

Withdrawal of Antihypertensive Medications

Jack Froom, MD, Jeffrey S. Trilling, MD, Shing-shing Yeh, MD, PhD, Irving H. Gomolin, MDCM, Anne-Marie Filkin, MD, and Roger C. Grimson, PhD

Background: Pharmacologic treatment of hypertension reduces risks of stroke, congestive heart failure, renal failure, and mortality, but whether medications, once begun, need to be continued for life is uncertain.

Methods: Several search strategies on MEDLINE using key words "medication," "withdrawal," "discontinuance," and "therapy" in several combinations, nested within "hypertension," were not productive. Accordingly, articles known to the authors and citations within them were reviewed. A survey of a random sample of members of the New York Academy of Family Practice was conducted to ascertain current practice of practicing physicians.

Results: Eighteen studies of antihypertensive medication withdrawal were located and all were reviewed. In 12 trials average success rates of 40.3 percent after 1 year of follow-up and 27.7 percent after 2 years were achieved. In six studies limited to elderly patients, an average success rate of 26.2 percent was obtained for periods of 2 or more years. The trials, however, were heterogeneous in design, patient selection criteria, and follow-up. The survey of family physicians indicated that 79.1 percent attempt withdrawal of antihypertensive medications in hypertensive patients whose blood pressure is controlled and who are without symptoms from medication.

Conclusions: We conclude that successful withdrawal of antihypertensive medications can have substantial benefits with few or no adverse consequences and might be successful in about one third of patients. Additional research is required to substantiate rates of successful medication withdrawal, to define the best method of withdrawing medications, and to delineate characteristics of patients in whom withdrawal is most likely to succeed. (J Am Board Fam Pract 1997;10:249-58.)

Risks for the complications of hypertension (stroke, congestive heart failure, renal failure, and mortality) are reduced by pharmacologic and other therapies.¹⁻⁷ In recent years the value of treating hypertension in older persons has also been established.⁸⁻¹¹ Although there is strong evidence of benefit from treatment, there is uncertainty about whether medications, once begun, need to be continued for life.

The fifth report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure¹² suggests that reduction in antihypertensive drug therapy may be attempted after blood pressure has been controlled for 1 year, but it is pessimistic about the success of discontinuing therapy: "Patients whose drugs have

been discontinued should have regular follow-up because blood pressure usually rises again to hypertensive levels, sometimes months or years after discontinuance, especially in the absence of sustained improvements in life style." The accompanying references cite only a single paper by Stamler and colleagues¹³ in support of that conclusion. Stamler et al combined drug therapy withdrawal with reductions in body weight and excess salt and alcohol consumption during a 4-year period. Thirty-nine percent of patients who received nutritional guidance remained normotensive without drugs compared with only 5 percent in the group that only discontinued drugs.¹³ A World Health Organization committee contends that success of antihypertensive drug withdrawal is unlikely and "is usually followed sooner or later by the return of the blood pressure to pre-treatment levels."¹⁴ Yet, withdrawal of antihypertensive medications, if successful, can confer great benefits (reduction in costs and side effects) and therefore merits reassessment. To assess success rates, we reviewed

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From the Department of Family Medicine, State University of New York at Stony Brook. Address reprint requests to Jack Froom, MD, Department of Family Medicine, Health Science Center, State University of New York at Stony Brook, Stony Brook, NY 11794-8461.

studies of withdrawal of antihypertensive medications. To determine how often physicians attempt medication withdrawal, we surveyed New York State family physicians.

Methods

Several search strategies on MEDLINE using the key words "medication," "withdrawal," "discontinuation," and "therapy" in several combinations, nested within "hypertension," were not productive. Many of the articles were published before key words were in common use, and it appears that currently there is no standard method of classifying articles about antihypertensive medication withdrawal. Instead, we accessed pertinent articles we knew of and reviewed references cited within them. We were able to locate only 18 trials of antihypertensive medication withdrawal, 6 of which were limited to older persons. We do not know whether we missed some trials, although absence of citation within recent reports suggests that the number missed would be small. Because of the paucity of literature, all articles were included.

The studies were evaluated for characteristics of the patient population (age, sex, duration and type of antihypertensive medications, end-organ damage), and study characteristics (inclusion and exclusion criteria, criteria used to restart medications, placebo or other controls, frequency of blood pressure measurements, duration of follow-up, and predictors and rates of successful medication withdrawal). Standard methods of rating research design used to judge clinical trials were inappropriate for several reasons. There was no standard method for medication withdrawal, patient inclusion and exclusion criteria varied markedly, and there was no way to tell whether all patients from whom medication was withdrawn actually had hypertension. Because all the patient and study characteristics differed in the several trials that were rated, a formal meta-analysis is unwarranted. Yet, the withdrawal of antihypertensive medications without return of elevated blood pressure is worth reporting. For purposes of comparison, the major study characteristics are displayed in two tables, whereas other components of the studies are described in the text.

To determine current practice of primary care physicians concerning antihypertensive medication withdrawal, we surveyed 1000 (random sam-

ple of 1752) members of the New York State Academy of Family Physicians by mail. In addition to demographic data and practice characteristics, the primary question was, "Do you sometimes attempt to discontinue antihypertensive medications in a hypertensive patient whose blood pressure is well controlled and who is without symptoms from the medication?" Physicians who answered that question affirmatively were asked in how many patients they attempted to stop medications during the last 6 months. Data were analyzed using a chi-square method.

Antihypertensive Medication Withdrawal Trials

As early as 1962, Page and Dustan¹⁵ reported successful withdrawal of treatment in hypertensive patients, but there have been surprisingly few additional trials of discontinuation of antihypertensive medication. In their study of 27 severely hypertensive patients, blood pressure reverted to pretreatment levels in 4 patients, and in an additional 14 there were modest increases in diastolic blood pressure that did not exceed 20 mmHg. Nine patients (33 percent) maintained either normal or near normal blood pressure for 6 months to 5 years after treatment was withdrawn.¹⁵ Fernandez and colleagues¹⁶ reported considerably more success in 24 patients initially treated for 48 weeks and subsequently observed for an additional 48 weeks. Eighteen (75 percent) remained normotensive (145/90 mmHg or lower) during the follow-up period.

Equally positive results have been reported by Maland et al¹⁷ in a study in which only 26 percent of patients receiving placebo had a return of hypertension. These patients had mild hypertension, were taking only diuretics, and were free of cardiovascular disease. In a group of 66 patients followed by Alderman and colleagues¹⁸ for 1 to 2 years after withdrawal of antihypertensive medication, 69.8 percent remained normotensive after 1 year and 54.5 percent remained normotensive after 2 years. This study took place in the workplace, and some patients were treated by private physicians. Among the 19 patients in whom medication was restarted, 11 were treated by non-program physicians who were not using the treatment protocol.

Additional studies indicate that good results can be expected. In a 1-year study of 103 hypertensive patients, 37 percent remained normoten-

sive for 12 months after withdrawal of medication. Patients with cardiovascular or other severe chronic diseases or target organ damage were excluded. Most were taking only a single antihypertensive medication. A lower standing diastolic blood pressure while taking medication and a longer duration of normotension on drugs were predictive of successful medication withdrawal.¹⁹

Finnerty²⁰ suggested step-down treatment of mild systemic hypertension. Using chlorthalidone, he noted that a dose of 25 mg/d was as effective as 50 mg/d in all patients. When the dose was reduced to 12.5 mg/d, the diastolic blood pressure increased in 8 of the 67 patients. He was able to completely discontinue therapy (diastolic blood pressure 85 mmHg or lower) in 36 patients, comprising 54 percent of the entire group.

At the conclusion of the Medical Research Council study of mild hypertension,²¹ 1418 patients who had been treated with a diuretic, propranolol, or placebo were assigned to either continuation of medication or withdrawal. Of the 242 patients observed for 2 years, 44 percent of men and 54 percent of women who had diuretics withdrawn and 47 percent of men and 27 percent of women who had propranolol withdrawn had diastolic blood pressures below 90 mmHg. From 39 to 50 percent of patients in the groups that continued or had placebo withdrawn had normal diastolic blood pressure at 2 years. Treatment was restarted if blood pressures "rose to ethically unacceptable levels."

Some trials have been less successful. In the US Public Health Service Cooperative Study of Hypertension,²² 25 of 69 (36 percent) patients whose hypertension had been controlled for an average of 2 years remained normotensive without medication for at least 5 months. Of this group a gradual rise in diastolic blood pressure required reinstitution of therapy in 9 patients from 5 to 24 months later. The Veteran's Administration Cooperative Study Group on Antihypertensive Agents²³ reported a double-blind placebo-controlled trial in which 60 patients were randomized to placebo. In 42 of these patients, treatment was restarted because of increasing blood pressures (with diastolic blood pressure measurements ranging from greater than 129 mmHg at 1 visit to greater than 94 mmHg at 5 visits). Only 9 patients (15 percent) remained normotensive on placebo for the entire 1.5 years of observation.

Levinson and colleagues²⁴ reported discontinuation of antihypertensive therapy in 24 patients who had been controlled with diuretics alone. Eleven patients (46 percent) maintained normal diastolic blood pressures (90 mmHg or lower) for 9 months and 5 (21 percent) were able to do so for 12 months after stopping treatment. Placebo was discontinued if diastolic blood pressure exceeded 114 mmHg at any visit, exceeded 94 mmHg at any 3 visits, or averaged greater than 90 mmHg for 6 months. Fagerberg et al²⁵ had little success in a sample of 32 men aged 56 years in which treatment was withdrawn for between 1 day and 3 years; medication was restarted in the entire group. Boyle and colleagues²⁶ withdrew thiazide diuretics successfully in only 2 of 20 hypertensive patients. In summary, we were able to locate only 12 antihypertensive medication withdrawal trials in young to middle-aged persons. Data from these studies are displayed in Table 1.

Comparison of Treatment Trials

We combined data from the 12 studies¹⁵⁻²⁶ in Table 1 to estimate success rates. With a 1-year follow-up of 765 patients, successful withdrawal was achieved in 308, or 40.3 percent. The rate of success at 2 years decreased to 27.7 percent. All trials show decreasing success rates with time. The most common predictor of success was lower pretreatment blood pressure.^{17,22,23} Other factors reported to be associated with successful withdrawal are female sex,²¹ lower standing diastolic blood pressures while on treatment,^{19,23} absence of a family history of hypertension,¹⁶ ease of control of hypertension with medications,¹⁶ and both longer and shorter duration of drug therapy.^{19,24} These findings are detailed in Table 1. The combined data calculations for successful withdrawal of antihypertensive medications are estimates, however, and should be viewed with caution. Only 4 of the 12 sites used placebo. Heterogeneity between trials in criteria for patient enrollment, length of follow-up, and postwithdrawal blood pressure levels indicative of success causes major problems for comparisons.²⁷ Other problems are the relatively few patients in each trial and unavailable blood pressure readings at the same follow-up periods. Using these data to generalize to other patient populations is therefore unwarranted.

Table 1. Antihypertensive Medication Withdrawal Trials.

| Author | Age of Group (y) | Number of Patients | Follow-up Success Rate (%) (Duration) | Predictors of Success | Blood Pressure (mmHg) Requiring Medication Restart |
|--|------------------|--------------------|---------------------------------------|---|---|
| Page and Dustan ¹⁵ | Not reported | 27 | 33 (5 mo-5 y) | None found | Not reported |
| Fernandez et al ¹⁶ | 27-65 | 24 | 75 (> 48 wk) | No family history of hypertension Ease of control with drugs | 140/95 |
| Maland et al ^{17*} | 30-70+ | 31 | 74 (1 y) | Lower pretreatment BP | 1 DBP \geq 105, average of 2 DBP 96-104, average of 5 DBP \geq 90, average DBP > 90 after 24 wk |
| Alderman et al ¹⁸ | 55.7 \pm 8.3 | 66 | 69.8-54.5 (1-2 y) | None found | 2 BP values \geq 160/95, age < 65 y 2 BP values \geq 165/90, age \geq 65 y Any SBP \geq 200, any DBP \geq 100 |
| Mitchell et al ¹⁹ | 30-70 | 103 | 37 (1 y) | Longer duration of normal BP on drug treatment Lower standing diastolic BP on drug treatment | DBP persistently > 90 |
| Finnerty ²⁰ | 31-63 | 67 | 54 (57 mo) | Not reported | DBP > 85 |
| Medical Research Council ^{21*} | 35-64 | 242 | 27-54 (2 y) | Older age Female sex | Specific BP levels not stated |
| Thurm and Smith ²² | 20-65 | 69 | 36-23 (5-24 mo) | Lower pretreatment BP | Increased DBP |
| Veterans Administration Cooperative Group ^{23*} | 42% \geq 49 | 60 | 15 (18 mo) | Lower pretreatment BP Older age | Average DBP > 94 in 5 visits or > 129 in 1 visit |
| Levinson et al ^{24*} | Not reported | 24 | 46-21 (6 mo-1 y) | Lower DBP during drug treatment Younger age Shorter duration of drug treatment | DBP > 94-114 in 1-3 visits Average DBP > 90 |
| Fagerberg et al ²⁵ | 56 | 32 | 0 (1000 d) | Not reported | 170/105 Symptoms |
| Boyle et al ²⁶ | 51 | 20 | 10 (132 wk) | Not reported | DBP > 100 |

*Placebo substitute used.

BP - blood pressure, DBP - diastolic blood pressure, SBP - systolic blood pressure.

Antihypertensive Withdrawal in the Elderly

There are several compelling reasons to consider discontinuing antihypertensive drug therapy in elderly patients. Older patients are more sensitive to volume depletion and sympathetic inhibition than are younger patients. Because comorbid conditions and concurrent medications also are more frequent in the aged, risks of adverse drug interactions and side effects are increased.

We found 6 studies limited to patients aged 60 years and older. Hansen with others²⁸ reported that for 105 elderly hypertensive patients in which medications were withdrawn, blood pressures rose to unacceptable levels soon after withdrawal in 51, but 43 (41 percent) remained nor-

motensive for 11 months. Drug treatment was simplified for patients restarting medications. Before withdrawal 14 were taking 2 or more medications compared with 2 patients after restarting medications. Lernfelt et al²⁹ observed 25 hypertensive patients aged 70 years and older, with no evidence of cardiovascular disease, for 2 years after withdrawal of medication. Although blood pressure levels increased in 14 patients who completed the study, there were no changes in left ventricular morphology or diastolic function. In this group, however, there was a statistically significant decrease in left ventricular fractional shortening, but there were no signs of congestive heart failure. The blood pressure level used to in-

dicating failure of antihypertensive medication withdrawal was quite high at 200/105 mmHg or higher. In a group of general-practice patients, Straand and colleagues³⁰ reported successful withdrawal of diuretic therapy in 18 of 33 (55 percent) patients observed for 6 months. Diuretics were resumed if blood pressure levels rose above 230/120 mmHg or if there was an increase in two or more of the symptoms of anginal pain, dyspnea, orthopnea, or peripheral edema.

One of the largest studies is a 5-year follow-up of 333 elderly hypertensive patients aged 74 years and older in which withdrawal of treatment was successful during the first year in 40 percent and for the full 5 years in 20 percent of patients. During the period of no treatment the patients had a lower total mortality risk than that of the general Swedish population matched for age and sex and a lower risk of cardiovascular events than those who continued to be treated. Factors associated with successful withdrawal were single-drug therapy in low dosage and relatively low blood pressure before withdrawal.³¹

Nadal and colleagues³² report successful discontinuation of antihypertensive medication in 14 of 86 (16 percent) elderly patients during a 3-year period. Finally, Fotherby and Potter³³ were able to discontinue antihypertensive medication for 12 months in 25 percent of ambulatory patients aged 65 to 84 years and for 24 months in 20 percent. Predictors of successful stopping of medication were lower body mass index, lower electrocardiographic voltage ($rV_1 + sV_6$), and lower systolic blood pressures while on treatment.³³ The results of studies in the elderly are summarized in Table 2. Combined data from these trials give an average success rate of 26.2 percent for patients observed for 2 or more years.

The caveats that were stated for studies in younger persons apply to studies in the elderly as well. In addition, in none of the studies with elderly patients was a placebo substituted for the withdrawn medications, and blood pressure levels required to restart medications in 3 studies exceeded 180/105 mmHg.

Withdrawal Combined With Diet

That nutritional therapy can augment the effect of medication in hypertension³⁴ suggests using diet when attempting to withdraw antihypertensive medications. Langford and colleagues³⁵ studied

496 patients, randomized into control and discontinued-medication groups, with and without dietary intervention. At 56 weeks, 35.3 to 44.9 percent in the group no longer receiving medication remained normotensive. The addition of weight loss or sodium restriction increased from 44.9 to 59.5 percent the likelihood of remaining normotensive. The study by Stamler and colleagues cited above¹³ also showed that the combination of reduction of body weight and excess salt and alcohol consumption with drug therapy withdrawal is more successful than discontinuing drugs alone. These studies provide evidence for the value of combining dietary advice with attempts to withdraw antihypertensive medications.

Mechanism of Normalizing Blood Pressure

The mechanism that maintains normal blood pressure after withdrawal of drug therapy is unknown. The most frequently cited explanation is resetting of the baroreceptors to a lower level,^{16,22,25,36} but there is little experimental evidence to support this hypothesis.³⁷ Alderman et al¹⁸ suggest a varying natural history of hypertension in some patients based on the observation that 78 percent of untreated participants in the control arm of the Australian National Trial of Antihypertensive Therapy,⁶ whose initial diastolic blood pressures exceeded 100 mmHg, had lower blood pressure readings 4 years later. Other suggested mechanisms are changes in total peripheral resistance³⁸ and structural vascular changes.³⁹

Benefits of Discontinuing Medication

There is ample documentation that antihypertensive medication can cause serious side effects.¹² Discontinuation of medication can reduce symptoms, as shown in a report on 11,710 hypertensive patients in whom antihypertensive medication was stopped for 2 weeks. Before starting treatment, patients had more headaches, dizziness, and chest pain than those on treatment. After withdrawal of medication, except for headache, which increased in frequency, there were major reductions in coldness of extremities, weakness, impotence, wheezing, flushing, chest pain, and cough.⁴⁰

Normalization of electrolytes and carbohydrate and lipid metabolism after withdrawal of antihypertensive medications, as well as disap-

Table 2. Antihypertensive Medication Withdrawal Trials in Elderly Patients.

| Author | Age of Group (y) | Number of Patients | Follow-up Success Rate (%) (Duration) | Predictors of Success | Blood Pressure (mmHg) Requiring Medication Restart |
|-----------------------------------|------------------|--------------------|---------------------------------------|--|--|
| Hansen et al ²⁸ | 60+ | 105 | 41 (11 mo) | Not reported | BP \geq 160/90 |
| Lernfelt et al ²⁹ | 70 | 25 | 56-32 (2-4 y) | Low pretreatment BP Long duration of treatment Absence of LVH or obesity Female sex | SBP \geq 200 DBP \geq 105 |
| Straand et al ³⁰ | 75-95 | 33 | 55 (6 mo) | Younger age Absence of dizziness | BP \geq 230/120 Increases in 2 or more symptoms (dyspnea, angina, orthopnea, edema) |
| Ekbom et al ³¹ | 70-84 | 333 | 40-20 (1-5 y) | Monotherapy in low doses Lower BP during treatment | Average of 3 BP SBP \geq 180 DBP \geq 105 |
| Nadal et al ³² | 68-82 | 52 | 27 (3 y) | Male sex | DBP \geq 95 |
| Fotherby and Potter ³³ | 65-74 | 105 | 25-20 (1-2 y) | Lower BP during treatment Lower ECG voltage Lower BMI | On 2 consecutive visits SBP \geq 160 DBP \geq 90 |

BP - blood pressure, LVH - left ventricular hypertrophy, SBP - systolic blood pressure, DBP - diastolic blood pressure, ECG - electrocardiogram, BMI - body mass index.

pearance of impotence, dizziness, Raynaud phenomena, dyspnea, rash, lethargy, nausea, and headaches, have been reported.^{41,42} Recent reports of increased risk of myocardial infarction associated with calcium channel blockers suggest re-evaluation of therapy in hypertensive patients taking these medications.^{43,44} Alderman and Lamport⁴⁵ estimate that withdrawal of medication from 25 percent of hypertensive patients would result in an annual saving of \$1 billion. Although substantial savings in drug costs might be achieved, there could be cost increases from blood pressure monitoring while medication dosages are reduced in the process of withdrawal. Alderman et al¹⁸ suggest that "as many as 5 million Americans currently taking antihypertensive drugs could have therapy interrupted for at least one year and thus avoid both the hazards and costs of drug therapy."

Accuracy of Diagnosis

The issue of white coat hypertension has been addressed by Pickering et al.⁴⁶ In their study of 292 patients, 21 percent of untreated patients whose clinic diastolic blood pressure readings were con-

sistently above 90 mmHg had normal ambulatory pressure levels. Hoegholm et al⁴⁷ found remarkably similar findings; of 159 patients who had a diagnosis of hypertension, 24.8 percent were normotensive as determined by 24-hour ambulatory monitoring. These studies suggest that blood pressure readings obtained at office visits might not always be reliable, especially because ambulatory blood pressure readings correlate better with cardiac size and function than office blood pressure determinations.⁴⁸ Additional potential sources of incorrect diagnoses of hypertension are physicians who fail to obtain the requisite number of blood pressure readings and use incorrect techniques to measure blood pressure before instituting treatment. These data and others^{49,50} indicate that many patients with a diagnosis of hypertension could be normotensive.

The issue of using automated ambulatory blood pressure or self-measured blood pressure devices to confirm the diagnosis of hypertension in patients with mild elevations, however, is somewhat controversial, as evidenced by two recent reports that appeared in the same issue of the *Annals of Internal Medicine*. Appel and Stason⁵¹

concluded that "limited clinical applications of ambulatory blood pressure monitoring and blood pressure self-measurement in the diagnosis and management of hypertension appear to be warranted." Somewhat contrasting is a position paper from the American College of Physicians⁵² that concludes, "the available evidence does not warrant widespread dissemination or routine use of automated ambulatory blood pressure measurement at this time."

Hazards of Drug Withdrawal

None of the studies quoted in this paper show adverse consequences from withdrawing antihypertensive medications. Because a substantial number of patients whose blood pressure was normalized following withdrawal of medications later revert to hypertensive levels, long-term or lifetime follow-up is required. There is some concern that withdrawal of medication will contribute to lack of follow-up care, but there is no evidence that such concern is valid.⁴⁵

Guidelines for Withdrawal of Medication

In a report of Framingham data, Dannenberg and Kannel⁵³ suggested that guidelines are needed for physicians who wish to attempt withdrawal of medication in hypertensive patients. They propose that for patients receiving multiple blood pressure medications, after normotension has been achieved for 6 to 12 months, all but one medication can be gradually withdrawn. Patients on a single medication who are normotensive for 6 to 12 months should have that medication withdrawn if pretreatment blood pressures were only mildly elevated or if notable improvement in risk factor reduction (decreases in body weight and sodium consumption and increases in exercise) has occurred since starting medication. Patients withdrawn from medication should be monitored every 3 to 6 months for life and encouraged to reduce risks from overweight, excess sodium ingestion, and lack of exercise. The authors further suggest that these guidelines be tested in controlled clinical trials and be reviewed by the Joint National Committee. Unfortunately, there is little evidence of large-scale controlled clinical trials to test those guideline recommendations, and the fifth annual report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure contained few specific directions to guide

withdrawal of antihypertensive medications.¹²

There are patients in whom withdrawal of antihypertensive medications is clearly unwarranted. These patients are those who have congestive heart failure or renal insufficiency and those for whom the medication serves purposes other than blood pressure reduction, such as control of angina pectoris.

Current Practice

We surveyed 1000 New York State family physicians to determine whether family physicians attempt antihypertensive medication withdrawal in patients whose blood pressure is well controlled and who are not experiencing problems from the medications. Sixty-three questionnaires were returned because of incorrect addresses. After three mailings there were 535 responses (57 percent). Most responders were male (76.0 percent), aged 31 to 50 years (76.8 percent), and board certified (92.9 percent), and 64.9 percent taught medical students or residents. Among responders, 79.1 percent reported that they sometimes stopped antihypertensive therapy in patients whose blood pressure was well controlled and who were free of symptoms from the medication(s); on average 5.6 patients had their medications discontinued during the previous 6 months.

Although a response rate of 57 percent is not unusual for surveys of this kind, it is possible that few of the nonresponders attempted to withdraw antihypertensive medications. Even if true of all nonresponders, 45 percent of the total sample attempted medication withdrawal. Another limitation of the survey data concerns the accuracy of recall for the number of patients in whom medication was stopped during the preceding 6 months. Physician characteristics that predict stopping antihypertensive medications were being younger than 50 years ($P = 0.002$), having finished residency training after 1990 ($P = 0.008$), achieving board certification ($P < 0.001$), and teaching medical students ($P < 0.001$). These data indicate that a substantial percentage of family physicians in New York State attempt to discontinue antihypertensive medications in some of their patients.

Conclusions

The 50 to 60 million patients with hypertension in the United States benefit from large-scale

studies that show prevention of complications by pharmacologic and other therapies that lower blood pressure,¹⁻¹¹ and from the vigorous program of detection and management of hypertension promoted by the Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure.¹² Yet, as many as 25 percent of patients might have an incorrect diagnosis because of white coat hypertension and will benefit from discontinuing medications. For the additional many patients who have achieved normotension with medications for 6 months or longer, it might be possible to withdraw these medications.

Although many physicians attempt withdrawal of antihypertensive medications, there are few data to guide them in selection of appropriate patients and technique of withdrawal. The potential benefits for a patient in whom antihypertensive medication can be withdrawn, even partially or intermittently, are great. The hazards, if any, are minimal. Research is needed to answer the following questions:

1. In what proportion of patients can antihypertensive medications be permanently withdrawn?
2. Which factors predict successful withdrawal of antihypertensive medications?
3. What are the hazards, if any, of withdrawing antihypertensive medications?
4. What is the best technique for withdrawing antihypertensive medications?
5. How common is white coat hypertension?
6. Can blood pressures of patients be adequately monitored by self-measurement, and what is the role of ambulatory blood pressure measurements?

In a society faced with decreasing medical resources, an investment in research to answer these questions is likely to reap substantial rewards.

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