

## Detection of undiagnosed and inadequately treated high blood pressure in dentistry by screening

### ABSTRACT

**Background:** Worldwide, hypertension is considered as an important health issue due to its unbearable complication of cardiovascular, renal, and nervous system diseases.

**Aims and Objective:** The aim was to find the prevalence and inadequately treated undiagnosed hypertension in the general population attending the Outpatient Department (OPD) of the Department of Oral and Maxillofacial Surgery, King George's Medical University, Lucknow.

**Materials and Methods:** A total of 2500 patients were enrolled in the study within the age group of 20–60 years, attending dental clinics. For every patient, blood pressure (BP) was taken three times, and all the readings were grouped into four categories including normal, prehypertensive stage, Stage 1, and Stage 2 of hypertension. In the dental clinic, the BP assessment was done considering parameters such as sex, smoking and alcohol, the effect of local anesthesia, gutkha chewing, age group, and regular exercise.

**Results:** About 24.39% of undiagnosed hypertensive patients were found among all who attended the OPD of the department of oral and maxillofacial surgery. It was observed that the rise in BP was 16.71% and 2.35% in Stage 1 and Stage 2, respectively, after giving the local anesthesia.

**Conclusion:** This study reveals that early diagnosis of undiagnosed and inadequately treated hypertension among general people notified by dentists is an important role, and this should be promoted and emphasized to restrict fatal life complications.

**Keywords:** Complications, dentistry, general population, hypertension

### INTRODUCTION

Hypertension – or raised blood pressure (BP) – is a serious health issue that significantly elevates the risks of heart, brain, kidney, and other diseases. Worldwide, 1.13 billion people estimated to have elevated BP and most of them (two-thirds) are living in low- and middle-income nations. In 2015, 1 in 4 men and 1 in 5 women were found to have hypertension. Fewer than 1 in 5 hypertensives have control over their hypertension. It is also a major cause of premature death (death before the average age) of hypertensive individuals in the world. The global reach point for noncommunicable diseases is to decrease the prevalence of hypertension up to the level of 25% by 2025 (baseline 2010).<sup>[1,2]</sup>

The prevalence of hypertension is different across different countries of the world. African Region of the World Health Organization has the maximum prevalence (27%), whereas

the America had declared it a minimum prevalence (18%). In a review of the present scenario, the number of hypertensive adults increased from 594 million in 1975 to 1.13 billion in 2015, and this was mainly in low- and middle-income nations due to an increase in risk factors of hypertension within

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individuals.<sup>[2]</sup> Hypertension is known as “silent killer.” Most people are unaware of their hypertension because there may be an absence of warning signs or symptoms. This is the reason that BP should be measured periodically. An alarming increase in elevated BP in the Indian subcontinent was observed by the Global Burden of Hypertension 2005 study which concluded that 20.6% of Indian men and 20.9% of Indian women had hypertension, resulting in 57% of all stroke expiries and 24% of all coronary heart diseases.<sup>[3]</sup>

The American Society of Anesthesiologists has declared that at the time of routine dentistry, the chances of cardiovascular complications in a hypertensive individual should be anticipated. Many undiagnosed hypertensive patients seek dental therapy on a regular interval, and many (73%) of these have been opining for a family physician by the dental doctors.<sup>[4]</sup>

### Aims and objectives

The main objective of this study was to find the prevalence of undiagnosed elevated BP along with uncontrolled hypertension in the general people who attended tooth extraction at King George’s Medical College, Lucknow.

### MATERIALS AND METHODS

This study was conducted in a total of 2500 patients who attended the department of oral and maxillofacial surgery for dental therapy from September 2019 to February 2020.

#### Inclusion criteria

Patients within the age range of 20–60 years, all known hypertensive patients taking antihypertensive drugs, and patients with Stage 1 and Stage 2 hypertension in the first reading were included in the study, and all were questioned for hypertension, diabetes, the habit of smoking, and alcohol consumption while taking history.

#### Exclusion criteria

Pregnant and breastfeeding/lactating mothers, patients aged below 20 years or above 60 years, and patients requiring surgical extraction were excluded from the study. Those patients who were having obstructive sleep apnea, hyperaldosteronism, diabetes mellitus, chronic kidney disease, Cushing syndrome, and other causes of endocrine abnormalities were also excluded from the study.

Ethical clearance was taken from the Institutional Ethics Committee.

#### Methodology

Patients included in the study were well explained about the study along with their informed consent. The BP was measured

on the left hand arm. The BP was measured by palpatory method, on the radial pulse, whereas by auscultatory method, using a sphygmomanometer and a stethoscope on the brachial pulse with the patient sitting in the chair in a comfortable position. The BP was taken thrice for every participant. After waiting for 10–15 min in the outpatient department, the first measurement of BP was done just after the patient was sitting in the chair (step 1). A preprepared standardized medical questionnaire form was filled after taking a full medical history by operating dentist [Figure 1]. Just after it, local anesthesia containing 2% lignocaine with 1:80,000 adrenaline administered. The next reading of BP was taken within 5 min after local anesthesia (step 2) and the third reading after the tooth extraction (step 3). The assessment of the patient’s anxiety was not done. All the readings were divided into the normal, prehypertensive stage, Stage 1, and Stage 2 of hypertension<sup>[5]</sup> [Table 1] according to the 8<sup>th</sup> Report of the Joint National Committee on the Management of High Blood Pressure in Adults, published hypertension guidelines in 2013.

Patients having raised BP (>140/90 mmHg) for the first measurement were deferred from tooth extraction and referred to their family physician for the management of hypertension. The BP was assessed for the gender, personal habits of gutkha chewing, smoking, and alcohol, medical conditions, regular exercise, age, and the effect of local anesthesia after the first reading of BP was taken.

#### Statistics

The data of all 2500 patients were fed into an Excel Spreadsheet. Data were statistically analyzed using SPSS 18 version software (SPSS Inc., Chicago, IL, USA) and Microsoft Excel.  $P < 0.05$  was considered to be statistically significant.

### RESULTS

This study was done in a total of 2500 patients (979 men and 1521 women). There were 439 patients in the age group of 20–30 years, 681 patients were in the age group of 31–40 years, 654 patients were in the age group of 41–50 years, and 648 patients were in the age group of 51–60 years.

In the present study, among the 2500 patients, a total of 610 new patients were diagnosed with hypertension, and they

**Table 1: Classification of hypertension according to the Joint National Committee 8 Guidelines**

Category	Systolic BP (mmHg)	Diastolic BP (mmHg)
Normal	<120	<80
Prehypertension	120-139	80-89
Hypertension stage 1	140-159	90-99
Hypertension stage 2	>160	>100

BP: Blood pressure

MEDICAL HISTORY QUESTIONNAIRE		Please complete this form using BLOCK CAPITALS and BLACK INK		
It is important for your dentist to have your medical history and understand your health needs before any examination or treatment is carried out. If you are a new patient to the practice, please complete the following form for your first assessment. All information provided will be kept strictly confidential.				
Your personal details				
Title (Mr, Mrs, Miss, Ms, other title)				
First name(s) (please include all forenames in full)			Surname	
Address				
Postcode				
Date of birth	D	D	M	M
Home telephone number		Work telephone number		
Mobile telephone number		Email address		
Occupation		Company name		
How did you hear about us?		How long since you last visited a dentist?		
Details of contact in case of emergency/ Next of Kin				
Name		Telephone		
Are you insured for any dental care?		<input type="checkbox"/> Yes <input type="checkbox"/> No (optional)		
If yes, under which insurer or plan?		Do you consent to us sharing information about your treatment with them? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Medical History Questionnaire – Confidential				
Please fill in this section carefully. It is important that your dentist has your full medical history. Please ask your dentist's advice if you are unsure about any of the questions.				
GP name				
Telephone				
Address				
Postcode				
	Y	N	Give details here and overleaf	
Are you presently under medical care (e.g. doctor, hospital, clinic or specialist)?	<input type="checkbox"/>	<input type="checkbox"/>		
Are you taking any medications prescribed by your doctor? (E.g. tablets, ointments, injections or inhalers, including contraceptives and hormone replacement therapy)?	<input type="checkbox"/>	<input type="checkbox"/>	Please list	
<b>If so please state what medication it is</b>				
Are you taking medication for osteoporosis (e.g. Alendronic Acid)?	<input type="checkbox"/>	<input type="checkbox"/>		
Are you carrying a medical warning card?	<input type="checkbox"/>	<input type="checkbox"/>		
<i>Applicable to women only</i> Are you pregnant or is it possible you may be pregnant?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from allergies to any medicines i.e. penicillin, substances (e.g. latex/rubber) or foods?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from heart problems, angina, blood pressure problems or stroke?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever had liver disease (e.g. jaundice, hepatitis) or kidney disease?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from bronchitis, asthma or other chest condition?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever had any form of cancer?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from any infectious diseases (including HIV and hepatitis)?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from a condition that led to your blood being refused by the Blood Transfusion Service?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from fainting attacks, giddiness, blackouts or epilepsy?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever had a bad reaction to a local or general anaesthetic?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever suffered from diabetes?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever had a major operation or recently received hospital treatment?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you have hay fever and/ or eczema?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you have Arthritis?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you have a pacemaker?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you bruise easily or have you ever bled excessively?	<input type="checkbox"/>	<input type="checkbox"/>		
Are you taking, or have you taken, any steroids in the last two years?	<input type="checkbox"/>	<input type="checkbox"/>		
Did you as child or since have growth hormone treatment before the mid 1980s?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you ever been diagnosed or suspected as having variant Creutzfeldt-Jakob disease (vCJD)?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you had heart surgery?	<input type="checkbox"/>	<input type="checkbox"/>		
Have you had brain surgery?	<input type="checkbox"/>	<input type="checkbox"/>		
Is there anything we haven't asked you about that you think we should know?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you smoke, and if yes how many a day?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you drink alcohol? If yes, how many units a week?	<input type="checkbox"/>	<input type="checkbox"/>		
Do you weigh 20 stone/125kg or above?	<input type="checkbox"/>	<input type="checkbox"/>		
Date				Completed by (please tick)
Patient Signature				Self <input type="checkbox"/> Parent <input type="checkbox"/>
Staff Initials				Guardian <input type="checkbox"/>

Figure 1: Medical history questionnaire

were unaware of their hypertensive condition (578 patients in Stage 1 hypertension [22.98%] and 32 patients in Stage 2 hypertension [1.20%]).

A total of 208 patients were taking antihypertensive treatment and of them, 119 patients had inadequately controlled BP, hence they deferred from tooth extraction (5.02%).

The correlation of BP with age was done and found Stage 1 hypertension in most of the older age patients (51–60 years), and these also had a significant rise in BP postextraction. The prehypertensive stage was found in maximum patients in both pre- and postextraction stages in the age group of 31–40 years [Tables 2 and 3]. Furthermore, many of the patients in the age group of 41–50 years were found in the prehypertensive stage, followed by Stage 1 postextraction [Tables 2-4].

Patients with multiple comorbidities taking therapy for the same, 51.97% of cases were prehypertensive and 36.87% of them were categorized under Stage 1 hypertension [Table 4b].

## DISCUSSION

Hypertension is a highly prevalent and most important modifiable risk factor for cardiovascular, cerebrovascular, and renal diseases. Hence, worldwide, it is an important public health issue. In dentistry, the key part of any dental therapy is patient assessment. In most of the studies, it is concluded that dental care professionals are playing an important role in a patient's complete health by measuring BP and diagnosing undiagnosed hypertension.

This study was done to investigate the prevalence of undiagnosed hypertension along with uncontrolled BP in the general population.

The prevalence of hypertension in the present study (22.98%) is similar to the finding of Ojehanon and Akhionbare<sup>[6]</sup> (19.7%), Fernández-Feijoo, *et al.*<sup>[4]</sup> (29.2%), and Tormo *et al.*<sup>[7]</sup> (34.3%) in their study.

This study reveals that a significant number of cases were unaware of elevated BP. These cases have more chances of prolonged heavy bleeding and having medical emergencies in the dentistry. This provokes the value of screening of hypertension in the dentistry. These cases were opined to a physician for the treatment of hypertension.

In the current study, higher age was significantly concerned with elevated BP [Tables 2-4a]. Elevation in BP with advancing age is mostly due to an increase in the hardening of the arterial and

**Table 2: Relation of hypertension and age before local anesthesia**

BP stages Step 1	20-30 years, n (%)	31-40 years, n (%)	41-50 years, n (%)	51-60 years, n (%)
NR	166 (59.75)	171 (32.98)	123 (32.94)	46 (8.01)
PH	110 (40.1)	302 (60.11)	187 (49.96)	273 (43.96)
S1	0	38 (17.01)	60 (15.89)	244 (48.02)
S2	0	0	0	0

NR: Normal, PH: Prehypertension, S1: Stage 1 hypertension, S2: Stage 2 hypertension, BP: Blood pressure

**Table 3: Relation of hypertension and age after local anesthesia**

BP stages Step 2+3	20-30 years, n (%)	31-40 years, n (%)	41-50 years, n (%)	51-60 years, n (%)
NR	106 (37.94)	108 (22.01)	42 (11.21)	37 (7.01)
PH	171 (62.05)	260 (49.98)	187 (51.21)	129 (20.98)
S1	0	142 (28.03)	142 (37.89)	404 (66.08)
S2	0	0	0	42 (7.03)

NR: Normal, PH: Prehypertension, S1: Stage 1 hypertension, S2: Stage 2 hypertension, BP: Blood pressure

**Table 4: Percentage of patients in various stages of hypertension among variables**

<b>(a) Number of cases in different stages of hypertension after the second and third readings of BP</b>				
Age group	NR (%)	PH (%)	S1 (%)	S2 (%)
20-30	37.94	62.05	0	0
31-40	20.92	50.92	28.05	0
41-50	12.02	49.95	37.98	0
51-60	5.99	20.99	66.01	7.02
<b>(b) Among the cases who were found to have various systemic disorders as mentioned in the questionnaire and were taking medications for that</b>				
Medications (%)	9.98	51.97	36.87	0.59
<b>(c) The effect of gender on blood pressure</b>				
Male (%)	15.47	58.10	22.94	2.940
Female (%)	29.92	53.01	15.02	2.55
<b>(d) Blood pressure of patients with different habits was compared to assess the relationship of the habit and hypertension</b>				
Gutkha (%)	27.90	64.96	6.32	0
Smoking (%)	15.01	71.93	13.03	0
Alcoholic (%)	19.56	64.52	15.04	1.21
<b>(e) Among the cases who exercised on a regularly</b>				
Exercise (%)	10.58	58.95	29.92	0
<b>(f) About 45.5% of patients with body mass index &gt;24.9 were having S2</b>				
BMI >24.9 (%)	27.33	28.98	30.02	45.45
<b>(g) Number of patients of hypertension before and after giving local anesthesia</b>				
Before (n)	506	872	392	0
After (n)	293	747	688	42

NR: Normal, PH: Prehypertension, S1: Stage 1 hypertension, S2: Stage 2 hypertension, BP: Blood pressure, BMI: Body mass index

arteriolar wall. Moreover, other pathophysiological causes may be decreased baroreceptor sensitivity, increased responsiveness

to sympathetic nervous system stimuli, altered renal sodium metabolism, and an altered renin–aldosterone relationship.<sup>[8]</sup> Furthermore, older people often have comorbidities, suggesting that age plus raised BP are the valuable medical risk factor for the cases attending the dental clinic.<sup>[9]</sup>

On comparing hypertension of male and female cases, it was observed that males were in higher numbers than females in Stage 1 and Stage 2 hypertension. The occurrence of prehypertension was higher in female patients [Table 4c]. This may be due to the higher number of female cases in the study sample, which is similar to the study outcomes of Lei *et al.*<sup>[10]</sup> Biological and behavioral factors (such as smoking, alcohol consumption, and exercise) are responsible for sex variation.<sup>[11]</sup> The biological factors are sex hormones, chromosomal differences, and other biological sex differences that are protective for raised BP in females.

Smoking leads to disturbance of endothelial function, arterial stiffness, inflammation, lipid modification, as well as a change in antithrombotic and prothrombotic factors. Thus, it is an important cardiovascular risk factor. Cigarette smoking does the hypertensive role, primarily by the activation of the sympathetic nervous system.<sup>[12]</sup> This is the reason that smokers in this study have a high prevalence of hypertension [Table 4d].

Exercises lead to important autonomic and hemodynamic variations influencing the cardiovascular system and reduce the future chances of a rise in BP.<sup>[4]</sup> No statistically significant relationship was found in the present study between hypertension and exercise [Table 4e].

Body mass index (BMI) is mostly used to determine the obesity within a population. The positive correlation between BMI and BP has been observed in Asian peoples. In this study also, a similar finding was there.<sup>[13]</sup> About 45.45% of cases with BMI > 24.9 were having Stage 2 hypertension [Table 4f].

A slight elevation in BP was found after giving local anesthesia [Table 4g]. It may be due to the sensitivity of alpha receptors to the epinephrine of blood vessels in the skeletal muscles. Anxiety and white coat hypertension may be other explanations.

Few types of research have demonstrated a decrease in systolic BP after local anesthesia,<sup>[14]</sup> which is against the current study. In controlled hypertensive patients, the BP and cardiac output may be falsely measured because of the interaction between the medication and epinephrine.

## CONCLUSION

This study resulted in estimating the prevalence of undiagnosed and inadequately controlled hypertension

in general people. It enhances the fact that all dentistry professionals be aware of monitoring BP of every case, mainly for those undergoing tooth extractions to prevent life-threatening complications of high BP. Patients also get aware of their BP earlier in age along with awareness of their inadequately controlled BP to help its control and decrease morbidity and mortality. Ignorance may cause prolonged bleeding and occurrence of a medical emergency in the dentistry.

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## Conflicts of interest

There are no conflicts of interest.

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