Original Research Article

Gender Difference in Blood Pressure Control and Cardiovascular Risk Factors With Diagnosed Hypertension

Abstract:

Objective: Our study was designed to compare the gender difference in Blood Pressure Control and Cardiovascular Risk Factors in patients of Liaquat University of Medical and Health Sciences Jamshoro Pakistan.

Methodology: This cross-sectional study was conducted in Liaquat University of Medical and Health Sciences Jamshoro Pakistan from December 2019 to December 2020. Blood pressure was measured twice by trained physicians using aneroid sphygmomanometers after a standardized protocol. Patients were asked to sit with both feet on the floor for ≥5 minutes before the first BP measurement. Both the two BP measurements were taken 60 seconds apart. For this research we defined hypertension as systolic BP ≥140 mm Hg, diastolic BP ≥90 mm Hg.

Results: We conducted a comparison between Hypertensive and nonhypertensive participants of the male and female groups. High blood pressure increased the level of uric acid in both male and female groups (351 ± 92 vs 303 ± 75). We observed that the hypertensive male population reported a high prevalence of cardiovascular risk factors due to increase amount of total cholesterol level, triglyceride and low-density lipoprotein cholesterol (5.45 ± 1.01, 1.42 ± 0.85, 2.56 ± 0.70) than females (5.15 ± 0.91, 1.29 ± 0.87, 2.30 ± 0.63).

Conclusion: Our results concluded that the male hypertensive population is more prone to future cardiovascular risk due to increased amount of total cholesterol levels, triglycerides, and low-density lipoprotein cholesterol, and sex hormones (androgens).

Keywords:

Gender prevelance, Cardiovascular risk Factors, Hypertension

Introduction:

Rapid urbanization, aging, poor lifestyle, unhealthy diet patterns, and globalization are one of the most challenging disorders in developing countries which lead to hypertension disorder[1]. Hypertension become a world emergency especially in developing countries that need proper treatment to reduce the risk of cardiovascular events and occurrence[2]. In the modern world, hypertension is one of the major challenging disorders leading to heart attack, stroke, and vascular complications. The high mortality ratio due to cardiovascular disease usually happened due to elevated blood pressure levels[3]. In 2008, approximately 1 billion deaths were reported in the world adult population due to hypertension[4]. Medical experts claims that in 2025, hypertension become an alarming situation that may cause 1.7 billion adult death. In low-income countries, annually 6 million deaths are reported due to hypertension[5]. Hypertension is now identified as a major contributor to disease burden in many parts of the world. Nearly 2/3rd hypertensive patients live in underdeveloped countries. One of the studies stated that 3.4% male adult population and 6.8% female population are suffering from hypertension worldwide enhances the risk of cardiovascular disorders[6]. In 2000, 2-4% urban population of low-income Asian countries were suffering from hypertension in which their blood levels ranges ≥160/≥95 mmHg)[7]. The global burden of disease claimed that the cardiovascular mortality ratio would increase in 2023 due to hypertension. Benjamin's study reported a low prevalence of hypertension in women younger than 65 years of age group when compared to men[8]. But when women reached above 65 years of age majority of them face elevated blood pressure levels in their elderly life period[8]. In past, a very limited amount of literature was produced to demonstrate the gender differences of hypertension and predict future cardiovascular risks. Our study was designed to fill this gap. Our study aimed to compare the gender difference in Blood Pressure Control and Cardiovascular Risk Factors in ..... population With Diagnosed Hypertension.

Methodology:

This cross-sectional study was conducted in Liaquat University of Medical and Health Sciences Jamshoro Pakistan from December 2019 to December 2020. In this study, BP screening was done among the adult population aged 40 years or over. Before initiating the research, ethical approval was obtained from the hospital research ethics committee and research was conducted by following Helsinki principles. All the participants were well-known about the objectives and nature of the research. Written and verbal consent were obtained from every participant. Survey analysis was used for gathering data related to Cardiovascular Disease Risk Factors. The questionnaire was obtained from the WHO MONICA and used for further analysis[9,10]. Blood pressure was measured twice by trained physicians using aneroid sphygmomanometers. Patients were asked to sit with both feet on the floor for ≥5 minutes

before the first BP measurement. Both the two BP measurements were taken 60 seconds apart. For this research we defined hypertension as systolic BP ≥140 mm Hg, diastolic BP ≥90 mm Hg. We also used antihypertensive medication were used to maintain the definition of hypertension (systolic BP ≥140 mm Hg, diastolic BP ≥90 mm Hg) throughout the study. BP control or normotensive was as diastolic BP <90 mm Hg and systolic BP ≥140 mm Hg. After BP measurements, all the participants were divided into two groups normotensive participants, having no medical history of hypertension, and hypertensive participants, those who reported hypertension even after utilising antihypertensive medications. We measured the patient weight to analyze the risk factors. Body mass index was measured by the criteria defined by WHO experts for overweight (BMI ≥ 24 kg/m2) and obesity (BMI ≥ 28 kg/m)[11]. Participants who currently smoking more than one cigarette and hookah were categorized as current daily smokers. At the time of the survey, blood samples were taken from each participant for analyzing levels of serum total cholesterol (TC), triglyceride (TG). Furthermore, laboratory analyses of low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), urea, creatinine, and uric acid (UA) were also performed.

Statistical analysis was performed by using SPSS 23.0. Continuous variables were measured in mean and standard deviations whereas a two-tailed student t-test was used to compare the differences between the two groups. Categorical variables were measured by using the Chi-square test whereas column proportion was measured by using the z test. To determine independent risk factors of hypertension we used multivariate binary logistic regression with a 95% confidence interval for adjusted odds ratios.

Results:

In this study total of 2652 patients were recruited of which 72% were female and 28% were male (Table 1). We observed that females aged 50 or above had a high frequency of hypertension as compared to men. However, overall the weighted prevalence indicated high hypertension in the male population (61.2% in men vs. 48.8% in the women population). Though the sample of male participants was 2 times little than female population still we observed the high prevalence of hypertension at the age of 80 or above (78.3% [63.6-89.1]. The prevalence of hypertension increased with age in both men and women but the hypertension prevalence of males was comparitively lower than female participants at age group of 60-69 (61.2% [55.5-66.7] vs 62.8 % [58.5-66.9]) and 70-79 (60.8% [53.0-68.3] vs 65.8 % [58.8-72.4]). Comparitively, the weighted frequency of hypertensive male population was high at age of 40 (59.7% [47.5-71.7]) than women (34.1% [30.0-38.4]). We observed that women were more concerned to check their BP within a month which is associated with good blood pressure control. Overall we observed that hypertension prevalence remained unchanged in the male population but continuously shifted in female participants.

The systolic blood pressure and diastolic blood pressure in male and female populations are represented in table 3. Our study reported similar systolic (144 ± 18 mmHg vs 144 ± 18 mmHg) and diastolic blood pressure (92 ± 9 vs. 92 ± 9 mm) in both male and female groups with hypertension. In the normotensive group, we observed elevated diastolic blood pressure in the female population (76 ± 6) compared to men (75 ± 7).

In table 4, we conducted a comparison between Hypertensive and nonhypertensive participants of the male and female groups. High blood pressure increased the level of uric acid in both male and female groups (351 ± 92 vs 303 ± 75). We observed that the hypertensive male population reported a high prevalence of cardiovascular risk factors due to increase amount of total cholesterol level, triglyceride and low-density lipoprotein cholesterol (5.45 ± 1.01, 1.42 ± 0.85, 2.56 ± 0.70) than females (5.15 ± 0.91, 1.29 ± 0.87, 2.30 ± 0.63). In contrast hypertensive women reported increase in high density protein than males (1.37 ± 0.38 vs 1.33 ± 0.33). The normotensive group of male population reported high amount of HDL than hypertensive patients (1.36 ± 0.32 vs 1.33 ± 0.33). Multivariate analysis of our study reported higher BMI, higher LDL-C levels and older age as independent risk factors of hypertension in the female population (Table 5).

Table 1: Demographic characteristics of recruited patients

Age (years)	Female N= 1936	Male N= 716	Total N= 2652
≥80	44 (2.3%)	46 (6.4%)	90 (3.4)
70-79	199 (10.3%)	166 (23.2%)	365 (13.8)
60-69	521 (26.9%)	304 (42.5%)	825 (31.1)
50-59	659 (34%)	128 (17.9%)	787 (29.7)
40-49	513 (26.5%)	72 (10.1%)	585 (22.1)
Smoking	100 (3.77%)	358 (13.49%)	458 (17.2%)

Table 2: Weighted prevelance of hypertension in male and female population

Age (years)	Weighted prevelance in female population (95% C.I)	Weighted prevelance in male population (95% C.I)

≥80	72.7% (57.2-85.0)	78.3% (63.6-89.1)
70-79	65.8 % (58.8-72.4)	60.8% (53.0-68.3)
60-69	62.8 % (58.5-66.9)	61.2% (55.5-66.7)
50-59	53.6% (49.7-57.4)	61.7% (52.7-70.2)
40-49	34.1% (30.0-38.4)	59.7% (47.5-71.7)

Table 3: Systolic and diastolic blood pressure in male and female population

	Male		**Female**		P- value
	Hypertensive group	Normotensive group	Hypertensive. group	Normotensive group	
Diastolic blood pressure	92 ± 9	75 ± 7	92 ± 9	76 ± 6	P>0.05
Systolic blood pressure	114 ± 18	116 ± 10	114 ± 18	116 ± 11	P>0.05

Table 4: Blood parameters of male and female population associated with risk of cardiovascular disorders.

Blood parameters	Males		Females	
	Hypertensive	Normotensive	Hypertensive	Normotensive
UA (µmol/L)	351 ± 92	317 ± 90	303 ± 75	291 ± 70
TC (mmol/L)	5.45 ± 1.01	5.25 ± 1.01	5.15 ± 0.91	5.04 ± 0.89
CREA (µmol/L)	72.2 ± 52.9	66.6 ± 16.1	65.9 ± 16.4	64.8 ± 12.7

TG (mmol/L)	1.42 ± 0.85	1.24 ± 0.71	1.29 ± 0.87	1.15 ± 0.72
Urea (mmol/L)	6.57 ± 2.13	6.26 ± 1.53	6.25 ± 1.78	6.04 ± 1.60
LDL-C (mmol/L)	2.56 ± 0.70	2.40 ± 0.61	2.30 ± 0.63	2.23 ± 0.57
HDL-C (mmol/L)	1.33 ± 0.33	1.36 ± 0.32	1.37 ± 0.38	1.38 ± 0.43

Table 5: Multivariate Binary Logistic regression of risk factors contributing in hypertension

	Odd ratio	95% CI for OR		Wald	p-value
		Lower	Upper		
Age					
≥80	3.302	2.008	5.429	22.161	<0.001
70-79	1.687	1.255	2.268	12.024	0.001
60-69	1.609	1.269	2.040	15.434	<0.001
50-59	1.333	1.090	1.630	7.850	0.005
40-49	1.356	1.136	1.540	37.480	<0.001
Male Vs Female	1.353	1.111	1.647	9.077	0.003
BMI					
Obesity	3.299	2.609	4.172	99.388	<0.001
Overweight	1.517	1.263	1.821	19.956	<0.001
Underweight/ normal	1.623	1.251	1.987	99.762	<0.001

Constant	0.052	0.003	0.678	103.128	0.001
UA (umol/L)	1.003	1.002	1.004	25.202	0.001
Urea (mmol/L)	1.015	0.969	1.064	0.406	0.524
LDL-C (mmol/L)	1.295	1.142	1.469	16.206	<0.001
TG (mmol/L)	1.104	0.987	1.234	2.993	0.084
Smoking	1.235	0.984	1.551	3.302	0.069

Discussion:

Our study reported recent trends in blood pressure control and highlights the cardiovascular risk factors associated with hypertension. Our study found a slightly high prevalence of hypertension among males but excluded large gender differences. We observed that the male population reported a high prevalence of cardiovascular risk factors as compared to females in terms of obesity, total cholesterol level and also reported low HDL levels. Elevated blood pressure level is one of the major causes of mortality in many regions. A study conducted in 2015 reported 4.5 million deaths in men and 4.0 million deaths in women due to high systolic blood pressure in low-income regions[13]. A study of Reckelhoff[14] observed high blood pressure among the male population as compared to females but this relationship could be varied by age. A study by Whelton[15] observed higher systolic blood pressure in women compared to men. Furthermore, they observed lower diastolic blood pressure in women than men. In our study, we did not find any significant gender differences in terms of systolic and diastolic blood pressure. In both genders, we observed similar systolic blood pressure (144 ± 18 vs. 144 ± 18 mmHg) and diastolic BP (92 ± 9 vs. 92 ± 9 mmHg). This similarity occurred due to the sample selection. We only include patients aged 40 years or above for analysis. Our results are similar to the worldwide survey of Zhou et al[13]., in which he reported similar SBP and DBP among the male and female populations aged ≥50 years.

Multivariate analysis of Hyman et al[16]., reported uncontrolled blood pressure among the male population due to lack of awareness. In our multivariate analysis, we observed older age, higher BMI, higher LDL-C levels as independent risk factors of hypertension in the female population. Sex hormones are the major contributors to elevate blood pressure. Androgens levels could

increase the blood pressure level in the male population[14]. After menopause women usually observed elevated systolic blood pressure which is thought to be secondary to the withdrawal of vasodilator effects of endogenous estrogen. This effect also increased arterial stiffness, reduces the production of endothelial nitric oxide, and causes salt sensitivity. Our study did not observe the blood pressure control rate in premenopausal and postmenopausal women because 80% of women diagnosed with hypertension were postmenopausal.

Aging is another risk factor for hypertension. Increasing age is highly associated with uncontrolled blood pressure levels[17]. Researches observed increased levels of systolic blood pressure and pulse pressure in elder age group of women as compared to the older age male population[18,19]. However, the DBP level remains the same in both genders[18]. But our results are in contradiction of these results and we did not observe any significant difference in systolic blood pressure of both genders. After menopause large population of women are suffering from obesity which is another contributory factor of hypertension-related cardiovascular diseases. The previous study of Framingham[20] reported a high prevalence of cardiovascular diseases in the female population after menopause. Menopause increases waist circumference and fat mass. The changes in body composition play a vital role in uncontrolled blood pressure[20]. Our study reported high obesity levels in the male population due to poor lifestyle which could be a threat for future cardiovascular diseases in the future.

Limitations of the study:

The prevalence of hypertension awareness depends on the education status and socio-demographics of the patients. However, no availability of these variables limits our study to observe significant gender differences among hypertensive patients. Family history is another important variable to demonstrate the gender differences and risk of cardiovascular diseases but our questionnaire lack this variable. We recommend that further research would be needed to understand sex-specific outcomes associated with hypertension.

Conclusion:

Our results concluded that the male hypertensive population is more prone to future cardiovascular risk due to increased amount of total cholesterol levels, triglycerides, and low-density lipoprotein cholesterol, and sex hormones (androgens).

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