

TREATMENT OF DIFFICULT-TO-CONTROL BLOOD PRESSURE IN A MULTIDISCIPLINARY CLINIC AT A PUBLIC HOSPITAL

Laurent S. Tao MD,¹ Peter Hart MD,¹ Emma Edwards RN,¹ Arthur T. Evans MD MPH,² Eric Whitaker MD MPH,^{1,2} Pamela Smith MD¹

Cardiovascular morbidity and mortality in disadvantaged populations remains high. Few innovative strategies or services to treat chronic diseases have been critically analyzed in these patients. We evaluated our initial experiences with a newly established multidisciplinary clinic for the treatment of difficult-to-control hypertension and describe reasons for poor blood pressure control as well as treatment strategies. Patients with blood pressures greater than 140/90 despite concurrent treatment with three or more medications for at least three months were referred to our clinic. Data regarding socio-demographic characteristics, health beliefs and behaviors were collected. Two physicians jointly proposed an explanation for lack of blood pressure control. A multidisciplinary team of physicians, nurses, pharmacists, and nutritionists aggressively assessed and reinforced educational objectives tailored to individual needs. 58% of patients achieved target blood pressure at six months, but 22% were lost to follow-up. The most common reasons for previous treatment failure were volume overload and poor medication adherence. We conclude that a multidisciplinary clinic for difficult-to-control blood pressure can be successful in a large, urban hospital serving a disadvantaged minority population. However, more study is needed to delineate the specific reasons for success and further refine treatment strategies. (*J Natl Med Assoc.* 2003;95:263-269.)

Key Words: refractory hypertension ♦ ethnicity ♦ patient care team ♦ adherence

INTRODUCTION

The treatment of difficult-to-control hypertension in disadvantaged populations—poor, urban, or ethnically diverse—is a challenge

that few individual practitioners or institutions have successfully addressed. This is a public health issue of significant importance, as uncontrolled hypertension leads to increased health care expenditures as well as higher rates of morbidity and mortality¹⁻⁴. The high prevalence of poor blood pressure control in such populations is multifactorial. Even when barriers such as access to blood pressure screening, primary care, and medications have been overcome, significant numbers of patients have persistently elevated blood pressures despite the use of multiple medications and the best efforts

© 2003. ¹Division of General Medicine & Primary Care and ²Collaborative Research Unit Department of Medicine Cook County Hospital and Rush Medical College, Chicago, IL. Funding Source Department of Medicine, Cook County Hospital. Corresponding Author Laurent S. Tao, MD 1900 W. Polk St., 9th Floor, Chicago, IL 60612 (312) 633-7810

of their primary care physicians⁵⁻¹⁰. For this group of patients with difficult-to-control blood pressure, we organized a multidisciplinary clinic to examine the reasons for the problem and to devise strategies to successfully address them.

The management of hypertension, like most other chronic diseases, requires careful consideration of patients' understanding and attitudes regarding diet, personal habits, social supports, health beliefs, and a host of other factors¹¹⁻¹⁹. For approximately 27% of patients, primary care physicians are successful in teaching self-management skills and in controlling their hypertension²⁰. Nevertheless, failure to maintain target blood pressure is common^{3,20,21}, and up to 18% of hypertensive patients fulfill criteria for difficult-to-control hypertension⁹. For some homogenous populations who are well educated and highly motivated, a more intense, multifaceted, multidisciplinary approach has been shown to be effective²². However, it is uncertain whether such a model would be equally successful in a very different setting—a public health care system serving an urban, poor, predominantly African American population.

In this report, we evaluate our initial experiences with a newly established difficult-to-control blood pressure clinic in an urban, public hospital and describe the reasons for patients' poorly controlled blood pressure, our treatment strategies, and our successes and failures.

METHODS

A multidisciplinary hypertension clinic was established in the summer of 2000 to treat patients with difficult-to-control hypertension within the Cook County ambulatory health care network. The team of providers included three general internists, a nurse health educator, pharmacist, and dietician. Eligible patients with difficult-to-control hypertension were defined as having blood pressure persistently greater than 140 mm Hg systolic or 90 mm Hg diastolic despite concurrent treatment with three or more anti-hypertensive medications for at least three months. A classification of resistant hypertension usually necessitates use

of a diuretic; two of our patients did not use a diuretic due to intolerable side effects, but met other criteria for the definition and were included in the study.

Setting

The Cook County ambulatory health care network serves over 800,000 patients in Chicago and the surrounding communities, offering free health care and medications to those without health insurance or who are unable to afford medical care. Thus, the network serves an ethnically diverse (70% African American, 20% Hispanic/Latino, 10% other) disadvantaged population.

Data Collection

Using standardized data collection instruments, we collected data on socio-demographic characteristics, health beliefs and attitudes, and health behaviors. Items were designed to accrue information on topics previously found by other studies to be most relevant to our population, including knowledge of target blood pressure and the current medication regimen, exercise, diet, and use of herbal or nontraditional medicine. We also recorded the results of a detailed clinical history and physical examination. At the conclusion of the initial evaluation, the clinic physician suggested the most likely explanation for the poorly controlled blood pressure in order to guide the treatment plan for that patient. A second physician then independently reviewed the records, and if there was disagreement about the most likely causal factor, a consensus diagnosis was reached after jointly reviewing the data and further discussion. Potential causal factors included nonadherence, volume overload, drug interactions, white-coat hypertension, obesity, suboptimal dosing, and diet. Volume overload was determined clinically in patients with evidence of excess sodium intake, progressive renal disease, or fluid retention. Blood pressure was measured at each visit according to a standard protocol—twice in both arms with an appropriately sized cuff after the patient had

Table 1. Patient characteristics (n = 50)

Characteristic	
Age years, mean \pm SD (range)	63 \pm 11 (27-79)
Women n (%)	33 (66)
Ethnicity n (%)	
African American	47 (94)
Hispanic/Latino	3 (6)
Baseline blood pressure mm Hg, mean \pm SD (range)	
Systolic blood pressure	177 \pm 23 (145-240)
Diastolic blood pressure	93 \pm 15 (60-138)
Duration of hypertension years, mean \pm SD (range)	18 \pm 13 (1-57)
Number of antihypertensive medications n (%)	
3	9 (18)
4	25 (50)
5 or more	16 (32)
Class of antihypertensive medication n (%)	
Diuretic	48 (96)
Calcium-channel blocker	39 (78)
Alpha-blocker	34 (68)
Angiotensin-converting-enzyme inhibitor	33 (66)
Beta-blocker	30 (60)
Vasodilator	20 (40)
Comorbidity n (%)	
Diabetes mellitus	25 (50)
Hypercholesterolemia	25 (50)
Left ventricular hypertrophy	17 (34)
Chronic renal insufficiency	15 (30)
Congestive heart failure	11 (22)
Cerebrovascular accident	6 (12)
Documented coronary artery disease	3 (6)

rested in a sitting position for five minutes. The average of two readings for the arm with the higher blood pressure was used as the final clinic blood pressure.

Evaluation and Treatment Strategies

An evaluation for secondary causes of hypertension was initiated for all patients with risk factors or a suggestive history or physical examination. Thirty-four (68%) patients were evaluated for secondary hypertension. Standardized protocols for each presumed diagnosis were followed according to the accessibility and quality of various diagnostic tests in our hospi-

tal. For example, an abdominal MRI and/or captopril renogram was the test of choice for diagnosis of renal artery stenosis, depending on the individual characteristics of the patient. An individualized treatment plan addressed behavior modification, self-management skills, and medical therapy.

Medication decisions were guided by the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VI)³. Unless contraindicated, all patients received a beta-blocker and a diuretic. Patients with a history of heart failure or diabetes routinely received angiotensin-converting-enzyme inhibitors. To simplify therapy, treatment protocols emphasized once-daily dosing and the least number of medications; thus, doses were maximized before additional medications were added to the regimen. A minority of patients received home blood pressure monitors based on supply, the patient's ability to perform measurements accurately, and the need to exclude white-coat hypertension.

All patients also received one-on-one education with a nurse health educator, pharmacist, and nutritionist about hypertension, exercise, weight loss, nutrition, and techniques to improve adherence to medications. Using a standard curriculum, educational topics were tailored to individual needs.

Follow-up visits were scheduled every 2 weeks for the first month and then monthly until the blood pressure was successfully controlled. At each visit, patients were encouraged to bring their medication bottles so that adherence to the prescribed medication regimen could be monitored. Both the physician and nurse reinforced the need for medication adherence, assessed patient understanding of proper dosing, and explained possible side effects. In addition, educational objectives were reevaluated and aggressively pursued through review of videotapes, written materials, and one-on-one counseling.

The endpoint for clinic participation was maintaining a target blood pressure of less than

Table 2. Primary cause of difficult-to-control hypertension

Cause	Number Controlled	Number Improved	Number Unimproved n (%)	Number Lost to Follow-up	Total
Nonadherence	12 (60)	3 (15)	2 (10)	3 (15)	20 (40)
Volume Overload	5 (33)	1 (7)	2 (13)	7 (47)	15 (30)
Drug Interactions*	5 (100)	0	0	0	5 (10)
Obesity	2 (67)	0	0	1 (33)	3 (6)
White-Coat Hypertension	1 (50)	0	1 (50)	0	2 (4)
Suboptimal Dosing	2 (100)	0	0	0	2 (4)
Undetermined	2 (100)	0	0	0	2 (4)
Diet	0	0	1 (100)	0	1 (2)
Total	29 (58)	4 (8)	6 (12)	11 (22)	50 (100)

*Drug interactions all involved non-steroidal anti-inflammatory agents.

140/90 (130/85 for patients with diabetes mellitus) for two consecutive clinic visits. When this goal was achieved, the patient was discharged back to the primary care provider for ongoing care.

When patients were discharged from the clinic and referred back to their primary care physician, we repeated the initial survey to assess change in knowledge and attitudes about hypertension and its management. Patients also rated the perceived effectiveness of ten different aspects of the clinic and identified the interventions they considered most useful in achieving blood pressure control.

RESULTS

The characteristics of the first fifty patients enrolled in the clinic are described in Table 1. The typical patient was a 60-year-old diabetic African-American woman with a history of hypertension for 18 years taking 4 different anti-hypertensive medications, including a diuretic, calcium-channel blocker, alpha-blocker, and ACE-inhibitor. Of the fifty patients, 33 (66%) were female and 25 (50%) were diabetic.

The most common reasons for poor blood pressure control were volume overload and poor medication adherence (Table 2). None of the patients had secondary hypertension.

Initial and final systolic and diastolic blood

pressures for each patient are shown in Figures 1 and 2. After six months of follow-up, 29 (58%) of the 50 patients had achieved and maintained their target blood pressure and were referred back to their primary physician. The mean duration of time to maintenance of target blood pressure was 3.8 months. Four (8%) patients had improved blood pressure control but had not maintained target levels over two consecutive visits. Six (12%) had not improved, and 11 (22%) were lost to follow-up. The medical interventions are described in Table 3.

When interviewed at 6-months follow-up, over 75% of patients endorsed the following five interventions as being helpful in achieving better blood pressure control: physicians who specialized in the treatment of hypertension, medication changes, education about hypertension, nutrition, and exercise. Of these, there was no agreement on the single most important factor.

DISCUSSION

We demonstrated that a multidisciplinary clinic for difficult-to-control blood pressure can be successful in a public health setting serving a disadvantaged minority population. Our success rate over 6 months of 58% compares favorably to the success rate (64%) in a private

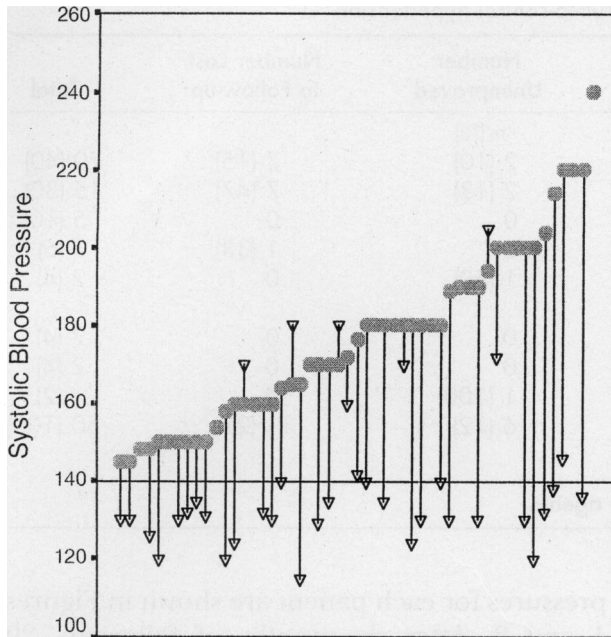


Figure 1. Initial and final systolic blood pressures for each patient enrolled in the clinic. The circles represent initial systolic blood pressures, and the arrows represent final systolic blood pressures. The horizontal line at 140 mm Hg depicts the target systolic blood pressure for patients without diabetes mellitus. Those with diabetes mellitus had a target systolic blood pressure of 130. Of note, three patients had initial readings at target, though review of medical records revealed uncontrolled blood pressures at previous clinic visits.

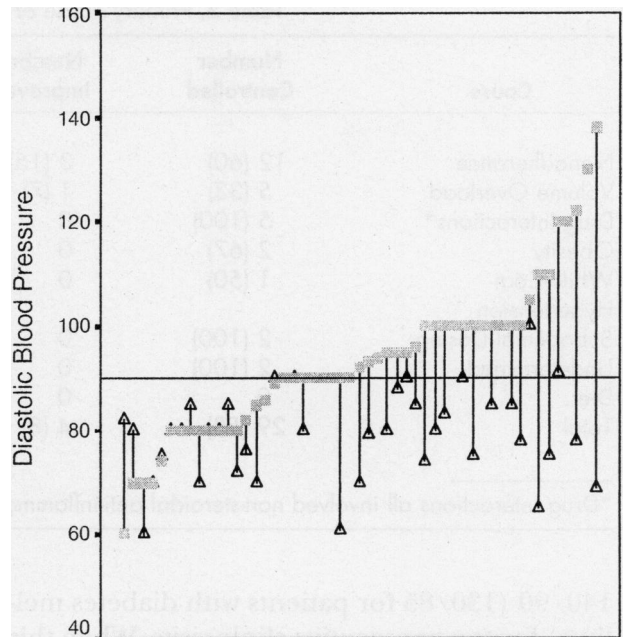


Figure 2. Initial and final diastolic blood pressures for each patient enrolled in the clinic. The circles represent initial diastolic blood pressures, and the arrows represent final diastolic blood pressures. The horizontal line at 90 mm Hg depicts the target diastolic blood pressure for patients without diabetes mellitus. Those with diabetes mellitus had a target diastolic blood pressure of 85.

setting that serves primarily well-educated, Caucasian patients²³. The fact that eleven subjects of fifty were lost to follow-up highlights why blood pressure can be so difficult to control in a population in which intense personal and socioeconomic pressures supersede health care priorities²⁴⁻²⁶. If these eleven subjects had been excluded, the success rate would have been 74%.

It is instructive to compare our success with the results of the African-American Study of Kidney Disease and Hypertension (AASK)²⁷; in African-American patients with hypertension and renal disease, the percentage of patients at target blood pressure increased from 20.0% to 78.9% over 14 months. Clearly, it is possible to meet national health goals even in extremely challenging patient populations.

Table 3. Medication changes in patients who achieved blood pressure control

Medication	Added	Increased	Decreased	Removed
Loop diuretic	5	6	0	1
Calcium-channel blocker	4	9	0	1
Alpha-blocker	4	7	0	5
Vasodilator	3	3	1	4
Thiazide diuretic	1	1	0	4
Angiotensin-converting enzyme inhibitor	1	6	0	0
Beta-blocker	1	3	0	4
Total	19	35	1	19

Previous studies found that nonadherence^{23,28-30} and volume overload²³ are the most common reasons for poor blood pressure control, and we confirmed these findings in a predominantly African-American, inner-city population. Although secondary hypertension has been reported among patients evaluated for difficult-to-control hypertension at a rate of 5

to 15 percent^{23,31}, we found no cases of secondary causes despite actively considering the diagnosis and performing tests in 68% of all patients referred to the clinic. Since our finding of no cases of secondary hypertension among 50 patients has a 95% confidence interval that includes a 7% underlying risk, it is possible that our population is not dissimilar from others described in the literature. It is uncertain whether our low rate of secondary hypertension is because primary care physicians had previously identified those patients and referred them to another subspecialty clinic or because African-Americans have lower rates of secondary hypertension. This controversy will be investigated further as we enroll more patients.

We were most successful at controlling the blood pressures of patients with consensus initial diagnoses of nonadherence (twelve of twenty patients) or drug interactions (five of five patients). An additional 30% of the patients with nonadherence showed improvement in blood pressure after six months but did not meet goal. Similar success has been reported in other studies of clinics that provide intensive education about medication and dietary adherence with frequent follow-up visits²².

The most successful medication intervention was better diuretic therapy—either by increasing the dose within a class or by switching from a thiazide to a loop diuretic (Table 3). Diuretics are frequently effective even when patients have no clinical evidence of volume expansion^{10,32,33}.

We believe that our clinic, when used as an adjunct to the care provided by the patient's primary care physician, was effective in controlling blood pressure. Moreover, this reorganization of existing resources, with little additional expense incurred for training or materials, seems to be a fairly low-cost option for improving rates of blood pressure control.

This study has several limitations. First, there is no concurrent control group and regression to the mean might explain improvement in blood pressure. However, since all patients

were referred from primary care providers who had tried and failed to control hypertension with at least three medications for at least three months, we are confident that all patients truly had poorly controlled blood pressure at entry. Furthermore, every patient's blood pressure was checked twice at each clinic visit using accurate and reproducible methods.

A second limitation is that we were unable to identify the specific interventions responsible for successfully lowering blood pressure, since several interventions were implemented simultaneously at each visit. Enrollment in the clinic and increased time and attention to a single medical problem may have been as important to the patients as modifying their medication regimens. Further research is necessary to discern which elements of the clinic are most effective and useful to the patients.

Finally, this evaluation involved a small number of patients and a short duration of follow-up. It will be important to follow more patients for a longer time to verify persistent blood pressure control after discharge from the clinic. Our initial evaluation, however, suggests a model for successfully treating difficult-to-control hypertension that might be generalizable to a variety of settings, even among culturally diverse and disadvantaged populations.

Since most patients had poorly controlled blood pressure for over 10 years, our 58% success rate was gratifying. But the reasons for success—after 10 years of effort by primary care physicians had failed—are still nebulous. All patients listed multiple factors as important contributors in achieving control, but no single factor was described as being the most important by a majority of the patients. This supports the development of a multifactorial causal model and the use of a multifaceted, multidisciplinary treatment approach. But these results suggest another intriguing possibility, that the *process* of the clinic experience may be as important as its content. In other words, the systematic exploration of the psychosocial determinants of health and disease and emphasis on the patient's own strategic role may be equally

as important as the educational programs and medication changes that we implement. By respectfully validating the complexity, difficulty, and uniqueness of each patient's life, this experience may have empowered patients to participate more fully in the treatment plan, which ultimately may be much more beneficial than merely "throwing another prescription at the problem."

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