Abstract—A major invitational hypertension meeting was hosted by the Department of Veterans Affairs (VA) in Washington, DC, on May 26 to 28, 1999. It followed a report that only 25% of hypertensive veterans had adequate levels of treated blood pressure and focused on how control of hypertension could be improved both immediately and in the future. After the presentation of brief outlines of 5 unresolved basic science questions, 2 general topics were considered: (1) 30 years of change in hypertension and its treatment and (2) current healthcare delivery mechanisms and how to improve them. Since 1970, the severity of hypertension has decreased, malignant hypertension has disappeared, and the prognostic roles of systolic and diastolic blood pressure have been reversed as hypertension became milder. Five VA Cooperative Studies have provided important data: the 1970 Freis Trial report demonstrated the value of treatment, 2 trials showed that some controlled patients can decrease or even discontinue pharmacological treatment without recrudescence, a blinded trial was performed on the efficacy of different antihypertensive drugs, and an unblinded trial showed that diuretics and β-blockers are the most effective agents when caregivers choose the agent and dose. Two healthcare models were considered: (1) the patient-friendly VA Hypertension Screening and Treatment Program that was introduced in 1972, which controls 80% of patients at the goal of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure with diuretics and keeps patients in the program an average of 7.5 years, and (2) the newer primary care health maintenance organization–like model in the VA and throughout the United States. Choosing a regimen and monitoring control of blood pressure and compliance with therapy were discussed. The meeting was closed with 6 general recommendations for improving the care of hypertensive patients. (Hypertension. 2000;35:853-857.)

Key Words: hypertension, detection and control ■ hypertension, malignant ■ diuretics ■ drug therapy ■ blood pressure

On May 26 to 28, 1999, the Department of Veterans Affairs (VA) held a major invitational hypertension meeting in Washington, DC, entitled “Improvement in the Management of Hypertension in 2000 and Beyond.” The meeting resulted from concern that hypertensive veterans were not receiving optimal antihypertensive treatment. This concern was fostered by a report in the New England Journal of Medicine by Berlowitz et al,1 who examined the records of 800 hypertensive veterans treated by primary care physicians at 5 New England VA outpatient clinics between 1990 and 1995. They found that only 25% had reached the goal blood pressure recommended by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure VI (JNC VI) (ie, blood pressure of <140 mm Hg systolic and <90 mm Hg diastolic).2 Although the percentage of veterans whose blood pressures were controlled at this level approximated what the Third National Health and Nutrition Examination Survey (NHANES III) reported for the United States as a whole,3 Dr Kenneth Kizer, the Undersecretary of Health for the VA, was not satisfied with the VA results and proclaimed an initiative to improve the management of hypertensive care. The VA has long been a leader in the field of antihypertensive therapy. It conducted the first multicenter trial,4,5 demonstrating the benefit of antihypertensive treatment, and followed this by introducing a special hypertension program to treat the large number of untreated veterans identified in this trial as deserving treatment. For the next 25 years, special VA categorical hypertension clinics in the Hypertension Screening and Treatment Program (HSTP) achieved both excellent blood pressure control, with most patients achieving goal blood pressure, and excellent long-term adherence to therapy, with patients kept in the program for an average of >7.5 years.6

Dr Kizer’s initiative called for an early meeting of invited experts in hypertension to consider what was already known about hypertension and how that information could be used to immediately improve current patient care. The initiative also called for the development of proposals for new trials to further improve patient care in the future. Included were plans...
for a larger meeting next year to inform VA primary care physicians about the expert recommendations and to implement them throughout the VA.

The expert meeting in May covered 3 general topics: (1) unresolved questions in basic science that could lead to improved patient care; (2) pertinent information on the treatment of hypertension that had been obtained during the past 25 years, including changes in the pattern of hypertension during this interval; and (3) current mechanisms for the delivery of medical care, their strengths and weaknesses, and how improvement could be implemented throughout the VA.

**Basic Science**

Dr Theodore Goodfriend outlined several major unanswered basic science questions, beginning with questions about the underlying mechanisms of hypertensive disease, why it was apparently useful during human evolution, and why it had become detrimental in the present world. Five specific topics were subsequently addressed: (1) neural and humoral cardiovascular integration, (2) the relationship of angiotensin to cardiovascular growth, (3) emerging information about human genetics and pharmacogenetics, (4) mechanisms and effects of block of the renin-angiotensin system, and (5) effects of obesity on blood pressure.

**Thirty Years of Clinical Change**

The treatment of hypertension has undergone a dramatic change since the 1970 report of a landmark VA Cooperative Study chaired by Dr Edward Freis. The report indicated that the pharmacological treatment of mild and moderate hypertension markedly reduced morbidity and mortality rates. This trial was the first randomized, double-blind, placebo-controlled, multicenter therapeutic trial instituted for cardiovascular disease. The first part of the trial dealt with severe hypertension and demonstrated a prompt and striking benefit of treatment: Within 16 months, 27 of 73 placebo-treated patients, but only 2 of 70 actively treated patients, developed morbid events. However, it was the second part of the trial, which dealt with moderate hypertension, that caught the attention of the medical community, and then the public, in the United States and was eventually embraced worldwide. It made the treatment of hypertension a major national priority. In that report, 194 patients with moderately severe hypertension who received placebo developed 76 events within 39 months, whereas 186 actively treated patients developed only 22 events during the same time period.

The trial results quickly prompted the Honorable Elliot Richardson, then Secretary of the Department of Health, Education, and Welfare, to establish an expert group to provide guideline recommendations for the treatment of hypertension. This first set of guidelines, which initiated the concept of “step care,” led to the establishment of the National High Blood Pressure Education Program and was the forerunner of the 6 subsequent reports of the JNC.

Salient points of 4 subsequent VA Cooperative Studies were briefly reviewed. The first was an extension of the landmark Freis trial and demonstrated that when therapy of well-controlled hypertensives was withdrawn, the hypertension usually, but not always, returned, and that when it did return, the return was usually prompt. Eighty-six patients from the prior trial (27 with severe hypertension and 59 with moderate hypertension) whose diastolic blood pressure (DBP) had been well controlled for 2 years were blindly rerandomized: 60 to placebo and 26 to continued active treatment. They were subsequently followed for 18 months, by which time hypertension had reappeared in 42 of the placebo-treated participants, but it had not reappeared in 9 of the placebo-treated participants. In 39 of the 42 patients with recrudescent hypertension, the return of elevated blood pressure occurred within 6 months. The 9 patients with no return of hypertension within 18 months had entirely normal pressures, averaging 131/83 mm Hg.

The second trial dealt with a similar problem: Could patients with well-controlled hypertension have their antihypertensive therapy stepped down? The overall result in this more complicated, randomized, double-blind trial suggested that many patients were able to have their antihypertensive medication “stepped down” but relatively few could completely discontinue an agent without recrudescent hypertension. Thus, the percentage of those who were controlled remained unchanged when patients receiving hydrochlorothiazide alone reduced their dose by 50%, but when the drug was discontinued, two thirds lost control. For patients receiving hydrochlorothiazide plus a second agent, most remained controlled when the second agent was halved, but only a few remained controlled when it was discontinued.

Two subsequent trials compared the efficacy of currently available antihypertensive drugs. In the double-blind “monotherapy study,” almost 1300 patients were randomized to receive 1 of 6 classes of drugs or placebo. The goal was to attain a DBP of <90 mm Hg and to maintain it at <95 mm Hg for 1 year. There were significant differences in the percentages of white and black patients and of young and old patients (≥60 years) controlled with different agents. The most effective agents were the calcium antagonist diltiazem in blacks and the α-agonist clonidine in whites. Diltiazem produced goal DBP in 69% to 85% of all 4 age/race groups. The agents that achieved goal DBP in half or more of a group were diltiazem and atenolol in young blacks; diltiazem, hydrochlorothiazide, and clonidine in older blacks; all agents tested except hydrochlorothiazide in young whites; and all agents tested in older whites.

The most recent of the 4 VA Cooperative Studies was dramatically different in design, being neither randomized nor double-blind. Rather, it was a “real life” trial that examined the antihypertensive effects of available drugs when the choices of drug and dosage were left to the caregiver. This trial involved 6100 veterans who were treated in 6 HSTP clinics. In these clinics, diuretics were the most effective agent, controlling systolic blood pressure (SBP) at <140 mm Hg in just more than half of the patients who received that agent. The least effective agents were calcium antagonists, which controlled SBP at <140 mm Hg in just less than one third of patients. The effect on DBP followed the same pattern as SBP. The difference between the average blood pressures associated with these 2 agents was 8/5 mm Hg. A diuretic and, to a lesser extent, a β-blocker were not only the most effective but also the least expensive.
antihypertensive agents; the benefit of diuretic was obvious despite the minor adverse metabolic effects, which are often cited. A 10-year follow-up of the same population is currently being analyzed to determine the relationship of morbidity and mortality to treatment regimen.

The effects of other recent large-scale treatment trials were presented as meta-analyses and clearly demonstrated decreases in stroke, myocardial infarction, and congestive heart failure. The recent Hypertension Optimal Treatment (HOT) Trial randomized >18,000 patients worldwide to 1 of 3 DBP goals in an attempt to define optimum goal blood pressure. The target goal DBP levels were <80, <85, and <90 mm Hg; however, the average attained DBP levels were 81, 83, and 85 mm Hg. The DBP associated with the lowest incidence of major cardiovascular events was 82.6 mm Hg, and the DBP associated with the lowest incidence of cardiovascular death was 86.5 mm Hg.

Changes in the course of hypertensive disease and in the incidence of its complications during the past 30 years were then addressed: the disappearance of malignant hypertension, the general decrease in the severity of hypertension, and the reversal of the roles of SBP and DBP as the primary indicator of future hypertensive complications. First, malignant hypertension, with its hemorrhagic and/or exudative retinopathy plus papilledema in young hypertensives, has become very rare and geographically limited. Its incidence has decreased steadily throughout most of the United States, although it still occurs in the southeast United States (ie, in the “Stroke Belt”). Originally seen in all 4 race/gender groups (whites and blacks, men and women), it tended to disappear, first in whites of either gender and then in black women, while becoming much less frequent in black men. This disappearance has usually been ascribed to the widespread treatment, at least minimal treatment, of severe diastolic hypertension. However, it seems likely that other factors were also involved, including diet, smoking, or other environmental changes.

While this was occurring, there was an overall reduction in the severity of hypertension as demonstrated by changes in both the level of blood pressure and the fraction of the population who are hypertensive. The decrease in average blood pressure for the entire adult US population, both hypertensive and normotensive, between NHANES I in 1971 to 1974 and NHANES III in 1988 to 1991 averaged 10/10 mm Hg. Some, but not all, of this decrease was due to the inclusion of the blood pressures of treated patients. It is surprising that both SBP and DBP decreased by the same amount since the change in SBP is usually considerably greater. Some of the large decrease in DBP was presumably due to the aging population with the resultant increase in isolated systolic hypertension, but there may well be other contributing factors.

The great increase in antihypertensive treatment is certainly at least in part responsible for the well-recognized decrease by >50% in stroke and coronary heart disease since 1970. Unfortunately, there have been less easily explained increases in congestive heart failure and end-stage renal disease during the latter part of this period. One possible explanation for the increase in cardiac failure is a shift in pathophysiology since the beginning of the treatment era in 1970. The early primacy of systolic dysfunction associated with increased left ventricular afterload has been replaced in recent years by an increased prevalence of diastolic dysfunction associated with ventricular fibrosis in the elderly and in patients with left ventricular ischemia. We hope that the use of new pharmacological agents will reverse the rising frequency of congestive heart failure. Explanations for the rising prevalence of end-stage renal disease may involve failure to lower blood pressure to the very low levels required and differences in the therapeutic efficacy of various agents in this situation. Specific antihypertensive agents have recently been shown to have an increased effect on intrarenal hemodynamics.

Despite early suggestions from the Framingham Heart Study and other sources, there has generally been continued reliance on the DBP rather than the SBP as an indicator of future morbidity and mortality. The fifth report of the JNC (JNC V) mentioned that SBP of >140 mm Hg was potentially treatable; but it was not until JNC VI that a treatment goal of <140 mm Hg for SBP was definitively recommended. In 1939, N.M. Keith, H.P. Wagener, and N.W. Barker focused on DBP and showed that malignant hypertension (with its hallmark of extremely high DBP in relatively young patients) limited average life expectancy to <1 year. Even then, it was recognized that very high SBP in older people was also prognostically serious, but it was not as universally fatal since some elderly patients survived for years. Although definitive data were few, it was generally held that hypertensive patients with a DBP of >120 mm Hg had the worst prognosis. As average pressures in the United States have decreased and “mild” hypertension has become the major concern, SBP is gradually becoming recognized as the best predictor of hypertensive complications. Some recent trials go further and suggest that for older patients, survival does not depend at all on DBP, although DBP is still clearly related to survival in young patients.

Clinical Management
The third part of the meeting dealt with different approaches to providing clinical care for patients with hypertension. Two major models were emphasized. The first was the VA’s long-standing categorical HSTP. The first HSTP clinics were started in the early 1970s, shortly after the report of the landmark Freis trial, to handle large numbers of untreated hypertensive veterans, and these clinics have continued to treat hypertensive veterans ever since. Care is provided in these clinics by carefully selected and specially trained nurse specialists under physician supervision. Later, physician’s assistants were cast in the same role. At first, there were frequent severe and complicated hypertensives, whose blood pressure control often required physician input. The severe diastolic hypertensives have gradually been replaced by the increasingly common mild hypertensives, along with isolated systolic hypertensives, thus decreasing the number of patients for whom a physician’s advice was needed. The more recent patient population has had increasingly frequent additional chronic diseases, such as ischemic heart disease and diabetes.
mellitus, which the clinic nurses and physician’s assistants managed after the diseases had been stabilized.

From the outset, the HSTP clinics included 2 innovations: (1) each patient was assigned an individual caregiver whose home telephone number was provided, making him or her continually available to help with any health problem; and (2) every routine outpatient visit was made by appointment, so the average waiting time in clinic was <15 minutes. The premise behind these innovations was that if patients were to remain in follow-up care over many years, that care had to be accessible and convenient. A recent evaluation found the average follow-up time was 7.7 years for all patients in a sample of 6 HSTP clinics. From the beginning, when inexpensive drugs were the only drugs available, particularly diuretics, β-blockers, and reserpine, they were found to be effective and were emphasized at HSTP clinics.

In this era of increasing medical care costs, the VA is attempting to conserve its resources by turning to primary care clinics. A major difference in the treatment of hypertension between the typical HSTP clinic and the current VA primary care clinic is often a matter of emphasis. Although hypertension is the most common disease entity among veterans and is the major contributor to cardiovascular morbidity and mortality, the primary care clinician may fail to accord it prompt attention. In these clinics, hypertension sometimes seems to be approached as an asymptomatic chronic disease that is unlikely to progress to an early catastrophic complication, and hence, effective treatment can be deferred. Regardless of the reason, Berlowitz et al reported that, despite frequent primary care clinic visits, the dose of antihypertensive medication was increased at only one fourth of the visits when blood pressure was inadequately controlled.

The current shift in the VA to primary care outpatient clinics has been likened to something resembling the health maintenance organization (HMO) model, and the meeting participants were specifically asked to consider various schemes providing care, including the HMO model. HMOs vary widely in efforts to control blood pressure and in success in doing so, although neither the patient nor his or her HMO usually has definitive information on this aspect of care. Beginning in 2001, the Health Plan Employer Data and Information Set (HEDIS) will provide the public with data regarding the care of hypertension: specifically, the percentage of hypertensive patients who have attained the JNC VI goal of SBP of <140 mm Hg and DBP of <90 mm Hg.

Clearly, the frequent movement of patients from one provider to another is a major problem for the HMO. Because of the usual short-term tenure in many HMOs, there is little emphasis on the long-term follow-up that is necessary to provide maximum benefit in the form of decreased morbidity and mortality rates. The new HEDIS measure noted above, while in a constructive direction, will not deal with other vital questions: the time necessary to achieve control, the number of clinic visits required, the length of time control is maintained, continuity of care, discontinuation of a regimen because of real or perceived adverse side effects, morbidity and mortality rates among patients, and overall patient satisfaction with the care received.

Three points were brought out during the ensuing discussion. First, strong sentiment was expressed for retaining the demonstrated beneficial aspects of the VA’s HSTP clinics in some form. These outpatient facilities have a unique record of controlling hypertensive disease for most patients over long periods of time with the use of inexpensive drugs and infrequent visits. The HSTP clinic may need to be modified to meet the current VA philosophy, but their patient-friendly approach certainly should not be scrapped until a comparably effective substitute is available.

Second, despite the plethora of new antihypertensive drugs, it was emphasized that the diuretic, the β-blocker, and the less frequently used reserpine continue to be both effective and inexpensive in a majority of patients. It was also emphasized that appropriate low-dose drug combinations very often are effective and rarely produce untoward effects.

Finally, home blood pressure measurements were suggested as an important way to involve the patient in his or her care and thereby increase long-term compliance. This well-established approach also provides the caregiver with valuable information about usual blood pressure levels outside the physician’s office. By so doing, it decreases expensive clinic visits and avoids the problem of “white coat” hypertension.

### Recommendations

#### Proposed Investigations

Six future trials were proposed that were designed to provide clinically useful information; the first 2 were deemed the most important.

1. A comparison of the degree of blood pressure control and long-term patient retention in patient-friendly HSTP clinics versus that in current VA primary care clinics.
3. An evaluation of pulse wave velocity as an alternative to using SBP for the diagnosis and evaluation of the severity of hypertension and atherosclerosis on success in controlling blood pressure and on the cost-effectiveness of care.
4. An evaluation of positive family history, in conjunction with other available characteristics, as a major risk factor for morbidity and mortality rates in patients with mild systolic/diastolic hypertension or with isolated systolic hypertension.
5. A test of the efficacy of various methods to prevent hypertension, including low sodium, high potassium, isotonic exercise, and maintenance of normal body mass index.
6. An examination of the risk factors that underlie end-stage renal disease to test whether intensive efforts to reduce blood pressure affects the appearance and rate of progression of end-stage renal disease (the VA population, with its generally low socioeconomic status and its large minority component, is well positioned to approach the problem).

#### Specific Recommendations

The following recommendations to improve patient care were proposed.
1. Use the SBP rather than the DBP as the major predictor of hypertensive complications and, hence, as the major goal of treatment.

2. Educate both physician and patient to emphasize the importance of achieving a goal SBP of <140 mm Hg.

3. Ensure that appropriate low-dose, low-cost combination tablets of antihypertensive agents are available for VA outpatient pharmacies.

4. Continue the essential aspects of the HSTP model: patient-friendly clinics dedicated to long-term follow-up, with each patient having a concerned and knowledgeable caregiver dedicated to the achievement of goal blood pressure.

5. Convene an early meeting to acquaint VA physicians with the meeting recommendations and to implement them throughout the VA health care system.

References


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