

Hypertension Management in Patients With Diabetes

The need for more aggressive therapy

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OBJECTIVE — Clinical trials have demonstrated the importance of tight blood pressure control among patients with diabetes. However, little is known regarding the management of hypertension in patients with coexisting diabetes. To examine this issue, we addressed 1) whether hypertensive patients with coexisting diabetes are achieving lower levels of blood pressure than patients without diabetes, 2) whether there are differences in the intensity of antihypertensive medication therapy provided to patients with and without diabetes, and 3) whether diabetes management affects decisions to increase antihypertensive medication therapy.

RESEARCH DESIGN AND METHODS — We abstracted medical records to collect detailed information on 2 years of care provided for 800 male veterans with hypertension. We compared patients with and without diabetes on intensity of therapy and blood pressure control. Intensity of therapy was described using a previously validated measure that captures the likelihood of an increase in antihypertensive medications. We also determined whether increases in antihypertensive medications were less likely at those visits in which the diabetes medications were being adjusted.

RESULTS — Of the 274 hypertensive patients with diabetes, 73% had a blood pressure $\geq 140/90$ mmHg, compared with 66% in the 526 patients without diabetes ($P = 0.04$). Diabetic patients also received significantly ($P = 0.05$) less intensive antihypertensive medication therapy than patients without diabetes. Less intensive therapy in diabetic patients could not be explained by clinicians being distracted by the treatment for diabetes.

CONCLUSIONS — There is an urgent need to improve hypertension care and blood pressure control in patients with diabetes. Additional information is required to understand why clinicians are not more aggressive in managing blood pressure when patients also have diabetes.

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Clinical trials have convincingly demonstrated the importance of intensive treatment of hypertension among patients with diabetes. Among older hypertensive patients receiving placebo while enrolled in studies such as the Systolic Hypertension in the Elderly Program (SHEP) and the Systolic Hypertension in

Europe Study (Syst-Eur), those with coexisting diabetes had an approximate doubling in cardiovascular morbidity and mortality (1,2). The Hypertension Optimal Treatment (HOT) study and the U.K. Prospective Diabetes Studies (UKPDS) have shown the benefits of achieving tighter blood pressure control (3,4). For

example, in HOT, patients with diabetes randomized to a target diastolic blood pressure of 80 mmHg or less had a 50% reduction in major cardiovascular events compared with those with a target diastolic blood pressure of 90 or less. Moreover, the benefits of tight blood pressure control in patients with diabetes exceed the benefits of tight glycemic control and extend not only to the prevention of macrovascular disease, but also to the prevention of microvascular complications (4). The need for especially aggressive blood pressure control in patients with diabetes has been recognized in clinical practice guidelines. The American Diabetes Association has long advocated that “hypertension should be treated aggressively to achieve and maintain blood pressure in the normal range (5).” Since 1993, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure has recommended a target blood pressure of $<130/85$ mmHg in hypertensive patients with diabetes, as compared with $<140/90$ in patients without diabetes (6).

A considerable gap exists between guideline recommendations for hypertension treatment in the general population and achieved levels of blood pressure control (7–9). Most patients with hypertension have inadequate blood pressure control, and surveys indicate that many physicians would not intensify therapy despite persistently elevated blood pressures (10–12). In previous work, we demonstrated that clinician failure to increase antihypertensive medications despite elevated blood pressures contributes to poor blood pressure outcomes (13). However, less is known regarding the treatment of hypertension among patients with diabetes. Studies consistently demonstrate that most diabetic patients do not achieve recommended levels of blood pressure control, and in fact, as with patients without diabetes, the majority have a blood pressure of $>140/90$ mmHg (14–16). Despite recommendations for more aggressive hypertension therapy in the

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Abbreviations: HOT, Hypertension Optimal Treatment; VA, Department of Veterans Affairs.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

See accompanying editorial, p. 534.

presence of coexisting diabetes, it is unclear whether there are any differences in how clinicians manage blood pressure in hypertensive patients with and without diabetes.

To examine this issue, we have addressed the following three questions. First, are hypertensive patients with coexisting diabetes achieving lower levels of blood pressure than patients without diabetes? Second, are there differences in the intensity of antihypertensive medication therapy provided to patients with and without diabetes? Finally, does diabetes management affect decisions to increase antihypertensive medication therapy?

RESEARCH DESIGN AND METHODS

Study subjects and sites

The study sample and sites have been previously described (13). Briefly, we studied men with hypertension receiving regular medical care at five Department of Veterans Affairs (VA) sites in New England between 1990 and 1995. Eligible patients were initially identified through VA databases and had to meet three criteria. First, they had to have made at least one visit to a general medicine or medical subspecialty clinic during a 6-month period beginning 1 January 1990 (three sites) or 1 January 1993 (two sites). If a patient had more than one visit during this period, we randomly selected one as the "index" visit. Second, they had to have made an "outcome" visit 1.5–2.5 years after the index visit. This visit was randomly selected from among all general medical and medical subspecialty visits during this period. Third, the patients had to have made at least one visit between the index and outcome visits. As VA outpatient databases contained neither diagnoses nor provider-specific information, we reviewed the medical records of eligible patients to determine whether two additional criteria were met. First, both the index and outcome visit had to be with a physician. Second, hypertension had to be deemed an active problem during the year preceding the index visit. Hypertension was deemed active if it was listed as a problem in any note or if it had ever been diagnosed and the patient was receiving antihypertensive therapy. In creating our final sample, we oversampled patients with coexisting diabetes so that the prevalence of diabetes among hypertensive

patients in our sample is somewhat higher than among all hypertension patients. Presence of diabetes was based on a chart diagnosis of diabetes from before the index visit. As diabetes precludes military service, most diabetes patients in the VA system have type 2 diabetes.

Data collection

We collected data from all visits to general medicine clinics, medical subspecialty clinics, and unscheduled visits to the emergency room or walk-in clinic starting with the index visit and ending with the outcome visit. Study nurses reviewed medical records to obtain clinical information including dates of the visits, reasons for visits, physical examination findings, diagnoses, and test results. We recorded up to four blood pressure measurements per visit. Only one measurement was available, however, for 80.5% of the visits in which a blood pressure was recorded. When multiple measurements were available at a single visit, we used the average. Additional data on demographic characteristics and coexisting medical conditions were obtained from entries before the index visit.

Information on changes in antihypertensive and diabetes medications was abstracted from three sources: clinicians' progress notes, medical orders, or computerized pharmacy records. We considered an "increase" in antihypertensive medications to have occurred at a visit anytime a new medication was started or the dose of an existing medication was increased. Substitutions among medications in the same class, such as from one ACE inhibitor to another, were not considered as an increase because such changes often reflect formulary changes.

Analyses

In comparing the management of hypertension for diabetic versus nondiabetic patients, we considered both an outcome and a process measure. Our outcome measure was the level of blood pressure control for each patient at the time of the outcome visit. If no blood pressure measurement was available for the outcome visit, we used the blood pressure closest in date to the outcome visit, provided it was within 90 days. We calculated the mean systolic and diastolic blood pressure for patients with and without diabetes and compared them using a *t* test. We also calculated the percentage of hyper-

tensive patients that would be considered poorly controlled using either a threshold $\geq 140/90$ or $\geq 160/90$ mmHg and compared diabetic and nondiabetic patients using a χ^2 test. Our process measure is based on our previous work (13) and described the intensity of antihypertensive medication therapy received by each patient between the index and outcome visit. It captured whether a patient received more "increases" in therapy than the norm, taking into account those characteristics at each visit associated with a greater likelihood of an increase. Scores are calculated as the observed number of increases minus the expected number of increases, divided by the number of visits and can range from -1 to $+1$. We classified a score of >0.05 as "more intensive" therapy than "average," and a score of <-0.05 as "less intensive" therapy. We examined whether patients with diabetes received more intensive therapy using a linear regression model with intensity of therapy as the dependent variable and presence of diabetes as the independent variable. We controlled for other patient characteristics possibly associated with intensity of therapy by including age, race, coronary artery disease, cerebrovascular disease, peripheral vascular disease, BMI, and renal insufficiency in the model.

In examining the effect of diabetes management on hypertension therapy, we considered only those patients with both diabetes and hypertension. We divided visits into two groups based on the presence or absence of a change in diabetes medications. We then compared the proportion of visits for each group with an increase in antihypertensive medications using a χ^2 test.

RESULTS

Our study sample consisted of 800 male veterans with hypertension; 274 (34%) had coexisting diabetes. Patients with diabetes were more likely to be of nonwhite race, have coronary artery disease, and a higher BMI but were otherwise similar to patients without diabetes (Table 1).

Outcome blood pressure determinations were available for 782 hypertensive patients. Patients with diabetes had worse blood pressure control than those without diabetes. The mean systolic blood pressure in diabetic patients was 148.4 mmHg compared with 143.8 in nondiabetic patients ($P = 0.002$). No differences were noted in the mean diastolic blood

Table 1—Baseline characteristics of hypertensive patients with and without diabetes

| | Diabetic | Nondiabetic | P |
|--|------------|-------------|--------|
| n | 274 | 526 | |
| Age (years) | 65.9 ± 8.3 | 65.3 ± 9.5 | 0.40 |
| Duration of hypertensive (years) | 12.9 ± 5.2 | 12.4 ± 5.4 | 0.28 |
| Nonwhite race (%) | 32 (11.7) | 35 (6.7) | 0.01 |
| Number of antihypertensive medications (%) | | | |
| 0 | 27 (9.8) | 41 (7.8) | 0.32 |
| 1 | 81 (29.6) | 183 (34.8) | |
| 2 | 85 (31.0) | 169 (32.1) | |
| ≥3 | 81 (29.6) | 133 (25.3) | |
| Selected coexisting conditions (%) | | | |
| Coronary artery disease | 117 (42.7) | 180 (34.2) | 0.02 |
| Cerebrovascular disease | 29 (10.6) | 58 (11.0) | 0.85 |
| Hyperlipidemia | 65 (23.7) | 140 (26.6) | 0.37 |
| BMI (kg/m ²) | 29.2 ± 4.8 | 27.8 ± 4.3 | <0.001 |
| n | 245 | 437 | |

Data are means ± SD and n (%).

pressures (83.0 vs. 82.3 mmHg, $P = 0.35$). A total of 73% of diabetic patients had a blood pressure $\geq 140/90$ mmHg, compared with 66% of nondiabetic patients ($P = 0.04$). Among patients with a blood pressure above this threshold, most had either elevated systolic blood pressure (57%) or elevated systolic and diastolic blood pressures (38%); only 5% had an isolated elevation in diastolic blood pressure. There was no difference between diabetic and nondiabetic patients in the pattern of blood pressure elevation ($P = 0.55$). The proportions of patients with blood pressure $\geq 160/90$ mmHg were similar for patients with and without diabetes (42 vs. 38%, $P = 0.26$).

Hypertensive patients with diabetes received less intensive antihypertensive medication therapy than patients without diabetes. Mean intensity scores were -0.02 for diabetic patients vs. 0.0 for those without diabetes ($P = 0.05$). Diabetic patients were more often in the group receiving less intensive therapy and less often in the group with more intensive therapy (Table 2, Fig. 1). The presence of diabetes remained significantly associated with less intensive hypertension therapy in regression models adjusting for other baseline patient characteristics (Table 2).

The 274 patients with both hypertension and diabetes had 2,052 medical clinic visits over the study period. Increases in antihypertensive medications occurred in 13.5% of the 156 visits where diabetes medications were changed and

in 9.9% of the 1,896 visits in which there were no changes in diabetes medications ($P = 0.20$).

CONCLUSIONS

The importance of aggressive treatment of hypertension in the setting of diabetes is well recognized (17). Hypertension patients with diabetes are at considerably greater risk for cardiovascular events. Consequently, lowering of blood pressure will prevent more cardiovascular events than similar reductions in nondiabetic patients (1,2). Yet, studies suggest that many diabetic patients do not achieve adequate blood pressure control. For example, in

Table 2—Results of regression model evaluating association of diabetes with intensity of therapy, adjusting for other patient characteristics

| Patient characteristic | Coefficient* | P |
|-----------------------------|--------------|--------|
| Diabetes | -0.0180 | 0.04 |
| Nonwhite race | -0.0201 | 0.18 |
| Age | -0.0005 | 0.25 |
| Coronary artery disease | -0.0149 | 0.08 |
| Cerebrovascular disease | 0.0192 | 0.14 |
| Peripheral vascular disease | 0.0399 | <0.001 |
| Renal insufficiency | -0.0232 | 0.10 |
| BMI (kg/m ²)† | 0.0006 | 0.57 |

*A negative coefficient indicates less intensive therapy; †mean values were assigned to the 118 patients with missing BMI; results were essentially unchanged if these patients were dropped from the regression model.

the Third National Health and Nutrition Examination Survey (NHANES-III), 31% of all diabetic patients and nearly 60% of those with previously diagnosed hypertension had a blood pressure $>140/90$ mmHg (15,18). Among elderly diabetic patients seen in an academic medical center, 85% had a blood pressure $\geq 130/85$ (16). We have now performed a comprehensive comparison of hypertension management between patients with and without diabetes. Our results highlight three important findings.

First, diabetic patients with hypertension are not being adequately controlled. Only 27% had a blood pressure $<140/90$ mmHg, and fewer had achieved recommendations for a blood pressure $<130/85$. Furthermore, blood pressure control, especially systolic, was worse in diabetic patients than in those without diabetes. The importance of controlling systolic blood pressure, particularly in older patients, has been emphasized in a recent clinical advisory statement by the Coordinating Committee of the National High Blood Pressure Education Program (19). The difficulty of achieving systolic blood pressure control, however, among hypertensive patients is also being increasingly recognized (11). While inadequate control of blood pressure is a national concern (20), it is particularly problematic among patients with diabetes.

Second, not only was blood pressure control worse, but hypertension was being managed less intensively in patients with diabetes. At individual visits, diabetic patients were less likely to have an increase in therapy. This effect persisted even after adjusting for other factors that could influence the intensity of therapy, including age, race, and coexisting conditions. This suggests that poor blood pressure control in patients with diabetes may not be due to physiological factors but rather reflects differences in management.

Finally, our results begin to explore why diabetic patients may be receiving less intensive hypertension therapy. We hypothesized that clinicians may be busy managing diabetes and consequently would not be willing or able to increase the antihypertensive medications. However, this was not the case. Increases in antihypertensive medications were no more likely to occur at those visits in which hypoglycemic medications were not changed as in those visits with a change in the diabetes medications. The

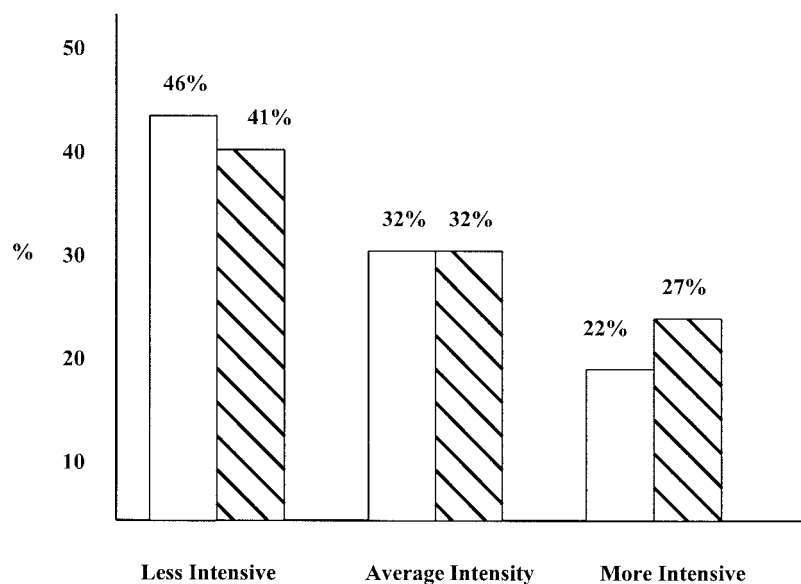


Figure 1—Intensity of hypertension therapy: percentage of diabetic (□) and nondiabetic (▨) patients receiving more or less intensive hypertension therapy than the norm.

fact that increases in blood pressure medications were more common (albeit not significantly different) at visits with a change in diabetes medications may suggest that those clinicians who are aggressive in managing diabetes are also aggressive in managing hypertension. Further work is required to understand why clinicians are less aggressive in managing hypertension in patients with coexisting diabetes.

We can only speculate as to why clinicians were not more aggressive in their management of hypertension. They may have been unfamiliar with published guidelines or disagreed with their content, particularly on the need to treat mild elevations of systolic blood pressure. However, undertreatment of chronic medical conditions such as hypertension and diabetes appears to be common, even when clinicians agree with guideline recommendations. Recently, Phillips et al. (21) proposed the term “clinical inertia” to describe this phenomenon. They ascribed it to three main factors: clinician overestimation of the intensity of care they provided, clinician lack of training and the absence of organizational supports necessary in order to treat to target, and the use of “soft” reasons to justify not intensifying therapy.

In measuring treatment intensity, we used a previously validated measure that describes whether a patient received more increases in antihypertensive medications than would be expected based on their clinical presentation (13). It captures the likelihood that a new antihypertensive

medication will be started or the dosage of an existing medication increased when confronted with an elevated blood pressure. This study also highlights how our measure of treatment intensity may be used to understand hypertension care in important subgroups of patients. Future studies could examine care in groups other than those with diabetes, including the elderly, ethnic minorities, or in patients with renal disease.

Patients with diabetes were significantly more obese than patients without diabetes. Hypertension may be especially difficult to control in obese patients, particularly if they have obstructive sleep apnea (22). Additionally, blood pressure in obese patients could be falsely elevated through the use of a sphygmomanometer cuff that is too small. While this could possibly explain why diabetic patients had higher blood pressures, it cannot explain why clinicians were less likely to act on these elevated readings.

A limitation of this study is that we used data from 1990 to 1995. While the need for tighter blood pressure control among patients with multiple cardiovascular risk factors was recognized during this period and expert panels were suggesting that blood pressures <140/90 might be appropriate (23,24), it may not have been widely disseminated among primary care clinicians. Guidelines published by the Joint National Committee did not recommend a tighter level of control until 1993 (6). The results today may be different from those in our study pe-

riod. However, others have suggested that there have not been any major changes in physicians’ hypertension practices over the past 10 years (11). In a study with more recent data that evaluated elderly patients seen between 1996 and 1998, the mean systolic blood pressure among all diabetic patients, not just those identified as hypertensive, was >145 mmHg (16).

Our study was performed in a sample of male mostly elderly veterans with good access to medical care and medications. Patients mostly had type 2 diabetes. Our results may not be generalizable to other patient populations and settings. This too requires further study.

Improving hypertension care is a national concern (20) and is central to the National Diabetes Education Program’s current effort to enhance cardiovascular outcomes. Their ABC educational campaign is stressing control of HbA_{1c} (A), blood pressure (B), and cholesterol (C) (25). Our results are consistent with this effort in emphasizing an especially great need for improved care for hypertensive patients with diabetes. Yet, effective methods for improving clinicians’ practices are poorly defined (26), particularly in the area of hypertension management. Given the special issues in managing hypertension among patients with diabetes, interventions specific to this group of patients likely will need to be developed. We advocate urgent attention to the development of such interventions so as to minimize complications among a group of

patients already at exceptionally high risk for cardiovascular events.

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