Original Article
Risk factors for depression among elderly subjects with hypertension living at home in China

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Abstract: Objective: Studies of factors associated with symptoms of depression in the elderly in China are scarce, especially for those with hypertension residing at home in the general population. Methods: We conducted a cross-sectional study to determine the risk factors for depression in a hypertensive population residing in Beijing in 2004. The sample population consisted of 1064 people aged $\geq$ 60 years dwelling in an urban district, a suburb, and in mountain country. Statistical sampling techniques included cluster, stratification, and random selection. Trained staff using a comprehensive geriatric assessment questionnaire, a standard survey instrument in China, completed the assessments. During person-to-person interviews, data were collected regarding demographic characteristics and living and health conditions. Results: Symptoms of depression were scored according to the Center for Epidemiologic Studies-Depression (CES-D) screening test. We showed that factors that were associated with a higher incidence of depression were living in a rural area, being illiterate, without a mate, low income, experiencing a significant stressful life event, poor sleep pattern, poor functional status, and poor cognitive function. Logistic regression analysis indicated that elderly participants with hypertension were significantly more likely to develop depression symptoms under conditions of illiteracy, experiencing a significant stressful life event, poor sleep habits, and poor functional status. Conclusions: Our study determined risk factors for depression in elderly patient with hypertension, and these risk factors are modifiable. This indicates that depression in these patients can be prevented by appropriate lifestyle changes and psychological health education.

Keywords: Hypertension, depression, geriatrics

Introduction

Hypertension is a common disease that compromises the health of the elderly. It is a main risk factor for stroke, heart disease, and renal failure [1]. The prevalence of hypertension was about 27.2% in the year 2000 in China [2], and is increasing year-by-year [3].

Primary hypertension has psychosomatic aspects and has been associated with depression; depression can increase the risk of sudden cardiac death [4]. In one report from the Netherlands, the incidence of depression among people with hypertension was 20%-30% [5, 6], but in China it is 15.8% [7]. The present cross-sectional study explored the depression status of elderly individuals with hypertension in Beijing, and determined associated factors.

Methods

Study design

This is a retrospective study. Data for these analyses came from the Beijing Longitudinal Study of Aging. This cross-sectional study comprised 1064 people aged $\geq$ 60 years dwelling at home in the general population in Beijing in 2004. Sampling was taken from an urban district, a suburb, and the country (mountain) using the well-established statistical sampling techniques cluster, stratification, and random selection. Specifically, sampling was performed in three stages. Firstly, 18 administrative divisions

Table 1. Effect of demographic characteristics on the depression symptoms associated with hypertension

		Total	Depression symptoms (%)	χ^2	P
Gender	Male	502	67 (13.3)	1.907	0.167
	Female	562	92 (16.4)		
Age (y)	< 75	570	78 (13.7)	2.192	0.139
	≥ 75	477	81 (17.0)		
Area	Rural	569	123 (21.6)	42.850	0.000
	Urban	495	36 (7.3)		
Literacy	Illiterate	457	91 (19.9)	34.629	0.000
	Literate	607	68 (11.2)		

were divided into city and country categories and three representative districts were chosen from each. Secondly, streets and villages were randomly selected. Thirdly, individuals were chosen based on the proportion of elderly in the population of Beijing. The study was approved by the Xuanwu Hospital committee on ethics of human experiments.

Sample selection

The sample population consisted of 1847 elderly people aged ≥ 60 years in Beijing in 2004, sampling from an urban district, a suburb, and the country (mountain). Of the 1847, 1826 had blood pressure measurements of whom 1133 (62.0%) were hypertensive. Among the hypertensive individuals 1064 (93.9%) were screened with the Center for Epidemiologic Studies-Depression (CES-D) screening test [8]. There were 502 (47.2%) men and 562 (52.8%) women, with an age range of 60-100 (74.2 ± 7.0) years. The participants lived in an urban district (495, 46.5%), in suburbs (290, 27.3%) and in the country (mountain; 279, 26.2%). In this study, we combined those living in the suburbs and country, and classified the group as rural (569, 53.5%).

Data collection

The assessments were completed by trained staff using standard survey instruments. During person-to-person interviews, data were collected regarding demographic characteristics, living conditions, health conditions, and via the CES-D. Exclusion criteria were secondary hypertension, dementia, or inability to answer the questions.

The literacy status of participants was recorded as illiterate or literate. Those who had attended primary school or higher were considered literate. Marriage was divided into the categories married and not married, with married defined as legal marriage, and not married defined as divorced, widowed, or never married. Subjects were also stratified by monthly income: < US$90, US$90-180, and ≥ US$180. Occupations were recorded as either white-collar or physical laborer. A significant stressful life event is defined as an important family event such as a divorce, financial problems, severe disease, or a natural disaster. Sleeping quality was divided into 2 groups: well and not well. The course of hypertension was divided into 2 groups: < 5 years and ≥ 5 years.

Functional status was based on activities of daily living (ADL) and the instrumental ADL (IADL) [9]. The ADL and IADL consist of 14 items, and the performance of each activity is rated as performed with independence (score of 1), partial dependence (score of 2), or complete dependence (score of 3). Cognitive function was measured with the Mini Mental State Examination (MMSE) scale with 11 items; possible scores ranging from 0 to 30. Participants were stratified by educational level to determine thresholds for cognitive function. The thresholds for those who were illiterate, or attended at most primary school, middle school, or university were ≤ 17, 17-20, 21-22, and 23-24, respectively. Participants who scored below the threshold value for their education group were recorded as cognitive dysfunction [10].

Measurement of blood pressure

Blood pressure was measured in a quiet environment by trained doctors. Two sitting blood pressure readings were taken on the right arm after 5 min of rest. Systolic and diastolic blood pressures were Korotkoff I and V, respectively, and an average was taken of the two values.

The definition of hypertension was systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg. Individuals were screened for a definite diagnosis of hypertension whether or not they were receiving antihypertensive drugs.

Table 2. Effect of social-psychology factors on the depression symptoms associated with hypertension

		Total	Depression symptoms (%)	χ^2	P
Marriage	Married	699	87 (12.4)	9.997	0.002
	Not married	365	72 (19.7)		
Occupation	White-collar	265	20 (7.5)	33.945	0.000
	Physical labor	328	36 (11.0)		
Monthly income (US$)	< 90	529	116 (21.9)	41.619	0.000
	90-180	254	25 (9.8)		
	> 180	281	18 (6.4)		
Significant life event	No	601	52 (8.7)	43.221	0.000
	Yes	462	107 (23.2)		
Sleep quality	Well	767	67 (8.7)	83.322	0.000
	Not well	297	92 (31.0)		

Evaluation of depression

The CES-D scale was used to assess depression symptoms [11]. The CES-D is a 20-item self-report rating scale designed to measure current levels of depression symptoms. It is widely used and is a reliable and valid instrument. Scores range from 0 to 60; higher scores indicate more depression symptoms. Scores ≥ 16 are generally consistent with depression of clinically depressed patients [11, 12].

Statistical methods

All statistical analyses were performed using SPSS software for single factor analysis, and logistic analysis was done to explore the association between those factors and depression in hypertension. *P* < 0.05 was considered statistically significant.

Results

Factors associated with depression symptoms in hypertension: single factor analysis

Results of the single factor analysis of demographic characteristics revealed that elderly people with hypertension who lived in rural areas and were illiterate had a higher incidence of depression (**Table 1**). In addition, the influence of social-psychological factors including occupation, marital status, income, significant life events, and sleeping habits were analyzed (**Table 2**). Those individuals who did physical labor had a higher incidence of depression compared with the white-collar group. Those

individuals who were not married had a higher incidence of depression. The results revealed that the higher the income, the lower the incidence of depression. Those individuals who had experienced a significant stressful life event had a higher incidence of depression. Those who had poor sleep habits also had a higher incidence of depression.

Analysis of the effect of somatic health factors on symptoms of depression in hypertension included course of hypertension, level of hypertension, functional status, and cognitive function (**Table 3**). The results showed that the course of hypertension had no effect on the incidence of depression, but incidence of depression tended to increase with blood pressure. Those who were illiterate or with worse functional status had a higher incidence of depression.

Factors associated with depression symptoms in hypertension: multiple factor analysis

With depression as the dependent variable and gender, age, area, literacy, occupation, marital status, income, significant stressful life event, sleep habits, course of hypertension, level of hypertension, functional status, and cognitive function as independent variables, logistic analysis showed that education, occupation, significant stressful life event, sleep habits, and functional status were the independent factors influencing depression in elderly hypertensive individuals (**Table 4**).

Discussion

Our data originated from a population-based cross-sectional epidemiological study performed with older subjects (≥ 60 years), who lived at home in the general population of Beijing. Hypertension with no known specific cause (i.e., primary or essential hypertension) may be considered a single disease or the secondary result of any of a number of other diseases of various causes [13]. As blood pressure ranges quantitatively on a continuum from

Table 3. Effect of somatic health factors on the depression symptoms associated with hypertension

		Total	Depression symptoms (%)	χ^2	P
Course of hypertension (y)	< 5	631	93 (14.7)	0.051	0.821
	≥ 5	433	66 (15.2)		
Level of hypertension	1	515	70 (13.6)	6.061	0.048
	2	264	39 (14.8)		
	3	99	23 (23.2)		
Functional status	Independent	708	64 (9.0)	58.032	0.000
	Dependent	356	95 (26.7)		
Cognition	Normal	885	114 (12.9)	18.872	0.000
	Abnormal	175	45 (25.7)		

Table 4. Logistic regression analysis

Factors	B	S.E.	Wald	df	Sig	Exp (B)	95% CI
Gender	0.099	0.366	0.074	1	0.786	1.104	0.539-2.261
Age	-0.105	0.345	0.094	1	0.760	0.900	0.458-1.769
Area	-0.354	0.595	0.355	1	0.552	0.702	0.219-2.251
Literacy	0.991	0.436	5.168	1	0.023	2.693	1.146-6.327
Marital status	-0.351	0.357	0.962	1	0.327	0.704	0.350-1.419
Income	-0.257	0.357	0.521	1	0.471	0.773	0.384-1.555
Significant life event	1.173	0.333	12.374	1	0.000	3.230	1.681-6.208
Sleep quality	1.269	0.326	15.180	1	0.000	3.559	1.879-6.740
Course	0.376	0.363	1.068	1	0.301	1.456	0.714-2.967
Functional status	1.507	0.358	17.714	1	0.000	4.515	2.238-9.110

low to high, it reflects a complex network of various environmental and social-psychological factors against a genetic background [14], and tends to increase with age [15, 16]. With psychosomatic components, it can be concomitant with depression [17]. Hypertension and depression influence each other. On the one hand, depression can promote the occurrence and development of hypertension and increase the risk of cardio-cerebrovascular diseases. On the other, hypertension is prone to aggravate depression [18]. Therefore, exploring the factors that affect depression in elderly patients with hypertension has vital significance for the prevention and control of hypertension and improvement of the quality of life of the elderly.

Results of the present study showed that the prevalence of depression in elderly individuals with hypertension was higher for those living in rural areas, illiterate, and unmarried, with low income, poor sleep quality, poor functional status, and who had experienced significant stressful life events. This is in keeping with previous research results [19]. People living in rural areas are mostly peasants with little education and low income. They rarely have medical insurance, and thus cannot receive a prompt diagnosis and treatment when suffering from high blood pressure. Poor health and mental status make them more prone to depression. Furthermore, elderly hypertensive patients who are divorced or widowed often feel lonely and isolated and are less willing to communicate with other people, exacerbating the likelihood of depression. Unfortunate life events encourage negative emotions in the elderly, and poor sleep also leads to anxiety and depression. The loss of mental and physical abilities increases loneliness in the elderly, and enhances symptoms of depression.

The logistic regression analysis showed that literacy, life events, sleep quality, and functional status had independent effects on the incidence of depression symptoms in elderly patients with hypertension (P = 0.023, 0.000, 0.000 and 0.000, respectively). This suggests a need for better health education, supportive care, a reduction in the negative effects of important life events, and improved sleep quality. The efficacy of hypertension drug therapy is influenced by symptoms of depression. A previous study found that depression can cause the regulation of the autonomic nervous system's hypothalamic-pituitary-adrenal axis to dysfunction [20]. This can increase vascular tone and resistance to the control of blood pressure.

A study found that the typical profile of a person in need of blood pressure control was an aged patient on antidepressant treatment for depression [19]. However, some antihyperten-

sive drugs have side effects that cause depression, leading some doctors to recommend the end of the use of beta-blockers to treat hypertension among older persons [21]. A verapamil SR strategy is a viable alternative to beta-blocker therapy for hypertensive patients, especially those at risk for depression [22]. Other studies found that the evidence regarding the association between beta-blockers and depression is inconclusive [23], so further studies on the influence of depression are needed.

Depression symptoms are closely associated with hypertension. They are a precipitating factor of hypertension, and hypertension can worsen symptoms of depression. Clinical doctors should note the greater potential of hypertensive elderly patients to experience symptoms of depression, educate their patients, and control precipitating factors, even while administering active antihypertensive medications and antidepressants to prevent disease progression and improve health-related quality of life. For hypertensive patients, early detection and treatment of symptoms of depression is an important component of the treatment and management of hypertension.

Our sample was restricted to community residents in Beijing, so our result is not representative of the overall Chinese population. Moreover, since the cross-sectional study cannot reflect the association between risk factors and outcomes, a follow-up study is needed.

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Disclosure of conflict of interest

None.

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