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Hypertension risk factors and cardiovascular reactivity to mental stress in young men

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Abstract

Hypertension risk may be associated with increased pressor response to mental stress. However, studies using family history as a predictor of reactivity have obtained mixed results. We assessed cardiovascular responses to mental arithmetic stress (a 5-min serial subtraction task) in male medical students ($n = 220$) at three levels of hypertension risk based on parental history and the subject's systolic blood pressure (SBP): low (SBP < 125 mm Hg *and* 0 or 1 hypertensive parent), moderate (resting SBP ≥ 125 mm Hg *or* 2 hypertensive parents), or high (resting SBP ≥ 125 mm Hg *and* 1 or 2 hypertensive parents). High risk men showed the greatest blood pressure responses (+22/+16 mm Hg), while moderate and low-risk groups showed correspondingly smaller responses (+17/+13 and +14/+11 mm Hg, p's < 0.02). Family history alone did not predict differential reactivity. This study replicates and extends our previous work suggesting the importance of using both family history and resting blood pressure level in determining future risk for hypertension in studies of cardiovascular reactivity in relation to hypertension risk in males.

Keywords: Risk factors; Stress; Hypertension; Mental arithmetic; Reactivity; Parental history

1. Introduction

This study compared two hypertension risk factors, a parental history of hypertension and a slightly elevated systolic blood pressure (SBP) as predictors of cardiovascular reactivity to mental arithmetic stress. Our goal was to replicate and extend an earlier study showing that men at high risk for future hypertension, by virtue of parental history and a high normal resting SBP, had larger cardiovascular responses to a challenging mental arithmetic task than did their lower risk counterparts (Everson et al., 1992).

Elevated resting blood pressure (BP) in early adulthood and a positive parental history of essential hypertension are both predictors of future hypertension (Borghi et al., 1986; Feinleib, 1979; Julius and Schork, 1978; Matthews et al., 1993). The occurrence of exaggerated BP responses to a variety of challenges in young normotensives having one or more risk factors has led to the "reactivity hypothesis." This hypothesis postulates that exaggerated reactivity to psychological stress may be either a risk marker for or a contributor to the development of hypertension (Borghi et al., 1986; Manuck et al., 1990; Fredrikson and Matthews, 1990). Tests of the

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hypothesis have yielded inconsistent results when family history of hypertension alone has been used to index risk (Muldoon et al., 1993).

Two longitudinal studies have shown the greatest incidence of hypertension in men having both a positive parental history and a high normal SBP (Thomas and Duszynski, 1982; Paffenbarger et al., 1968). We adopted the following hypertension risk classification scheme from Thomas and Duszynski (1982): low risk SBP < 125 mm Hg and no or one hypertensive parent (PH − or +1); moderate risk: SBP ≥ 125 mm Hg or two hypertensive parents (PH +2); and high risk: SBP ≥ 125 mm Hg and one or two hypertensive parents (PH + 1 or +2).

Note that the model of hypertension risk implied by this classification scheme is not an additive combination of the two risk factors because a person may be considered low risk despite having one hypertensive parent (PH + 1). An additive model would assume that one risk factor would place an individual at moderate or elevated risk and not in the lowest risk group. The present model implies that PH + 1 bears implications for the person's future risk only if the presumed familial risk is actually expressed as an elevation in that individual's own BP. If BP is not elevated, the parental history variable alone (PH + 1) is not indicative of increased risk and does not predict increased cardiovascular reactivity to mental stress. Instead, as a risk factor, PH bears a dependent or interactive relationship to the person's BP.

Accordingly, we predicted that heart rate (HR) and BP responses to mental arithmetic (MA) would be greater with increasing risk for hypertension using the above classification. We also predicted that a positive family history of hypertension without elevated BP would not be a significant predictor of differential reactivity to mental stress. The present paper presents data from a replication sample, allowing comparison with the earlier study, and also presents the combined data.

2. Method

2.1. Subjects

The subjects were 220 healthy, male medical students recruited from the University of Oklahoma Medical School. Our previous study reported on the first 105 students (Everson et al., 1992); the present paper reports on an additional 115 students in a replication sample, and a total sample of 220. None of the subjects was currently taking any medication with potential effects on the cardiovascular system. All subjects gave informed consent approved by the Institutional Review Board of the University of Oklahoma Health Sciences Center and the Veterans Affairs Medical Center. Subjects were paid for their participation.

We formed low, moderate, and high risk groups as described above. The total sample included 145 low risk, 44 moderate risk, and 31 high risk cases. Of these, 64 (29%) had SBP ≥ 125 mm Hg and 96 (44%) had at least one hypertensive parent. The greater than expected prevalence of PH + individuals (Kannel and Thom, 1986) was due to the specific recruitment efforts that focused in part on PH + 1 individuals.

2.2. Procedure

The following protocol was observed: preliminary rest period (5 min), casual BP readings (5 min), extended rest period (15 min), MA (5 min), personal and family medical history interview, and a 15-min final rest period. Preliminary analyses showed that the average BP did not change from the first to the last 5-min period of the extended rest period. Accordingly, the average SBP during the 15-min extended rest was used for risk classification.

The MA task consisted of 5 min of serial subtraction and all instructions for the task were prerecorded. Each subject began with the number 1372 and had to subtract continuously by 7s, 13s, and 18s in successive 100-sec phases as fast and accurately as he could.

In the medical history interview we asked each subject if either of his parents had ever been diagnosed with essential hypertension. These statements were verified by the subjects' parents in the form of a questionnaire. The parental report determined the final classification of the subject's PH status. As reported previously, disagreement between subjects' and parents' reports occurred in less than 10% of the cases. This level of agreement is consistent with previous reports (Allen et al., 1987; Ditto, 1986; Sausen et al., 1992).