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Mini Review

Missing Factor in Lifestyle Diseases: "The Role of Disturbed Autonomic (Sympathetic) Functions"

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Abstract

The pandemic of noncommunicable diseases is increasing swiftly. The role of disturbed autonomic functions especially with increased basal sympathetic discharge is found in various diseases. Sympathetic discharge originates from hypothalamus. The cortex modulates functions of the hypothalamus. Mental stress and burnout are associated with poor physiological cortico-hypothalamic signals and increased basal sympathetic discharge. There is a need to rethink about basal autonomic functions its association with cortical activity and various diseases.

Keywords: *Lifestyle Diseases; Autonomic (Sympathetic) Functions; Cortical Activity*

Introduction

The pandemic of multi-factor, noncommunicable, lifestyle diseases is rising rapidly. The important diseases include hypertension, diabetes, acute coronary syndrome (ACS), osteoporosis, metabolic dysfunction associated fatty liver disease (MAFLD) etc. The autonomic nervous system is a part of the nervous system that maintains most of the visceral functions through a balance between two opposite systems i.e. parasympathetic and sympathetic systems. This balance produces homeostasis in maintaining blood pressure, heart rate, bowel and bladder functions and all visceral functions [1]. Imbalance between these two systems favors the development of multiple noncommunicable diseases. A clinical association of high basal sympathetic activity is present in various diseases [2-11].

Association of increased basal sympathetic discharge and additional findings in various diseases

1) Hypertension-elevated basal sympathetic discharge and increased left ventricular ejection force (LVEFo) [2,3].
2) Acute coronary syndrome (ACS) - elevated basal sympathetic discharge, ATP (Adenosine Tri Phosphate) mismatch and endothelial dysfunction [4,5].
3) Type 2 diabetes mellitus - insulin resistance [6,7].
4) Osteoporosis - elevated sympathetic activity [8].
5) Irritable bowel syndrome - elevated sympathetic and reduced parasympathetic activity [9].

6) Prostatic hyperplasia (BPH) - elevated sympathetic activity [10].

7) Metabolic dysfunction associated fatty liver disease (MAFLD) - elevated sympathetic activity [11].

Origin of basal sympathetic activity

Basal sympathetic activity is sympathetic activity that maintains normal blood pressure and heart rate. It arises from the hypothalamus (the paraventricular nucleus PVN). It is linked to the limbic system. The prefrontal cortex, insular cortex and cingulate gyrus are important cortical areas that modulate the activity of the hypothalamus [1-6].

The role of the cerebral cortex

The cerebral cortex is the primary site from where nerve impulses are generated. Cortical nerve impulses originate in the cerebral cortex, primarily within pyramidal neurons, found in the cortex's various layers. These neurons, particularly those in the motor cortex, send their axons to the other cortical areas and subcortical areas. The cerebral cortex has extensive connections with the hypothalamus; the hypothalamus receives afferent from the limbic system (cingulate gyrus) and the neocortex and other areas [1]. The cortex therefore has some indirect control (modulating effect over the hypothalamus) over the sympathetic nervous system. Electroencephalography (EEG) is used to assess the cortical activity.

In previous studies, a synchronized rhythm in eye closure state in EEG is associated with normal basal sympathetic discharge as compared to a desynchronized (fast beta activity) rhythm is associated with increased basal sympathetic discharge. Desynchronized state is clinically associated with stress, mental burnout and likely physiological depletion of neurotransmitters like acetylcholine [2,3,6,7].

So, it is concluded that mental stress/burnout results in impaired cortical-hypothalamic signals and increased basal sympathetic rhythm. Increase in sympathetic activity is associated with impaired functions of various organs/systems (discussed above) despite having their, own auto regulation.

Conclusion and Suggestions

Pandemic of various life style disease is directly linked with imbalance in autonomic functions especially high basal sympathetic discharge.

Maintaining normal basal sympathetic rhythm by preventing stress/burnout and sleep duration of around 7 hours will help in replenishing neurotransmitters and reducing noncommunicable diseases. A joint effort by an individual/state and national level is necessary to reduce the pandemic of such diseases.

The need to understand the basal activity of autonomic nervous system and cortical influence in maintaining vital functions and to revisit its role in the development of various diseases is the current demand.

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