Original Article

OPEN ACCESS

Contributing factors and their association with blood pressure control amongst hypertensive patients

Ghulam Mujtaba Nasir[1], Haroon Rashid Khan[2], Khuram Parvez[3], Juwayria Omar[4], Alishba Mukhtar[5]

[1]Doctoral Researcher, Horizon 2020, Mari Sklodowska-Curie, European Fellowship at Robert Gordon University, United Kingdom
[2]Public Health Specialist, Department of Community Medicine, Islamabad Medical and Dental College, Bahrakahu, Islamabad
[3]Emergency Medicine Consultant, Royal Blackburn Teaching Hospital, United Kingdom
[4]Assistant Professor, Fazaia Medical College, Air University, Islamabad
[5]Women Medical Officer, Muralla, Mandi Bahaudin

ABSTRACT

Objective: To assess contributing factors and their association with blood pressure control amongst hypertensive patients.

Methodology: This cross sectional comparative study was conducted at OPD general medicine dept, Pakistan Institute of Medical Sciences, from July to December 2018. Hypertensive patients of both genders, having age more than 18 years, and on antihypertensive medication form at least six months were included in the study. Optimally controlled BP was defined as an average systolic BP < 140 and diastolic BP < 90 mmHg if the patient is younger than 60 years, or an average systolic BP < 150 and diastolic BP < 90mmHg if patient was older than 60 years. Logistic regression was applied to assess the effect of different factors on blood pressure control of the hypertensive patients.

Results: In the study sample majority 107 (55.4%) of the patients belonged to 41-60 years age group, and females 106 (54.9%) were predominant. Main bulk 155 (80.3%) of the patients was married and mostly 80 (41.5%) patients had monthly income in the range of 25000-50000. About half 89 (46.1%) of the patients enrolled for the study were doing adequate physical activity. Optimized blood pressure was found in 92 (47.67%) patients.

Conclusion: The proportion of hypertensive patients whose blood pressure was optimally controlled was relatively low and less than half of patients had blood pressure in acceptable limits. Age group (41-60) years, routine use of vegetable on most days of week, physical activity, adherence to treatment and taking less than three drugs have a strong relationship with blood pressure to keep in optimized limits.

Key Words: Hypertension control, Contributing factors, Optimized blood pressure.

Introduction

Hypertension has become a major health apprehension in many developing countries. It is considered as silent killer causing other non-communicable diseases including organ failure. The incidence of hypertension is extremely high throughout the world. More than one billion adults are suffering from hypertension according to the reports of world health organization. This disease is rising sharply and it is estimated that it will increase to

1.56 billion till 2050. Many social issues like sedentary lifestyle, stress, excessive use of salt, alcohol consumption and physiological factors are considered as leading cause of hypertension.[1,2]

The prevalence of hypertension is quite high with a magnitude of 40.8% and very low control rate of 32.3%. It is associated with many severe health conditions like chronic kidney disease, cardiovascular disease and cerebrovascular disease.[3] The environmental factors such as obesity, diabetes, smoking, excessive salt intake and cultural factors like sedentary life styles have been identified as the factors accelerating the prevalence of hypertension in middle and later decades of life in Pakistani population. Many of these tend to aggregate in middle age when sedentary life style is adopted particularly in women.[4]

Hypertension has become a major cause of morbidity and mortality due to its high prevalence in both developing and developed countries. The condition of rise in prevalence of hypertension is worsening in developing countries due to economic improvement and urbanization. These developing countries are going through epidemiological transitions and the life expectancy is increasing, causing increase in prevalence of hypertension and its associated comorbid diseases. The proper management of hypertension reduces the risk of associated disease like myocardial infarction, stroke and chronic kidney disease.[5,6] Hypertension causes strain on the heart and arteries due to increased workload, which results in the form of myocardial dysfunction, congenital heart disease and kidney failure.[7] Over the last few decades, much progress has been achieved regarding hypertension medications and many therapeutic classes are currently available. They have been shown to be effective in reducing morbidity and mortality related to hypertension. However, less than one third of hypertensive patients have controlled blood pressure in most countries.[8]

Previous researches have found some factors may significantly contribute to keep the blood pressure in optimized limits. These factors include female gender, higher age, regular use of vegetable on most days of week, physical exercise and less than three drugs per day are important contributors for blood pressure control. Some comorbidities like cardiovascular disease, diabetes mellitus and asthma may cause the worsening of blood pressure control.[9]

Number of studies had reported the prevalence and correlates of hypertension in Pakistan but evidence is lacking about the prevalence of contributing factors of BP control among hypertensive patients on treatment. So, this study has been planned to quantify the proportion of patients who had adequately controlled their blood pressure, and to identify factors associated with it.

Methodology

This cross-sectional comparative study was conducted on hypertensive patients visiting to the outpatient department of medicine, Pakistan Institute of Medical Sciences, (PIMS) hospital Islamabad. The study was conducted in a period of six months from July to December, 2018. Ethical approval of the study was taken from hospital ethical board. All the patients with diagnosed hypertension visiting for routine checkup or any minor issue to OPD were enrolled after taking informed written consent. Hypertensive patients of both genders, having age more than 18 years, and on antihypertensive medication form at least six months were included in the study. A total of 193 patients were enrolled for the study. Sample size was calculated by using WHO sample size calculator with the help of 95% confidence interval, 42.9% rate of blood pressure control[10] and 7% margin of error.

Information regarding demographic characteristics like age, gender, education level, physical activity and use of drugs for blood pressure control were noted in a structured performa. SHO step wise approach and Morisky Green Levine Scale were used for data collection which are both previously validated tools. Optimally controlled BP was defined as an average systolic BP < 140 and diastolic BP < 90 mmHg if the patient is younger than 60 years, or an average systolic BP < 150 and diastolic BP < 90mmHg if patient was older than 60 years. Patients with score of ≥ 3 (range: 0±4) on the 4-items Morisky Green Levine Scale self-reported measures of medication taking behavior were assessed as having good adherence to medications, otherwise classified as non-adherent.

The analysis showed that age, education level, physical activity, use of vegetable on most days of the week, and use of less than three drugs per day were significant (p-value ≤ 0.05) contributing factors for blood pressure control.

All the collected data was entered and analyzed by using SPSS v. 25. Descriptive statistics like mean ± SD was

calculated for quantitative data and frequencies with percentage for qualitative data. Logistic regression was applied to assess the effect of different factors on blood pressure control of the hypertensive patients. P-value < 0.05 was considered significant.

Results

In this cross-sectional study, a total of 193 patients of hypertension were included. Majority 107 (55.4%) of the patients belonged to 41-60 years age group followed by 66 (34.2%) who were more than 60 years old. In the study sample females 106 (54.9%) were predominant as compared to males 87 (45.1%). Main bulk 155 (80.3%) of the patients was married. Mostly 80 (41.5%) patients had monthly income in the range of 25000-50000 category, followed by 61 (31.6%) patients in >50000 income group. About half 89 (46.1%) of the patients enrolled for the study were doing adequate physical activity, followed by 56 (29%) patient who were doing low level of physical activity. But 48 (24.9%) patients were not doing any king of physical activity.

Most 116 (60.1%) of the patients were not using vegetables, only 77 (39.0%) had a routine of vegetable intake. A considerable number 67 (34.7%) of patients were fond of top adding salt. In these patients some comorbidities were common like 24 (14%) had cardiovascular disease, 56 (29%) had diabetes mellitus and 36 (18.7%) had asthma. Main bulk 125 (64.8%) of the patients in the study ample were using < 3 drugs per day and 68 (35.2%) were using > 3 drugs per day. More than half 123 (63.7%) of the patients were adherent to the drug and 70 (36.6%) were poorly adherent as elaborated in table I.

The results of this study showed that 92 (47.67%) patients had blood pressure controlled and 101 (52.33%) patients whose blood pressure was not in required normal limits. Different contributing factors were assessed for their association with blood pressure control in this study.

The analysis showed that age is a significant (p-value < 0.05) contributor for hypertension control but only patients having age > 60 years had 2.81 times more chance of blood pressure to be in normal limits as compared to patients of age < 40 years. Although females were showing 1.46 times more chances of hyper tension control but this result was not statistically significant (p-value > 0.05). The educational level showed a very strong relationship with hypertension control, the patients whose

education was matric had 10.49 times more chance of blood pressure to be in acceptable limits as compared to illiterate patients. Similarly, patients with graduate or post graduate level of education also indicated significant (p-value < 0.05) association with hypertension control with ORs of 6.24 and 6.59 respectively. On the basis of results there was no any relationship of monthly income with hypertension control.

Table I: Distribution of different characteristics of the patients

Characteristics	Frequency	%
Age of the patient		
< 40	20	10.4
41-60	107	55.4
>60	66	34.2
Gender of the patient		
Male	87	45.1
Female	106	54.9
Marital Status		
Single	17	8.8
Married	155	80.3
Divorced/Separated	21	10.9
Education level		
Illiterate	60	31.1
Matric	67	34.7
Graduate	46	23.8
Post Graduate	20	10.4
Monthly Income		
< 25000	52	26.9
25000-50000	80	41.5
> 50000	61	31.6
Physical Activity		
No physical exercise	48	24.9
Low level physical activity	56	29.0
Adequate physical activity	89	46.1
Vegetable Use		
Yes	77	39.9
No	116	60.1
Top added salt		
Yes	67	34.7
No	126	65.3
Cardiovascular Disease		
Yes	27	14.0
No	166	86.0
Diabetes Mellitus		
Yes	56	29.0
No	137	71.0
Asthma		
Yes	36	18.7
No	157	81.3
No. of drugs using per day		
< 3	125	64.8
≥ 3	68	35.2
Adherence to drug		
Adherent	123	63.7
Poor adherent	70	36.3
Total	193	100.0

Physical activity was significant (p-value < 0.05) contributing factor for hypertension control and patients having low level of physical activity had 8 times more chances of blood pressure to be in normal limits as compared to patients with no physical activity. Surprisingly the patients with adequate physical activity level had only 1.33 times more chance of blood pressure control without any statistical significance (p-value > 0.05). The use of vegetable increases the chances of blood pressure control significantly (p-value < 0.05) with odds ratio of 2.26. The patient who were no using top added salt had 7.22 times more chance of blood pressure to be in normal limits as compared to patients who had habit of top adding salt. The cardiovascular disease did not show any relationship with hypertension control. But the patients without comorbidities of diabetes mellitus and asthma had significantly (p-value < 0.05) higher chance of blood pressure control as compared to patients

having these diseases with odds ratios of 4.19 and 4.32. The patients who were using less than 3 drugs per day had significantly (p-value < 0.05) 2.20 times more chances of blood pressure to be in normal limits as compared to patients on ≥3 drugs per day. The adherent patients to drug also had significantly (p-value < 0.05) more chances of blood pressure control with an OR of 2.91 as compared to patients with poor adherence as elaborated in detail in table II.

Discussion

Hypertension being a cardiovascular ailment is a result of many interrelated etiologies. It may originate functional and structural abnormalities of cardiovascular system, if not controlled and treated. These abnormalities are harmful for vital organs of the body like heart, kidneys and brain. So, hypertension has become main reason of disability and mortality all over the world.[11] Hypertension

Table II: Univariate and Multivariate analysis of different contributing factors of hypertension control

Characteristics	Categories	Hypertension control		Sig.	Exp(B)	95% C.I. for EXP(B)	
		Controlled	Uncontrolled			Lower	Upper
Age	< 40	12 (60.0%)	8 (40.0%)	.030	1		
	41-60	43 (40.2%)	64 (59.8%)	.764	0.80	.18	3.45
	>60	37 (56.1%)	29 (43.9%)	.018	2.81	1.19	6.65
Gender	Male	38 (43.7%)	49 (56.3%)		1		
	Female	54 (50.9%)	52 (49.1%)	.359	1.46	.65	3.31
Education level	Illiterate	24 (40.0%)	36 (60.0%)	.038	1		
	Matric	32 (47.8%)	35 (52.2%)	.004	10.49	2.13	51.60
	Graduate	21 (45.7%)	25 (54.3%)	.024	6.24	1.27	30.77
	Post Graduate	15 (75.0%)	5 (25.0%)	.024	6.59	1.29	33.75
Monthly Income	< 25000	20 (38.5%)	32 (61.5%)	.874	1		
	25000-50000	42 (52.5%)	38 (47.5%)	.722	0.81	.26	2.57
	> 50000	30 (49.2%)	31 (50.8%)	.861	1.09	.42	2.82
Physical Activity	No PA	9 (18.8%)	39 (81.3%)	.001	1		
	Low level PA	30 (53.6%)	26 (46.4%)	.000	8.03	2.54	25.37
	Adequate PA	53 (59.6%)	36 (40.4%)	.548	1.33	.53	3.34
Vegetable Use	No	46 (59.7%)	31 (40.3%)		1		
	Yes	46 (39.7%)	70 (60.3%)	.007	2.26	1.25	4.07
Top added salt	Yes	19 (28.4%)	48 (71.6%)		1		
	No	73 (57.9%)	53 (42.1%)	.000	7.22	2.66	19.59
Cardiovascular Disease	Yes	10 (37.0%)	17 (63.0%)		1		
	No	82 (49.4%)	84 (50.6%)	.150	2.56	.71	9.20
Diabetes Mellitus	Yes	17 (30.4%)	39 (69.6%)		1		
	No	75 (54.7%)	62 (45.3%)	.007	4.19	1.47	11.96
Asthma	Yes	11 (30.6%)	25 (69.4%)		1		
	No	81 (51.6%)	76 (48.4%)	.009	4.32	1.43	13.04
No. of drugs using per day	≥ 3	41 (60.3%)	27 (39.7%)		1		
	< 3	51 (40.8%)	74 (59.2%)	.010	2.20	1.20	4.02
Adherence to drug	Poor adherent	45 (64.3%)	25 (35.7%)		1		
	Adherent	47 (38.2%)	76 (61.8%)	.001	2.91	1.58	5.25
	Total	92	101				

and its related complications cause 9.4 million deaths every year. South Asia is a populous area having almost 25% people residing in this area and half of the disease burden is attributed to non-communicable diseases. In this area hypertension and its related diseases are major contributor to death and disability.[12,13]

The results of this study showed that 92 (47.67%) patients had blood pressure controlled and 101 (52.33%) patients whose blood pressure was not in required normal limits. Which is similar to some studies like Muleta et al, who found 43.51%[14], and Shelley D with 49.8%.[15] But some studies from Chilean (59.7%)[16], Greece (55.6%)[17], and South Africa (57%) have showed quite higher rates than our study.[18]

Main cause of morbidity and mortality due to cardiovascular disease is high blood pressure or hypertension worldwide. A very important and preventable risk factor contributing to 13% deaths is hypertension, which has become a major public health problem globally.[19] There are many health benefits of keeping the blood pressure lower than normal or optimal levels for long time. For instance, effective and sustained lowering of the BP of hypertensive patients by 2 mmHg reduces the risk of CVD events by up to 10%. Similarly, if systolic blood pressure is managed to be lowered by 20 mmHg the risk of dying from a stroke and coronary heart disease will decrease by 50%.[20]

The analysis showed that age is a significant (p-value < 0.05) contributor for hypertension control but only patients having age > 60 years had 2.81 times more chance of blood pressure to be in normal limits as compared to patients of age < 40 years. Many studies support this result of age being a significant contributor for blood pressure control. Studies also have shown that gender has significant relationship with gender but our study did not show any relationship of gender with blood pressure. [10, 21]

The educational level and Physical activity showed a very strong relationship with hypertension control, the patients whose education was matric had 10.49 times, graduate and post graduate had 6.24 and 6.59 more chance of blood pressure to be in acceptable limits respectively as compared to illiterate patients and patients having low level of physical activity had 8 times more chances of blood pressure to be in normal limits as compared to patients with no physical activity. Similar results have been shown in the literature.[22]

The use of vegetables increases the chances of blood pressure control significantly (p-value < 0.05) with odds ratio of 2.26. The patient who were not using top added salt had 7.22 times more chance of blood pressure to be in normal limits as compared to patients who had habit of top adding salt. These results are in very much agreement with other studies showing eating foods high in vegetables reduces blood pressure of hypertensive patients and added salt being a significant contributor for uncontrolled blood pressure.[23, 24]

The patients without comorbidities of diabetes mellitus and asthma had significantly (p-value < 0.05) higher chance of blood pressure control with odds ratios of 4.19 and 4.32. The patients who were using less than 3 drugs per day and good adherent patients to drug showed 2.20 and 2.91 times more chances of blood pressure to be in normal limits as compared to their counterparts. Previous studies also support the results that existence of comorbid diseases like diabetes mellitus and asthma decreases the chances of blood pressure control.[25]

Targeted intervention to improve management of hypertension in primary care setting could make a substantial difference in the improvement of hypertensive patient prognosis. Measures can be taken to assess the level of medication adherence and to investigate predicators of medication. A number of diverse strategies can be used to improve blood pressure control. In majority of the patients, blood pressure control is achieved with combination therapy; but low adherence rate is observed in patients taking multiple pills. Interventions designed to meet patient's requirements are necessary to achieve sufficient adherence to drug regimens. Achieving satisfactory adherence may have far greater impact than any other plan to improve antihypertensive treatments.

Conclusion

On the basis of the results of this present study it can be concluded that the proportion of hypertensive patients whose blood pressure was optimally controlled was relatively low and less than half of patients had blood pressure in acceptable limits. Age group (41-60) years, routine use of vegetable on most days of week, physical activity, adherence to treatment and taking less than three drugs have a strong relationship with blood pressure to keep in optimized limits. Whereas some factors like habit of top adding salt, having comorbid diseases including diabetes mellitus and asthma and poor adherence to

medication were found to have a negative impact on keeping blood pressure in optimal limits.

References

1. Farooq MA, Rehmat S, Rana AI, Farooqui M, Soban M, Ali RW, et al. Prevalence and determinants of hypertension among business class community of Lahore, Pakistan. Int Current Pharm J. 2016;5(10):79-81.

2. Keshari, P, Shankar H. Behavioural risk factors and hypertension among 40 years and above age group in urban Varanasi. J Com Health Manag. 2015;2(1):17-21.

3. Shafi ST, Shafi T. A survey of hypertension prevalence, awareness, treatment, and control in health screening camps of rural central Punjab, Pakistan. J Epidemiol Global Health. 2017;7:135–140.

4. Aziz KU. Evolution of Systemic Hypertension in Pakistani Population. J Coll Physicians Surg Pak 2015;25(4):286-291.

5. Yang G, Kong L, Zhao W, et al. Emergence of chronic non-communicable diseases in China. Lancet. 2008;372(9650):1697–705.

6. Shah N, Shah Q, Shah AJ. The burden and high prevalence of hypertension in Pakistani adolescents: a meta-analysis of the published studies. Arch Pub Health. 2018;76:20.

7. Ishtiaq S, Ilyas U, Naz S, Altaf R, Afzaal H, Muhammad SA, et al. Assessment of the risk factors of hypertension among adult & elderly group in twin cities of Pakistan. J Pak Med Assoc. 2017;67(11):1664-1669.

8. Al-Qahtani AM. Prevalence and Determinants of Blood Pressure Control among Hypertensive Patients in Primary Care Centers, Najran, Saudi Arabia. Biomed Pharmacol J. 2018;11(2): 821-825.

9. Teshome DF, Demssie AF, Zeleke BM. Determinants of blood pressure control amongst hypertensive patients in Northwest Ethiopia. PLoS ONE. 2018;13(5):e0196535.

11. Forouzanfar MH, Alexander L, Anderson HR, Bachman VF, Biryukov S, Brauer M, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015; 386(10010):2287-323.

12. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2013;380(9859):2224-2260.

13. Hasan M, Sutradhar I, Akter T, Das Gupta R, Joshi H, Haider MR. Prevalence and determinants of hypertension among adult population in Nepal: Data from Nepal Demographic and Health Survey 2016. PLoS ONE. 2018;13(5):e0198028.

14. Muleta S, Melaku T, Chelkeba L, Assefa D. Blood pressure control and its determinants among diabetes mellitus comorbid hypertensive patients at Jimma University

    medical center, South West Ethiopia. Clin Hypertens. 2017 ;23:29.

15. Shelley D, Tseng T-Y, Andrews H, Ravenell J, Wu D, Ferrari P, et al. Predictors of blood pressure control among hypertensives in community health centers. Am J Hypertens. 2011;24(12):1318–1323.

16. Sandoval D, Bravo M, Koch E, Gatica S, Ahlers I, Henríquez O, et al. Overcoming barriers in the management of hypertension: the experience of the cardiovascular health program in Chilean primary health care centers. Int J Hypertens. 2012;2012:405892.

17. Skliros E, Vasibossis A, Loumakis P, Sotiropoulos A, Giannakaki G, Razis N. Evaluation of hypertension control in Greek primary care units. The VANK study. J Hum Hypertens. 2003;17(4):297.

18. Adeniyi OV, Yogeswaran P, Longo-Mbenza B, Ter Goon D. Uncontrolled hypertension and its determinants in patients with concomitant type 2 diabetes mellitus (T2DM) in rural South Africa. PLoS One. 2016;11(3):e0150033.

19. Vijver Svd, Akinyi H, Oti S, Olajide A, Agyemang C, Aboderin I, et al. Status report on hypertension in Africa - Consultative review for the 6th Session of the African Union Conference of Ministers of Health on NCD's. Pan African Med J. 2013;16(38):45-49.

20. Yip W, Wong TY, Jonas JB, Zheng Y, Lamoureux EL, Nangia V, et al. Prevalence, awareness, and control of hypertension among Asian Indians living in urban Singapore and rural India. J Hypertens. 2013;31(8): 1539-46.

21. Chow CK, Teo KK, Rangarajan S, Islam S, Gupta R, Avezum A, et al. Prevalence, Awareness, Treatment, and Control of Hypertension in Rural and Urban Communities in High-, Middle-, and Low-Income Countries. JAMA. 2015; 310(9):959-968.

22. Jafar TH, Silva Ad, Naheed A, Jehan I, Liang F, Assam PN, Legido Quigley H, Finkelstein EA, Ebrahim S, Wickremasinghe R, Alam D, Khan AH; COBRA-BPS Study Group. Control of blood pressure and risk attenuation: a public health intervention in rural Bangladesh, Pakistan, and Sri Lanka: feasibility trial results. J Hypertens 2016;34:1872–1881.

23. Ke L, Ho J, Feng J, Mpofu E, Dibley MJ, Li Y, et al. Prevalence, Awareness, Treatment and Control of Hypertension in Macau: Results from a Cross-Sectional Epidemiological Study in Macau, China. Am J Hypertens. 2015; 28(2).

24. Hoque MN, Mondal NI, Moni SY, Chowdhury RK. Determinants of blood pressure control in hypertensive diabetic patients in Rajshahi District of Bangladesh. J Biomet Biostat 2012;S7:001.

25. Duncana P, Howeab L, Manakusac Z, Purdya S. Determinants of blood pressure control in rural Kwa Zulu Natal, South Africa. South African Fam Pract.2014;56(6):297-304.