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LITERATURE REVIEW : THE ASSOCIATION BETWEEN CORTISOL AND STRESS LEVELS IN HYPERTENSION PATIENTS

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Abstract

Hypertension is one of the leading causes of morbidity around the world. Between 1990 and 2019, the number of people with hypertension doubled, rising from 650 million to 1.3 billion. Hypertension is defined as high blood pressure with a systolic pressure higher than 140 mmHg and a diastolic pressure higher than 90 mmHg on both measurements taken at a five-minute interval during a period of sufficient rest or calm. Stress is the leading cause of hypertension because it increases cortisol output by the adrenal glands, which leads to hypertension. This study is a literature review investigated the association between cortisol levels and stress levels in hypertension patients using a journal review using comparative research approaches. The results indicate that there is a link. Cortisol levels and stress levels are linked in hypertensive patients because when stressed, the body releases more stress hormones (adrenaline and cortisol), which activates the Renin Angiotensin Aldosterone System (RAAS), causing blood pressure increase..

Background

Hypertension is one of the most frequent diseases in society. The World Health Organisation (WHO) has released its first report on the adverse effects of high blood pressure. According to the survey, approximately four out of every five patients with high blood pressure do not receive sufficient therapy. However, if countries improve services, 76 million fatalities may be prevented between 2023 and 2050 (World Health Organization, 2023). Between 1990 and 2019, the number of people with hypertension doubled, rising from 650 million to 1.3 billion. Currently, nearly half of the world's high blood pressure patients are unaware of their disease. More than 75% of adults with hypertension live in low- and middle-income nations (World Health Organization, 2023). According to Riskesdas 2018, the prevalence of hypertension in Indonesia is 34.11%, and the estimated number of hypertension patients is 63,309,620 people. The death rate due to hypertension in Indonesia is 427,218 people (Kemenkes, 2019).

Hypertension is defined as having a systolic blood pressure of 140 mmHg or higher and a diastolic blood pressure of more than 90 mmHg. The pressure on humans increases naturally throughout the day. High blood pressure is considered harmful if it persists (Tika, 2021). Stress is one of the primary causes of hypertension. Stress can temporarily raise blood pressure. When stressed, stress hormones increase, leading the heart to pump blood faster and blood pressure to increase (Nuraini, 2015). Stress is one of the primary factors that triggers cortisol release in the body. A stressor causes the hypothalamus to activate the sympathetic nervous system, releases CRH, which stimulates the release of adenocorticotrophin hormone (ACTH) and Cortisol, and causes the release of vasopressin. Cortisol secretion is influenced not just by stress, but also by the diurnal system (Sri et al., 2021).

Cortisol is the primary glucocorticoid secreted by the adrenal cortex. Aside from its metabolic, anti-inflammatory, and immunosuppressive properties, cortisol has a permissive influence on the function of other hormones, including epinephrine. Cortisol can increase the action of epinephrine, causing vasoconstriction (narrowing of blood vessels) by non-genetic pathways. Vasoconstriction of renal afferent arterioles indirectly promotes renin secretion by limiting the supply of oxygen-rich blood to the kidneys, which eventually activates the renin-angiotensin-aldosterone system (RAAS), resulting in hypertension (Muñoz-Durango et al., 2016; Sri et al., 2021). According to the statement above, the problem raised in this study is the link between cortisol and stress levels in hypertension patients. The purpose of this study was to look into the association between cortisol and stress levels and the occurrence of hypertension in hypertensive individuals.

Method

This evaluation investigated the association between cortisol levels and stress levels in hypertension patients using a journal review using comparative research approaches. The approach utilised in preparing this review was library research, which involved searching for sources or documents in the form of primary material in Sinta-recognized national and international periodicals. In addition, this study searches for data utilising other online resources such as Google and other magazine sites, reference materials in the form of books, information, and the internet.

Result and Discussion

Hypertension is described as a persistent increase in systolic blood pressure to 140 mmHg or more, as well as an increase in diastolic blood pressure to more than 90 mmHg (Debora et al., 2023). Hypertension is diagnosed if blood pressure is measured within two days and the systolic blood pressure is 140 mmHg or higher, the diastolic blood pressure is 90 mmHg or above (World Health Organization, 2023). Chronic high blood pressure can damage the kidneys, heart, and brain if not treated early and properly (Delfriana Ayu et al., 2022). Hypertension can be divided into two categories based on the cause: primary hypertension and secondary hypertension. Primary hypertension is defined as elevated blood pressure with an unknown cause. Secondary hypertension is produced by other pathological processes, such as renal parenchymal disease or primary hyperaldosteronism (Kadir Bagian et al., 2016). Gender, age, heredity, lack of exercise, stress, obesity, salt intake, smoking habits, and alcohol consumption are all factors that contribute to high blood pressure (Zheng et al., 2020).

Stress is the leading cause of hypertension. Stress is the body's reaction to changes that necessitate a physical, psychological, and emotional response, control, and/or adjustment. Stress can arise from situations, conditions, ideas, and/or produce irritation, anger, uneasiness, and anxiety (Silverman et al., 2010). The cause of stress is called a stressor Stress takes many forms and puts pressure on people, causing a reaction known as stress. The stressor can originate from outside, known as an external stressor, or from within, known as an internal stressor. External stressors are the result of a person's interactions with their surroundings. This can produce trauma for the individual, such as losing a loved one or career, while internal stressors such as worry, anger, and guilt can put pressure on the individual (Godeberta et al., 2023).
Stress is classified into three categories: mild stress, moderate stress, and severe stress (Andriana & Prihantini, 2021).

1. Mild Stress, is a stress symptom that does not interfere with the individual's physiological functioning. These symptoms are usually moderate and common, such as forgetting or falling asleep during activities.
2. Moderate Stress, is a sign of stress that can persist from a few hours to many days. Moderate stress symptoms might disturb an individual's physiology, such as lack of attention, menstrual cycle abnormalities, or digestive disorders. Examples of moderate stresses are activities that are excessively heavy or failure to carry out commitments at work.
3. Severe Stress, is a symptom of persistent stress that might last several days or months. Symptoms are becoming more severe than they were previously. Symptoms may include palpitations, sweating, increased anxiety in the extremities, and easy panic. Financial difficulties, a difficult-to-cure sickness, or home failure are all examples of stressors under severe stress.

Stress stimulates the adrenal glands to secrete more cortisol. Cortisol is the primary glucocorticoid secreted by the adrenal cortex. Aside from its metabolic, anti-inflammatory, and immunosuppressive properties, cortisol has a permissive influence on the function of other hormones, including epinephrine (Sri et al., 2021). Cortisol supports a variety of roles, that include:

1. Metabolic Effects
   Cortisol's metabolic effects improve blood glucose levels while decreasing protein and fat storage. Specifically, cortisol serves the following functions: Stimulates hepatic gluconeogenesis, which is the conversion of non-carbohydrate sources (such as amino acids) to carbs in the liver. Gluconeogenesis plays a vital role in replenishing liver glycogen stores and maintaining appropriate blood sugar levels in between meals. This change is significant because the brain can only use glucose for metabolic fuel, whereas neural tissue cannot store glycogen. Inhibits glucose uptake and utilisation by most tissues, with the exception of the brain, allowing glucose to be used by the brain, which requires it as metabolic fuel. Encourages protein breakdown in a variety of tissues, including muscles. Cortisol raises blood amino acid levels by converting specific muscle proteins into their constituent amino acids. These mobilised amino acids are ready to be employed in gluconeogenesis or elsewhere as needed. Increases lipolysis, which breaks down fat stored in adipose tissue and releases fatty acids into the bloodstream. These mobilised fatty acids can be employed as an alternate metabolic fuel for tissues that can use it instead of glucose, freeing up glucose for storage in the brain (Godeberta et al., 2023).
2. Permissive Effects
   Cortisol is extremely significant because to its permissive qualities. For example, cortisol levels must be adequate for catecholamines to cause vasoconstriction. If left untreated, a cortisol deficiency can cause circulatory shock in stressful settings that necessitate immediate broad vasoconstriction Made et al. (2017).
3. The Role of Adaptation to Stress
   Cortisol is an important hormone that helps people deal with stress. Stress is defined as the body's nonspecific general response to any factor that surpasses or will override its compensating ability to sustain homeostasis. Although the specific role of cortisol in stress adaptation is uncertain, the explanation below may be appropriate, however hypothetical. Humans or primitive animals that were injured or facing a life-threatening scenario would postpone consumption. Cortisol's activity, which triggers a shift in protein and fat reserves in order to enhance carbohydrate stores and blood sugar levels, will help protect the brain from malnutrition during this forced fast. Furthermore, the amino acids produced by protein

breakdown can be used to heal damaged tissue in the event of a physical injury. As a result, the amount of glucose, amino acids, and fatty acids accessible for usage when needed has increased (Yuliadi, 2021).

Increasing cortisol levels in the blood can help with anxiety and stress, which are thought to be generated by metabolic consequences. However, raising cortisol has both positive and harmful effects on the body, such as boosting blood pressure (Sri et al., 2021). Conducted a study with 59 hypertensive respondents, of whom 27 had mild hypertension, 20 had moderate hypertension, 11 had severe hypertension, and 1 had very severe hypertension, resulting in 49.2% experiencing moderate to severe levels of stress. 33.9% were in the mild stress category, while only 16.9% were in the normal category, implying that the higher the stress level, the more common the recurrence of hypertension. Made et al. (2017)

Similar research was undertaken by Sri et al. (2021), Compared to the normal pregnancy group, there was a substantial link. Pregnant women with high levels of the hormone cortisol are 20 times more likely to develop gestational hypertension. Delavera et al. (2021) studied 13,667 individuals aged ≥15 years, with hypertension as the dependent variable and stress psychological conditions as the independent variable. Other variables included respondent characteristics such as age, gender, BMI, tobacco consumption, fruit and vegetable consumption, fast food consumption, and physical activity. This study found a link between psychological stress and the incidence of hypertension (P=0.05).

Increased cortisol and stress levels can raise the risk of hypertension. When a person is stressed, the hypothalamus-pituitary-adrenal (HPA) axis is activated, boosting the release of adrenal gland chemicals, including cortisol and epinephrine. Cortisol increases the action of epinephrine, causing blood vessels to constrict. Renal afferent arterioles will also narrow and activate the Renin Angiotensin Aldosterone System (RAAS) due to decreased blood flow, which transports oxygen to the kidneys (Sri et al., 2021). When the Renin Angiotensin Aldosterone System (RAAS) is activated, peripheral resistance, sodium and water reabsorption, heart rate, and cardiac output rise, as does blood pressure (Muñoz-Durango et al., 2016). Aside from that, continuous stress weakens the immune system and disrupts the proper functioning of the body's systems. A weakened immune system makes people more vulnerable to sickness, and chronic stress can eventually lead to hypertension due to the continuous release of stress hormones (adrenaline and cortisol) into the blood, which raises sugar levels and lowers libido (Lu et al., 2019).

Conclusion

Cortisol levels and stress levels are linked in hypertensive patients because when stressed, the body secretes more stress hormones (adrenaline and cortisol), which activates the Renin Angiotensin Aldosterone System (RAAS), causing blood pressure to rise. Prolonged stress raises blood sugar levels and suppresses the immune system and libido.

Recomendation

It is hoped that health personnel may discover and implement effective techniques to assist hypertension patients in dealing with the stress they endure, which will keep hypertensive patients from developing more serious issues.

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