

A STUDY ON CARDIOVASCULAR AUTONOMIC FUNCTIONS IN CAREGIVERS OF STROKE PATIENTS

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ABSTRACT

BACKGROUND

Stroke (cerebrovascular accident) is an important cause of disability in countries like India and longterm care of these bedridden patients is usually undertaken by the family members. A caregiver is a person who takes responsibility for those who cannot completely care for themselves. Taking care of a chronically ill member in the family usually causes stress to the caregiver causing disturbances in the autonomic function. Thus, the present study is undertaken to find out the effect of longterm caregiving on cardiovascular autonomic functions in a caregiver.

MATERIALS AND METHODS

57 caregivers of post-stroke bedridden patients, both male and female, were included in this longitudinal study. Parasympathetic activity was assessed by observing the heart rate changes to immediate standing from lying down position, heart rate changes during deep breathing and heart rate changes during Valsalva manoeuvre. Sympathetic activity was assessed by observing blood pressure changes on immediate standing from lying down position and blood pressure changes during sustained hand grip.

RESULTS

The results of the present study showed statistically significant decrease in Valsalva ratio, decrease in the heart rate following deep breathing and statistically significant increase in systolic blood pressure in response to immediate standing suggestive of autonomic imbalance.

CONCLUSION

Our findings suggest that longterm caregiving is accompanied by dysfunction of the cardiac autonomic nervous system, and these individuals are more prone to autonomic neuropathy.

KEYWORDS

Caregiver, Stroke, Autonomic Function Tests.

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BACKGROUND

Stroke (cerebrovascular accident) is emerging as an important cause of premature death and disability in countries like India, largely driven by demographic changes and enhanced by the increasing prevalence of the key modifiable risk factors.¹ Studies on the burden of stroke and the availability of health services will help the policy makers to tackle the burden of stroke. After initial hospitalisation and rehabilitation, 75-80% of stroke survivors return to community, and depend on their family members' emotional and instrumental support for their daily activities.

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Majority of stroke survivors continue to live with disabilities, and longterm care is largely undertaken by family members. During the treatment or as the disease progresses, sometimes the symptoms may worsen and physical status of the patient may deteriorate. The situation reaches to a point where a person is required to provide more assistance with activities such as bathing, dressing, eating, climbing stairs and transportation. An individual may need care due to loss of health, loss of memory, any illness, incident of falling, depression, grief, or a disabling condition. One of the advantages of being in a society is the family members who provide care to ill or disabled relatives. A primary caregiver is a person who takes primary responsibility of someone who cannot completely care for themselves.² The primary caregiver may be a family member, a trained professional or another individual. In the families, caregivers are usually spouses or children of elderly parents.³ Depending on culture there may be various members of the family engaged in caregiving. Stroke caregivers have to deal with stroke patient's mobility, self-care, depression and personality changes.⁴

The burden associated with caring a chronically ill family member usually causes stress for the caregiver. Research on family caregivers has consistently demonstrated that increased caregiver burden relates to decreased mental and physical health, particularly among Alzheimer’s and stroke caregivers.⁵ Caregiving has been linked to psychiatric disorders such as depression and anxiety, lower perceived health status, elevated blood pressure, and greater cardiovascular reactivity. Schulz and Beach found that caregivers who experienced strain due to caregiving had an increased risk of mortality compared to non-caregiving controls.⁶

Chronic stress may also reduce baroreflex performance, thus impairing one of the major cardioprotective autonomic reflex mechanisms⁷ ultimately favouring the occurrence of hypertension. The mechanistic role of autonomic dysregulation in the context of stress has been explored in a variety of animal or laboratory models⁸ and relatively few studies have addressed the association between autonomic dysfunction and real-life stress in humans. Cardiovascular autonomic function testing may be an important part in the risk assessment of coronary artery disease because of its frequent association with microvascular disease resulting in myocardial hypoperfusion.

Computerised analysis of spontaneous blood pressure and heart rate fluctuations offer an insight into autonomic cardiovascular regulation⁹ with no need of external stimulation on the cardiac and vascular targets. These type of studies appear well suited to explore the impact of stress on autonomic cardiovascular control and the possible effects of suggested countermeasures¹⁰ Thus, the present study is an attempt to find out the effect of longterm caregiving on cardiovascular autonomic functions in a caregiver.

MATERIALS AND METHODS

After obtaining the ethical clearance from the institute, fifty seven caregivers of stroke patients, (37 female and 20 male) were included in the study. Based on the prevalence of stroke in rural areas of India, sample size calculated using the formula $N = Z^2_{1-\alpha/2} Xp(1-p)/d^2$, was 47. For sample attrition few samples were added. Subjects with signs and symptoms of autonomic dysfunction like dizziness, palpitation, headache, blurred vision, fainting, peripheral reflexes and sensations in legs were excluded from the study. Children, pregnant women, subjects with diabetes mellitus, hypertension, congestive heart failure were also excluded.

Informed consent was obtained from subjects included in the study and were then subjected to a battery of five cardiovascular autonomic function tests proposed by Ewing and Clarke.¹¹ The tests were done before giving care (day 1), and one year after giving care. Parasympathetic activity was assessed by observing the heart rate changes to immediate standing from lying down position, heart rate changes during deep breathing and heart rate changes during Valsalva manoeuvre. Sympathetic activity was assessed by observing blood pressure changes on immediate standing from lying down position and blood

pressure changes during sustained hand grip. Detailed instructions regarding the procedure which was employed for each test were given to the subjects. Different manoeuvres were demonstrated to the subjects and they were trained to perform the tests.

RESULTS

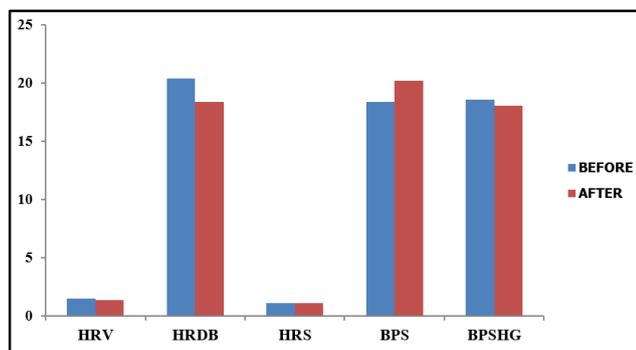
The results of the tests were expressed as means and differences between two groups. Statistical analysis was done by applying the paired student “t” test. P values <0.05 were considered to be statistically significant.

The mean values of the 30:15 ratio (the longest R-R occurring about 30 beats after standing divided by shortest R-R interval which occurs at about 15 beats after standing) which was used to assess the heart rate response to standing in caregivers before was 1.09 ± 0.03 and after caregiving was 1.08 ± 0.03 which was not statistically significant. The mean heart rate variation (the difference between the maximum and the minimum heart rates) during deep breathing before caregiving was 20.38 ± 2.94 and after caregiving was 18.40 ± 3.40 and the mean values of Valsalva ratio (ratio of longest R-R interval during phase IV to the shortest R-R interval during phase II) to assess the heart rate response to Valsalva manoeuvre before caregiving was 1.50 ± 0.13 and after caregiving was 1.40 ± 0.17 which was statistically significant suggestive of altered parasympathetic activity.

The mean increase in the diastolic blood pressure during sustained hand grip before caregiving was 18.56 ± 2.16 and after caregiving was 18.03 ± 2.60 which is not statistically significant, whereas the mean reduction in the systolic blood pressure (mmHg) in response to the immediate standing before caregiving was 18.38 ± 2.28 and after caregiving was 20.21 ± 3.86 which is statistically significant suggesting altered sympathetic activity.

Test	Before	After	P Value
HR Response to Valsalva manoeuvre (HRV)	1.50 ± 0.13	1.40 ± 0.17	0.003*
HR Response during deep breathing (HRDB)	20.38 ± 2.94	18.40 ± 3.40	0.004*
HR Response to Standing (HRS)	1.09 ± 0.037	1.08 ± 0.038	0.72
blood pressure response to standing (BPS)	18.38 ± 2.28	20.21 ± 3.86	0.01*
Blood Pressure Response to Sustained Hand Grip (BPSHG)	18.56 ± 2.16	18.03 ± 2.60	0.06

Table 1. Cardiovascular Autonomic Functions before and after Caregiving



Graph 1. Cardiovascular Autonomic Functions before and after Caregiving

DISCUSSION

The autonomic nervous system (ANS) has traditionally been described as a specific motor output portion of the peripheral nervous system. The ANS maintains homeostasis of cardiovascular, gastrointestinal, thermoregulatory, endocrine and papillary functions. The assessment of autonomic function is an important part of the evaluation of peripheral and central nervous system. Abnormalities of autonomic function leads to orthostatic hypotension, incontinence, diarrhoea, dryness of mouth and so on. The autonomic function tests are performed to confirm the clinical diagnosis of autonomic neuropathies and to assess the intactness of pathways of sympathetic and parasympathetic systems. This longitudinal study to assess the effect of caregiving on cardiovascular autonomic function was conducted in 57 caregivers of stroke patients. This study was conducted using five noninvasive autonomic function tests before caregiving and one year after caregiving. It is known that abnormal responses to autonomic function tests may precede clinical symptoms in diabetics with autonomic neuropathy.¹² Few studies were conducted on caregivers and minimal literature is available on the effect of caregiving on autonomic functions. The results of the present study showed altered sympathetic and parasympathetic function suggestive of autonomic neuropathy in the subjects after one year of caregiving. The findings of the present study are consistent with the findings of Daniel Lucini et al,¹³ Yiming Wang, Xun Jhaw et al.¹⁴ Our findings are also similar to the findings of Ahmed A Battah et al.¹⁵

The results of the present study indicates early parasympathetic and sympathetic damage. The possible explanation would be the stress associated with longterm caregiving. Studies have found that psychological changes in stroke patients such as dependency, irritability and immature behaviour are often cited as the major cause of stress among caregivers¹⁶ which in turn result in altered autonomic activity.

CONCLUSION

The results of the present study suggest altered cardiovascular autonomic functions which is one of the early features of autonomic neuropathy. Thus, early diagnosis and intervention may prevent the complications associated with

autonomic dysfunction. Further studies related to effect of caregiving on physical health and mental health of a caregiver can be taken up for better understanding of effects of longterm caregiving. Physicians who are treating the older adults may be in a best position to identify caregivers at risk. Older married couples should be evaluated for their health status as well as the caregiving demands that exist in the home environment.

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