ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 2(K), pp. 24561-24566, February, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

PREVALENCE AND RISK FACTORS OF HYPERTENSION AMONG DENTAL OUT PATIENTS: A CROSS SECTIONAL STUDY

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DOI: http://dx.doi.org/10.24327/ijrsr.2018.0902.1683

ARTICLE INFO

Article History:
Received 16th November, 2017
Received in revised form 25th December, 2017
Accepted 23rd January, 2018
Published online 28th February, 2018

Key Words:

Blood pressure, psychosocial stress, skin fold thickness and unawareness.

ABSTRACT

Hypertension is labelled as a global health burden that can trigger an array of cardiovascular events. It is influenced by various modifiable risk factors like BMI, deleterious habits, physical activity and non modifiable risk factors like age, gender and geographic distribution.

Aim and Objective: To determine the prevalence of hypertension among dental patients and correlate various risk factors like age, gender, obesity, family history with the same.

Methods: A cross sectional study was conducted among the 311 dental out patients who were unaware of their hypertensive state. Covariates like age, gender, deleterious habit body mass index (BMI), skin fold thickness (SFT), family history, physical activity and psychosocial stress were also recorded in a structured proforma.

Results: The overall prevalence of hypertension was 30.2%; higher predilection being found among males. Statistical significance was found between risk factors like gender, BMI, SFT, smoking, alcohol drinking, family history, stress and high blood pressure ($P<0.0001$). However, increasing age and physical activity were found to be statistically non significant with high blood pressure ($P>0.0001$).

Conclusion: Hypertension may be influenced by various factors BMI, SFT, family history, deleterious habit and gender. As an oral physician, early detection of hypertension prompts better management in a dental clinic. Awareness along with life style modifications will help to prevent the ill effects of hypertension.

INTRODUCTION

Hypertension is relatively a common disorder affecting majority of the adult population worldwide[1].High blood pressure (BP) is ranked as the third most important risk factor for burden of disease in south Asia (2010)[2]. It is defined as having systolic blood pressure (SBP) ≥ 140 mm of Hg or diastolic blood pressure (DBP) ≥ 90 mm of Hg[1]. It can lead to serious ailment like cardiovascular problems, cerebrovascular stroke and even untimely death. Prevalence of hypertension is soaring up in the urban areas in developing countries because of change in life style.

Gupta R *et al*, (2004), had estimated that hypertension is responsible for 57% of all stroke deaths and 24% of all coronary heart diseases [3]. Anchala R *et al*, (2014), reported that about 33% urban and 25% rural Indians are hypertensive; of these only 42% of urban and 25% of rural were aware of their hypertensive state [2].

Multiple risk factors are responsible for alterations in the blood pressure: genetic predisposition, age, gender, BMI, diet, salt intake, stress, alcohol drinking or smoking habit, lifestyle. Its insidious, asymptomatic and long standing nature results in increased mortality and morbidity. It is named as "Silent Killer" because it produces harm to vital organs like heart, brain, kidney and eyes before producing any symptoms [4][5].
In developing countries, people are changing their lifestyle, adopting modern means of living like using computers, eating junk food and sedentary jobs [6] [7]. All these factors influence the homeostasis of BP which eventually results in hypertensive state. Psychosocial stress is one of the most important causes of

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increased BP [8]. Till now there have been no consistent results on co-relation between hypertension and psychosocial stress [9] [10].

Thus the aim and objective of this study was to assess and correlate the relationship between age, gender, BMI, abnormal SFT, smoking and alcohol consumption, family history and psychosocial stress with the prevalence of hypertension.

MATERIAL AND METHODS

Study Design and Setting: This cross sectional study was carried out in the department of Oral Medicine and Radiology in a dental college at Bhopal

Study Period: The study was conducted from July 2014 to September 2014.

Study Sample: 311 dental patients were randomly screened for the study, which consisted of 157 males and 154 females of age above 30 years. Patients with known history of hypertension or those under antihypertensive medications were excluded from the study.

Ethical clearance: A written informed consent was taken from each patient and ethical clearance was obtained by the Institutional Ethical committee.

Data Collection: Individuals were explained about the study. Information on demographic data, medical history, family history, habit history, physical activity and occupation was recorded by personally interviewing the patient. The obtained information was recorded in a structured proforma.

Stress evaluation: Psychosocial stress was evaluated by a *structured questionnaire* prepared by the department of Psychiatry, wherein responses to relevant questions were recorded.

Blood pressure measurement: First of all, the patient was comfortably seated on a chair. Using a sphygmomanometer the BP was measured using auscultatory method at 15 min intervals. The first and second reading was taken before and after the interview and the third reading was taken after filling the questionnaires. The average of two elevated blood pressures was taken and then corrected to the nearest figure. The hypertensive state of the patient was based on the JNC VII criteria [11]:

Classification of Blood Pressure	SBP (mm of Hg)	DBP(mm of Hg)
Normal	<120	<90
Pre-hypertension	120-139	80-89
Hypertension Stage 1	140-159	90-99
Hypertension Stage 2	160	100

The hypertensive patients were classified as *mild hypertensive* (Pre-hypertension), *moderate hypertensive* (Hypertension stage 1) and *severe hypertensive* (Hypertension stage 2).

***Body mass index (BMI) calculation*:** BMI of each patient was obtained by using the formula [11]:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}.$$

The individuals were then categorized as obese ($\leq$25 kg/m^2) and non obese (>25 kg/m^2).

Skin fold of thickness (SFT): The skin fold thickness was recorded using Lafayette's skinfold caliper II (Fig 1). Skinfold measurement for women and men were based on Jackson Pollock three site method i.e. triceps, suprailliac and thigh and chest, abdominal and thigh respectively. A vertical fold of skin was taken and measurement was recorded 1cm away from the fingers with help of caliper. Percent of fat for women and men were determined from the standard table. Those whose SFT was abnormal were recorded after tallying with the standard table given in lafayette's manual [12].

Statistical Analysis: The data so obtained was then analysed using Chi-square test and Pearson's coefficient. P value $\leq$ 0.0001 was taken significant.

RESULTS

Out of total 311 patients, 30.2% were hypertensive, 44.6% were obese, 46.8% were smokers, 40.4% were alcoholics, 45.7% were stressed, 41.4% had positive family history of hypertension and 45.7% had abnormal SFT (Table 1). Higher predilection for hypertension was observed in males (60.6%) than females (39.3%) (Table 1). The average blood pressure in this study was 130/90 mm of Hg (male-136/94 mm of Hg, female-128/88 mm of Hg). In our study both SBP and DBP was prevalent more among males of 31-40 years age group. After the age of 40, the systolic hypertension was found to increase with increasing age upto70 years in both sexes. However, in females diastolic hypertension was found to be predominant in the older age group (Fig 1).

Among the hypertensives 26.6% were obese, 40% were smokers, 28.7% were alcohol drinkers, 41.4% were stressed, 25.5% had positive family history, 16% exercised regularly and 35% were found with abnormal SFT (Table 2). Among the obese, overall mean BMI was 32.5 kg/m^2 (males-31 kg/m^2 and females- 34 kg/m^2).

Of the severe hypertensives, 44% were obese, 38.4% stressed, 41.6% with positive family history, 18% smokers and alcohol drinkers, 20% exercised regularly and 42% had abnormal SFT (Table 2).

Table 1 Percentage of prevalence of hypertensives, obesity, smokers, slcoholics, stress, family history, physical activity, abnormal SFT among different age groups.

Age	Hypertensive			Obese			Smokers			Alcohol Drinkers			Stress			F/History			Physical activity			Abnormal SFT		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
31-40 (n=80)	11	8	19	2	5	7	10	0	10	7	0	7	3	1	4	2	3	5	8	9	17	3	6	8
41-50 (n=78)	13	9	22	4	5	9	8	0	8	9	0	9	5	2	7	5	4	9	7	4	11	4	5	9
51-60 (n = 78)	14	7	21	4	7	11	11	0	11	9	0	9	7	5	12	6	7	13	3	4	7	5	9	14
61-70 (n=75)	19	13	32	6	9	15	15	0	15	13	0	13	11	9	20	8	4	12	2	1	3	5	7	12
311	94 (30.2%)			42 (44.6%)			44 (46.8%)			38 (40.4%)			43 (45.7%)			39 (41.4%)			38 (40.4%)			43 (45.7%)		

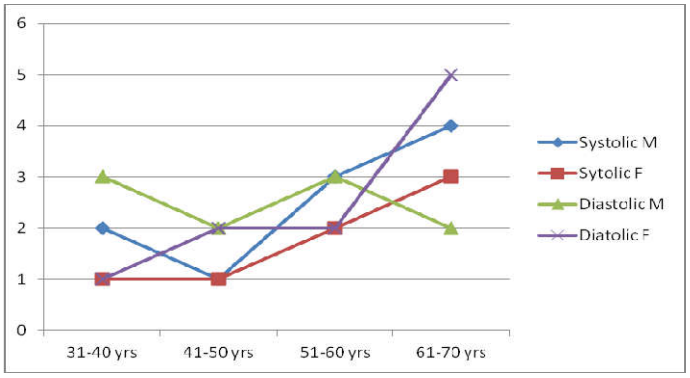

Fig 1 Age and sex related distribution of systolic hypertension ≥ 140 and diastolic hypertension ≤ 90mm of Hg among patients.

DISCUSSION

Hypertension is a global health concern and leading cause of myocardial infarction, encephalopathy, stroke and death. Hypertension can be of two types: primary and secondary. Usually when the cause is unknown it is referred as "*primary or essential hypertension*" and when it is due to other secondary causes like chronic renal disease, pheochromocytoma it is called as "*secondary hypertension"* [13].

Physiology of hypertension is affected by ethnic and racial differences, which is marked across the Indian subcontinent.

Table 2 Percentage of obesity, smoking, alcoholics, stress, family history, physical activity and abnormal SFT among the hypertensive individuals

Hypertensive	Obese			Smokers			Alcohol Dirnkers			Stress			F/History			Physical activity			Abnormal Skin Fold Thickness		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Mild Hypertensive (n = 57)	2	3	5	19	0	19	13	0	13	7	4	11	4	2	6	2	4	6	3	4	7
Moderate Hypertensive (n = 20)	5	4	9	12	0	12	9	0	9	8	5	13	3	5	8	2	4	6	5	7	12
Severe Hypertensive (n = 17)	5	6	11	7	0	7	5	0	5	7	8	15	6	4	10	2	1	3	5	9	14
Total (n=94)	25 26.59%			38 40.4%			27 28.7%			39 41.4%			24 25.5%			15 15.9%			33 35.1%		

Patients who regularly exercised were found to be either mild or moderately hypertensive and those with less physical activity were severely hypertensive.

Overall prevalence of normotensives was 69.7%, out of which 7.83% were obese, 2.76% were smokers, 5% were regular drinkers, 2% were stressed, 7% had relevant family history, 10.5% regularly worked out and 4.6% had abnormal skin fold thickness (Table 3).

This accompanied by the lack of published data should propel responsible oral physicians to pursue research of this Indian disease.

The overall prevalence of hypertension in this study is 30.2% which is similar to the WHO 2008 estimates, in which the prevalence of hypertension was 32.5% among Indians.[1]Sindhu S *et al* (2014), in a systematic review, reported wide variation in prevalence of hypertension in different parts of India.

Table 3 Percentage of prevalence of obesity, smokers, alcoholics, stress, family history, physical activity and abnormal SFT among the normotensive individuals.

Age	Normotesives			Obese			Smokers			Acohol Drinkers			Stress			F/History			Physical activity			Abnormal skin fold thickness		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
31-40 (n=80)	34	27	61	1	3	4	1	0	1	3	0	3	1	0	1	3	2	5	3	5	8	1	2	3
41-50 (n=78)	33	23	56	1	1	2	2	0	2	3	0	3	0	0	0	2	1	3	4	3	7	0	2	2
51-60 (n = 78)	38	19	57	2	1	3	0	0	0	1	0	1	0	1	1	4	2	6	4	1	5	2	2	4
61-70 (n=75)	23	20	43	2	4	6	3	0	3	4	0	4	1	1	2	3	2	5	2	1	3	0	1	1
311	217 (69.7%)			17 (7.83%)			6 (2.76%)			11 (5%)			4 (2%)			15 (7%)			23 (10.5%)			10 (4.6%)		

Obesity, smoking, alcohol drinkers and stress were highest among the older (61-70years) age group while positive family history and abnormal SFT were highest among 51-60 years. Deleterious habits i.e. cigarette smoking and alcohol drinking were found only among the males (Table 1 and Table 3).

All the variables associated with hypertension were found to be statistically significant ($p<0.0001$) except the relationship of hypertension with increasing age group and physical activity ($p>0.0001$) (Table 4). This study signifies that hypertension is not related to age and regular exercise/physical activity.

The highest prevalence was reported in Maharashtra i.e. 56.40% and lowest in Tirupathi, Andhra Pradesh i.e. 5.41%. These differences may be due to their different lifestyle, socioeconomic status and geographic variation [4].

Hypertension results from a complex interaction between genetics, environmental factors, socioeconomic status, physical makeup, age, stress and habits like smoking, alcohol drinking [14-17]. Studies have shown that angiotensinogen (AGT) gene and protein is the first reported gene that is linked to hypertension.

Table 4 Correlation of hypertension with obesity, smoking and drinking habit, stress, family history, abnormal SFT.

		Hypertension (n= 94)	Normotensives (n=217)	
1.	**Obese**	**25 (26.6%)**	**17 (7.83%)**	**P < 0.0001**
	Non obese	69 (73.4%)	200 (92%)	
		Hypertensives (n= 94)	**Normotensives (n=217)**	
2.	Smokers	**38 (40%)**	**6 (2.76%)**	**P < 0.0001**
	Non-Smokers	56 (59%)	211 (97.2%)	
		Hypertensives (n= 94)	**Normotensives (n=217)**	
3.	**Alcoholics**	**27 (28.7%)**	**11 (5%)**	**P < 0.0001 (S)**
	Non-Alcoholics	67 (71.2%)	206 (94.9%)	
		Hypertensives (n= 94)	**Normotensives (n=217)**	
4.	Stressed	**39 (41.4%)**	4 (1.8%)	**P < 0.0001 (S)**
	Non-stressed	55 (58.5%)	213 (98%)	
		Hypertensives (n= 94)	**Normotensives (n=217)**	
5.	**Positive-family history**	**24 (25.5%)**	**15 (6%)**	**P < 0.0001 (S)**
	No family history	70 (74.4%)	202 (93%)	
		Hypertensives (n= 94)	**Normotensives (n=217)**	
6.	**Physical activity**	**15 (16%)**	**23 (10.5%)**	**P > 0.0001 (NS)**
	No-physical activity	79 (84%)	194 (89%)	
		Hypertensives (n= 94)	**Normotensives (n=217)**	
7.	**Abnormal SFT**	**33 (35%)**	**10 (4%)**	**P < 0.0001**
	Normal SFT	61 (64. 8%)	207 (95%)	

8.	**AGE**	**Hypertenisves (n= 94)**				**Normotensives (n=217)**	
		Total	**Mild**	**Mod.**	**Sev.**		
	31-40 years (n=80)	19 (20.2%)	18	1	0	61 (28%)	P > 0.0001 (NS)
	41-50 years (n= 78)	22 (23.4%)	11	7	4	56 (25.8%)	
	51-60 years (n= 78)	21 (22.3%)	12	7	2	57 (60.6%)	
	61-70 years (n= 75)	32 (34%)	16	6	10	43 (45.7%)	

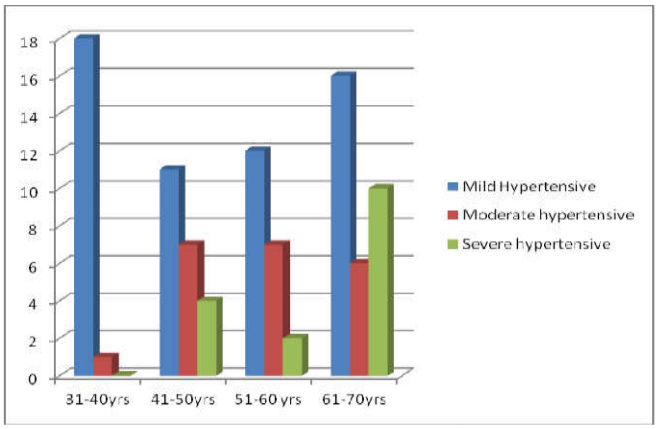

Fig 2 Graph representing distribution of mild, moderate and severe hypertenisve patients among different age groups.

AGT gene is a member of serpin gene superfamily, present on chromosome 1(1q42-q43). In vivo studies in rat models have reported that over expression of this AGT gene is responsible for inducing high BP. Positive association between plasma level of AGT and BP has been reported in various studies [18].

Age related hypertension is usually common, but it is not universal in nature. Mostly in tribal population, BP doesn't increase with age, probably due to their primeval lifestyle [7][19]. The mean BP in the study group (ranged from 31-75 years) was 130/90 mm of Hg which is similar to a report by Das *et al* (2005) [7]. 30% of the young patients (31-40 years) were found to be in *pre hypertensive stage* i.e. mildly hypertensive (Table 4 and Fig 2). Young individuals are usually stressed out quoting reasons like family issues, unemployment, financial problems and stressful working conditions [7][15]. It has been hypothesised that the risk of developing cardiovascular diseases may be accelerated in younger individuals at pre-hypertensive stage.

Influence of gender in prevalence of hypertension in our study, has been observed highest among men for both SBP and DBP in the younger (31-40 years) age group. However, increased DBP was prevalent among women after the age of 40 probably because of obesity, stress at work and family similar to the study by Das *et al* (2005) [7]. It has been evidenced that cardiovascular events are usually low in females [20]. Animal models showed lowered BP in females are rennin angiotensin system dependant. Females of the species, managed to achieve lower plasma and tissue level of angiotensin II; maintaining lower number of functional angiotensin type 1 receptor in the membrane of target tissue such as kidney would result in less angiotensin type 1 receptor mediated vasoconstriction in females [20].

In this study, cofactors like obesity, stress, positive family history of hypertension, abnormal SFT, smoking and drinking habit was found to have significant association ($p<0.0001$) with hypertension except age and physical activity (Table 2). All these factors considerably increase the risk of developing cardiovascular problems like coronary heart disease, cardiomyopathy, myocardial infarction and arrhythmia [21].

Stress can cause hypertension as it stimulates the nervous system, to produce vasoconstricting hormones and also through reiterated elevations in BP. Psychosocial stress can have both direct and indirect effects on raising blood pressure. Indirect effects of stress can be associated with other risk factors like obesity, physical inactivity, smoking and alcohol drinking [22]. However, Agyei *et al*, reported a negative association between stress and high BP [8]. The present study showed statistically significant ($p<0.0001$) association of stress with hypertension similar to a report by Bo H *et al* (2015) [23]. Non-pharmacologic methods of stress management like psychiatric counselling, biofeedback, meditation and acupressure have been found effective in lowering BP [22].

Obesity or high BMI is of paramount importance, as a cardiovascular risk factor, as it is a major cause for high blood pressure. Triceps skin fold thickness, waist to height ratio and waist circumference has been advocated to be more authentic in determining the total body fat as compared to BMI [24]. The exact pathophysiology is still undetermined; various authors have emphasised on certain factors like increased leptin levels,

hyperinsulinemia, increased activity of rennin-angiotensin-aldosterone system, and sympathetic nervous system activity suggests that obesity is linked to hypertension [25]. In this study, we found significant correlation between hypertensives and abnormal SFT ($p<0.0001$). It is similar to report a report by Rao PC *et al* (2013) where triceps, biceps, abdominal, suprascapular and suprailliac skin fold thicknesses were found higher among hypertensives as compared to normotensives [5]. The worldwide estimate of hypertension due to alcohol is 16% [26]. Individuals consuming three-four drinks per day (heavy drinkers) are at greater risk of hypertension and other coronary heart diseases as compared to low and moderate drinkers [27] [28]. Increased peripheral vascular resistance, decrease in plasma- rennin activity and beta-adrenergic function are probable causes for increase in BP [29]. Along with this study ($p<0.0001$), Son MK (2011) ($p=0.007$) (ref) and Rao PC *et al*, (2013) (ref) ($p<0.005$) showed significant association between alcohol drinkers and hypertensives [5] [29].

Cigarette smoking has been considered as an important factor that causes acute rise in blood pressure; it acts synergistically with hypertension to increase the risk of heart disease. Smoking (nicotine) results in release of catecholamines and vasopressin that are associated with hemodynamic and metabolic changes, mediated through adrenergic mechanism [30]. Studies by Elliot and Simpson (1980), Cryer (1976) and Aronow (1970) have supported its correlation with hypertension; however few studies failed to prove its positive association. This present study showed that increased smoking is statistically associated with high BP. ($p<0.001$) [31].

A number of cofactors such as amount of salt intake, diet, lipid profile and socioeconomic status need to be determined so as to determine whether they play a role in hypertension which itself has become a rising cause of premature death worldwide.

CONCLUSION

Hypertension has a "*vice like grip*" on many organs resulting in need for extreme caution in dealing with these patients ranging from bleeding to prescriptions of medication to dealing with side effects of already prescribed medications. The main objective behind this study was to detect the prevalence of undetermined hypertension among dental out-patients. About one third of the dental patients are unaware of their high BP. An oral physician would fail in his duty to rule out undiagnosed or poorly controlled hypertension while carrying out dental treatment which could run the sudden risk of cardiovascular events. During dental procedures like extraction epinephrine containing local anaesthetics has been considered unsafe as it may result in increased pulse rate and BP.

Life style modifications are necessary to prevent the ill effects of hypertension. "Awareness is the best motivator"- smoking, alcohol consumption, stress should be wisely dealt with, before they affect the phenotype. Individuals must be encouraged to indulge themselves in healthy eating, outdoor activities, regular exercise, and healthy lifestyle; which will help us to replace deskbound activities like watching TV, or using computer which has crept into the society

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How to cite this article:

Preeti Nair *et al.*2018, Prevalence And Risk Factors of Hypertension Among Dental out Patients: a Cross Sectional Study. *Int J Recent Sci Res.* 9(2), pp. 24561-24566. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0902.1683

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