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Neurological Symptoms In Hypertension: Association With Blood Pressure Levels

Natasha Mustafa[1], Imtiaz Manzoor[2], Razia aijaz[3], Zarghoona Wajid[4]

Ahsan Ali Siddiqui[5], Munsif Adil[6], Shahzain Hasan[7], Adnan Anwar[8*]

[1]Lecturer, Department of Forensic Medicine, Altibri Medical College, Karachi, Pakistan

[2]FCPS, Consultant Physician, Chiniot General Hospital, Karachi, Pakistan

[3]Post Graduate trainee, Internal medicine, Jinnah Hospital, Karachi, Pakistan

[4]M Assistant, Musavvir Stem cell Clinic and Pathology Laboratory, Pakistan

[5]Msc Public Health, Specialist Family Medicine, Ministry of Health, Riyadh, Pakistan

[6]Medical Officer, Medicare Hospital Karachi, Pakistan

[7]Medical Officer, Hamdard University Hospital, Pakistan

[8]M.Phil, Assistant Professor, Department of Physiology, Al Tibri Medical College Karachi, Pakistan

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***Corresponding author:** Adnan Anwar, MBBS, M.Phil, Assistant Professor, Department of Physiology, Al Tibri Medical College Karachi, Pakistan. E-mail. anwaradnan32@gmail.com*

Abstract

Background: Hypertension is defined as a systolic blood pressure of 140 mmHg or more, or a diastolic blood pressure of 90 mmHg or more or taking anti-hypertensive medication; and is identified as the leading risk factor for mortality worldwide. A better understanding of the relation of signs and symptoms of hypertension with its severity is of key importance for its management in resource limited settings; this is particularly true for neurological symptoms as their presence may indicate hypertensive encephalopathy.

Objective: To determine the association of neurological symptoms with blood pressure levels in hypertensive patients.

Methods: A cross-sectional study was carried out on a total of 292 conveniently sampled patients, aged 18 or above, with self-reported history of hypertension and on anti-hypertensive medication. The relevant information from each patient was collected by means of a structured questionnaire whereas the blood pressure level was measured with the help of sphygmomanometer using stethoscope. Inferential analysis was performed by applying chi-square test and binary logistic regression. The significance level was set at 0.05.

Results: The study results revealed that among the neurological symptoms studied presence of vertigo (p=0.011) and confusion (p=0.001) were significantly associated with higher systolic blood pressure level whereas none of them were significantly associated with diastolic blood pressure level. Moreover, the binary logistic regression analysis showed that after controlling for the confounding effects of other neurological symptoms only confusion was significantly associated with systolic blood pressure level (p=0.018, AOR 1.87, 95% C.I. 1.11-3.16) whereas none of the neurological symptoms studied was significantly associated with diastolic blood pressure level.

Conclusion: Based on the study results it can be concluded that some of the neurological symptoms of hypertension are associated with the systolic blood pressure level of the patients, but not with diastolic blood pressure level.

Key words: Neurological Symptoms; Hypertension; Blood Pressure Levels

Introduction

Hypertension is defined as a systolic blood pressure of 140 mm Hg or more, or a diastolic blood pressure of 90 mm Hg or more, or taking antihypertensive medication [1]. The comparative Risk Assessment Collaborating Group identifies hypertension as the leading risk factor for mortality worldwide [2]. It has been shown to increases the risk of various illnesses like stroke, myocardial infarction, kidney failure and blindness [3]. Its high prevalence and poor control are said to be important determinants of the increasing epidemic of cardiovascular diseases in developing countries [4]

The vast majority of patients suffering from arterial hypertension have essential or primary hypertension whereas only 5–10% of them have secondary hypertension [5]. In the

year 2000, more than quarter of world's adult population was estimated to have hypertension and the number of adults with hypertension was projected to increase by 60% in the year 2025. [6].Based on data gathered before 2004, the prevalence of hypertension in Pakistan is reported to be 17% [7].

Based on the recommendations of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7), blood pressure for adults aged 18 years or older has been classified into four categories as normal, pre hypertension, stage 1 hypertension and stage 2 hypertension: Normal- systolic<120 mm Hg, diastolic<80 mm Hg; Pre hypertension- systolic 120-139 mm Hg, diastolic 80-89 mm Hg; Stage 1 Hypertension- systolic 140-159 mm Hg, diastolic 90-99 mm Hg and Stage 2 Hypertension-160 mm Hg or greater, diastolic 100 mm Hg or greater [8].

For better diagnosis and prompt management of most illnesses, clinical correlation can never be emphasized enough, and so is the case with hypertension. A better understanding of the relation of signs and symptoms of hypertension with its severity is of key importance for its management in resource limited settings, where there is almost always a dearth of diagnostic facilities. The neurological symptoms of hypertension include, but are not limited to, headache, nausea, visual disturbances, confusion and seizures. Presence of such symptoms may indicate hypertensive encephalopathy [9, 10]. Asa thorough literature search did not reveal ample local pertinent data, this study was therefore intended to determine the association of neurological symptoms with blood pressure levels in hypertensive patients.

Materials and Methods

A cross-sectional study was carried out in the outpatient department of a secondary care hospital of Karachi. The ethical approval of the study was sought from the relevant authority. By employing convenient sampling technique, a total of 292patients aged 18 or above were included in the study. Self-reported history of hypertension and taking anti-hypertensive medication were the inclusion criteria of the study. History of diabetes, cardiac events, neurological disorders, cluster headache, gastrointestinal disease, visual problems, and morbid obesity were exclusion criteria of the study.

Verbal informed consent was taken from each patient and then the relevant information was collected by means of a structured questionnaire designed specifically for the study. The blood pressure level was measured with the help of sphygmomanometer using stethoscope. The data were coded, entered and analyzed on SPSS version 20. Chi-square test was applied to determine the association of neurological symptoms with blood pressure levels whereas binary logistic regression was applied to develop risk assessment models for the study outcomes. The significance level was set at 0.05.

Results

The study results revealed that among the neurological symptoms studied vertigo (p=0.011) and confusion (p=0.001) were significantly associated with systolic blood pressure level where patients who were stage 2 hypertensive were more likely to have vertigo and confusion than those who were stage 1 hypertensive or were normotensive/pre-hypertensive (73.8% vs. 56.8% and 46.3%, and 85.7% vs. 65.2% and 51.6% respectively) (table 1).

The study results further revealed that none of the neurological symptoms studied were significantly associated with diastolic blood pressure level (table 2).

Table 1: Neurological Symptoms and Systolic Blood Pressure Level

Variables (n=292)	Systolic Hypertension			P
	Stage 2 Hypertensive	Stage1 Hypertensive	Normotensive/Pre-hypertensive	
Headache	Frequency (%)	Frequency (%)	Frequency (%)	
Yes	34(81.0)	117(75.5)	62(65.3)	0.095
No	8(19.0)	38(24.5)	33(34.7)	
Vertigo				
Yes	31(73.8)	88(56.8)	44(46.3)	0.011
No	11(26.2)	67(43.2)	51(53.7)	
Nausea				
Yes	11(26.2)	43(27.7)	18(18.9)	0.284
No	31(73.8)	112(72.3)	77(81.1)	
Confusion				
Yes	36(85.7)	101(65.2)	49(51.6)	0.001
No	6(14.3)	54(34.8)	46(48.4)	

Table 2: Neurological Symptoms and Diastolic Blood Pressure Level				
Variables (n=292)	**Diastolic Hypertension**			**P**
	Stage 2 Hypertensive	**Stage1 Hypertensive**	**Normotensive/Pre-hypertensive**	
Headache	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**	
Yes	17(77.3)	93(74.4)	103(71.0)	0.737
No	5(22.7)	32(25.6)	42(29.0)	
Vertigo				
Yes	13(59.1)	70(56.0)	80(55.2)	0.941
No	9(40.9)	55(44.0)	65(44.8)	
Nausea				
Yes	6(27.3)	35(28.0)	31(21.4)	0.434
No	16(72.7)	90(72.0)	114(78.6)	
Confusion				
Yes	17(77.3)	82(65.6)	87(60.0)	0.246
No	5(22.7)	43(34.4)	58(40.0)	

Moreover, the binary logistic regression analysis showed that after controlling for the confounding effects of other neurological symptoms only confusion was significantly associated with systolic blood pressure level (p=0.018) where those with confusion had significantly greater odds of having systolic hypertension than those without (AOR 1.87, 95% C.I. 1.11-3.16) (table 3).

Moreover, the binary logistic regression analysis further showed that after controlling for the confounding effects of other neurological symptoms none of them was significantly associated with diastolic blood pressure level (table 4).

Table 3: Multivariable Analysis of Associations with Systolic Blood Pressure Level				
Variables (n=292)	**AOR**	**95% C.I.**		**P**
		Lower	**Upper**	
Headache	1.4	0.792	2.5	0.243
Vertigo	1.35	0.789	2.33	0.27
Nausea	1.21	0.64	2.3	0.554
Confusion	1.87	1.11	3.16	0.018

Table 4: Multivariable Analysis of Associations with Diastolic Blood Pressure Level				
Variables (n=292)	**AOR**	**95% C.I.**		**P**
		Lower	**Upper**	
Headache	1.13	0.65	1.96	0.66
Vertigo	0.89	0.54	1.48	0.666
Nausea	1.35	0.77	2.38	0.291
Confusion	1.33	0.81	2.18	0.26

Discussion

The study results revealed that among the neurological symptoms studied presence of vertigo and confusion were significantly associated with higher systolic blood pressure level ($p<0.05$ for both)whereas none of them were significantly associated with diastolic blood pressure level.

Moreover, the binary logistic regression analysis showed that after controlling for the confounding effects of other neurological symptoms only confusion was significantly associated with systolic blood pressure level ($p<0.05$, AOR 1.87, 95% C.I. 1.11-3.16) whereas none of the neurological symptoms studied was significantly associated with diastolic blood pressure level.

The study results did not show headache to be significantly associated with either systolic or diastolic blood pressure level, a finding well in line with published literature. Fuchs FD et al., in 2003 did not find headache to be significantly associated with hypertension (OR 1.02, 95% CI 0.79 to 1.30) [11]. Sherif SM et al., in 2012 did not report any significant difference in the prevalence of headache among hypertensive and normotensive subjects (38.1% vs. 39.6%, p=0.848) [12]. Similarly, Kruszewski P et al., in 2000 concluded that headaches were not directly associated with blood pressure elevations in patients with either stage 1 or stage 2 hypertension as blood pressure levels from headache periods were not significantly higher than those periods when headache was not present, blood pressure levels measured before the initiation of pain were not significantly different from values at the beginning of headache and in the vast majority of such patients their maximum blood pressure levels were recorded during headache-free periods [13]. Wiehe M et al., in 2002 also reported that episodic and chronic tension-type headache in lifetime or during previous year was not associated with hypertension. Moreover, individuals with optimal or normal blood pressure complained of migraine more frequently than the participants with high-normal blood pressure or hypertension [14]. Likewise, Hagen K et al., in 2002 found that patients with a systolic blood pressure of ≥150 mm Hg had 30% lower risk (risk ratio (RR)=0.7, 95% CI 0.6–0.8) of having non-migrainous headache at follow up than those with systolic pressure lower than 140 mm Hg. For diastolic blood pressure, the risk of non-migrainous headache decreased with increasing values for both genders and was not influenced by use of antihypertensive medication [15]. Tzourio C et al., in 2003 also found mean systolic blood pressure to be lower in patients with migraine than in those without headache (128 mmHg vs. 137 mmHg). Moreover, the frequency of migraine decreased significantly with increasing blood pressure [16]. Similarly, Muiesan ML et al., in 2006 found that office and 24 hour blood pressure values did not differ between subjects without headache and subjects with headache. Moreover, no differences in prevalence of headache and migraine were observed between hypertensive patients and normotensive subjects [17]. Gus M et al., in 2001 also concluded that mild hypertension had no association with the occurrence of headache and variation of blood pressure [18]. Similarly, Benseñor IJ et al., in 2002 did not report any significant difference in blood pressure values in women with chronic daily headache as compared to women without headache [19].

Literature shows some contrary findings as well, though far less frequently. Pietrini U et al., in 2005 found hypertension to be among the factors leading to an increase in the frequency and severity of both migraine and tension-type headache attacks [20]. Cirillo Met al., in 1999 also concluded headache to be significantly associated with hypertension [21]. Likewise, Gipponi Set al., in 2010 concluded that an association does exist between chronic daily headache and hypertension, but not necessarily a causal one [22].

Such heterogeneous data warrants in depth evaluation as the relationship between blood pressure level and headache may not necessarily be a linear one. Gupta VK in 2006 presented an interesting and biologically plausible hypothesis. According to him headache in hypertension patients results from a complex interaction between systemic BP, cranial blood flow, ocular autonomic function, ocular choroidal perfusion, and intraocular pressure, the factors which determine the mechanical properties of the corneoscleral envelope, and the endogenous pain control mechanism [23].

The study results showed vertigo to be positively associated with the level of systolic blood pressure, albeit only before multivariable analysis. A thorough literature search did not reveal ample relevant data in order to make a meaningful comparison of this finding. Parfenov VA in 2005 though found vertigo to occur in 20% patients with hypertension but cited it to be unrelated to elevated blood pressure and rather due to associated neurological, peripheral vestibular and other diseases [24]. Zeigelboim BS et al., in 2006 also reported presence of alterations in the peripheral vestibular system in patients with systemic arterial hypertension [25]. Moreover, Ohashi N et al., in 1990reported to find hypotension significantly more often in peripheral vestibular disorders and hypertension in central nervous system disorders among patients with vertigo, dizziness and disequilibrium [26]. Moreover, the study results did not show nausea to be significantly associated with either systolic or diastolic blood pressure level. Literature also does not show any evidence of existence of such an association.

The only studied neurological symptom found significantly positively associated with both systolic and diastolic blood pressure levels was confusion, and this association persisted even after controlling for the potential confounding effects of other variables. The prevalence of neurological deficit in hypertensive emergencies has earlier been reported to be 21% [27]. Moreover, it is known that hypertensive encephalopathy is characterized by acute or sub-acute onset of confusion, among other symptoms. 9Thambisetty Met al., in 2003 also reported that headache and confusion in the setting of severe hypertension may support the diagnosis of hypertensive encephalopathy [28]. Although more relevant studies were not available for a direct comparison, this finding warrants further exploration because of its potential management and prognostic implications.

Limitations

The prime limitation of the study was use of convenient sampling technique because of resource constraints, limiting

the generalizability of study findings. It is further acknowledged that being a cross-sectional study, limitation in recall may have affected the study results.

Conclusion and Recommendation

Based on the study results it can be safely concluded that some of the neurological symptoms of hypertension are associated with the systolic blood pressure level of the patients, but not with their diastolic blood pressure level. Further exploration of the described findings is recommended as it may assist in early development of a risk assessment profile of such patients in resource limited local settings which may prove invaluable in their prompt management.

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