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Relationship of Emotional Intelligence with Pre-Hypertension and its Impact on Autonomic Nervous System as Assessed by Heart Rate Variability in Adult Males

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Abstract

Objectives:

1. To compare emotional intelligence score in normotensives and pre-hypertensives.
2. To compare emotional intelligence score with heart rate variability (HRV)
3. To compare HRV in normotensives and pre-hypertensives.

Methodology: 30 pre-hypertensive males and 30 age matched controls of 25 – 50years of age were enrolled. BP was measured using mercury sphygmomanometer. Pre-hypertension was defined as systolic BP from 121 to 139mm Hg or diastolic BP from 80 to 89mm Hg. Emotional intelligence was measured by Schutte Self-Reported Emotional Intelligence Test and subjects were categorized into two groups: Group A: Low EI (Score <111), Group B: High EI (Score >111) HRV was measured in the supine position for 5 minutes. Frequency domain parameters viz HFnu and LF/HF ratio were used for analysis of autonomic dominance.

Results: Mean EI score was significantly less in pre-hypertensives as compared to controls. Low EI subjects had a significantly lower mean HFnu and a significantly higher mean LF/HF ratio showing lower parasympathetic and higher sympathetic activity in them. Pre-hypertensives had lower mean HFnu and higher LF/HF ratio showing lower parasympathetic and higher sympathetic activity in them.

Conclusions: Low EI subjects are more prone to develop pre-hypertension, had lower parasympathetic & higher sympathetic activity increasing the risk to develop hypertension in future.

Clinical Significance: Beside life style modification, improving EI is an important measure to manage pre-hypertension and prevent hypertension.

Keywords: *Emotional Intelligence; Prehypertension; Heart Rate Variability.*

Introduction

Prehypertension is an emerging common risk factor for not only hypertension, but also cardiovascular target organ complications. The term "prehypertension" was defined in 2003 by JNC 7 as SBP 120–139 and/or DBP 80–89 mmHg.[1] According to a study done in urban Indian Population, the age and sex adjusted prevalence of prehypertension was 32.3 per cent; it was significantly higher in males (36%) compared to females 28.1%. Prehypertension tends to progress to hypertension over a relatively short time course, and is a risk factor for development of microalbuminuria and cardiovascular disease, with consequently increased mortality. However, the origins and pathogenesis of the syndrome are not yet well understood.[2]

In the modern times enhanced performance demands stress is present universally, and none of us can escape

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daily life stresses. Stress is the result of an interaction between the individual and the environment in which the individual assesses deficiencies in coping strategies in response to a demanding situation. There is the existence of four processes during this interaction. The first is perception of internal or external stimulus; the second is evaluation of that stimulus as a threat to wellbeing; the third is appraisal of cognitive, physical coping resources, and the fourth is complex set of cognitive and somatic responses known as the stress response.[3,4]

Researches have found a wide range of important life outcomes can be predicted by the emotional intelligence (EI). EI is the ability to recognize emotion, reason with emotion and emotion-related information, and process emotional information as part of general problem solving. High-level of EI can significantly predict healthy functioning, as well as the distress and experience of traumatic stress. Individuals with high EI experienced less stress at work.[4]

Emotions have been defined as "brief, organized set of responses (including psychological changes, expressive behaviours, action tendencies, and subjective experiences) that optimize how individuals address challenges and exploit opportunities that arise in the events that they encounter". Intelligence has been defined as "ability to understand complex ideas, adapt effectively to the environment, learn from experience, engage in various forms of reasoning overcome obstacles by taking thought".[5] EI is defined as "the ability to perceive and express emotion, assimilate emotion and thought, understand and reason with emotion, and regulate emotion in the self and others."[7]

Schutte Self Report Emotional Intelligence Test is a valid and reliable questionnaire to assess EI. It consists of 33 questions. A score below 111 is considered as low EI.[8]

Autonomic nervous system (ANS) activity is viewed as a major component of the emotion response. For example, negative emotions such as anger, anxiety & fear response are characterized by sympathetic response such as α and β adrenergically mediated cardiovascular effects: increased heart rate, increased blood pressure (BP), and increased total peripheral resistance. Whereas positive emotions such as amusement, contentment, affection response is characterized by sympathetic deactivation or parasympathetic dominance. [9]

Valuable insight of ANS function can be gained non-invasively through Heart rate variability (HRV) analysis, a measurement of beat to beat changes in heart rate. HRV is a simple and non-invasive indicator for the detection and investigation of possible cardiac autonomic activity whether sympathetic or parasympathetic dominance. Low HRV is often an indicator of abnormal and inadequate adaptation of the ANS, which may indicate presence of physiological malfunction. The decrease in autonomic activity can be an early sign for the prediction of the risk for cardiovascular and metabolic disease.[10]

The present study was designed to determine the association between Pre-Hypertension, EI and HRV.

Objectives:

1. To compare EI score in normotensives and pre-hypertensives.
2. To compare EI score with HRV
3. To compare HRV in normotensives and pre-hypertensives.

Materials and Method

The present study was a cross sectional study designed to investigate the association among pre-hypertension, EI and HRV. The study was done in Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur. Ethical clearance was obtained from the Institutional Ethical Committee and written informed consent was obtained by all subjects. The study consisted of 30 Pre-hypertensive male subjects between 25 – 50 years of age and equal number of age matched normotensive controls were enrolled in the study. Subjects who were smokers & alcoholics and who were suffering from diabetes mellitus, hypertension, cardiovascular or respiratory diseases were excluded from the study.

BP was measured using mercury sphygmomanometer taking all necessary precautions. Subjects were allowed to sit quietly for 15 min prior to assessment of BP; three consecutive measurements were made 5 min apart, and BP was determined as the mean of the three readings. Pre-hypertension was defined as systolic BP from 121 to 139mm Hg or diastolic BP from 80 to 89mm Hg. [1]

EI was measured by Schutte Self-Reported Emotional Intelligence Test. It consists of 33 questions. Each question asks about emotions or reactions associated with emotions. After deciding whether a statement is generally true, the subjects were supposed to use the 5-point scale to respond to the statement: "1"

if strongly disagree, the "2" if somewhat disagree, "3" neither agree nor disagree, the "4" somewhat agree, and the "5" strongly agree. Each item is given marks according to the option serial and responses to items 5, 28, and 33 are reverse coded. The total sum will give the EI score and subjects were categorized into two groups:

Group A: Low EI (Score < 111),

Group B: High EI (Score > 111)[8]

Method of measuring HRV

HRV was measured in the following way: ECG was recorded using standardized in house built Analogue ECG Amplifier, with Audacity 1.3.13 license free software in the supine position for 5 minutes after 10 minutes of supine rest. Subjects were instructed to close the eyes and to avoid talking, moving of hands, legs and body, coughing and sleeping during the test.

ECG was recorded in dot wave form with 8000 samples/second, the recorded wave was subjected to digital filtering to filter the noise and amplification to increase the size of ECG wave. Using beat finder every 'R' wave was recorded as beat and the real time was noted. The data was then exported as labels to notepad and from there to Microsoft excel to find out 'R-R' interval, this was saved in notepad. The notepad file was opened in Kubios HRV Analysis software 2.2 version license free software and the report sheet was saved in JPEG format. Frequency domain parameters viz HFnu and LF/HF ratio were used for analysis of autonomic dominance (sympathetic or parasympathetic).[11,12]

Descriptive statistical analysis was carried out on the data thus obtained. Independent t test was used for comparison among EI, Pre-hypertension and frequency domain parameters of HRV. Significance was assessed at 5% level of significance.

Results

Mean age of the subjects was 39.2 $\pm$ 5.23 years. Low EI was observed in 23 out of 60 subjects (38.3%) out of which 20 subjects were pre-hypertensives and 3 normotensives. Mean EI score was significantly less in pre-hypertensives as compared to normotensive controls [Table 1]. Low EI subjects had a significantly lower mean HFnu and a significantly higher mean LF/HF ratio [Table 2] showing lower parasympathetic and higher sympathetic activity in them. Pre-hypertensives had lower mean HFnu and higher LF/HF ratio than normotensive controls [Table 3] showing lower parasympathetic and higher sympathetic activity in them.

Discussion

Our study intended to investigate the relationship of EI with pre-hypertension and its impact on ANS in adult males. Pre-hypertensives had a lower EI than their normotensive counterparts which means they cannot manage their emotions well and are emotionally unstable. Our results were consistent with other studies. A study done in Bhavnagar revealed a low EI among hypertensives as compared to normotensives. Lower EI can be claimed to contribute to the occurrence of physical problems, such as abnormal BP. Failure to manage anger, the control of which indicates better EI, increases blood cholesterol and adrenaline and thus hardens the arteries and increases the probability of affliction with cardiovascular disease.[13]

A study done by Mokhtari et al showed that training on EI without employing other approaches, such as psychotherapy, family therapy and counselling, resulted in a significant reduction in systolic and diastolic BP of patients suffering from coronary artery disease. This clearly indicates that lower EI can be one of the cause of high BP. [14]

As discussed above, EI is the ability to restrain negative feelings such as anger, self-doubt, stress, anxiety and instead focus on positive ones such as confidence, empathy and congeniality. Low emotional intelligent individuals find it hard to manage their negative emotions and land up being under constant stress. This stress activates sympathetic nervous system which may cause an increase in BP in them. Our study showed that low EI subjects had significantly lower mean HFnu and a significantly higher mean LF/HF ratio. This reveals that they have lower parasympathetic and higher sympathetic activity. Our study showed an increased sympathetic activity in Pre-hypertensives as analysed by HRV indicating sympathetic dominance in pre-hypertensives.[15]

The researchers found that both anger and appreciation caused a change in autonomic activation. The two emotional states produced very different effects in terms of sympatho-vagal balance. Anger produced sympathetically dominated power spectrum, whereas appreciation produced shift toward increased parasympathetic activity.[16,17]

These shifts were correlated with shifts in HRV to 'healthier' patterns correlating with lower cardiac risk. It strongly suggest that shifting to and maintaining a

sincere, positive emotional state may shift physiology towards better health. This may explain why optimists have significantly lower mortality than pessimists.[18]

Executive brain areas, such as the prefrontal cortex, exert an inhibitory influence on sub-cortical structures, such as the amygdala, allowing an individual to adaptively respond to demands from the environment, and organize their emotional and behavioural responses effectively. Thus, at rest, active cortical brain areas are indicative of greater inhibitory and emotional regulation. These neural structures are also responsible for the regulation of the autonomic nervous system activity. The heart is under tonic inhibitory control by the ANS. Vagal parasympathetic control represents the major descending inhibitory pathway, adaptively regulating emotional responses. It is suggested that this common reciprocal inhibitory cortico-subcortical neural circuit serves as the structural link between psychological processes such as regulation of emotions. The individuals with low EI fails to regulate emotions and are under constant negative stress, so the inhibitory influence of pre-frontal cortex is deranged and this results in increased sympathetic activity and decreased parasympathetic activity in them.[19]

Our study also showed a strong association of pre-hypertension with increased sympathetic & decreased parasympathetic activity. Similarly, a study showed autonomic imbalance in pre-hypertensives was due to increase in both sympathetic activity and vagal inhibition. Increased BP was associated with reduced HRV in children. Children with high BP had a significantly lower HF and higher LF/HF ratio indicating a sympathetic dominance in high BP.[20,21]Another study indicates sympatho-vagal balance may be altered towards sympathetic predominance in essential hypertension which is supported by markedly decreased parasympathetic activity.[22]A significant decrease in HFnu and a significant increase in LFnu & LF/HF ratio in hypertensives as compared to normotensives showing sympathetic dominance has been shown.[23]

Table 1: Comparison of EI in Pre-hypertensives and normotensives

		N	Mean ± Std. Deviation	p value
EI	Normotensives	30	127.2 ± 13.5	**< 0.01**
	Pre-hypertensives	30	109.5 ± 11.2	

Table 2: Comparison of HFnu & LF/HF ratio with EI

		N	Mean ± Std. Deviation	p value
HFnu	Low EI	23	46.12 ± 9.98	< 0.01
	Normal EI	37	73.12 ± 9.09	
LF/HF Ratio	Low EI Normal EI	23 37	1.27 ± 0.55 0.39 ± 0.2	< 0.01

Table 3: Comparison of HFnu & LF/HF ratio in Pre-hypertensives and normotensives

		N	Mean ± Std. Deviation	p value
HFnu	Normotensives	30	54.73 ± 10.95	**< 0.01**
	Pre-hypertensives	30	71.1 ± 16.76	
LF/HF ratio	Normotensives Pre-hypertensives	30 30	0.44 ± 0.24 1.03 ± 0.67	< 0.01

Conclusion

The present study showed that there exists a direct relationship of EI with Pre-hypertension & ANS. Low EI subjects are more prone of becoming pre-hypertensives through decrease in parasympathetic & increase in sympathetic activity increasing the risk to develop hypertension in near future.

In modern times, as a result of fast changing social values & lifestyle, there is an increase in feeling of insecurity, increased ambitions and feeling of competition to excel. This contributes to emotional imbalance which leads to various physical, psychological and psychosomatic problems due to sympatho-parasympathetic imbalance along with pre-hypertension and finally hypertension and other cardiovascular morbidities. So, to prevent pre-hypertension and its consequences, besides life style modification, we have to strengthen our EI.

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References

1. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA 2003; 289:2560–72.

2. Yadav S, Boddula R, Genitta G, Bhatia V, Bansal B, Kongara S et al. Prevalence & risk factors of pre-hypertension & hypertension in an affluent north Indian population. Indian J Med Res 2008;128:712-720.
3. Lazarus RS and Folkman S. Stress, Appraisal, and Coping, New York: 4. Springer. 1984.
4. Singh Y, Sharma R. Relationship between general intelligence, emotional intelligence, stress levels and stress reactivity. Annals of Neurosciences 2012;19(3):107-111.
5. Cote S. Emotional Intelligence in Organizations. Annual Review of Organizational Psychology and Organization Behavior 2014;1:459–488.
6. Petrides, KV, Furnham A. Trait emotional intelligence: behavioural validation in two studies of emotion recognition and reactivity to mood induction. European Journal of Personality 2003;17(1): 39–57.
7. Cherniss C. Emotional Intelligence: Toward Clarification of a Concept. Industrial and Organizational Psychology 2010;3(2):110–126.
8. Schutte NS, Malouff JM, Hall LE, Haggerty DJ, Cooper JT, Golden C et al. Development and validation of a measure of emotional intelligence. Personality and Individual Differences 1998; 25(2): 167–177.
9. Kreibig SD. Autonomic Nervous System Activity in Emotion: A Review. J Biopsycho 2010;03:1-10.
10. McCraty R, Atkinson M, Tomasino D, Goelitz J, Mayrovitz HN. The impact of an emotional self-management skills course on psychosocial functioning and autonomic recovery to stress in middle school children. Integr Physiol Behav Sci. 1999 Oct-Dec;34(4):246-68.
11. Mahesh Kumar K, Dilara K, Maruthy KN, Sundareswaran L. Validation of PC based Sound Card with Biopac for digitilization of ECG recording in Short term HRV Analysis. N Am J Med Sci 2016;8(7):307-311.
12. Tarvanien MP, Niskanen JP, Lipponen JA, Rantaaho PO, Karjalainen PA. Kubios HRV – Heart rate variability software. Computer method and programs in Biomedicine 2014;113(1):210-220.
13. Kantariya AS, Desai MD. Emotional Intelligence in Patients with High Blood Pressure and Heart Disease. The International Journal of Indian Psychology 2016;4(1):20-24.
14. Mokhtari Z, Alipor A, HasanzadehPS, Exiri FM. The Effect of Components of Emotional Intelligence on Physical Health Indicators of Hospitalized Cardiac Patients. Pars Journal of Medical Sciences 2014;12(1):9-16.
15. Mayuran L. Impact of emotional intelligence on stress management: study of schools with banks in Jaffna district. Global Journal of Commerce and Management Perspectives 2013;2(6):67 – 71.
16. McCraty R, Atkinson M, Tiller WA, Glein R, Watkins AD. The effects of emotions on short term power spectrum analysis of heart rate variability. The American Journal of Cardiology 1995;76(14):1089-1093.
17. Tiller W, McCraty R, & Atkinson M. *Altern Ther Health Med.* 1996; 2(1):52.
18. Kubzansky LD, Sparrow D, Vokonas P, Kawachi I et al. Is the glass half empty? A prospective study of optimism and coronary heart disease in the normative aging study. *Psychosom Med.* 2001; 63:910–916.
19. Williams DP, Cash C, Rankin C, Bernardi A, Koenig J, Thayer JF. Resting heart rate variability predicts self-reported difficulties in emotion regulation: a focus on different facets of emotion regulation.Front Psychol 6:1-8.
20. Pal GK, Amudharaj D, Pal P, Saranya K, Lalitha V, Gopinath K et al. Study of sympathovagal imbalance by spectral analysis -of heart rate variability in young pre-hypertensives. Indian J Physiol Pharmacol 2011;55(4):357–363
21. Xie GL, Wang JH, Zhou Y, Xu H, Sun JH, Yang SR et al. Association of High Blood Pressure with Heart Rate Variability in Children. Iran J Pediatr 2013; 23 (1): 37-44.
22. Patil SS, Gyanajyoti. A study of heart rate, blood pressure and heart rate variability at rest, in normotensive and hypertensive adult male subjects. Int J Cur Res Rev 2015;15(18): 11-14.
23. Natarajan N, Balakrishnan AK, Ukkirapandian K. A study on analysis of Heart Rate Variability in hypertensive individuals. International Journal of Biomedical and Advance Research 2014;5(2):109-111.