

Assessment of Cardiovascular Sympathetic Function Tests in Hypertensive Patients

Vaishali V. Patil¹, Vinod V. Kharde², Hiremath D. A.³, Jyothi J. Patil⁴

¹Assistant Professor of Physiology, ²Senior Registrar, ³Professor, ⁴Resident,

^{1,2}Dept. of Anaesthesiology P.D.V.V.P.F's Vikhe Patil Medical College & Hospital, Ahmednagar, Maharashtra, India.

³Dept. of Anaesthesiology S. N. Medical college Bagalkot, Karnataka, India.

⁴Dept. of Cardiothoracic surgery, Manipal Hospital, Bangalore, Karnataka, India.

Abstract

Background : Hypertension is a common disorder affecting 15% of adult population in India. Autonomic neuropathy affects 10 - 40% of hypertensive patients. We conducted this study to find out the incidence and preponderance of sympathetic involvement in hypertensive patients and its relationship with the duration and severity of hypertension.

Material and Methods : The present study was conducted on 30 (male and female) patients, aged 35-65 years, to find out incidence of cardiac autonomic neuropathy and also duration and severity of hypertension. These patients were examined with four variables viz, systolic and diastolic blood pressure, pulse rate and body weight. The subjects were randomly selected. The progressive autonomic readjustments were assessed by a battery of tests including cardiovascular responses to pulse rate, hand-grip tests and orthostatic hypotension. These tests were carried out on window based Cardiac autonomic neuropathy analyzer system called CANWIN.

Results : Laboratory findings suggest that sympathetic autonomic functions were abnormal in more than seven years of duration of hypertension and more in females than in males and also that sympathetic autonomic neuropathy occurs earlier in female hypertensive patients than in males.

Conclusion : There was significant increase in sympathetic activity in hypertensive patients. Assessment of autonomic neuropathy will allow early identification of risk factors for various cardiac complications.

Key words : Hypertension, sympathetic nervous system, blood pressure

Introduction

Hypertension is a common disorder affecting 15% of adult population in India, yet much progress has not been made to prevent and control this disorder [1]. Autonomic neuropathy affects 10 - 40% of hypertensive patients. A strong association exists between cardiovascular autonomic dysfunction and hypertension. Along with diabetes and heart disease, hypertension has contributed to the morbidities and mortalities in general population. According to the European Society of hypertension and European Society of cardiology guidelines for the managements of arterial hypertension, blood pressure is classified as Normal: Systolic Blood pressure less than 120 mm Hg and Diastolic Blood pressure less than 80 mm Hg. Hypertension: Systolic Blood pressure more than 140 mm Hg and Diastolic Blood pressure more than 90 mm Hg.

Hypertension is more prevalent in urban areas than in rural areas. The reason could be the difference in heredity, smoking, body fat and life style of city

dwellers and villagers. In majority of the cases, the actual cause of this disorder is unidentified which is the reason why it is called primary hypertension. The other type is called secondary hypertension in which the causes may be renal, endocrine, neurological or mechanical. Micro vascular changes result in end organ damage which is responsible for mortality and morbidity in hypertension. Involvement of autonomic nervous system is a well known complication of hypertension. The development of autonomic neuropathy in hypertension was found to correlate with duration of hypertension. Silent myocardial infarct is more common in hypertension due to involvement of cardiac autonomic nerves. Tests to examine the autonomic nervous system were complex, invasive and often unpleasant. Now simple and non- invasive tests based on cardiovascular reflex are available [2] and are performed by using computerized instrument called CANWIN i.e. Windows based Cardiac Autonomic Neuropathy Analyzer. In mild hypertensive patient cardiac autonomic dysfunction may be mildly

Address for correspondence

Dr. Vaishali V. Patil, Assistant Professor, Department of Physiology, P.D.V.V.P.F's Medical College & Hospital, Ahmednagar – 414111, Maharashtra, India. **E-mail :** drvinodkharde@gmail.com

symptomatic and autonomic neuropathy has worse prognosis. We conducted this study to find out the incidence and preponderance of sympathetic involvement in hypertensive patient and to find out variables like duration and severity of hypertension. Modern medicines can treat hypertension but in the long run they have side effects [3]. In the early 1970s improvements in the specificity and sensitivity of assays for catecholamines in the body fluids led to a revival of interest in the sympathetic nervous system in hypertension. In addition the emergence of effective therapeutic strategies based on interference with sympathetic neurotransmission and blockade of alpha or beta adrenoceptors encouraged the view that a primary disturbance of the sympathetic nervous system or its central regulation might underlie the development of essential hypertension or at least be an important factor in the maintenance of high blood pressure.

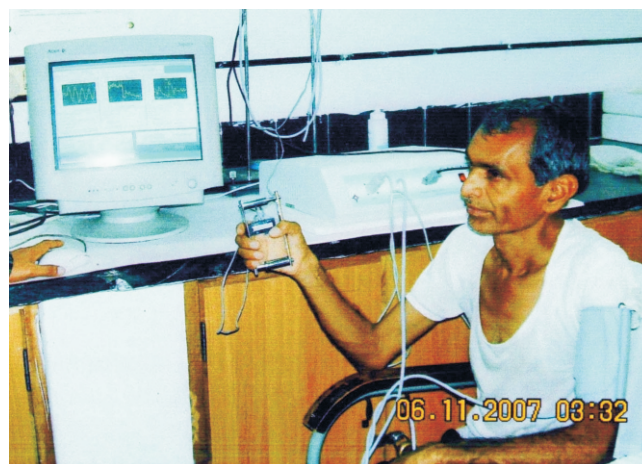
The critical role of the sympathetic nervous system in the regulation of arterial pressure and in the pathophysiology of hypertension has been championed for many decades [4, 5, 6].

Materials and methods

The present study was carried out on all cases of hypertension either attending the outpatient department or admitted in medical wards of Pravara Rural Medical College and Hospital. Patients were recruited for this study (15 male and 15 female). Informed consent was taken from the patients. The study protocol was approved by the Ethical committee of the institute. Freshly detected cases as well as known cases of hypertension were included in the present study. Only confirmed cases of hypertension were selected for this study. Some patients were on antihypertensive therapy. Patients with other diseases causing autonomic neuropathy were excluded from the study. Data on clinical history regarding age, sex, occupation, type of work, family history, socioeconomic status, and addictions were obtained and recorded from all the patients. Special emphasis was given in history for finding out any symptoms suggestive of autonomic neuropathy involvement. Body mass index was assessed.

About ... CANWIN

CANWIN is the state of the art PC windows based Cardiac Autonomic Neuropathy (CAN) analysis system with interpretation (Figure 1). It has an extensive database to keep track of the patient history and for archive test retrieval and comparisons being fully automatic, the need of manual recordings, readings and calculations is eliminated. Inbuilt time domain waveform analysis and blood pressure measurements make the task of conducting both tests very easy.



**Figure 1. Canwin
(cardiac autonomic neuropathy analyzer)**

Precautions for measurements :

- Patient should not eat drink, smoke, chew tobacco etc. at least half an hour prior to test as this would result in shift in results.
- Test should be conducted only when the patient is relaxed. Test may obtain erroneous results if the patient is mentally stressed, anxious, or impatient. Hence, the patient must be allowed to relax for 5-10 minutes before starting the test.
- The measurements were done when the patients breathing pattern was found normal on canwin.
- Patients were instructed to restrict the movements while the test is carried.
- The tests were conducted in specified time of the day to avoid any differences in the measurement and also any discomfort to the patients.

Following methods for evaluation of sympathetic nervous system were used :

Tests for sympathetic autonomic functions

1. Pulse rate /minute by palpatory method.
2. Postural hypotension (Orthostatic).
3. Sustained handgrip.

Data obtained was analyzed to provide percentile norms and correlation co-efficient between the parameters.

Results

In the present study, 30 patients were studied (15 males and 15 females). The range of age was 45 to 65 yrs in both males and females. Duration of hypertension was 2yrs to 10 yrs in male and 5yrs to 15yrs in female. The results of the tests were analyzed in two groups i.e. one is duration of hypertension less than 7yrs of duration

and more than 7yrs of duration of hypertension and other is sex wise comparison in the entire study. Table 1 summarizes the duration wise comparison of hypertension. The sympathetic tests i.e. postural hypotension and sustained handgrip are highly significant in the study group. Table 2 shows sex wise comparison.

Discussion

We studied the cardiac sympathetic function tests in hypertension. Sympathetic nervous system is the regulatory mechanism of cardiovascular system. Effects on cardiovascular autonomic tests were compared in hypertension of different chronicity. The sympathetic tests are significant in longer duration than of lesser duration hypertension. The significant differences in sympathetic activity in longer duration of hypertension suggest the mal-adjustment in cardiovascular regulatory reflexes. The search for no hemodynamic factors that affect the heart in hypertensive patients has focused mostly on neurohumoral factors, principally the sympathetic systems [7].

Through the arterial baroreceptors, changes in arterial pressure are sensed and signals to the nucleus tractus solitarius and other brain stem centers rapidly alter sympathetic tone to the cardiovascular system. Increases in sympathetic activity influence vascular smooth muscle tone, heart rate, the adrenal medulla to regulate epinephrine release and the kidney to reduce

renal blood flow and sodium excretion. In addition, the low-pressure volume receptors in the venous system sense changes in distension and filling of the capacitance vessels and alter sympathetic activity and renal excretion of salt and water [8]. This ability of the sympathetic system and adrenergic mechanisms to elicit sustained hypertensive effects may be partially due to the interactions with associated humoral mechanisms and to the effects on the kidney [9]. Sympathetic tests are highly significant ($p < 0.01$) in supine position for systolic blood pressure in females than in males and there is no difference in diastolic blood pressure among these groups. Orthostatic pressure changes in standing is highly significant for diastolic blood pressure ($p < 0.01$) in females than in male, Systolic blood pressure changes before and after handgrip was again highly significant in female than in male.

This suggests that sympathetic autonomic neuropathy occur earlier in female hypertensive patients than in male. These changes are due to drastic changes in female sex hormone after the menopause. These results explain the involvement of hypothalamo-hypophysial target gland axis especially involving adrenal gland. The present study concludes that it is worth investigating the patients for autonomic neuropathy in hypertension to prevent the cardiovascular complications. The pranayama, Kapalbhathi and specific yogasanas can prevent the cardiovascular sympathetic complications in hypertensive patients [10].

Table 1. Duration- wise comparison of various parameters in hypertensive cases

Parameters		Duration of hypertension		'p' value	Result
		< 7 years (n=15)	> 7 years (n=15)		
		Mean ± SD	Mean ± SD		
Age (yrs)		61.5±10.8	62.55±9.42	p>0.05	Not significant
Weight (kg)		67.75±8.22	65.35±4.29	p>0.05	Not significant
Pulse rate / min		76.37±7.22	79.3±6.41	p<0.05	Not significant
Blood Pressure in supine (mm of Hg)	SBP	115.75±13.54	127.0±17.16	p<0.01 p<0.05	Highly significant Significant
	DBP	73.5±11.34	73.95±6.96		
Blood Pressure in standing (mm of Hg)	SBP	116.62±13.22	125.6±14.72	p<0.01 p<0.05	Highly significant Significant
	DBP	78.5±11.41	75.9±7.14		
Blood Pressure before hand grip(mm of Hg)	SBP	116.0±3.01	124.1±11.34	p<0.01 p<0.05	Highly significant Significant
	DBP	74.12±11.21	72.75±7.09		
Blood Pressure after hand grip(mm of Hg)	SBP	128.25±11.76	138.25±14.82	p<0.05 p>0.05	Significant Not significant
	DBP	82.87±11.4	84.25±10.22		

Table 2. Sex wise comparison of various parameters in hypertensive cases

Parameters		Sex		'p' value	Result
		Males (n=15)	Females (n=15)		
		Mean ± SD	Mean ± SD		
Pulse rate / min		76.5±8.05	79.28±5.79	p>0.05	Not significant
Blood Pressure in supine (mm of Hg)	SBP	113.75±12.2	134.43±24.28	p<0.01	Highly significant
	DBP	71.56±9.29	77.86±10.61	p>0.05	Not significant
Blood Pressure in standing (mm of Hg)	SBP	114.87±11.4	131.86±25.06	p<0.05	Significant
	DBP	75.31±10.03	82.43±10.64	p<0.01	Highly significant
Blood Pressure before hand grip(mm of Hg)	SBP	113.0±10.79	132.57±22.16	p<0.01	Highly significant
	DBP	71.56±9.57	79.07±11.85	p<0.05	Significant
Blood Pressure after hand grip(mm of Hg)	SBP	125.44±10.04	144.86±22.07	p<0.01	Highly significant
	DBP	80.37±9.88	87.43±11.80	p>0.05	Not significant

SBP = Systolic Blood Pressure, DBP = Diastolic Blood Pressure.

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