International Journal of
Innovative Drug Discovery

e ISSN 2249 - 7609
Print ISSN 2249 - 7617

www.ijidd.com

BLOOD PRESSURE CONTROL WITH A CLINICAL PHARMACY-DIRECTED INTERVENTION

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ABSTRACT

A comparison was conducted between the control of blood pressure with clinical pharmacy specialists involved and that with conventional physician management. Analyses in this study were conducted using a parallel prospective design. A minimum baseline blood pressure of 140/90 mmHg was required for eligibility, as well as taking a minimum of one antihypertensive medication. Clinical pharmacy specialists provided hypertension management to eligible patients at one medical office (intervention cohort), whereas usual physician-directed care was provided to patients at another comparable medical office (control cohort). A six-month follow-up was used as the primary outcome measures. After clinical pharmacy-managed patients returned to usual care approximately 1.5 years after enrolment, medical records were reviewed for long-term BP control. The baseline cohort differences were adjusted for using multivariate analyses. In the intervention cohort, 101 subjects completed the study, while in the control cohort, 115 subjects completed it. Compared to control subjects (40.7% and 33.3%, respectively), clinical pharmacy-managed subjects had a higher chance of achieving goal blood pressure (64.6%) and receiving thiazide diuretics (68.1%) (adjusted p=0.002 and p<0.001, respectively). After returning to usual care after clinical pharmacy intervention, 22.2% of subjects had controlled blood pressure (P 0.001Managing hypertension with clinical pharmacy has reduced blood pressure. When clinical pharmacy management is discontinued, patient control is lost long-term.

KEY WORDS: Professional role, Blood pressure, Clinical Pharmacy.

INTRODUCTION

North American countries have a prevalence of hypertension of 28%, while European countries have a prevalence of 44% [1]. The global death rate from hypertension is 6% [2]. In general, goal blood pressure is difficult to achieve in a majority of the community. Good blood pressure control decreases cardiovascular disease and stroke incidence [3-4]. Only 30% of hypertensive Americans maintain a blood pressure of 140/90 mmHg. The authors reviewed studies on the control and treatment of hypertension in European and North American countries [5]. It was found that the BP control rate was approximately 10% [6]. In spite of receiving regular medical care, BP control is suboptimal. Five Veterans Affairs clinics have reported that 75% of patients with high blood pressure exceeded national guidelines, while less than 7% of hypertension-related visits are associated with increasing antihypertensive medication [7]. It has been shown that most uncontrolled hypertension cases are found in patients over 65 with good access to healthcare and frequent visits to doctors, according to a study of the third National Health and Nutrition Examination Survey data. The management of hypertension requires a more intensive approach [8]. Pharmacists may be able to facilitate a solution by assisting physicians. Researchers have repeatedly demonstrated that pharmacists help to reduce BP when they are involved in hypertension management [9-12]. The pharmacist's role varies by practice setting. These clinics manage and monitor blood pressure on a long-term basis [13]. Patients with hypertension were randomly assigned to be treated by pharmacists or by their doctors in a VA medical center study [9]. Clinical pharmacists prescribed drugs, changed therapy, and educated patients on drug safety. A pharmacist-managed cohort achieved 81% of its blood. Pressure goal at the end of a six-month study, compared to

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30% of patients with usual care (p=0.001). A minority of pharmacists practice in this setting, despite the clinical pharmacist's excellent performance in this study. Clinical pharmacists have been shown to be successful in managing hypertension in collaboration with physicians [10-12]. The role of the clinical pharmacist includes completing medication histories, educating patients, and assessing adherence. Additionally, clinical pharmacists recommend medication changes to physicians based on their evaluation of pharmacotherapy. Pharmacists and physicians managed BP control rates differently for patients with controlled blood pressure (55-60%) than only physicians (20-43%) [10-12]. Despite the above studies showing improved blood pressure control when pharmacy involvement is involved, it is unknown whether improved blood pressure control is maintained after patients return to their usual physician care. A large health maintenance organization was studied in order to compare hypertension control under the guidance of clinical pharmacy specialists to traditional physician-directed management. Patients returned to physician-directed medication without following up with a clinical pharmacy specialist long-term after this study assessed whether blood pressure control was maintained.

METHODS

A six-month prospective, parallel evaluation of care processes covered approximately 385,000 lives in the metropolitan area. The Institutional Review Board did not review the study since there was no change in patient care in the medical offices. Although this research used personal health information for evaluation of programs, it was conducted in accordance with the Helsinki Declaration of 1975. In the enrolment period, all patients under 18 years old who visited medical offices on routine basis and had a blood pressure reading of 140/90 mmHg or higher and who were currently taking anti-hypertensive medication were eligible. Physicians or nurses managed hypertension in this medical office for all patients. In this medical office, hypertension patients were receiving routine care for their condition. Prior to enrolling, the clinical pharmacy specialist confirmed that the initial readings were elevated

The study enrolled all adult hypertensive patients aged 18 and older (similar numbers of patients, doctors, and staff at medical offices, their socioeconomic status, and their geographic location were all considered) Using the International Classification of Diseases, Ninth Revision diagnosis code 401 for hypertension, these patients were retrospectively identified from administrative data. At least one antihypertensive medication was being received by included patients (control subjects), and their blood pressure was already 140/90 mmHg. A clinical pharmacy specialist did not intervene in the control subjects' care, which was physician-directed until BP control was reached (140/90 mmHg) or six months had passed. Follow-up blood pressure monitoring was available to pharmacy-managed subjects in three ways: 1) at clinics, 2) in the patients' homes, or 3) free community services. These subjects who preferred not to purchase a kit but wanted to monitor their blood pressure at home could borrow a monitor (LifeSource Model 3UA702-V). A BP monitor loaned to subjects during the study can be kept by the subject at the end of the study. By demonstrating the use of the BP cuff on the patient, the clinical pharmacy specialist demonstrated how the cuff should be used. Following that, auscultations were performed in an effort to ensure that the readings obtained by self-measurement and those obtained by a clinical pharmacy specialist were within two millimetres of one another (in mmHg).

Four community/senior centers in the area were provided for clinical pharmacy-managed subjects interested in checking their own blood pressure. Visiting these centers meant getting your blood pressure checked by a registered nurse for free. Clinical pharmacy specialists instructed patients using home or community blood pressure monitoring to contact them at prearranged times to report their readings. Further evaluation of hypertension severity and treatment effectiveness was carried out based on the results of the readings. Pharmacists in medical offices noted a pattern of subjects using neither of the above monitoring methods. Additionally, to the readings obtained by other healthcare professionals, the clinical pharmacy specialist assessed the subject's blood pressure during each visit. Measurements obtained by clinical pharmacy specialists were used to assess hypertension severity and treatment effectiveness. An expert in clinical pharmacy made recommendations for changing hypertension medication for patients under clinical pharmacy care. Patients receiving angiotensin-converting enzyme inhibitors had their serum potassium levels monitored by the clinical pharmacy specialist. Additionally, nonpharmacological therapies (e.g., diet, exercise) were discussed when appropriate. Following up with the subject was determined by a clinical pharmacy specialist. If scheduled phone calls or appointments were missed, subjects were contacted. As long as the subjects' blood pressure was controlled, monthly checkups were mandatory. According to the Fifth Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC V), a blood pressure control level of 140/90mmHg was defined at the time of the study, regardless of patients' other disease states [14].

Patients under clinical pharmacy management were co-signed by their primary care physicians, whose medications were approved, and other medical problems were managed by the clinical pharmacy specialist. BP control was achieved after six months or until subjects reached a target level. After the follow-up period, if BP control was achieved but unsustainable, a clinical pharmacy specialist was responsible for reassessing the subject for further hypertension management if BP control had not been achieved. We only analysed the outcomes of those

subjects who were referred back to a clinical pharmacy specialist after a referral was made.

Outcome Measures and Statistical Analysis

Data was gathered from medical charts for study variables. BP measurements and BP medications were collected at enrolment (baseline) along with sex, age, diabetes status, highest or lowest systolic and diastolic blood pressures. At approximately 1.5 years after enrolment, the lowest or most recent systolic and diastolic blood pressures and BP medications were collected (outcome), and at approximately six months after enrolment, the lowest or most recent systolic and diastolic blood pressures were collected (long term blood pressure control). Within six months of the start of the study, the primary objective was to achieve a blood pressure of 140/90 mmHg (BP control). The method of monitoring blood pressure at follow-up was also compared (clinic versus at home) in addition to changes in systolic and diastolic blood pressure from baseline, and as well as the number of office visits and telephone conversations associated with BP.

Subjects without six-month follow-up measurements did not have their systolic and diastolic BPs measured. The patient's blood pressure reached its lowest reading. It was used as the indicator of long-term blood pressure control. This analysis included only subjects with six-month follow-up blood pressure measurements and blood pressure readings taken. It was determined whether a "white coat effect" existed by comparing blood pressure control rates between patients managed by a clinical pharmacy and patients managed by a medical office for follow-up blood pressure measurements."

Based on independent sample t-tests, we compared diastolic and systolic blood pressures in study cohorts, as well as involvement in office visits and telephone interactions related to blood pressure. It was examined whether nominal- and ordinal-level variables (sex, blood pressure control, location of blood pressure monitoring, diabetes status, and hypertension medication use) were associated with the study cohorts using chi-square tests. In this study, long-term blood pressure control was evaluated using McNemar's test. To examine the relationship between the study cohort and BP control, along with changes in systolic and diastolic BP, multivariate regression analyses were conducted with age, gender, and variables that showed statistically significant between-group differences. An alpha level of 0.05 was used.

RESULTS

As part of the clinical pharmacy-managed cohort and control cohort, 115 patients were initially enrolled. We did not include two subjects in the control cohort in the final analysis because they died during the study period. At the time of death, neither subject's blood pressure was under control. The clinical pharmacy-managed group had 25 subjects with no follow-up BPs, while the control group had zero. BP readings were taken five days after the first follow-up for the clinical pharmacy-managed cohort and ten days for the control cohort, respectively (p 0.001). The mean age and gender distributions were similar between the clinical pharmacy-managed and control cohorts (Table 1). Diabetes was diagnosed in a greater percentage of controls (p=0.019), while alpha blockers were prescribed to nearly half of clinical pharmacy-managed subjects (p=0.009).

Table 1. Baseline patient characteristics

Characteristic	Control (n=101)	Clinical pharmacy- managed (n=115)	P-value
Mean age in years (sd)	63.7 (13.5)	63.7 (12.7)	0.777
Female (%)	55.7	67.3	0.226
Blood pressure			
Mean systolic (sd) (mmhg)	157.8 (16.4)	165.3 (18.0)	0.008
Mean diastolic (sd) (mmhg)	92.3 (11.7)	97.3 (14.3)	< 0.001
Diabetes (%)	18.7	7.8	0.017
Medication (%)			
Thiazide diuretic	32.4	42.5	0.204
Loop diuretic	4.5	3.8	0.297
Beta blocker	34.2	43.6	0.253
Ace inhibitor	34.5	32.2	0.613
Alpha blocker	9.8	1.7	0.007
Dihydropyridine ca++ blocker	12.7	11.5	0.955
Non- dihydropyridine ca++ blocker	17.0	23.2	0.435
Central acting agent	7.5	5.3	0.984

Table 2. Patient outcomes

Outcome	Control (n=101)	Clinical pharmacy- managed	P-value (n=115)
Blood pressure			
Bp controlled (%)	42.5	63.7	0.003[1]

Mean systolic mmhg Δ (sd)	-16.5 (22.0)	-27.3 (24.5)	0.049[1]
Mean diastolic mmhg Δ (sd)	-6.4 (11.5)	-17.4 (10.7)	<0.0012
Medication (%)			
Thiazide diuretic	32.5	67.2	<0.001
Loop diuretic	6.6	3.5	0.296
Beta blocker	33.02	46.7	0.077
Ace inhibitor	35.7	36.4	0.927
Alpha blocker	8.2	2.7	0.007
Dihydropyridine ca++ blocker	14.6	16.2	0.735
Non- dihydropyridine ca++ blocker	17.2	23.2	0.436
Central acting agent	7.2	11.3	0.528
Mean count of bp-related office visits (sd)	2.7 (0.9)	2.4 (2.0)	0.030
Mean count of bp-related phone calls (sd)	0.3 (0.6)	2.5 (2.2)	<0.001
Home/community bp monitoring (%)	2.7	53.4	<0.001

Following control of preperiod systolic and diastolic blood pressures, diabetes status, and alpha blocker use, the clinical pharmacy-managed subjects had a greater chance of achieving BP control by six months (p=0.002). As a result, their systolic and diastolic blood pressures were also reduced by greater amounts (p=0.048) than those in the control group.

According to the results of a six-month follow-up study of subjects with BP measurements in a medical office, subjects managed by clinical pharmacists (59.6%) were more likely than control subjects (40.5%) to have controlled their blood pressure. Age, sex, preperiod systolic and diastolic blood pressure, diabetes, and alpha blocker use were adjusted for (p=0.018).).

Compared with control subjects, clinical pharmacy-managed subjects were more likely to be prescribed thiazide diuretics six months after follow-up (p<0.001). During the follow-up period, BP-related office visits were more frequent in control subjects (p=0.020) than in clinical pharmacy-managed subjects. As a result, clinical pharmacy-managed subjects had 31 less office visits during the six-month follow-up period. Comparatively, the mean number of BP-related phone calls was higher for patients whose medications were administered by clinical pharmacies (p=0.001). A clinical pharmacy-managed subject was more likely to use home/community monitoring compared with a control subject (p<0.001).

Among 40 pharmacy-managed subjects (71.7%) and 72 control subjects (64.7%), long-term BP readings were recorded. Clinical pharmacy-managed and control cohorts took, on average, 613.8 days to obtain their first long-term BP reading (p 0.001). Those under clinical pharmacy management whose blood pressure control decreased over time returned to usual care (p<0.001). During the 6-month follow-up period, only 22.2% of clinical pharmacy-managed and 20.8% of control subjects had maintained blood pressure control (p=0.835).

DISCUSSION

A clinical pharmacy specialist managed patients' blood pressure better than usual care, according to this study. In addition, we found that patients returned to usual care after clinical pharmacy management decreased significantly in their blood pressure control. Compared with usual physician care, our study demonstrated a 59% increase in BP control rates as compared with other clinical pharmacy-directed studies [9-12].

According to one study, combining physician and pharmacist care helped manage hypertension better than usual physician care [11]. Patients' medication histories were collected by clinical pharmacists prior to physician visits. A medical record for the patient contained recommendations for changes to the patient's antihypertensive drug therapy. In their study, 55% of patients receiving clinical pharmacy management were able to keep their blood pressure under control, while only 20% of subjects in the control group achieved this task (p<0.001). Researchers also conducted a study in which clinical pharmacists analyzed patients' antihypertensive therapy and recommended drug regimens based on evidence. 65% of patients attained their goal blood pressure with this clinical pharmacy-managed intervention, compared with 43% of patients receiving usual physician care (p=0.02).

Self-monitoring of blood pressure was an option for subjects in our study. A majority of patients managed by clinical pharmacies chose this method of monitoring their blood pressure. A number of studies have shown that patients with uncontrolled hypertension who used self-monitoring devices to monitor their blood pressure in conjunction with pharmacist intervention had significantly better blood pressure control than those with usual care [12], suggesting that this monitoring method may have contributed to our results. Although BP control was higher in the clinical-pharmacy managed cohort when only subjects' six-month follow-up BP was measured in the medical office, we still found a significantly higher rate in the study group with a medical office measure. A clinical

pharmacy specialist-directed intervention with other components (namely, BP control) may have been the primary contributor(s) to better BP control.

It is possible that the increased use of home monitoring in our clinical pharmacy-managed cohort may have been a contributing factor to fewer visits to the doctor associated with high blood pressure. It is noteworthy that the rate of medical office visits associated with hypertension is higher than that of other chronic conditions. It is possible to reduce healthcare costs by lowering the number of visits related to BP, while simultaneously improving BP control.

As a result of clinical pharmacy management, thiazide diuretics were more likely to be prescribed to our clinical pharmacy-managed cohort as a treatment for hypertension. It was previously recommended that thiazide diuretics be treated with uncomplicated hypertension by JNC guidelines [14]. Although they are highly recommended as first-line therapy for uncomplicated hypertension by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of Hypertension (JNC 7), they are also prone to cardiovascular complications when they are used in combination with diabetes. Compared with other antihypertensive agents, thiazide diuretics have a low acquisition cost, so thiazide diuretics are expected to save health care costs as well. We found that our clinical pharmacy specialist-directed intervention was in accordance with national guidelines because we found that 82% of intervention subjects used thiazide diuretics.

In addition, we found that subjects exposed to clinical pharmacy care for long periods of time did not maintain their blood pressure control. For clinical outcomes to improve (e.g., stroke frequency to be reduced), blood pressure must be controlled for an extended period of time.[18] According to the control subjects, 22.5% of their BPs did not follow up after six months, while 0.0% of those in the clinical pharmacy-managed subjects did not. This further demonstrates the importance of a multidisciplinary, systematic approach to hypertension management, which involves monitoring, managing, and preventing patients from falling behind on their pharmacotherapy.

A number of limitations are associated with this study. The medical office in which the patients received care determined whether the subjects were assigned to a clinical pharmacy-managed cohort or a control cohort. The results of this study were analyzed using multivariate analyses to adjust for potential biases resulting from the non-random assignment. Furthermore, we were unable to obtain data on race and ethnicity of our subjects. Race/ethnicity likely would not have been considered in our analysis since the vast majority of hypertension patients were white, non-Hispanic, commercially-insured Medicare patients. BP goals for patients with diabetes were not differentiated in the JNC V guidelines used in this study. Diabetes patients were considered to have controlled blood pressure when their arterial blood pressure was reduced to 140/90 mmHg. It is possible, as well, that the control cohort was less likely than the study cohort to achieve the desired BP reading due to the lower number of blood pressure readings. The authors speculate that self-measured BP values could introduce bias into the study because some of these BPs were recorded from the subjects themselves. The results of our study suggest that any bias related to BP self-measurement was minimal, since patient-recorded BPs are equivalent to monitor-stored values.

CONCLUSION

Due to better blood pressure control rates and drug selections that follow evidence-based guidelines, clinical pharmacists are more likely to be involved in the management of hypertension in this study. Aside from that, this study highlights the need for long-term follow-ups to be integrated into health care systems. As hypertension is a difficult disease to control, new strategies are needed to manage it. Our study found that patients are significantly more likely to succeed in achieving their blood pressure goals when clinical pharmacists are involved in their care.

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