>, phase IV of Valsalva maneuver<sup>(8)</sup>, apnoeic face immersion in ice water<sup>(6)</sup>, and tachycardia response to intravenous atropine after beta-blockade with propranolol<sup>(3)</sup>.

## RESULTS

Table 1 gives the details of the observations made during the various procedures outlined. Three patients showed abnormal responses. All three belonged to the bacilliferous group. Patient LL-1 had a postural fall of systolic blood pressure of 50 mm Hg accompanied by marked giddiness. He had a resting heart rate of 94 beats per minute which persisted unchanged throughout various procedures, thus showing complete sympathetic and parasympathetic denervation of the heart. The other two patients (BL-1 and BL-2) had postural fall of systolic blood pressure of 10 mm and 14 mm Hg, respectively. Both showed inadequate tachycardiac response to standing and to intravenous atropine. BL-1 did not show any response to carotid massage and BL-2 showed a bradycardia of only four beats per minute to carotid massage. Thus, these two patients also showed partial cardiac dysautonomia.

## DISCUSSION

Our study shows definite evidence of involvement of cardiac autonomic control in three patients having leprosy. Jain *et al*<sup>(7)</sup> showed a block of circulatory reflexes in 9 of

<sup>1</sup>Received for publication 19 December 1977.

<sup>2</sup>H. N. Khattri, F.R.C.P. (Edin), Assistant Professor of Cardiology; K. Radhakrishnan, M.D., Senior Resident in Neurology; S. Kaur, M.D., Assistant Professor of Dermatology; B. Kumar, M.D., Lecturer in Dermatology; and P.L. Wahi, M.D., Professor and Head of the Department of Cardiology, Department of Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh-160 012, India. Requests for reprints to Dr. Khattri.

TABLE 1. Study of cardiovascular reflexes.

Patients	Orthostatic fall of BP (systolic) mm Hg	Sympathetic effects			Parasympathetic effects			Tachycardia response
		Standing	Hand immersion in ice water	Mental stress	Sinus arrhythmia	Carotid massage	Valsalva phase IV	
<b>Lepromatous</b>								
LL-1	50	A	A	A	A	A	A	A
LL-2	0	+	+	+	+	+	+	+
LL-3	0	+	+	+	+	+	+	+
LL-4	0	+	+	+	+	+	+	+
LL-5	0	+	+	+	+	+	+	+
<b>Borderline</b>								
BL-1	10	—	A	A	A	A	—	—
BL-2	14	—	A	A	A	A	—	—
BL-3	0	+	+	+	+	+	+	+
BL-4	0	+	+	+	+	+	+	+
BL-5	0	+	+	+	+	+	+	+
<b>Tuberculoid</b>								
TT-1	0	+	+	+	+	+	+	+
TT-2	0	+	+	+	+	+	+	+
TT-3	0	+	+	+	+	+	+	+
TT-4	0	+	+	+	+	+	+	+
TT-5	0	+	+	+	+	+	+	+
<b>Controls (10 normals)</b>	0	+	+	+	+	+	+	+

+ = Normal; — = Abnormal; A = No response.

110 leprosy patients in that the reflex overshoot after the Valsalva maneuver was absent. However, this deals with only one aspect of the dysfunction. Morphologic studies by Ermakova (5) showed involvement of the sympathetic chain and vagus nerves in leprosy. Khanolkar (9) emphasized the centripetal involvement of the nervous system in lepromatous leprosy and showed heavy infiltration of dorsal root ganglia and the sympathetic chain with acid-fast bacilli.

All three abnormal patients in our study were in the bacilliferous group and showed infiltration of skin and peripheral nerves with acid-fast bacilli. In the absence of direct morphologic evidence it remains a presumption as to whether such infiltration occurs in cardiac sympathetic and parasympathetic fibers. However, this explanation seems most logical. In order to be certain, follow-up studies are required, particularly to show the reversibility of the involvement of the autonomic nervous system with treatment of leprosy. Such a study is being planned.

#### SUMMARY

Responses to various tests of cardiovascular reflexes were studied in 15 patients with leprosy. Heart rate was continuously monitored by electrocardiogram and blood pressure was recorded simultaneously. Three patients showed evidence of cardiac dysautonomia, showing involvement of both the sympathetic and parasympathetic systems. These three patients belonged to the bacilliferous group.

#### RESUMEN

Se estudiaron las respuestas a varias pruebas sobre los reflejos cardiovasculares en 15 pacientes con lepra. La actividad cardíaca se midió continuamente por electrocardiograma y simultáneamente se registró la presión sanguínea. Tres pacientes mostraron evidencias de disautonomía cardíaca con afección tanto del sistema simpático como del parasimpático. Los tres pacientes correspondieron al grupo bacilífero.

#### RÉSUMÉ

Chez 15 malades souffrant de lèpre, on a étudié la réponse à diverses épreuves destinées à explorer les réflexes cardiovasculaires. Le rythme car-

diaque était enregistré de façon continue par électrocardiographie et la tension artérielle était enregistrée simultanément. Trois malades ont présenté des évidences de dysautonomie cardiaque, avec atteinte à la fois des systèmes sympathique et parasympathique. Ces trois malades appartenaient au groupe bacillifère.

#### REFERENCES

1. BENNETT, T., HOSKING, D. J. and HAMPTON, J. R. Cardiovascular control in diabetes mellitus. *Br. Med. J.* **2** (1975) 585-587.
2. BEVEGARD, B. S. and SHEPHERD, J. T. Circulatory effect of stimulating the carotid arterial stretch receptors in man at rest and during exercise. *J. Clin. Invest.* **45** (1966) 132-141.
3. CHAMBERLAIN, D. A., TURNER, P. and SNEDDON, J. M. Effect of atropine on heart rate in healthy man. *Lancet* **2** (1967) 12-15.
4. CURRENS, J. H. A comparison of the blood pressure in the lying and standing position. A study of five hundred men and five hundred women. *Am. Heart J.* **35** (1948) 646-653.
5. ERMAKOVA, N. Studies on leprosy. The central sympathetic and peripheral nervous system. *Int. J. Lepr.* **4** (1936) 325-335.
6. HEISTAD, D. D., ABBOD, F. M. and ECKSTEIN, J. W. Vasoconstrictor response to stimulated diving in man. *J. Appl. Physiol.* **25** (1968) 542-549.
7. JAIN, S. K., VISWANATHAN, R. and CHAKRAVARTHY, A. K. Circulatory reflexes in leprosy. *Indian J. Med. Res.* **53** (1965) 8-15.
8. JOHNSON R. H. and SPALDING, J. M. K. *Disorders of the Automatic Nervous System*, Oxford: Blackwells, 1974.
9. KHANOLKAR, V. R. Perspectives in pathology of leprosy. *Indian J. Med. Sci.* **9** (1955) Suppl. 1, pp 1-5.
10. LUMSDEN, C. E. Chapter 13. Leprosy and the Schwann cell *in vivo* and *in vitro*. In: *Leprosy in Theory and Practice*, 2nd edit., R. G. Cochran and T. F. Davey, eds., Bristol: John Wright & Sons, Ltd., 1964, pp 221-250.
11. MARTIN, J. B., RANDALL, H. T. and NOORT, S. Centrally mediated orthostatic hypotension. *Arch. Neurol.* **19** (1968) 163-173.
12. TAYLOR, S. H. and MEERAN, M. K. Different effects of adrenergic beta-receptor blockade on heart rate response to mental stress, catecholamines and exercise. *Br. Med. J.* **4** (1973) 257-259.
13. WHEELER, T. and WATKINS, P. J. Cardiac denervation in diabetes. *Br. Med. J.* **4** (1973) 584-586.