Journal of Psychosomatic Research 93 (2017) 33–40

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

Affective impairment in chronic low blood pressure☆

Stefan Duschek [a,*], Alexandra Hoffmann [a], Gustavo A. Reyes del Paso [b]

[a] UMIT - University of Health Sciences Medical Informatics and Technology, Institute of Psychology, Austria
[b] University of Jaén, Department of Psychology, Spain

ARTICLE INFO

Article history:
Received 5 August 2016
Received in revised form 21 November 2016
Accepted 10 December 2016
Available online xxxx

Keywords:
Hypotension
Blood pressure
Mood
Depression
Autonomic control

ABSTRACT

Objective: Physical complaints such as faintness, dizziness, cold limbs and headaches have been well-established in chronic low blood pressure (hypotension). This study investigated the occurrence of adverse emotional states and the symptoms of depression in this condition. As autonomic dysregulation, particularly diminished sympathetic tone, is believed to be involved in the etiology of hypotension, the impact of different facets of autonomic cardiovascular control on mood and depressive symptoms was also explored.
Methods: Forty individuals with chronic hypotension and forty normotensive control persons were presented with the Mood Scale and Beck Depression Inventory. Stroke volume, cardiac output, pre-ejection period, Heather index and aortic peak blood flow velocity were recorded under resting conditions as indices of beta-adrenergic inotropic drive. Respiratory sinus arrhythmia and baroreflex sensitivity were additionally obtained.
Results: Hypotensive individuals scored markedly higher on both questionnaire scales than controls, indicating an adversely affected emotional state and more severe depressive symptoms. In the entire sample, cardiac output, Heather index, and aortic peak blood flow velocity correlated negatively with the questionnaire scores; according to regression analysis, the Heather index explained the largest proportion of test score variance.
Conclusion: Although hypotension does not constitute a serious medical condition, the findings of an adverse affective state and increased burden with depressive symptoms corroborate the view that it can have a considerable impact on wellbeing and quality of life. The correlations of the beta-adrenergic indices with the questionnaire scales indicate that cardiac sympathetic regulation plays a key role in the psychophysiological mediation of hypotension-related mood impairment.

1. Introduction

Chronic hypotension is referred to as a persistent state of inappropriately low blood pressure independent of the occurrence of other pathological conditions [1]. The chronic form is distinguished from orthostatic hypotension (that is, circulatory problems when assuming an upright position) and symptomatic hypotension, which occurs, for example, due to blood loss or medication [2]. According to WHO [3] criteria, hypotension is diagnosed when systolic blood pressure falls below 100 mmHg in women and 110 mmHg in men. Chronically low blood pressure is relatively widespread; in the general population its prevalence has been estimated at 2–3% with younger women being especially affected [4,5].

It is generally the case that in research, as well as in clinical practice, relatively little importance is ascribed to chronic hypotension [5]. In contrast to elevated blood pressure, which constitutes a major risk factor for cardiovascular diseases, chronic hypotension is not regarded as a dangerous medical condition. However, low blood pressure is associated with increased risk in pregnancy [6,7]; and longitudinal studies have revealed associations of hypotension with brain atrophy and cognitive decline in the elderly [8,9]. Typical complaints reported by affected individuals include dizziness, cold limbs, fatigue, reduced drive and concentration difficulties [5]. Various studies comparing hypotensive individuals with those with blood pressure in the normotensive range confirmed the increased prevalence of the physical symptoms [10,11]. Furthermore, population-based studies of cases spanning the whole blood pressure spectrum revealed inverse relationships between blood pressure and symptoms like faintness, dizziness and poor appetite [12,13].

In the field of psychological symptoms ascribed to chronic hypotension, various studies have confirmed the presence of deficits in attention and memory [14,15]. In contrast, abnormalities in affect-related features have received less attention thus far. In a study on quality of life, conducted in 50 years old men drawn from the general population, an inverse association between systolic and diastolic blood pressure and mental wellbeing was observed [16]. In another study, blood pressure-

☆ Place of study: Institute of Psychology, UMIT - University of Health Sciences Medical Informatics and Technology.

* Corresponding author at: UMIT - University for Health Sciences, Medical Informatics and Technology, Institute of Psychology, Eduard Wallnöfer-Zentrum 1, 6060 Hall in Tirol, Austria.
E-mail address: stefan.duschek@umit.at (S. Duschek).

http://dx.doi.org/10.1016/j.jpsychores.2016.12.008
0022-3999/

dependent symptoms of depression were investigated in a male sample aged between 60 and 89 years [17]. Men with diastolic values below 75 mmHg scored higher on the Beck Depression Inventory [18] than those with elevated (diastolic values above 85 mmHg) or normal blood pressure (intermediate range). Categorically diagnosed depression was also more frequent in hypotensive men. By definition, the generalizability of these findings is limited by the sample composition, which is particularly relevant given that young women constitute the population primarily affected by chronic hypotension [5,19].

In addition to quantification of affective state and depressive symptoms in chronic hypotension, the present study aimed to investigate possible psychophysiological mechanisms of action mediating the expected mood impairment. Autonomic nervous system dysregulation is believed to be involved in the etiology of chronic hypotension, where reduced sympathetic activity may play a key role [5,20]. This is supported by evidence of diminished electrodermal activity (EDA), in terms of reduced tonic EDA level, faster EDA habituation to sensorial stimuli and a lower rate of spontaneous EDA fluctuations, in hypotensive vs. normotensive individuals [21,22]. Regarding cardiovascular sympathetic control, reduced stroke volume (SV) and cardiac output (CO), as well as a longer pre-ejection period (PEP), were reported in hypotension at rest, under stress conditions and during sleep [23–25]. Considering that SV and CO are positively, and PEP is inversely, related to cardiac contractility, and that the ventricles are innervated by the beta-adrenergic system, the findings suggest diminished cardiac sympathetic drive in hypotension. As sympathetic hypoactivity has been related to adverse mood states and depression [26–28], it may be considered as a factor relevant to the association between hypotension and mood impairment.

In this study, baroreflex sensitivity (BRS) and respiratory sinus arrhythmia (RSA) were investigated as further autonomic parameters potentially linking hypotension to an adverse affective state and depressive symptoms. The baroreflex consists of a negative feedback loop, in which activity changes in arterial baroreceptors, due to blood pressure fluctuations, precipitate compensatory changes in heart rate and myocardial contractility [29]. Baroreflex-related mechanisms have been suggested to contribute to the manifestation of chronic hypotension; and there is strong evidence that the baroreflex is also involved in behavioral regulation [30–33]. Regarding affective states, an association between high trait anxiety and reduced baroreflex control of heart rate was reported in a healthy sample [34]. High levels of state anxiety were related to lower baroreflex control of heart rate in elderly depressed patients [35]. Furthermore, in healthy subjects, proneness to worry was accompanied by reduced BRS [36]. In patients with coronary artery disease, higher burden with symptoms of depression was associated with lower BRS [37]. Various studies compared patients with depressive disorders and healthy controls in terms of baroreflex function. Lower BRS was observed in otherwise healthy patients with recurrent depression and no risk factors for cardiovascular disease [38]. Another study reported that initially reduced BRS in major depression was further decreased during antidepressant treatment [39]. A detailed analysis showed that lower BRS in depression was associated with increased gain of the afferent component of the reflex, without adjustment of its efferent component, and a higher number of reflex operations [40].

RSA, i.e. the variation in heart rate that occurs during a breathing cycle, constitutes the most well-established index of parasympathetic cardiac tone [29]. Increased parasympathetic cardiac tone has been proposed as an additional etiological factor underlying chronic hypotension, although empirical research has yielded mixed results [24,25]. Nonetheless, considering that various studies pointed toward the relevance of interindividual differences in RSA to affect regulation [41,42], and given the well-established reduction in heart rate variability in depressive disorders [39,40,43,44], this parameter was also included in our analysis.

In the study, the main hypothesis, of an adversely affected emotional state and increased burden with depressive symptoms in chronic hypotension, was tested. While previous research on this topic was conducted in older men [16,17], a sample of younger, healthy individuals, with a high proportion of female subjects, was presently included. In contrast to the previous studies [16,17], hypotensive individuals were selected according to WHO criteria [3]. For the first time, the role of autonomic cardiovascular autonomic control in mediating hypotension-related mood impairment was investigated. For this purpose, cardiac sympathetic control was assessed using impedance cardiography. Obtained parameters comprised SV, CO, PEP, the Heather index (HI) and aortic peak blood flow velocity (velocity index, VI), all of which are linked to contractility and beta-adrenergic inotropic influences [29,45]. In addition, BRS was extrapolated from continuous blood pressure measurements using time domain analysis [46]. RSA was computed by means of spectral analysis of ECG recordings [29]. While lower cardiac sympathetic drive was expected to be associated with stronger adverse affect and higher burden with depressive symptoms, the current state of research was not conducive to forming directed hypotheses regarding the impact of BRS and RSA. On account of evidence of lower body weight in hypotensive vs. normotensive individuals [5,30], and considering possible associations of body weight with affective state and depression, body mass index (BMI) served as a control variable in all analyses.

2. Method

2.1. Participants

The study sample included 40 participants with hypotension according to WHO [3] criteria and 40 normotensive control persons (35 women and 5 men in each group). Health status was assessed by means of an anamnestic interview and a questionnaire covering diseases of the cardiovascular, respiratory, gastro-intestinal and uro-genital systems, as well as the thyroid and the liver, in addition to metabolic diseases and psychiatric disorders. Persons suffering from a relevant physical disease or mental disorder were excluded from participation. In addition, none of the participants used any kind of medication affecting the cardiovascular or central/peripheral nervous system. In total, 67 of the participants were university students (34 in the hypotensive sample, 33 in the control group). The remaining subjects were drawn from the workforce. Table 1 provides information about blood pressure and heart rate, as recorded at the beginning of the study session, in addition to age and BMI data.

2.2. Assessment of affective state and depression

The “Befindlichkeits-Skala” [Mood Scale] [47] was applied for quantification of current affective state. This 28-item self-rating scale, which is widely used in German-speaking countries, includes positive and negative adjectives, which are related to general aspects of well-being (e.g. cheerful, relaxed), as well as to more specific emotions (e.g. depressed, insecure). Higher values on the scale represent a more adversely

Table 1
Means (M) and standard deviations (SD) of systolic blood pressure, diastolic blood pressure, heart rate, age and body mass index in both samples; t and *p* values of the group comparison (df = 78 for all parameters except body mass index, where Welch's unequal variances *t*-test with df = 68.14 was applied).

	Hypotension		Control group		t	*p*
	M	SD	M	SD		
Systolic blood pressure (mmHg)	95.41	6.69	119.57	4.17	−19.03	<0.01
Diastolic blood pressure (mmHg)	64.59	6.30	77.21	5.48	−9.57	<0.01
Heart rate (beats/min)	71.70	9.54	81.00	12.00	−3.20	< 0.01
Age (years)	24.70	4.90	24.00	4.26	0.68	0.50
Body mass index (kg/m^2)	20.15	1.85	21.89	2.77	−3.30	< 0.01