Hypertension Awareness and Psychological Distress

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Abstract

There is conflicting evidence regarding the association of hypertension with psychological distress, such as anxiety and depressive symptoms. The association may be due to a direct effect of the raised blood pressure; side effects of treatment; or the consequences of labelling. In a representative study of 33,105 adults (aged 51.7 ±12.1 yrs, 45.8% men) we measured levels of psychological distress using the 12-item General Health Questionnaire and collected blood pressure, data on history of hypertension diagnosis, and medication usage. Awareness of hypertension was confirmed through a physician's diagnosis or the use of anti-hypertensive medication and unaware hypertension was defined by elevated clinic blood pressure (systolic/ diastolic ≥140/90 mm Hg) without prior treatment or diagnosis. In comparison with normotensive participants, an elevated risk of distress (General Health Questionnaire score ≥4) was observed in aware hypertensive participants (multivariable adjusted odds ratio [OR]=1.57, 95% CI, 1.41 – 1.74), although not in unaware hypertensives (OR = 0.91, 95% CI, 0.78 – 1.07). Anti-hypertensive medication and co-morbidity was also associated with psychological distress although this did not explain the greater risk of distress in aware hypertensives. We observed a weak curvilinear association between systolic blood pressure and distress which suggested that distressed participants were more likely to have low or highly elevated blood pressure. These findings suggest that labelling individuals as hypertensive, rather than elevated blood pressure per se, may partially explain the greater levels of distress in patients treated for hypertension.

Keywords

depression; anxiety; blood pressure; medication; cardiovascular risk; labelling

Introduction

Studies examining the association of hypertension with psychological distress, such as anxiety and depressive symptoms, have produced mixed findings. Several studies have reported positive associations (1–4), whereas others have observed weak (5) or no associations (6). There is even some evidence to suggest lower blood pressure (BP) in participants with depressive or anxiety disorders (7,8). A related issue is the effect of labelling patients as hypertensive (9). Several studies have suggested that individuals

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'labelled' as hypertensive might adopt a sick role that can impair quality of life (9). Therefore the association between hypertension and psychological distress may be due to; a direct effect of the BP itself; side effects of treatment; or the consequences of labelling. Few studies have comprehensively addressed all of these issues.

The aim of the present study was therefore to examine if psychological distress was directly related to raised BP *per se* or other factors arising from hypertension diagnosis such as 'labelling'.

Methods

Participants were recruited into the Health Survey for England and Scottish Health Survey (between 1994 to 2004), both representative, general population-based studies sampling individuals living in households in each country (10). Study participants gave full informed consent and ethical approval was obtained from the London Research Ethics Council. The study adhered to the principles of the Declaration of Helsinki and Title 45, U.S. Code of Federal Regulations, Part 46, Protection of Human Subjects, Revised November 13, 2001, effective December 13, 2001. The procedures followed were in accordance with institutional guidelines.

During a household visit, systolic and diastolic BP was measured with an Omron HEM-907 blood pressure monitor three times in the sitting position after 5-minute rest between each reading. The initial reading was discarded and an average of the second and third BP recordings was used for the present analyses. Hypertension was defined according to the 7th report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (systolic/diastolic BP ≥140/90 mmHg or use of antihypertensive medication) (11). Nurses also collected information about physician-diagnosed cardiovascular diseases (CVD) (stroke, ischemic heart disease, angina symptoms, hypertension and diabetes), recorded medication usage, and measured weight and height to calculate body mass index [weight (kilograms)/height (meters) squared].

In a separate visit, within a maximum of two weeks of the clinical assessment, interviewers collected information on psychological distress using the 12 item version of the General Health Questionnaire (GHQ-12), a widely-utilized measure of psychological distress in population-based studies (12). The GHQ-12 enquires about symptoms in the last 4 weeks. We employed a GHQ-12 cut off score of ≥4 to denote psychological distress. This definition has been validated against standardised psychiatric interviews and has been strongly associated with depression and anxiety (12). Interviewers also collected information on self-reported smoking (current/ex-smoker/never) and participation in moderate-vigorous physical activity sessions lasting for at least 30 (walking and heavy domestic activity) or 15 (recreational sports and exercise) minutes (none, up to 3 sessions per week, more than 3 sessions per week).

Participants were categorised into three groups to define hypertensive status: normotensive (no previous diagnosis of, or treatment for hypertension and with BP <140/90 mmHg); aware hypertensive (physician-diagnosed hypertension and/or taking antihypertensive medication); unaware hypertensive (no previous diagnosis or treatment of hypertension with BP ≥140/90 mmHg). The rationale for using these categories was to explore if the associations with psychological distress were related to labelling (unaware vs aware hypertensive). We used χ^2 and one-way ANOVA to examine differences in baseline characteristics across the normotensive and hypertensive groups. We used multivariate logistic regression to compute odds ratios (OR) with accompanying 95% confidence intervals (CI) for the association between hypertensive status and psychological distress.

Models were adjusted for potential confounding or mediating factors, such as age, sex, smoking, physical activity, cardiovascular morbidity, anti-hypertensive medication use, BP, and body mass index. We performed additional analyses to examine associations of systolic BP (SBP) and medication use with psychological distress. In the initial logistic regression analyses we entered SBP as a continuous variable and then a squared term (SBP× SBP) to examine the curvilinear association with psychological distress. In subsequent analyses we present the data per 10 mmHg increase in SBP. There were no clear differences in our results between men and women, so the data were pooled and sex-adjusted. All analyses were conducted using SPSS version 14.

Results

From the initial sample of 39,075 men and women who provided complete data on BP, history of hypertension, and medication usage, we excluded 5970 participants because of missing demographic and anthropometric data. Thus, the final analytic sample consisted of 33,105 participants (aged 51.7 ±12.1 yrs, 45.8% men). The excluded participants were older (62.3 vs 51.7 yrs, p<0.001) although there were no differences in sex distribution (men; 45.1% vs 45.8%, p=0.28).

As expected, the normotensive participants were younger, more likely to be female, more physically active, have lower body mass index, and had a lower prevalence of self-reported CVD compared with the aware hypertensive participants (Table 1). Unaware hypertensive participants were more likely to be male, undertake more physical activity, have higher BP but lower body mass index, and a lower prevalence of self-reported CVD compared with aware hypertensives .

Awareness of hypertension and psychological distress

Within the analytical sample, 15.7% (13.2% men, 17.7% women) of study members reported psychological distress. Participants aware of their hypertension were at higher risk of psychological distress and this association remained after adjustment for a number of potential confounders and mediators (Table 2). In contrast, unaware hypertension was not associated with distress.

To test the robustness of this finding, we performed a series of sensitivity analyses. First, we examined if the risk of psychological distress differed between aware hypertensives with controlled (SBP/DBP <140/90 mmHg, n=5784) and uncontrolled (SBP/DBP ≥140/90 mmHg, n=2249) blood pressure. An elevated risk of distress was observed in both controlled (multivariable adjusted odds ratio [OR]= 1.53, 95% CI, 1.37 – 1.71) and uncontrolled (OR = 1.79, 95% CI, 1.49 – 2.15)] aware hypertensives in comparison to normotensive participants.

Second, after the removal of 3277 participants with existing heart disease and diabetes the association between awareness of hypertension and psychological distress persisted (age and sex adjusted OR = 1.47, 95% CI, 1.35 – 1.59).

Third, we observed associations between anti-hypertensive drug use and psychological distress, which was particularly strong for use of diuretics (multivariate adjusted OR =1.21, 95% CI, 1.07 – 1.36) and calcium blockers (multivariate adjusted OR=1.25, 95% CI, 1.08 – 1.44). However, when we removed participants taking anti-hypertensive drugs (n=5069), there remained an elevated risk of distress in aware hypertensive participants (age and sex adjusted OR = 1.64, 95% CI, 1.49 – 1.81).

Blood pressure and psychological distress

We also examined the association between SBP and psychological distress. We observed both a linear (age and sex adjusted OR per unit SBP = 0.998, 95% CI, 0.996 – 1.00, p=0.018) and curvilinear [SBP]^2 (p=0.016) association with distress. The results suggested a U-shaped association (Table 2), with the lowest levels of distress at SBP levels of 140 – 150 mmHg, although the risk reduction compared to BP levels below and above this range was modest (~18%).

Discussion

In this representative study of adults we observed an elevated risk of psychological distress in participants aware of their hypertension, although there was no such association in unaware hypertensive participants. Use of anti-hypertensive drugs was associated with psychological distress but this did not explain the elevated levels of distress in aware hypertensives. We observed a weak curvilinear association between systolic BP and distress, which suggested that distressed participants were more likely to have low or highly elevated BP. This nonlinear association may partially explain the mixed results of several other studies where both positive and negative associations between BP and mood disorder have been observed (1–4, 7,8).

These findings suggest that the diagnosis of hypertension itself rather than elevated BP might partly explain the elevated risk of psychological distress in patients treated for hypertension. This is consistent with several other studies that have demonstrated higher psychological distress and lower well-being in labelled hypertensives and mislabelled normotensives in comparison with unaware hypertensives (9). For example, in a small sample of Spanish participants from the general population, health related quality of life, including physical functioning, vitality, mental health and pain thresholds, was better in unaware compared with aware hypertensive participants (13). Several mechanisms might explain the effects of labelling. Some evidence suggests that the act of labelling somebody as hypertensive can cause increases in sympathetic activity during mental stress (14,15), which might partly explain the associations with worse mental health. In a study of 214 normotensive and mildly hypertensive participants, the perception of being hypertensive was associated with greater anxiety during clinic blood pressure measurement and a larger white coat effect (16). Nevertheless, our results suggest that there were no differences in the levels of psychological distress in aware hypertensive participants with normal or elevated BP readings.

In previous studies, depressive disorder was associated with lower systolic BP (7), although use of tricyclic antidepressants was associated with greater risk of hypertension (5,7), which may correspond to increased risk of weight gain associated with these agents (17). We did not have available information on the use of psychotropic medication although we did run further analyses to exclude 475 participants with history of a psychiatric hospital admission, which did not alter the results. A further limitation is the cross-sectional design, thus we cannot infer causality nor determine the direction of the observed relationship between hypertension and psychological distress. For example, participants with symptoms of psychological distress may be more likely to seek medical advice and thus be diagnosed with hypertension. In most cases the measurement of BP and psychological distress (GHQ-12) were completed within a few days of each other, although with more simultaneous measurement (i.e., in the same screening) the associations may have been stronger. Common factors such as the central monoamine system may explain some of our results, since depression is characterised by altered levels of neuropeptide Y (18) that might also impact on sympathetic activity and cardiovascular regulation (19). Lastly, the use of Odds Ratios with a common outcome can be misleading (20). Psychological distress is on

the borderline for reaching the rare disease assumption (typically considered to be a prevalence of less than 10%). However, when we re-calculated relative risks the associations remained significant albeit slightly attenuated (e.g., the relative risk of distress in aware hypertensive vs. normotension was 1.36, 95% CI, 1.28 – 1.45).

Perspectives

These findings suggest that the act of labelling patients as hypertensive rather than elevated BP *per se* might partly explain the higher levels of psychological distress in patients treated for hypertension. The use of anti-hypertensive drugs was associated with psychological distress but this did not explain the elevated risk in participants aware of their hypertension. These findings might partly explain why prior studies have produced mixed findings regarding the association of hypertension/BP with common mental disorder, such as anxiety and depressive symptoms. Since psychosomatic factors are now known to be related to relevant health outcomes, the act of labelling might warrant clinical concern. Therefore, future research is required to better understand how a diagnosis might impact on the mental health of the patient. More sophisticated techniques may be required when informing the patient about their hypertension.

Acknowledgments

References

1. Patten SB, Williams JV, Lavorato DH, Campbell NR, Eliasziw M, Campbell TS. Major depression as a risk factor for high blood pressure: epidemiologic evidence from a national longitudinal study. Psychosom Med. 2009; 71:273–279. [PubMed: 19196807]

2. Jonas BS, Franks P, Ingram DD. Are symptoms of anxiety and depression risk factors for hypertension? Longitudinal evidence from the National Health and Nutrition Examination Survey I Epidemiologic Follow-up Study. Arch Fam Med. 1997; 6:43–49. [PubMed: 9003169]

3. Markovitz JH, Matthews KA, Kannel WB, Cobb JL, D'Agostino RB. Psychological predictors of hypertension in the Framingham Study. Is there tension in hypertension? JAMA. 1993; 270:2439–2443. [PubMed: 8230620]

4. Carroll D, Phillips AC, Gale CR, Batty GD. Generalized anxiety and major depressive disorders, their comorbidity and hypertension in middle-aged men. Psychosom Med. 2010; 72:16–19. [PubMed: 19933507]

5. Delaney JA, Oddson BE, Kramer H, Shea S, Psaty BM, McClelland RL. Baseline depressive symptoms are not associated with clinically important levels of incident hypertension during two years of follow-up: the multi-ethnic study of atherosclerosis. Hypertension. 2010; 55:408–414. [PubMed: 20065156]

6. Yan LL, Liu K, Matthews KA, Daviglus ML, Ferguson TF, Kiefe CI. Psychosocial factors and risk of hypertension: the Coronary Artery Risk Development in Young Adults (CARDIA) study. JAMA. 2003; 290:2138–2148. [PubMed: 14570949]

7. Licht CM, de Geus EJ, Seldenrijk A, van Hout HP, Zitman FG, van Dyck R, Penninx BW. Depression is associated with decreased blood pressure, but antidepressant use increases the risk for hypertension. Hypertension. 2009; 53:631–638. [PubMed: 19237679]

8. Hildrum B, Mykletun A, Stordal E, Bjelland I, Dahl AA, Holmen J. Association of low blood pressure with anxiety and depression: the Nord-Trøndelag Health Study. J Epidemiol Community Health. 2007; 61:53–58. [PubMed: 17183016]

9. Pickering TG. Now we are sick: labeling and hypertension. J Clin Hypertens. 2006; 8:57–60.

10. The Scottish Government Statistics. Scottish Health Survey Publications; http://www.scotland.gov.uk/Topics/Statistics/Browse/Health/scottish-healthsurvey/Publications

11. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension. 2003; 42:1206–1252. [PubMed: 14656957]

12. Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, Gureje O, Rutter C. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. Psychol Med. 1997; 27:191–197. [PubMed: 9122299]

13. Mena-Martin FJ, Martin-Escudero JC, Simal-Blanco F, Carretero-Ares JL, Arzua-Mouronte D, Herreros-Fernandez V. Health-related quality of life of subjects with known and unknown hypertension: results from the population-based Hortega study. J Hypertens. 2003; 21:1283–1289. [PubMed: 12817174]

14. Rostrup M, Kjeldsen SE, Eide IK. Awareness of hypertension increases blood pressure and sympathetic responses to cold pressor test. Am J Hypertens. 1990; 3(12 Pt 1):912–917. [PubMed: 2081012]

15. Rostrup M, Mundal HH, Westheim A, Eide I. Awareness of high blood pressure increases arterial plasma catecholamines, platelet noradrenaline and adrenergic responses to mental stress. J Hypertens. 1991; 9:159–166. [PubMed: 1849532]

16. Spruill TM, Pickering TG, Schwartz JE, Mostofsky E, Ogedegbe G, Clemow L, Gerin W. The impact of perceived hypertension status on anxiety and the white coat effect. Ann Behav Med. 2007; 34:1–9. [PubMed: 17688391]

17. Aronne LJ, Segal KR. Weight gain in the treatment of mood disorders. J Clin Psych. 2003; 64 (Suppl 8):22–29.

18. Stahl SM. Blue genes and the monoamine hypothesis of depression. J Clin Psych. 2000; 61:77–78.

19. Ruohonen ST, Savontaus E, Rinne P, Rosmaninho-Salgado J, Cavadas C, Ruskoaho H, Koulu M, Pesonen U. Stress-induced hypertension and increased sympathetic activity in mice overexpressing neuropeptide Y in noradrenergic neurons. Neuroendocrinology. 2009; 89:351–360. [PubMed: 19122447]

20. Zhang J, Yu KF. What's the relative risk? A method of correcting the odds ratio in cohort studies of common outcomes. JAMA. 1998; 280:1690–1691. [PubMed: 9832001]

Table 1

Characteristics of the study sample (n=33,105)

Variable	Normotensive[*]	Aware Hypertensive[†]	Unaware Hypertensive[‡]
N	22,673	8,033	2,399
Age (yrs)	48.7±10.7	58.5±12.2	57.2±11.8
Male (%)	43.3	48.6	60.7
Smoking (%)			
Never	43.6	37.4	39.2
Quit	29.1	39.9	34.2
Current	27.3	22.7	26.6
Physical activity (%)			
None	19.9	39.2	27.6
Up to 3/wk	45.1	38.4	45.4
3+/wk	35.0	22.4	27.0
Systolic BP (mmHg)	122.7±10.3	138.0±22.8	163.3±17.4
Diastolic BP (mmHg)	71.0±8.7	79.3±14.8	97.2±7.4
Body mass index (kg/m^2)	26.2±4.3	28.8±5.2	27.9±4.5
Cardiovascular disease[§] (%)	2.3	24.4	3.8
Diabetes (%)	1.3	8.0	1.9
Anti-hypertensive medication[¶] (%)	0	63.1	0
Self reported physician hypertension diagnosis (%)	0	82.1	0

[*] No previous diagnosis of hypertension or medication use with SBP/DBP <140/90 mmHg;

[†] Physician-diagnosed hypertension and/or medicated;

[‡] No previous diagnosis of hypertension or medication use with BP ≥140/90 mmHg.

[§] Physician-diagnosed stroke, ischaemic heart disease, angina.

[¶] Beta-blockers, ACE-inhibitors, diuretics, calcium blockers.

Table 2

Association between hypertensive status, blood pressure, and psychological distress (GHQ-12≥ 4).

	Cases/N	Age & Sex adjusted Odds Ratio (95% CI)	Fully adjusted Odds Ratio (95% CI)
Hypertensive category[*]			
Normotensive	3305/22673	1.00 (ref)	1.00
Aware hypertensive	1621/8033	1.76 (1.64 – 1.89)	1.57 (1.41 – 1.74)
Unaware hypertensive	256/2399	0.85 (0.74 – 0.98)	0.91 (0.78 – 1.07)
Systolic blood pressure[†]			
< 120 mmHg	1734/9793	1.00 (ref)	1.00
120 – 129.9 mmHg	1486/9673	0.91 (0.85 – 0.99)	0.93 (0.86 – 1.01)
130 – 139.9 mmHg	1243/8590	0.89 (0.82 – 0.97)	0.91 (0.84 – 0.99)
140 – 149.9 mmHg	184/1380	0.83 (0.71 – 0.98)	0.82 (0.70 – 0.98)
150 – 159.9 mmHg	160/1082	0.96 (0.81 – 1.15)	0.99 (0.82 – 1.19)
≥ 160 mmHg	376/2587	0.95 (0.84 – 1.08)	0.96 (0.84 – 1.10)
p-trend		0.047	0.134

[*] Full model adjusted for; age, sex, anti-hypertensive medication, moderate-vigorous physical activity (none/<3 per wk/3+ per wk), smoking, physician diagnosed diabetes and heart disease, systolic and diastolic blood pressure, body mass index.

[†] Full model adjusted for; age, sex, anti-hypertensive medication, moderate-vigorous physical activity (none/<3 per wk/3+ per wk), smoking, doctor diagnosed diabetes and heart disease, body mass index