

Original Research Article

Smoking and blood pressure levels in hypertensive patients: evaluating the role of gender, age and hypertension duration

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ABSTRACT

Background: Hypertension is estimated to affect about 40% of adults above 25 years of age globally. While many of the risk factors of hypertension are well known, such is not the case with smoking. Pertinent published literature is heterogeneous, with a dearth of relevant local data. Objectives was to study the relationship between smoking and blood pressure levels in hypertensive patients and to assess the effects of gender, age and hypertension duration on such a relationship.

Methods: A cross-sectional study was carried out on a total of 298 conveniently sampled patients, aged 18 or above, from the medical outpatient department of a secondary care hospital of Karachi. The relevant data were collected by means of a structured questionnaire whereas the blood pressure level was checked using sphygmomanometer with stethoscope. Mann Whitney U test was used for inferential analysis whereas the significance level was set at 0.05.

Results: Overall, both the systolic and diastolic blood pressure levels were significantly associated with smoking history ($p < 0.05$ for both) where they were found to be higher in smokers than in non-smokers. Furthermore, after gender, age and hypertension duration based stratifications; both the systolic and diastolic blood pressure levels were still significantly associated with smoking history in patients who were male, were ≥ 35 years old and had < 5 years hypertension duration ($p < 0.05$ for both) where they were again found to be higher in smokers than in non-smokers.

Conclusions: The study results showed a significant association of positive smoking history with higher mean systolic and diastolic blood pressure levels, though after stratifying for gender, age and hypertension duration, this relationship persisted only in patients who were male, were ≥ 35 years old and had < 5 years hypertension duration.

Keywords: Age, Blood pressure levels, Gender, Hypertension duration, Hypertensive patients, Smoking

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

According to World Health Organization, hypertension is known to increase the risk of various medical conditions such as heart attack, stroke, kidney failure and blindness and is estimated to affect about 40% of adults above 25 years of age and results in 7.5 million deaths annually.²

Moreover, the comparative Risk Assessment Collaborating Group identifies hypertension as the leading risk factor for mortality worldwide.³ The worldwide prevalence of hypertension is estimated to be from 3.4% in India to 72.5% in Poland.⁴ It is further estimated that the overall prevalence of hypertension is similar in both genders, and that it consistently increases with age worldwide.⁵ The prevalence of hypertension in Pakistan was earlier reported to be 17%; recent estimate however shows that 25.2% of the Pakistani population is suffering from raised blood pressure.^{6,7}

Hypertension is of two types, primary/essential and secondary. Essential hypertension can be defined as a rise in blood pressure of unknown cause that increases risk for cerebral, cardiac, and renal events.⁸ Secondary hypertension is defined as increased systemic blood pressure due to an identifiable cause. Only 5-10% of patients suffering from arterial hypertension have secondary hypertension, whereas the rest of them have primary hypertension.⁹

The management of high blood pressure is recommended to be two pronged, focusing on both life style modifications as well as anti-hypertensive medications. Lifestyle modifications include smoking cessation, moderate alcohol consumption, reduced sodium intake and increased physical activity whereas blood lowering medications include ACE inhibitors, angiotensin receptor blockers, thiazide diuretics and calcium channel blockers.¹⁰ The relevant guidelines suggest to initiate a pharmacologic treatment when blood pressure is 140/90mmHg or higher in adults younger than 60 years, or 150/90mmHg or higher in adults 60 years and older.¹¹

While many of the risk factors of high blood pressure are well known, such is not the case with smoking. Published literature exploring the association of smoking with hypertension is heterogeneous, and the debate is ongoing with no consensus achieved as of now.¹²⁻²⁰ To the best of authors' knowledge and as per a thorough literature search, in addition to the dearth of relevant data assessing the above mentioned relationship in Pakistan, any potential effects of demographic characteristics or of hypertension duration on such a relationship have not been evaluated much, neither internationally or locally.

The current study was therefore envisioned to help build a local evidence database thereby aiding in prioritization of risk management in hypertensive patients. Our objectives in the given context were to study the relationship between smoking and blood pressure levels in hypertensive patients and to assess the effects of gender, age and hypertension duration on such a relationship.

METHODS

After taking ethical approval, a cross-sectional study was carried out on 298 conveniently sampled patients, aged

18 or above, from the medical outpatient department of a secondary care hospital of Karachi. Self-reported history of hypertension and being on anti-hypertensive medication were the inclusion criteria whereas history of diabetes, cardiac events, neurological disorders, cluster headache, gastrointestinal disease and morbid obesity were the exclusion criteria of the study.

After taking verbal informed consent, the demographic information was collected from each patient by means of a structured questionnaire developed specifically for the study by the principal investigator. Afterwards, the blood pressure level was checked using sphygmomanometer with stethoscope. The collected data were entered and analysed on SPSS version 20. After checking normality, Mann Whitney U test was used for inferential analysis whereas stratification was used to control for the potential confounding effects of gender, age and hypertension duration. The significance level was at 0.05. The duration of study was 4 months.

RESULTS

The total data collected were of 372 patients but after excluding missing data for various study variables the final data analyzed were of 298 patients.

The study results revealed that while analyzing overall both the systolic and diastolic blood pressure levels were significantly associated with smoking history ($p=0.004$ and $p=0.039$ respectively) where both these blood pressure levels were found to be higher in smokers than in non-smokers ($147.57\pm 12.21\text{mmHg}$ vs. $140.54\pm 14.63\text{mmHg}$ and $88.90\pm 10.57\text{mmHg}$ vs. $84.76\pm 10.16\text{mmHg}$ respectively) (Table 1).

Table 1: Comparison of blood pressure levels among smokers and non-smokers (overall).

Variables (n=298)	Yes	No	P*
	Mean±SD	Mean±SD	
Systolic blood pressure (mmHg)	147.57±12.21	140.54±14.63	0.004
Diastolic blood pressure (mmHg)	88.90±10.57	84.76±10.16	0.039
*Mann Whitney U Test			

Furthermore, among male patients both the systolic and diastolic blood pressure levels were significantly associated with smoking history ($p=0.009$ and $p=0.035$ respectively) where both these blood pressure levels were found to be higher in smokers than in non-smokers ($146.89\pm 12.30\text{mmHg}$ vs. $139.90\pm 13.92\text{mmHg}$ and $88.39\pm 10.71\text{mmHg}$ vs. $83.52\pm 10.60\text{mmHg}$ respectively) (Table 2).

Moreover, among female patients neither of the systolic or diastolic blood pressure levels were significantly

associated with smoking history (p=0.056 and p=0.07 respectively) (Table 3).

Table 2: Comparison of blood pressure levels among smokers and non-smokers (males).

Variables (n=154)	Smoking history		p*
	Yes Mean±SD	No Mean±SD	
Systolic blood pressure (mmHg)	146.89±12.30	139.90±13.92	0.009
Diastolic blood pressure (mmHg)	88.39±10.71	83.52±10.60	0.035

*Mann Whitney U Test

Table 3: Comparison of blood pressure levels among smokers and non-smokers (females).

Variables (n=154)	Smoking history		p*
	Yes Mean±SD	No Mean±SD	
Systolic blood pressure (mmHg)	157.00±7.07	141.11±15.25	0.009
Diastolic blood pressure (mmHg)	96.00±5.65	85.85±9.65	0.035

*Mann Whitney U Test

Table 4: Comparison of blood pressure levels among smokers and non-smokers (<35 Years old).

Variables (n=40)	Smoking history		p*
	Yes Mean±SD	No Mean±SD	
Systolic blood Pressure (mmHg)	140.67±1.15	136.19±11.48	0.346
Diastolic blood Pressure (mmHg)	84.00±12.16	82.78±9.45	0.809

*Mann Whitney U Test

Table 5: Comparison of blood pressure levels among smokers and non-smokers (≥35 years old).

Variables (n=258)	Smoking history		p*
	Yes Mean±SD	No Mean±SD	
Systolic blood pressure (mmHg)	148.33±12.65	141.23±14.97	0.007
Diastolic blood pressure (mmHg)	89.44±10.49	85.07±10.25	0.044

*Mann Whitney U Test

Furthermore, among <35 years old patients neither of the systolic or diastolic blood pressure levels were significantly associated with smoking history (p=0.346 and p=0.809 respectively) (Table 4).

Moreover, among ≥35 years old patients both the systolic and diastolic blood pressure levels were significantly associated with smoking history (p=0.007 and p=0.044 respectively) where both these blood pressure levels were

found to be higher in smokers than in non-smokers (148.33±12.65mmHg vs. 141.23±14.97mmHg and 89.44±10.49mmHg vs. 85.07±10.25mmHg respectively) (Table 5).

Table 6: Comparison of blood pressure levels among smokers and non-smokers (<5 years hypertension duration).

Variables (n=177)	Smoking history		p*
	Yes Mean±SD	No Mean±SD	
Systolic blood pressure (mmHg)	146.18±11.04	139.03±12.74	0.019
Diastolic blood pressure (mmHg)	88.53±9.79	83.65±10.53	0.043

*Mann Whitney U Test

Table 7: Comparison of blood pressure levels among smokers and non-smokers (≥5 years hypertension duration).

Variables (n=121)	Smoking history		p*
	Yes Mean±SD	No Mean±SD	
Systolic blood pressure (mmHg)	149.38±13.84	142.77±16.86	0.077
Diastolic blood pressure (mmHg)	89.38±11.89	86.40±9.39	0.488

*Mann Whitney U Test

Furthermore, among patients with <5 years hypertension duration both the systolic and diastolic blood pressure levels were significantly associated with smoking history (p=0.019 and p=0.043 respectively) where both these blood pressure levels were found to be higher in smokers than in non-smokers (146.18±11.04mmHg vs. 139.03±12.74mmHg and 88.53±9.79mmHg vs. 83.65±10.53mmHg respectively) (Table 6).

Moreover, among patients with ≥5 years hypertension duration neither of the systolic or diastolic blood pressure levels were significantly associated with smoking history (p=0.077 and p=0.488 respectively) (Table 7).

DISCUSSION

The study results revealed that while analyzing overall both the systolic and diastolic blood pressure levels were significantly associated with smoking history where they were found to be higher in smokers than in non-smokers. Furthermore, after gender, age and hypertension duration based stratifications; both the systolic and diastolic blood pressure levels were still significantly associated with smoking history in patients who were male, were ≥35 years old and had <5 years hypertension duration where they were again found to be higher in smokers than in non-smokers.

Literature reports mix findings with regard to the effect of smoking on the blood pressure levels in hypertensive patients. Similar to the study findings, Primates P et al, in 2001 reported that older male smokers had higher systolic blood pressure than non-smokers, though no such differences were observed among younger men or for diastolic blood pressure, and that any independent chronic effect of smoking on blood pressure was small.¹² Likewise, Thuy AB et al, in 2010 reported that relative to non-smokers, the risk of hypertension for those who had longer duration of hypertension was 1.52 (95% CI 0.95-2.44).¹³ Contrary to the study findings where systolic and diastolic blood pressure levels were not significantly associated with smoking history in females, Bowman TS et al in 2007 though reported cigarette smoking to be modestly associated with an increased risk of developing hypertension in females.¹⁴

Equivocal findings in this regard have also been frequently reported. Leone A, in 2011 reported that a causal relationship between smoking history and increase in blood pressure is not yet clearly established.¹⁵ He further reported in 2015 that even though a close relationship exists between smoking and hypertension in the context of effecting heart and blood vessels, the specific role of each of them is difficult to establish.¹⁶ Similarly, Virdis A et al, in 2010 reported that available data do not provide clear evidence that a direct causal relationship exists between chronic smoking and blood pressure.¹⁷ Moreover, Narkiewicz K et al in 2005 also reported that the relationship between chronic smoking and development of hypertension is still unclear and debatable.¹⁸

Interestingly though, evidence regarding an inverse relationship between smoking and hypertension also exists. Okubo Y et al, in 2002 found adjusted systolic and diastolic blood pressures in light, moderate and heavy smokers to be significantly lower than in non- and ex-smokers.¹⁹ Likewise, Lee DH et al in 2001 observed progressive increases in blood pressure with the prolongation of smoking cessation in males, with the adjusted relative risks of hypertension in those who had quit smoking for <1, 1 to 3, and >3 years to be 0.6 (95% CI 0.2 to 1.9), 1.5 (95% CI 0.8 to 2.8), and 3.5 (95% CI 1.7 to 7.4), respectively, as compared to current smokers.²⁰

Even though a thorough literature search by the investigators did not shed much light on the effect of the studied demographic characteristics or of hypertension duration on the relationship between smoking history and blood pressure levels, the study findings clearly point out towards potential confounding effects of all of the gender, age and hypertension duration on such a relationship. The results of our study need to be verified by longitudinal studies, as these intriguing findings could prove useful in identifying and establishing a high risk profile of hypertensive patients, in the context of their

smoking habits, for assessment of risk and prioritization of its management in such patients.

The study findings should be interpreted with caution because the difference between acute and chronic smoking was not taken into consideration which could have affected the study results. It is further acknowledged that the use of convenient sampling technique and of self-reported data, because of resource constraints, may limit the generalizability of the study findings.

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