Non-Drug Therapy in Prevention and Control of Hypertension

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Abstract

Non-drug therapy is a very vital aspect in prevention and treatment of hypertension. The successive reports of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of Hypertension, WHO scientific report on primary prevention of essential hypertension and national High Blood Pressure Education Program’s working groups report on primary prevention of hypertension have stressed on the non-drug therapy.

Today a busy family physician does not spend enough time to explain to the patient various dietary and lifestyle modifications but straightaway prescribes the drugs. Every patient of hypertension from the stage of pre-hypertension to grade 2 hypertension should follow non-drug therapy. If non-drug therapy is strictly adhered, one can prevent cases of pre-hypertension from progressing to hypertension stage and one can reduce or stop the medications in Grade 1 (mild) hypertension.

We have discussed the role of low salt, high potassium diet, role of caffeine intake, calcium and magnesium supplements, fish oil intake, cigarette smoking, alcohol consumption, role of physical exercise, stress reduction and bio-feedback, yoga, meditation and acupuncture. These recommendations regarding diet and lifestyle modifications should be targeted to population at large through public health authorities, non-government organisations and news media.

INTRODUCTION

In the successive reports of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (HBP), non-drug therapy is recommended as it has long been considered efficacious. In addition, reports on primary prevention of HBP including the Primary Prevention of Essential Hypertension (Report of a WHO Scientific Group) and National High Blood Pressure Education Program’s (NHBPEP) working groups report on primary prevention of hypertension, have stressed on the non-drug therapy. We shall discuss some of the important aspects of non-pharmacological approaches such as salt intake, role of potassium, caffeine, calcium, magnesium and fish oil, cigarette smoking, alcohol consumption, role of physical exercise, obesity, stress reduction and biofeedback, yoga, meditation, and acupuncture.

SALT INTAKE

Kempner had put forward hypothesis that excess salt intake can raise BP and then he suggested rice and fruit diet (Kempner’s diet). Intersalt was the first large study (10079 men and women aged 20-59 years from 52 centres around the world) which estimated sodium and potassium excretion, blood pressure, body mass index and alcohol intake. Their conclusions were (1) Sodium excretion was significantly related to BP and atleast partly, this relationship is independent of body mass index and ethanol intake. (2) After correction for weight and ethanol consumption, a reduction in sodium intake of 100 mmol a day produced a reduction of 2.2 mm SBP and 0.1 mm Hg in DBP. Cutler et al in their analysis of 23 randomly controlled trials showed that 100 mmol/day reduction in sodium intake was associated with a decline of 5.7 mm Hg SBP and 2.7 mm Hg DBP in hypertensive subjects and 2.2 mm Hg/1.3 mm Hg in normotensives. The required daily intake of sodium (Na) in our diet is approximately 500 mgm of sodium chloride (NaCl). Under normal homeostatic conditions, sodium intake and sodium loss are in balance and the intracellular and extracellular concentrations of sodium are kept within physiological limits by an intricate regulatory system. However it is a universal practice that sodium is consumed much more than required and this seems to be related to the immense global burden of HBP and consequent complications such as coronary artery disease (CAD), stroke, heart failure and renal failure.
As regards relationship between salt intake and HBP, following interesting questions need to be addressed:1

1) Does salt intake raise BP, either within the desirable range or from desirable to undesirable?

2) Does a reduction in salt intake lower BP in persons with HBP or with BP in the desirable range?

3) Does salt intake cause persistence or progression of HBP after initiation of this problem by other, unknown, causes?

4) Are population differences in the increase of BP with age associated with the average salt intake of the populations?

5) Will reducing salt intake at the population level lower the incidence and prevalence of HBP and its cardiovascular complications? This is an important question as opinion on this issue will form the basis of national and international dietary recommendations regarding salt intake.

The mechanism of salt induced hypertension

Several studies have shown that hypertensive patients and their children handle salt differently. It is suggested that due to the presence of a sodium transport inhibitor, leucocytes of hypertensive patients are found to have a reduced sodium pump activity.2 This results in increased intracellular sodium leading to high intracellular calcium which is responsible for increased vascular tone. Due to abnormal sodium handling, renal sodium excretion is affected3 which leads to increase in extracellular fluid volume, an increased venous return and increased cardiac output. Autoregulation to achieve tissue perfusion leads to vasoconstriction and raised peripheral vascular resistance.

Salt restriction interrupts pathophysiologic chain of events by lowering extracellular fluid volume and lowers blood pressure similar to diuretic therapy.

It is therefore recommended that all cases of hypertension should restrict their sodium intake to approximately 6 gms of sodium chloride salt or 2.4 gms of sodium per day. In order to achieve that much sodium restriction, following measures should be adopted:4

a) Reduce salt for cooking by 50%.

b) Substitute natural foods for processed foods.

c) No sprinkling of salt on dining table.

d) Avoid salty snacks such as pickles, chutneys, papad, salted nuts.

e) Use salt substitutes containing potassium.

f) Avoid medications such as antacids as these are rich in salt.

It is now agreed that reducing salt intake is an essential part of dietary policy. The universal recommendation is to consume less than 10 gms of NaCl per day. The lower the better. WHO recommends 5 gms or less especially in populations known to have a high salt intake or a high prevalence of blood pressure.5

OTHER DIETARY FACTORS

The initial DASH study6 tested three diets over an eight week period with BP as an end-point (a) Typical diet (control), (b) A diet high in fruits and vegetables (fruit/veg), (c) A fruit/ veg diet combined with reduced fat and cholesterol intake (combined). Compared to control diet, the combined diet lowered SBP and DBP by 5.5 and 3.0 mm Hg respectively and fruit/veg diet lowered these values by 2.8 and 1.1 mm Hg, respectively. The BP lowering effect was seen in those with and without hypertension, in men and women, and in all ethnic groups, who were taking usual sodium intake of 3 gm/day and without weight loss. Among hypertensive patients, however, SBP and DBP dropped even more, up to 11.4 and 5.5 mm Hg, respectively, in comparison to those on control diet. It therefore seems that diet low in saturated fat and cholesterol and higher in fruits and vegetables may be more beneficial for BP and CV risk.

POTASSIUM

Wheaton et al7 in their meta-analysis of randomised controlled clinical trials showed that K supplementation was associated with a decrease in SBP and DBP of 3 and 2 mm Hg respectively.

Conversely Stamler8 reported the data from the Intersalt Study that habitual low intake of K was associated with an increased risk of high SBP and DBP. In the Nurses’ Health Study, (a cohort study of more than 51,000 American women nurses), normotensive women at the lowest percentage of K intake had lowering of SBP and DBP -2.0 and -1.7 mm Hg respectively with K supplementation.9

Possible mechanisms of BP lowering action of potassium

a) Increased sodium excretion

b) Decreased renin-angiotensin secretion

c) Decreased sympathetic nervous system activity

d) Direct dilatation of renal arteries and arterioles

Since the effect of K supplementation seems to be mild and perhaps limited to those persons taking low dietary K, community should be advised to maintain adequate K in the diet especially fruits and vegetables. JNC-VI10 recommends taking approximately 90 mmol of dietary potassium daily. However one should be careful in advocating high K diet in patients with hyperkalemia (Renal dysfunction or patients taking ACE inhibitors or angiotensin receptor blockers).

CAFFEINE

It is known to raise blood pressure but its regular use is not associated with hypertension.11 On acute consumption of 2-3 cups of coffee (250 mg of caffeine), BP rises by 5-15 mm Hg and may remain high for two hours. But chronic caffeine ingestion (500 mg/day for 4 weeks) is not accompanied by significant rise in blood pressure.

CALCIUM

Preyer et al12 in their meta-analysis of studies reported
from 1983 to 1993, found that Ca supplementation had no effect on BP.\textsuperscript{18} Similarly in the Nurses’ Health Study, there was no relationship between calcium intake and development of hypertension, there unlike K supplementation, supplementing of women with low Ca intake did not lower BP.\textsuperscript{14,19} It is therefore concluded that there is no justification for routine use of Ca supplements specifically to prevent hypertension.

**MAGNESIUM**

There is some evidence of an association between low dietary magnesium intake and higher blood pressure\textsuperscript{17} but there is not enough evidence of beneficial effects of magnesium supplementation.

**FISH OIL**

There is increasing evidence that fish oil benefits BP. In 350 nomotensive men and women aged 30 to 54 years, participants were assigned to placebo or 6 gms of purified fish oil daily for six months.\textsuperscript{20,21} These moderate amounts did not lower BP in normotensive persons but did increase HDL2 cholesterol. A meta analysis of 31 clinical trials of 1356 persons showed a close response effect of omega-3 fatty acids on SBP and DBP of -0.66 and 0.35 mm Hg/g respectively (Morris et al)\textsuperscript{22}. They suggested that the BP lowering effect may be strongest in hypertensive persons and those with dyslipidemia or clinical atherosclerosis. Appel et al\textsuperscript{23} in their report on meta-analysis of 17 clinical trials with fish oil showed that diet supplementation with relatively high doses (more than 3 gm/day) leads to BP reductions in hypertensive patients.

**ALCOHOL CONSUMPTION**

Alcohol has paradoxic effects on CVS, however, with a J shaped risk profile for alcohol intake reflecting the protection of small amounts of alcohol against coronary atheroma. This phenomenon is caused by an increase in HDL cholesterol concentrations or coronary artery dilatation, lower plasma fibrinogen values and inhibited platelet aggregation.\textsuperscript{24,25,26} Excessive alcohol consumption is an important risk factor for hypertension. The INTERSALT\textsuperscript{5} showed a strong and independent relation with alcohol and rising blood pressure. The exact mechanism of action is not clear but is postulated that activation of renin-angiotensin system, rise of plasma cortisol and stimulation of sympathetic system may be responsible.

**PHYSICAL ACTIVITY**

Physically active persons have lower blood pressure, reduced risk for cardiovascular and all cause mortality and live longer. Physical exercise reduces blood pressure.\textsuperscript{27} The benefit of physical activity to the primary prevention of hypertension has been shown by both clinical trials and longitudinal studies\textsuperscript{28,29} with the Harvard Alumni Study being the most notable of the later group. This study included 15,000 male alumni who were normotensive in 1962 (BP ≤160/95 mm Hg) but some of whom in second survey done in 1977 developed hypertension (BP ≥160/95). Comparing physically active (walking, climbing, sports) and sedentary, it was found that inactive alumni had a 35% greater risk for developing hypertension than the active group. Also another influencing risk was a BMI greater than 36, an increase in weight of more than 25 pounds since graduation and family history of hypertension.

Taylor-Tolbert et al\textsuperscript{30} showed that SBP and DBP are reduced upto 12-15 hours after a single submaximal exercise session in older hypertensive male persons. That a patient of hypertension walking vigorously for 15 minutes before breakfast, lunch and dinner would experience significant reductions in BP for nearly every hour of the day.

Today, physical exercise is considered as an important component of the non-drug treatment of hypertension. The American Heart Association considers physical inactivity to be a risk factor for IHD.\textsuperscript{31} Also NIH Consesus Development Panel on Physical Activity and Cardiovascular Health\textsuperscript{32} has drawn the same conclusion. Considering all studies, the recommendations for physical activity are: 1) All persons over two years of age should spend at least 30 minutes of endurance type physical activity on most (preferably all) days of the week, 2) Additional health and functional benefits can accrue with increased time in moderately intense activity, 3) People with symptomatic CHD, diabetes mellitus or other chronic health problems should be evaluated by a physician and given an exercise program appropriate for their condition, 4) Inactive men older than 40 years of age, women older than 50, or patients at high risk for CHD should see their physician before starting a program of vigorous physical activity and 5) resistance or strength development activities should be added at least two times a week.\textsuperscript{16,33,34}

**OBESITY**

It is claimed that obesity is the most important modifiable risk factor for hypertension.\textsuperscript{35} In the Nurses’ Health Study, obesity, alcohol consumption and older age were strong predictors of hypertension.\textsuperscript{19} Stamler et al\textsuperscript{38} in their findings in hypertension screening of 1 million Americans showed a strong correlation between elevated DBP (greater than 95 mm Hg) and obesity among all age, ethnic groups and both sexes. In their study, obese persons aged 20 to 36 years had more than double the odds of hypertension than normal weight subjects and triple that of underweight subjects. Obesity is becoming an important factor in the pathogenesis of hypertension, dyslipidemia, diabetes mellitus which together with hyperinsulinaemia makes up the “deadly quartet” or the metabolic syndrome.\textsuperscript{36}

The Intersalt study\textsuperscript{7} of 52 communities worldwide revealed that weight had the most significant independent correlation with blood pressure. Sympathetic nervous system activation seems to be the contributing factor in obese persons. Carbohydrate metabolism, amount of food intake and sympathetic nervous system activity are closely related. Obesity plays a major role in the initial development of
hypothesis and evidence shows this relationship begins in youth. In the Framingham off-spring study of young to middle-aged adults, 64% to 78% of newly developed hypertension was associated with obesity. Furthermore, children and adolescents at any age who had an initially high BP (especially SBP), higher BMI, higher weight, showed an increased risk for hypertension at follow up as adults.

Several clinical studies have shown direct benefit of weight reduction on hypertension. In the TOPH-I study, weight reduction was effective in decreasing SBP and DBP of 2.9 and 2.3 mm Hg respectively after an average loss of 3.9 kg of weight. Similar findings were reported in TOPH-II study which included longer follow-up of salt restriction and weight reduction. After seven years, the odds of hypertension were reduced by 77% in the weight loss group and 35% in the low sodium group compared with controls. In addition 80% of patients who continued with lifestyle modification (weight loss and salt restriction), could withdraw antihypertensive drugs.

During weight loss, a rapid reduction in BP is seen over 8-10 weeks probably related to diuresis and natriuresis. The BP continued to drop as the weight loss continued and the desired BP was maintained as long as weight did not increase. There seems to be a linear relationship between weight and blood pressure. The BP falls as there is reduction of weight. With reduction of weight, one can reduce or even stop the medications. Wassertheil Smoller et al in their prospective multifactorial study, placebo-treated control subjects who lost 4-5 kg had a blood pressure fall equivalent to that produced by either atenolol or chlorthalidone.

Exercise makes weight reduction more effective as shown by a finding that if a person walked 15 minutes a day and kept the same caloric intake, the weight loss in one year would be 10 lbs. Hence it is advisable to write a prescription for physical exercise in hypertensive patients.

**Cigarette Smoking**

Although there is lack of epidemiological evidence implicating smoking as a cause for hypertension, smoking is an important risk factor leading to increased morbidity and mortality in hypertensive patients. Our laboratory work using macrophage cell culture has shown that smoking causes endothelial cell dysfunction. Smoking independently raises BP, although epidemiologically the relationship between smoking and hypertension is often confounded by other factors such as alcohol consumption and lower consumption of fruits and vegetables (anti-oxidants) amongst smokers than non-smokers. Chain-smokers can have a sustained rise in BP, as shown by ambulatory BP monitoring which is presumably caused by regular nicotine infusion.

**Stress Reduction and Biofeedback**

The role of stress in causing hypertension is still not very clear. The role of chronic stress in the causation of persistent hypertension has not been clearly proven. However there is an evidence of link between job stress to long term BP elevation. In addition, short term studies have found applied stress to be associated with short term increases in BP. The role of surges of HBP due to acute stress needs to be evaluated.

A meta-analysis of 26 studies of BP control through behavioural or cognitive modifications by techniques such as stress reduction, progressive relaxation and biofeedback or meditation but these techniques did not include work place job strain, showed that cognitive techniques were superior to no therapy at all but not to self monitoring as a sole approach. However there are few small clinical trials which show that biofeedback intervention is effective in mild hypertension.

Finally, a consensus statement on the primary prevention of HBP states, in part, “on balance the available results provide insufficient evidence to recommend stress management as a useful strategy for the prevention of hypertension. Also the JNC-VI report found no support for the use of relaxation techniques for the prevention of hypertension. However there are other studies showing stress reduction with yoga, transcendental meditation, Rajyog meditation, biofeedback relaxation exercises benefit hypertensive patients by lowering BP.

**Yoga, Meditation (Mind-Body Techniques)**

These are widely practised for stress reduction. So far no substantial evidence in support of benefits of yoga, meditation is available. Yet the availability of some controlled research, its overall cost-effectiveness and its lack of side effects make further investigations of yoga a topmost priority. Currently, several clinical trials are in progress, which are examining effects of certain meditation techniques on hypertension particularly in the elderly and women.

**Acupuncture**

It is a widely practised therapeutic modality used for various conditions. However there is no published clinical trial to suggest unequivocal indication of its efficacy in treating hypertension. Many small case control studies have shown evidence of the potential usefulness of acupuncture in treating HBP but other studies provide equivocal results.

**Concluding Remarks**

Diet and lifestyle modifications are universally accepted as a very important aspect for not only management of hypertension but for prevention of hypertension. All hypertensive patients irrespective of the severity should follow the instructions regarding diet and lifestyle modifications. All cases of prehypertension stage should follow these modifications to prevent slipping into hypertensive stage. Similarly all cases of stage I hypertension (mild hypertension) should strictly follow non-drug therapy to reduce or even stop antihypertensive drugs. In order to benefit populations at large, implementation of the preventive steps suggested in this article should be carried out through public authorities, non-government organisations.
such action is taken on a large scale, we will have made poor use of the knowledge accumulated over decades of research.

REFERENCES


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**Announcement**

**National Workshop on Biomedical Waste**

**National Workshop on the Management of BMW** is organized at Choithram Hospital and Research Centre, Indore (MP) on 21st and 22nd Feb'2004. The workshop will provide update and grass root training on the BMW maangement for Health administratos, health engineers, nursing staff, voluntary health organizers, hospital infection control staff, microbiologists and clinicians.

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