Therapy in Nephrology & Hypertension

A Companion to Brenner & Rector's The Kidney

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Chapter 50

Dietary Salt Reduction

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CHAPTER CONTENTS

Cardiovascular diseases (CVDs) are the leading cause of mortality, morbidity, and disability worldwide.[1] Although CVDs are proportionally more relevant in developed countries, currently 70% of the total number of cardiovascular deaths occurs in developing countries. Globally, high blood pressure causes 7 million premature deaths per year.[1] In particular, hypertension affects approximately 1 billion individuals.[2] The burden of hypertension-related diseases is likely to increase as the population ages.[3] Overall, high blood pressure is the most important and independent risk factor for myocardial infarction, heart failure, stroke, and kidney disease. Accordingly, prevention and treatment of hypertension are increasingly regarded as a priority in both developed and developing countries.

Nonpharmacologic interventions, also termed lifestyle modifications, represent an essential approach to the primary prevention of high blood pressure and an important component of the treatment of hypertension. These lifestyle modifications are effective in decreasing blood pressure, increasing the efficacy of pharmacologic therapies, and decreasing the global risk of CVD. In this chapter, I evaluate the appropriateness of recommendations at a population level regarding the reduction of dietary salt intake, the different approaches to intervention needed to implement a successful strategy to prevent hypertension in developing and developed countries, and the recommendations to individuals to reduce dietary salt intake for the overall management of hypertension.

DEFINITIONS

Publications refer to sodium intake as either mass or millimolar amounts of sodium or mass of sodium chloride (salt) (1 g of sodium chloride = 17.1 millimolar amounts of sodium or 393.4 mg of sodium). In this chapter, the word *salt* is used to refer to sodium and sodium chloride intake. The term *reduction in dietary salt intake* implies the reduction in total sodium intake from all dietary sources including, for example, additives such as monosodium glutamate and preservatives.

EFFECT OF DECREASING DIETARY SALT INTAKE ON BLOOD PRESSURE AND CARDIOVASCULAR DISEASE

Animal studies, ecologic analyses, epidemiologic investigations, and clinical trials support a relationship between salt intake and blood pressure. The amount of dietary salt is an important determinant of blood pressure levels and of hypertension risk in both individuals and populations. This relationship is direct and progressive without an apparent threshold. Thus, the reduction in dietary salt intake is one of the most important and effective lifestyle modifications to decrease blood pressure and control hypertension.[4,5]

The importance of salt intake in determining blood pressure and the incidence of hypertension is well established. Furthermore, randomized, controlled clinical trials of moderate reductions in salt intake show a dose-dependent cause-and-effect relationship and a lack of threshold effect within usual levels of salt intake.[6] The effect is independent of age, sex, ethnic origin, baseline blood pressure, and body mass. Prospective studies[7–10] with one exception[11] also indicate that higher salt intake predicts the incidence of cardiovascular events. Finally, participants in randomized clinical trials of long-term moderate reduction in salt intake (e.g., ~2.5 g of salt reduction) show a 30% reduction in cardiovascular events 10 to 15 years later.[12]

That habitual salt intake could be associated with blood pressure levels was suggested several millennia ago, in the history of humankind, after the transition from food gathering to food producing with the addition of salt to preserve food and the consequent shift to a high-salt diet.[13]

More than 50 randomized clinical trials support a role for decreasing salt intake in the prevention and management of high blood pressure. In the largest of these trials, the Dietary Approaches to Stop Hypertension (DASH) trial,[14] salt reduction alone from a high to a low level was associated with a decrease in blood pressure of 8.3/4.4 mm Hg (systolic/diastolic) among hypertensive individuals and 5.6/2.8 mm Hg among normotensive individuals. Moreover, the combination of this amount of salt reduction and the DASH diet further decreased blood pressure by 11.5/5.7 mm Hg and 7.1/3.7 mm Hg, respectively, among those with and without hypertension. In subgroup analyses, significant effects of salt intake reduction on blood pressure levels were present in both genders and all racial and age groups, although they were more marked among African Americans, women, and those older than 45 years of age.[15]

Pooled estimates from meta-analyses of clinical trials on the effects of salt intake reduction on blood pressure levels indicate a decrease in blood pressure of 7.1/3.9 mm Hg in hypertensive individuals and 3.6/1.7 mm Hg in normotensive individuals per 100 mmol reduction of 24-hour urinary sodium excretion (~6 g of salt per day). For example, He and MacGregor[16] estimated blood pressure decreases of 5.0/2.7 mm Hg in hypertensives and 2.0/1.0 in normotensives for a median reduction in urinary sodium of 78 mmol/day. In the latest published meta-analysis of 40 randomized trials, an average decrease in urinary sodium excretion of 77 mmol/day was associated with a decrease in blood pressure levels of 2.5/2.0 mm Hg.[17] Blood pressure response was significantly greater in hypertensive than normotensive individuals (systolic: −5.2 vs. −1.3 mm Hg; diastolic: −3.7 vs. −1.1 mm Hg). Accordingly, findings from randomized clinical trials support a role for decreasing dietary salt intake in the primary prevention and management of hypertension.[18,19]

The response of blood pressure to dietary changes in salt intake, as to other environmental stimuli, may vary between individuals. This phenomenon has been termed salt sensitivity,[20] and it is likely to be due to the degree of response of the renin-angiotensin system.[21,22] The weaker the response of this system is to a change in sodium intake, the greater the response of the blood pressure will be. This phenomenon explains why the blood pressure–lowering effect of salt intake reduction is greater in hypertensive individuals, the elderly, and low-renin black populations. These groups are all characterized by weaker responses of the renin-angiotensin system to changes in the amount of salt ingested, showing a greater blood pressure decrease as a result of a decrease in dietary salt intake. Indeed, although a significant decrease in blood pressure induced by decreased salt intake has been observed in children and adolescents as well,[23] this response increases with age and is greatest in the elderly.[24] Furthermore, the blood pressure decrease observed in the elderly as a result of a dietary salt reduction may decrease the need for antihypertensive medication.[25] These observations are relevant to the prevention of hypertension-related diseases in developed countries, where the majority of strokes occur in the elderly and individuals with blood pressure levels below the treatment threshold for hypertension.[26] Nevertheless, several antihypertensive drugs blocking the renin-angiotensin system (e.g., angiotensin-converting enzyme inhibitors, β-blockers, angiotensin II receptor antagonists, and renin inhibitors) have an additive effect on blood pressure reduction in those patients already on a reduced salt diet[27] (see later).

Furthermore, people of black African origin show a greater blood pressure response when dietary salt intake is decreased.[14,22,28] For example, the efficacy of a moderate decrease in salt intake has recently been tested in two short-term trials in both urban and rural areas of West Africa (Nigeria and Ghana), where the prevalence of hypertension is increasing.[29,30] In both studies, a moderate decrease in salt intake was associated with a significant decrease in blood pressure. In areas such as sub-Saharan Africa, the prevalence of hypertension is increasing, the health care resources are scarce, and thus the identification of people with hypertension is still haphazard. The effectiveness of a decrease in salt intake at a population level might prove extremely important for policy makers.

Given the overwhelming evidence of the efficacy of decreasing dietary salt intake in the prevention and management of hypertension, the debate is currently based on issues regarding the long-term outcome benefits and thereafter the appropriateness of a population-wide strategy to reduce dietary salt intake. The major benefit of salt reduction is the lowering of blood pressure. It has been argued that the blood pressure decrease realistically achievable at a population level (i.e., 1–3 mm Hg in systolic blood pressure) is small, not clinically significant, and with long-term benefits remaining unclear.[31] However, a meta-analysis of 61 prospective studies estimated that even a decrease of 2 mm Hg in systolic blood pressure would determine a 10% decrease in stroke mortality and a 7% decrease in mortality from coronary heart disease or other cardiovascular causes, meaning a large number of premature deaths and disabilities would be avoided.[32] Other results corroborate these estimates and suggest that the benefits of such a small decrease in blood pressure, induced by reducing dietary salt intake, in the population would be almost immediate.[16] Finally, recent evidence from randomized clinical trials suggests a 30% decrease in CVD mortality after a moderate decrease in salt intake.[13] Moreover, although the principal benefit of decreasing dietary salt intake is a decrease in blood pressure, it is not the only one. There is a large body of evidence that supports other benefits: regression of left ventricular hypertrophy, reduction in proteinuria and glomerular hyperfiltration, reduction in bone mineral loss with age and osteoporosis, protection against stomach cancer, stroke, asthma attacks, and possibly cataracts.[33]

In light of the present evidence, decreasing dietary salt intake appears a plausible population-wide recommendation for the prevention and treatment of hypertension.[4,5] A decrease in dietary salt intake to no more than 6 g/day (2.3 g or <100 mmol of sodium) represents a reasonable goal at a population level given the current dietary patterns of high levels of salt intake worldwide. However, this decrease will be feasible in Western societies only if efforts are made by the food industry, manufacturers, and restaurants to decrease the amount of salt added to processed food.[34] In fact, in these societies, a large proportion of salt intake (75%–80%) comes from processed food and bread.[35] On the contrary, in developing countries where the prevalence of hypertension continues to increase, more traditional health promotion strategies would be applicable and nutritional education might have an important effect in these settings.[26,30,36] In the next sections, the issues pertaining to the implementation of public health strategies to reduce dietary salt intake in both developed and developing countries are more specifically addressed.

PUBLIC HEALTH STRATEGIES TO REDUCE SALT INTAKE IN DEVELOPED COUNTRIES

In developed countries, the estimated prevalence of hypertension is, on average, 28% in North America (Canada and the United States) and 44% in Western Europe.[37] Community-based intervention trials to decrease blood pressure by means of decreasing dietary salt intake are scanty. For example, a community-based intervention trial in Portugal over 2 years involved a whole town receiving a health education program to reduce salt intake, while another town was not given any advice and was used as a control.[38] The average blood pressure decreased by 3.6/5.0 mm Hg at 1 year and 5.0/5.1 mm Hg at 2 years in the former. In developed countries, the majority of an individual's salt intake is not added by the person but is already present in foods. Indeed, given that 75% to 80% of salt intake comes from salt added to bread and processed foods,[35] a population-wide strategy involving the food industry would be more effective in the long term. The North Karelia Project is a meaningful example to support this concept. The program was launched in 1972 in Finland to prevent noncommunicable diseases and, primarily, to decrease the mortality and morbidity from CVDs.[39] The interventions implemented during this trial were extensive: collaborations with the community, health services, and food industry were added to a mass media campaign. The results have been outstanding. Over 25 years, the age-adjusted mortality rate from CVDs among men aged 25 to 64 years decreased by 73%. These results clearly show that a comprehensive and collaborative program involving the food industry and health and community services is essential to successfully implement strategies of primary prevention of CVDs in developed countries.

A complementary approach to lower salt intake in developed countries may reside in the use of salt substitutes. The American Heart Association recommends the use of nonchloride salts of sodium because they do not increase blood pressure.[40]

In summary, in developed countries, comprehensive population strategies to reduce the average levels of salt intake are required. The expected benefits of a modest decrease in blood pressure across the whole population would be significant, especially on stroke, coronary heart disease, and all other cardiovascular conditions for which high blood pressure is a causative risk factor. The benefits would be greater in the elderly because they have a much higher stroke incidence (greater absolute risk); additionally, in this age group, most strokes occur at blood pressure levels not always requiring drug therapy (more stroke events attributable to the effect of blood pressure).

PUBLIC HEALTH STRATEGIES TO REDUCE SALT INTAKE IN DEVELOPING COUNTRIES

In developing countries, noncommunicable diseases are increasingly becoming an important threat to the health of populations.[1] Worldwide, stroke is second only to ischemic heart disease as a cause of death, and most of these deaths occur in developing countries.[41] For example, data from Tanzania suggest a high burden of stroke comparable with that observed in developed countries.[42] Likewise, in areas such as sub-Saharan Africa, the prevalence of hypertension is elevated and comparable with figures from developed regions.[2,36] Thus, preventing the impending epidemic of CVDs in these countries is critical as they are facing a rapid demographic change and already experiencing a double burden of disease, that is, communicable and noncommunicable. In the 30-year period from 2000 to 2030, the population of elderly persons is projected to double in many sub-Saharan African countries.

Salt consumption in developing countries is becoming more common as urbanization increases. However, interventions to decrease salt intake at a population level have not been extensively studied in these countries. The population approach to reduce salt consumption is particularly relevant in developing countries due to the cost-effectiveness of these measures.[43] Furthermore, in countries of sub-Saharan Africa where effective health care provision for chronic diseases is haphazard, a population strategy to limit salt consumption might prove extremely effective. It can be predicted that the same decrease in salt intake obtained with a behavioral intervention will be more effective in black African origin populations than in white populations due to the higher salt sensitivity of people of black African origin and because most of the salt ingested is added to food by the consumer, whereas processed food is used relatively rarely compared with in developed countries.[26] Two short-term trials in sub-Saharan Africa have confirmed that simple, cost-effective, and culturally adapted behavioral and educational interventions to decrease blood pressure can be successfully implemented.[29,30] Concerns about population-wide strategies to limit salt consumption in developing countries pertain to the perceived risk of counteracting worldwide policies directed at the prevention of iodine deficiency disorders through universal salt iodination. There is therefore an urgent need to consider alternative vehicles for the deliveries of iodine to populations.

In summary, in developing countries, which are experiencing an increasing burden of CVDs, multiple risk factor interventions and community-based programs of primary prevention should be encouraged. In particular, public health measures to promote dietary changes such as reduction in salt intake should be strongly recommended given that the prevalence of hypertension is likely to increase in these countries.

IMPORTANCE OF DIETARY PATTERNS

Diet plays a major role in the regulation of blood pressure and is one of the most important determinants of blood pressure levels in both individuals and populations. There are large variations in dietary patterns across populations that are likely to account for a considerable part of the observed differences in mean blood pressure levels, with populations consuming mostly plant-based diets having lower blood pressure than populations in industrialized countries. Additionally, even within industrialized countries, individuals consuming diets with increased intakes of fruits and vegetables and decreased intake of saturated fats tend to have, on average, lower blood pressure than individuals following more typical Western diets.[44]

DIETARY APPROACHES TO STOP HYPERTENSION (DASH) DIET

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[4] and a recent scientific statement from the American Heart Association[5] emphasize the importance of adopting a dietary regimen resembling the so-called DASH diet as one major lifestyle modification to prevent and treat hypertension. The DASH dietary plan provides large intakes of fruits, vegetables, and low-fat dairy products; comprises whole grains, poultry, fish, and nuts; and has limited amounts of red meat, sweets, and sugar-containing beverages. Thus, compared with habitual diets of Western societies, the DASH dietary pattern provides higher intake of potassium, magnesium, calcium, fiber, and proteins and lower intake of total fat, saturated fat, and cholesterol.[45] The blood pressure–lowering effect of this diet is the result of the combined effects of these nutrients when consumed together in food rather than of the specific effect of a single nutrient. Indeed, the DASH trial was designed to test the effects on blood pressure of a change in dietary patterns rather than the effects of a change in a single nutrient, as generally tested in previous trials.[46] This trial was an 11-week feeding program including 459 adults with (N = 133) and without (N = 326) hypertension. For 3 weeks, participants followed a control diet that was low in fruits, vegetables, and dairy products. Then, for the next 8 weeks, participants were randomly allocated to three groups and each group was fed a different diet. One group was fed the same control diet, the second group a diet richer in fruits and vegetables but similar to the control diet for other nutrients, and the third group was fed the DASH diet, which is a diet rich in fruits and vegetables, low-fat or fat-free dairy products, and reduced saturated and total fat content—in other words, a high potassium, magnesium, calcium, fiber, and protein diet. The salt intake was held constant in the three groups. Overall, findings indicated a gradient in the decrease in blood pressure among the diets. The DASH diet significantly decreased blood pressure by 5.5/3.0 mm Hg, and the fruits and vegetables diet significantly decreased blood pressure by 2.8/1.1 mm Hg compared with the control diet. Among subjects with hypertension, the blood pressure decreases in the DASH diet group were more marked. Further subgroup analyses showed significant effects of the DASH diet in all major subgroups (e.g., sex, race, age, body mass index), although the effects were more marked among African Americans than in whites.[47]

In 2001, findings from a further trial in the same population testing the effects of the DASH diet in combination with decreased salt intake were published.[14] A total of 412 participants were randomly allocated to two dietary regimens, one following a control diet representative of the average diet in the United States and one following the DASH diet. Within these two dietary regimens, participants were randomly assigned to three decreasing levels of salt consumption, defined as high (~9 g of salt or 150 mmol or 3.5 g of sodium per day, reflecting typical consumption in the United States), intermediate (<6 g of salt or 100 mmol or 2.3 g of sodium per day, reflecting the upper limit of the current recommendations), and low (<3 g of salt or 50 mmol or 1.6 g of sodium per day). Each feeding period lasted 30 consecutive days. Overall, findings indicate that (1) the DASH diet lowers blood pressure independently of the level of salt intake; (2) the blood pressure–lowering effect of a decrease in salt intake occurs by decreasing the salt intake even to levels below the currently recommended limit (i.e., <6 g/day); (3) the effects of salt intake reduction are observed in all major subgroups; (4) greater lowering effects on blood pressure may derive from the combination of the two interventions than from adopting either the DASH diet or low-salt diet individually. In fact, the difference in systolic blood pressure between the DASH low-salt group and the control high-salt group was a substantial decrease of 7.1 mm Hg in participants without hypertension and 11.5 mm Hg in participants with hypertension. The last finding resembles the effect of a single-drug therapy in hypertensive individuals. Thus, the combination of the DASH diet and decreased salt intake represents an alternative to drug therapy for individuals with mild hypertension and willing to comply with long-term dietary changes.

More recently, findings from the Optimal Macronutrient Intake Trial to Prevent Heart Disease (OmniHeart) have extended the observations derived from the DASH trial.[48]

ASSESSMENT OF HYPERTENSIVE PATIENTS

All hypertensive patients should have a thorough history and physical examination, but need only a limited number of routine investigations. It is beyond the scope of this chapter to discuss every detail of the clinical evaluation, but it is important to consider and document the following: the causes of secondary hypertension, contributory factors, complications of hypertension, CVD risk factors to allow the assessment of CVD risk, and contraindications to specific drugs. Routine investigation must include urine strip test for protein and blood, serum creatinine and electrolytes, blood glucose (ideally fasted), lipid profile (ideally fasted), and an electrocardiogram. A case should be made for the inclusion of 24-hour urinary collections for sodium, potassium, and creatinine to assess levels of sodium (salt) and potassium intake, given than more than 95% of the ingested salt and more than 80% of the ingested potassium are excreted in the urine daily. Chest radiograph, urine microscopy and culture, and an echocardiogram are not required routinely. An echocardiogram is valuable to confirm or refute the presence of target organ damage. When the clinical evaluation or results of these simple investigations suggest a need for further investigation, it may be best to refer for specialist advice if the additional investigations needed are difficult to arrange from general practice.

PRIMARY PREVENTION OF HYPERTENSION

Current approaches to the prevention of adverse cardiovascular sequelae due to hypertension are unsatisfactory because they require prolonged drug therapy for a large proportion of the adult population. Moreover, this strategy does not reduce the risk of treated hypertensive patients compared with that of the normotensive population.[49] A population strategy is therefore necessary to (1) prevent the increase in blood pressure with age and therefore decrease the prevalence of hypertension, (2) reduce the need for antihypertensive drug therapy, and (3) reduce CVD burden.

The following lifestyle modifications for the primary prevention of hypertension are consistent with those recently outlined by the U.S. National High BP Education Program and the British Hypertension Society: (1) maintain normal body weight for adults (e.g., body mass index 20–25 kg/m^2), (2) decrease dietary salt intake to less than 6 g/day (<100 mmol or <2.4 g of sodium per day), (3) engage in regular aerobic physical activity such as brisk walking (30 minutes per day, most days of the week), (4) limit alcohol consumption to no more than three units per day in men and no more than two units per day in women, (5) consume a diet rich in fruits and vegetables (e.g., at least five portions per day), and (6) consume a diet with reduced saturated and total fat content.

LIFESTYLE CHANGES IN ESTABLISHED HYPERTENSION

Recent controlled trials[5] have confirmed that lifestyle changes can lower blood pressure. Clear verbal and written advice on lifestyle measures and moderate decrease in dietary salt intake in particular (Box 50-1) should be provided for all hypertensive patients and also those with high-normal blood pressure or a strong family history. Effective lifestyle modification may lower blood pressure as much as a single blood pressure–lowering drug.[14] Combinations of two or more lifestyle modifications can achieve even better results. Lifestyle interventions reduce the need for drug therapy, can enhance the antihypertensive effects of drugs, reduce the need for multiple drug regimens, and can favorably influence overall CVD risk. Conversely, failure to adopt these measures may attenuate the response to antihypertensive drugs.

In patients with grade 1 (mild) hypertension, but no cardiovascular complications or target organ damage, the response to these measures should be observed during the first 4 to 6 months of evaluation. When drug therapy has to be introduced more urgently, for example, in patients with grade 3 (severe) hypertension, lifestyle measures should be instituted along with drug treatment. The initiation of drug treatment should never be delayed unnecessarily, especially in patients at higher levels of risk.

Weight reduction by calorie restriction is appropriate for the majority of hypertensive patients because most are overweight.[50] The blood pressure–lowering effect of weight reduction may be enhanced by a decrease in salt intake.[19] Salt reduction from an average of 10 to 5 g (5 g is ~1 teaspoon) daily lowers blood pressure by approximately 5/2 mm Hg, with greater blood pressure decreases in the elderly and in those with higher initial blood pressure levels. These effects are additive to the blood pressure–lowering effect of a healthy diet. As indicated earlier, all hypertensive patients should have clear verbal and written advice to reduce salt intake to less than 6 g/day (<100 mmol/day) (see Box 50-1). This will be achieved more effectively through dedicated sessions held by well-trained nurses or other health professionals outside the clinical consultation. In suitable cases, online resources aimed at increasing education and awareness about the salt content of food and how to read food labels and make an informed choice should be used. Many will already have stopped adding salt at the table and even when cooking, but few are aware of the large amount of salt in processed foods, such as bread (one slice contains on average of ~0.5 g of salt), some breakfast cereals, prepared meals, and flavor enhancers such as stock cubes or manufactured sauces. Patients and those who cook for patients should be provided with specific written advice.

THE NATIONAL INSTITUTE FOR CLINICAL EXCELLENCE–BRITISH HYPERTENSION SOCIETY ALGORITHM

Hypertension control remains suboptimal in the United Kingdom and around the world.[37] Most people require more than one drug to control blood pressure, and yet the majority of treated hypertensive patients continue to receive monotherapy.[37] The National Institute for Clinical Excellence and the British Hypertension Society have recently jointly published a treatment algorithm (ACD) designed to encourage improved blood pressure control (Fig. 50-1). The theory underpinning the ACD algorithm is that hypertension

Box 50-1 Practical Advice for Patients on How to Reduce Dietary Salt Intake

Target daily salt intake should not exceed 6 g/day

1. Never Add Salt to a Meal

Do Not	***Instead***
Use rock salt or sea salt Add sauces	Use pepper, garlic, lemon, and herbs.

2. Do Not Add Salt When Cooking

Do Not	***Instead***
Use stock cubes, gravy browning, soy sauce, salted dry fish, curry powers, and prepared mustards	Try other flavorings: any herbs, spices, lemon or lime, vinegar, onions, garlic, ginger, and chilies.

3. Avoid Manufactured or Processed Foods with Added Salt

Food Labeling

Salt is sodium chloride. At present, most food labels only report sodium as grams per 100 g of food. To convert to salt, multiply by 2.5.

1 g of sodium per 100 g of food is the equivalent to the saltiness of seawater.

Beware	***Ideally***
Most breads, many cereals Ready-made soups and meals, processed meats, pizzas, Chinese take out	Only choose food items with no more than 0.3 g of sodium per 100 g of food.

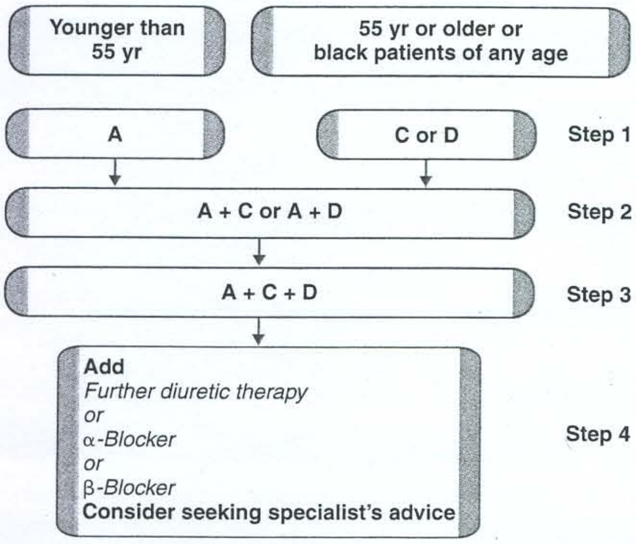

Figure 50-1 National Institute for Clinical Excellence–British Hypertension Society algorithm for the pharmacologic management of hypertension. A, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers; C, calcium channel blockers; D, diuretics.

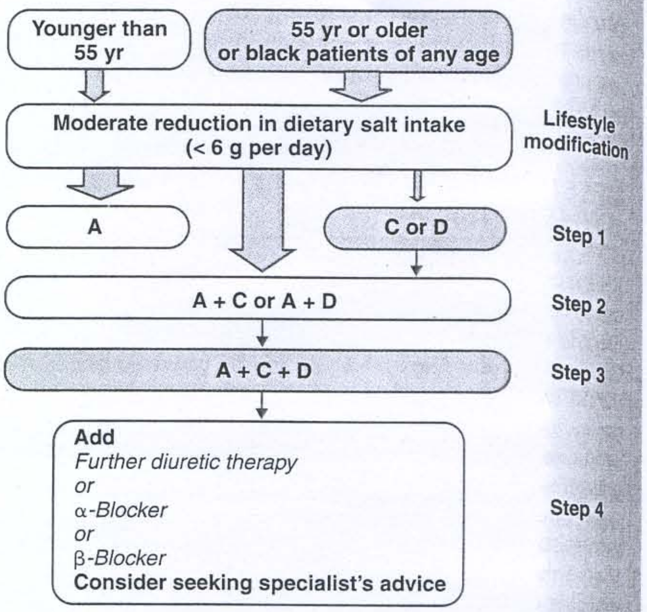

Figure 50-2 Modified National Institute for Clinical Excellence–British Hypertension Society algorithm with the inclusion of a moderate reduction in dietary salt intake as lifestyle modification step. The size of the arrow indicates the strength of the estimated effect. A, angiotensin-converting enzyme inhibitors or angiotensin receptor blockers; C, calcium channel blockers; D, diuretics.

can be broadly classified as high renin or low renin and is, therefore, best initially treated by one of two categories of antihypertensive drug, that is, those that inhibit (angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, renin inhibitors, or β-blockers) and those that do not inhibit (calcium channel blockers or diuretics) the renin-angiotensin system. Renin profiling studies have demonstrated that younger people (younger than 55 years) and whites tend to have higher renin levels relative to older people (older than 55 years) or the black population (of African descent). Thus, the drugs that reduce blood pressure at least in part by suppressing the renin-angiotensin system at one point or another are generally more effective as initial blood pressure–lowering therapy in younger white patients. In contrast, calcium channel blockers and diuretics are less effective as initial blood pressure–lowering therapy in these patients and are better used as first-line treatment in older whites or the black population of any age.[51] The detailed analysis of this algorithm is beyond the scope of this chapter. However, it is important to consider the use of a moderate dietary salt reduction in the overall therapeutic framework. A moderate reduction in dietary salt intake is effective in lowering blood pressure on its own but is also additive to pharmacologic treatment and can be as effective as a low-dose thiazide diuretic. Furthermore, based on the underlying principles informing the ACD algorithm, a moderate decrease in dietary salt intake can be added to the algorithm, emphasizing its additive blood pressure–lowering effect to drug classes that predominantly block the renin-angiotensin system (such as angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, renin inhibitors, β-blockers), with less predicted additive effect to thiazide and thiazide-like diuretics, dihydropyridine calcium channel blockers, and α-blockers (Fig. 50-2). Furthermore, a moderate decrease in dietary salt intake is more effective in low renin hypertension as seen in people of black African origin, in the elderly, and in many cases of type 2 diabetes and metabolic syndrome whether or not associated with hyperfiltration or microalbuminuria.

CONCLUSIONS

Extensive and consistent evidence provides the scientific basis for clinical and public health strategies directed at long-term lifestyle modifications to prevent and reduce the burden of disease related to high blood pressure in both individuals and populations. In the clinical setting, a comprehensive lifestyle intervention, including a moderate reduction in dietary salt intake, represents a cost-effective therapeutic option among nonhypertensive individuals with above-optimal blood pressure levels as well as among hypertensive individuals who are not receiving medication therapy but who comply with long-term lifestyle changes. In addition, a moderate decrease in dietary salt intake is an essential adjuvant therapy in hypertensive individuals who are already pharmacologically treated. In the public health arena, there is an urgent need to develop and implement population-wide strategies aimed at substantial societal changes to tackle the current epidemic of hypertension in both developed and developing countries. However, these changes will be realistic only if collaborative initiatives are implemented at multiple levels: government, manufacturers, health care providers, researchers, and the general public.[34] In the clinical setting, there is the need to provide specific and targeted advice on how to effectively reduce dietary salt intake and to provide support to patients to sustain the decreases by monitoring compliance through regular assessment of salt intake with 24-hour urine collections.

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