

Hypertension and Dentistry

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Abstract

Very commonly dentist confront with the management of patient with Hypertension, that includes disease recognition and its proper management, knowledge of treatment and oral adverse effects and risk assessment for dental treatment. Hypertension can cause various complications in dental procedures and various manifestations in oral cavity like xerostomia, gingival hyperplasia, lichenoid reaction and loss of taste. With increase in age and duration of history of hypertension there is higher risk for presence of carotid artery calcification which can lead to cardiovascular diseases in geriatric patients. In the recent interest of a dental setup, digital orthopantomographs can be used as most economical screening method for detection of carotid artery atheroma at the level of C3-C4 vertebrae and patients can be made aware of the risk of cardiovascular diseases. This facilitate the early referral of the patients to physician for further treatment. Therefore an interdisciplinary approach will help in the early detection of a serious illness in a dental office itself.

Keyword: Hypertension; Common Carotid Artery Calcification; Diagnosis; Management.

Introduction

The World Health Organization attributes hypertension, or high blood pressure, as the leading cause of cardiovascular mortality[1] and third most important risk factor for cardiovascular diseases in India. Hypertension is directly responsible for 57% of death in stroke and 24% of death in coronary artery disease. It is regarded as most important causes of premature death worldwide by WHO [2].

Although more than 70% of hypertensive patients are aware of the disease, only 23-49% are treated, and fewer (20%) achieving control [3]. Prevalence varies by age, race, education, and so forth. Hypertension is very closely related to common carotid artery atheromatous plaque formation which when embolized can lead to stroke. With increase in age and duration of history of hypertension there is

higher risk for presence of carotid artery calcification. Carotid artery calcifications can be detected on the panoramic radiograph below the mandibular angle and adjacent to the cervical vertebrae at the level of the C3-C4 intervertebral junction. Hypertension not only causes problems in dental procedures but can also be a risk factor for cardiovascular diseases.

Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) defines hypertension as a systolic blood pressure (SBP) greater than 140 mm Hg or a diastolic blood pressure (DBP) greater than 90 mm Hg. Prehypertension is defined as an SBP of 120 to 139 mm Hg and DBP of 80 to 89 mm Hg[4,36]. White-coat hypertension (WCH) refers to a persistently elevated office blood pressure in the presence of a normal blood pressure outside of the office [5].

Hypertension is classified as primary or essential hypertension (without an organic cause) and secondary hypertension (it has a well-established organic cause). Primary or Essential

Hypertension (without an Organic Cause) term used for medium to high BP for a long time (chronic) without a known cause, which is a very common form of hypertension, comprising about 90-95% of all patients with hypertension [6].

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Classification of Office Blood Pressure Levels (mmHg) [7]

Category	Systolic mmHg	Diastolic mmHg
Optimal	<120	<80
Normal	120-129	80-84
High normal	130-139	85-89
Grade 1 hypertension	140-159	90-99
Grade 2 hypertension	160-179	100-109
Grade 3 hypertension	≥180	≥110
Isolated systolic hypertension	≥140	<90

JNC 7 Classification of Hypertension [8]

Classification	SBP (mmHg)	DBP (mmHg)
Normal	<120	<80
Prehypertension	120-139	or 80-89
Stage I hypertension	140-159	or 90-99
Stage II hypertension	≥160	≥100

Secondary Hypertension [8]

Organs	Complications
Renal	chronic pyelonephritis acute and chronic glomerulonephritis polycystic kidney disease renal vascular stenosis or renal infarction other severe kidney disease (arteriolar nephrosclerosis) renin-secreting tumors
Endocrine	oral contraceptives adrenal hyper function (Cushing's syndrome, primary aldosteronism, congenital or hereditary adrenogenital syndrome) pheochromocytoma, myxedema acromegaly
Neurological	thyroid and parathyroid hyper function psychogenic "diencephalic syndrome" familial dysautonomia (Riley-Day) polyneuritis (acute porphyria, lead poisoning) increased intracranial pressure
Others	coarctation of the aorta increased intravascular volume (transfusion excessive polycythemia vera) polyarteritis hypercalcemia drugs (corticosteroids, cyclosporine) sleep apnea (parenchyma or renal vascular) pregnancy toxemia acute intermittent porphyria

Arterial blood pressure varies even under physiological conditions. However, it is immediately brought back to normal level because of the presence of well-organized regulatory mechanisms in body. Human body has four such regulatory mechanisms to maintain the blood pressure within normal limits. They are:

- Nervous mechanism for regulation of blood pressure - short term regulation. It is rapid among all the mechanisms involved in regulation of blood pressure. When arterial blood pressure

alters, the nervous systems brings the pressure back to normal within few minutes. Though it is rapid but it lasts for short period and then adapts to new pressure. Therefore it is called short term regulation. It operates through vasomotor system which includes three components - vasomotor center, vasoconstrictor fibers and vasodilator fibers.

- Renal mechanism for regulation of blood pressure - long term regulation. The kidneys play an important role in the long term regulation of

arterial blood pressure. In long duration the neural mechanism adapts to altered pressure and loses the sensitivity for regulation. In such conditions, the renal mechanism takes over and efficiently regulates blood pressure. Therefore it is called long term regulation. Renal mechanism regulates blood pressure in two ways i.e by regulation of extracellular fluid and through renin – angiotensin mechanism.

- Hormonal mechanism for regulation of blood pressure are done by various hormones. Few hormones increase the blood pressure while helps in decreasing it. Hormones which increase blood pressure are adrenaline, noradrenaline, thyroxine, aldosterone, vasopressin, angiotensin and serotonin. And those which decreases blood pressure are vasoactive intestinal polypeptide, bradykinin, prostaglandin, histamine, acetylcholine, atrial natriuretic peptide, brain natriuretic peptide and C – type natriuretic peptide.
- Local mechanism for regulation of blood pressure also regulate blood pressure in addition to other mechanisms. The blood is regulated by vasoconstriction or vasodilation. The vasoconstrictor substances are of vascular endothelial origin and are known as endothelins (ET). There are three types of endothelins identified till now they are ET1, ET2 & ET3. Vasodilators are of two types, they are vasodilators of metabolic origin and vasodilators of endothelial origin.

Pathogenesis

From family and epidemiological studies it is clear that hypertension results from a complex interaction between genetic factors and the environment [9]. There are at least 50 known factors which increase blood pressure, among which the most important are age (over 55 years for men, over 65 years for women), a family history of premature cardiovascular disease, smoking, increased consumption of alcohol, sedentariness, cholesterol rich diet, coexistence of other diseases (diabetes, obesity, dyslipidemia)[10, 11].

Severe headache
 Fatigue or confusion
 Vision problems
 Chest pain
 Difficulty breathing
 Irregular heartbeat
 Blood in the urine
 Pounding in your chest, neck or ears

Clinical Features of Hypertension[12,35]

Complications of Hypertension

High blood pressure causes severe damage to various organs in body. Long-standing hypertension accelerates atheroma and predisposes to coronary artery disease and cerebrovascular disease, Peripheral vascular disease, hypertensive retinopathy leading to retinal hemorrhages, retinopathy or optic neuropathy and blindness. In brain it causes strokes, convulsions, confusion and headache. In kidneys it cause renal failure [12]. Hypertension shortens life by 10–20 years. The risk of these sequelae is greater in people who also have diabetes and cardiac or renal disease.

The atheromas formed in the carotid artery bifurcation can be detected by dentists using routine panoramic radiographs. Traditionally, screening for cervical carotid artery atheromatous plaques was solely within the purview of physicians and was based on auscultation of the neck for a bruit. At best, this was a crude screening method because the examination had only 50% specificity and 50% sensitivity. As this method was based on physician's skill, it was subjective [13]. Friedlander in 1981 first unveiled the presence of soft tissue calcifications in this unvisited territory of panoramic radiographs. The reported prevalence of calcified atheromatous plaques ranges from 2% to 11% [14]. Atheromatous plaques found on panoramic radiographs indicated for routine dental treatment are useful for detecting asymptomatic patients at risk of stroke and referring such patients to physicians for further diagnosis and treatment so that to increase the length and quality of life for people with carotid artery atheromatous plaques [13].

It is a professional responsibility of a dental clinician to inform the patient of their hypertensive state and to offer medical advice, including appropriate referrals. There are no recognized oral manifestations of hypertension but antihypertensive drugs can often cause side-effects, such as xerostomia, gingival overgrowth, salivary gland swelling or pain, lichenoid drug reactions, erythema multiforme, alteration in taste and paresthesia [15]. Gingival bleeding is one of the common clinical features seen in hypertensive patients. In a study, Mailboridin *et al* studied the Micro lymphohemocirculatory bed and leucocytogram of gingival tissue by the light microscopy in patients with chronic periodontitis having normal and high arterial blood pressure. In most cases of arterial hypertension the gingival mucosa is characterized by widening of lymphatic vessels and interstitial spaces. In cases of inflammatory gingival pathology in arterial

hypertension the absolute neutrophil number is significantly higher showing for more acute inflammatory process and greater volume of tissue involvement. Thus, concluding that the increased periodontitis in hypertensive patients could probably attributed as one of the manifestation of hypertension. Similar findings were mentioned by Holmlund *et al* [16].

Hypo salivation was also found as one of the clinical manifestations in hypertensive patients. This hypo salivation is related to the sustained increase in both systolic as well as diastolic blood pressure and also in patients who are under antihypertensive medication especially with diuretics [17, 18].

Lichen planus like lesions or lichenoid reactions are white lesions characterized by linear striations occurring on the buccal mucosa. They are seen bilaterally and usually in the posterior regions. These are sometimes seen in hypertensive patients as a manifestation secondary to the use of the drug or medication. The most common drugs causing this side effect are the ACE inhibitor drugs especially the captopril [19,20,21]. An interesting association of diabetes mellitus, lichen planus and vascular hypertension has been described by Grinspan, this triad is called as Grinspan's syndrome by Grupper [22, 23].

Facial nerve paralysis in hypertension is because of edema or hemorrhage in the facial canal, but the exact etiology is unknown. Usually facial nerve paralysis is seen in patients with malignant hypertension. It is characterized by the sustained increase in systolic blood pressure ≥ 200 mm HG and/or sustained increase in diastolic blood pressure ≥ 120 mm HG [24]. But it is more significant in patients with increased diastolic blood pressure rather than increase in systolic blood pressure.

Gingival enlargement is also one of the most common clinical finding in patients with hypertension taking anti-hypertensive medication especially calcium channel blockers [25]. Gingival enlargements appear clinically as firm nodules of gingival overgrowth seen on either buccal or facial aspects and lingual or palatal aspects of the marginal gingiva. Sometimes they may even the entire crown causing difficulty in eating. The drugs, which cause the gingival enlargement are amlodipine, nifedipine [26, 27, 28].

Hypertensive Patient Management in the Dental Office

Initial evaluation of each patient with hypertension should include detailed family history of cardiovascular disease and other related diseases,

history of hypertension, medications, duration and antihypertensive treatment history, severity of disease, and its complications [29]. Before starting dental treatment, dentist has to assess the presence of hypertension, to determine the presence of associated organ disease and determine dental treatment changes needed [30].

Particular attention should be given to accurate measurement of BP in pregnant women, since pregnancy may alter the patient BP values, more than 10% of pregnant women having clinically relevant hypertension [31]. BP monitoring is also necessary in diabetic patients, patients with autonomous dysfunction, and elderly patients for which orthostatic hypotension is a big problem [32].

Dental treatment in hypertensive patients necessitates special attention, because any stressful procedure may increase blood pressure and trigger acute complications such as cardiac arrest or stroke.

Control of pain and anxiety is very important in patients with high medical risk [33]. Patients with cardiovascular disease have a high risk of complications due to endogenous catecholamines (adrenaline and noradrenaline) released from pain and stress. These catecholamines may increase dramatically

BP and cardiac output. This effect is reduced by controlling dental pain. Local anesthetics with epinephrine produce a longer and more effective anesthesia than simple LA, thus avoiding an exaggerated response to stress [34]. LA with vasoconstrictor should be avoided or used in low doses in patients taking nonselective beta-blockers or in patients with uncontrolled hypertension. The maximum recommended dose of epinephrine in a patient with cardiac risk is 0.04mg, which is equal to that containing about two cartridges of LA with 1: 100000 epinephrine or 4 cartridges with 1: 200000 epinephrine [34]. In patients with severe disease it may be useful to measure BP and heart rate after anesthetic injection. Slow administration and aspiration can prevent undesirable reactions.

The dentist must be familiar with other diseases treated with antihypertensive drugs (such as atenolol, amlodipine, and carteolol) as headaches, regional pain, renal failure, glaucoma, and congestive heart failure.

Most antihypertensive drugs have drug interactions with LA (local anesthetic) and analgesics.

- (i) Interaction of LA with nonselective beta-blockers may increase LA toxicity [33, 34].
- (ii) The cardiovascular effects of epinephrine used during dental procedures may be potentiated by

the use of medications such as nonselective β -blockers (propranolol and nadolol). Guidelines recommend decreasing the dose and increasing the time interval between epinephrine injections [35].

- (iii) Long-term use of NSAIDs may antagonize the antihypertensive effect of diuretics, β -blockers, α blockers, vasodilators, ACE inhibitors [36]. Short-term administration has, however, a clinically meaningful effect. Other pain relievers such as paracetamol can be used to avoid this side effect.

Grinspan's Syndrome

Grinspan in 1963 reported 23 patients having oral erosive lichen planus associated with diabetes mellitus and found 7 of them had hypertension. This triad was subsequently referred to as "Grinspan's Syndrome" by Grupper and Avul in 1965 [37]. Further research conducted by others confirmed the existence of this symptomatological triad. Drug therapy for diabetes mellitus and hypertension is capable of inducing lichenoid reactions of the oral mucosa, there is a speculation as to whether Grinspan's Syndrome is an iatrogenically induced syndrome or not [38].

Conclusion

Hypertension is one of the common risk factor for cardiovascular diseases in India. Various factors are responsible for high blood pressure like lifestyle, activities, diet, body mass etc. many a times in a dental setup patients who come for treatment may not be aware of their hypertensive status and oral physician should know to identify and manage such patients. Even risk of cardiovascular diseases can be identified by an oral physician by evaluating the routine panoramic radiograph for presence of any calcification at the level of C3-C4 vertebrae which is an indication for risk of probable cardiovascular disease.

When treating patients with hypertension the goals are to develop and implement timely preventive and therapeutic strategies compatible with the patient's physical and emotional ability to undergo and respond to dental care, the patient's social and psychological needs and desires; and limitations imposed on the clinical process by disease-specific, procedure specific, and functional capacity-related risk factors.

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