Home Blood Pressure Monitoring: Does It Improve Control?

Rogers MA, Small D, Buchan DA, et al. Home monitoring service improves mean arterial pressure in patients with essential hypertension: a randomized, controlled trial. Ann Intern Med 2001;134:1024–32.

Study Overview

Objective. To determine if a telecommunication system can improve blood pressure control.

Design. Randomized controlled trial. Patients and physicians were aware of the intervention.

Setting and participants. Patients with a diagnosis of essential hypertension were recruited from university-based internal medicine practices in the United States. Eligible patients were under evaluation for a change in antihypertensive therapy because of (1) elevated blood pressure (systolic blood pressure [SBP] of 140 mm Hg or higher or diastolic blood pressure [DBP] of 90 mm Hg or higher) despite treatment, (2) undesirable side effects of current medication, or (3) office SBP of at least 180 mm Hg or DBP of at least 110 mm Hg with no current use of antihypertensive medication. For patients with diabetes, heart disease, stroke, nephropathy, peripheral vascular disease, or hypertensive retinopathy, an office SBP of at least 130 mm Hg or an office DBP of at least 85 mm Hg was required for eligibility. Exclusion criteria were age younger than 18 years, pregnancy, secondary hypertension, and physical or mental inability to monitor blood pressure at home.

Intervention. Patients were randomized to receive either the intervention (n = 60) or usual care (n = 61). The intervention was a telecommunication service consisting of 3 components: automatic blood pressure recording at home, central processing, and electronic reports provided weekly to primary care physicians and patients. Patients were instructed to take their blood pressure 3 times in the morning before eating or drinking and 3 times in the evening before going to bed. After each reading, the device automatically dialed the telecommunication service and transmitted the data. Patients were asked to conduct this routine (3 readings twice daily) at least 3 days per week for a minimum of 8 weeks. Weekly reports contained information on mean SBP, mean DBP, and heart rate (overall, morning, and evening). Physicians participating in the intervention adjusted antihypertensive medications according to these reports. Usual-care patients were treated for hypertension according to guidelines of the Joint National Committee on Prevention, Detection, and Treatment of High Blood Pressure (JNC) [1].

Main outcome measures. The primary endpoint was change in mean arterial blood pressure. Change was assessed using 24-hour ambulatory blood pressure monitoring (ABPM) at baseline and exit. Median time from baseline to exit was 11 weeks.

Main results. Of 121 randomized patients, 56 in the home-service group and 55 in the usual-care group completed the trial. Mean age of subjects was 61.5 years. In general, patient characteristics, including sex, ethnicity, smoking history, and medical history (cardiovascular disease; stroke or carotid surgery; chronic bronchitis, emphysema, or chronic obstructive pulmonary disease) were equally distributed between the 2 study groups. However, mean body mass index (BMI) was slightly higher in the home-care group (31.5 versus 28.9; P = 0.038).

Among home-service patients, mean SBP decreased by 4.9 mm Hg (95% confidence interval [CI], –1.61 to –8.12 mm Hg; P = 0.005), mean DBP decreased by 2.0 mm Hg (95% CI, 0.14 to –4.04 mm Hg; P = 0.072), and average mean arterial pressure decreased by 2.8 mm Hg (95% CI, –0.59 to –5.05 mm Hg; P = 0.016) from baseline to exit. In contrast, patients who received usual care showed a 2.1–mm Hg increase in mean DBP (95% CI, –0.21 to 4.37 mm Hg; P = 0.08), a 0.1–mm Hg decrease in mean SBP (95% CI, –3.43 to 3.17 mm Hg; $P > 0.2$), and a 1.3–mm Hg increase in average mean arterial pressure (95% CI, –1.01 to 3.67 mm Hg; $P > 0.2$). When changes in pressure from baseline to exit were compared, statistically significant differences were observed between study groups for mean DBP (difference, 4.1 mm Hg [95% CI, 0.93 to 7.13 mm Hg]; P = 0.012), mean SBP (4.8 mm Hg [95% CI, 0.10 to 9.37 mm Hg]; P = 0.047), and mean arterial pressure (4.1 mm Hg [95% CI, 0.91 to 7.38 mm Hg]; P = 0.013). Coding outcomes as "improved" (ie, decrease in pressure from baseline to exit) versus "did not

"Outcomes Research in Review" is edited by Pedro J. Caraballo, MD, and Benoit Tonneau, MD, Department of Medicine, Albany Medical College, Albany, NY. Dr. Tonneau prepared review 1; Dr. Caraballo prepared reviews 2–4.

improve" showed that home-service patients were 2.32 times more likely to have improved DBP and 2.52 times more likely to have improved SBP than usual-care patients. When adjusted for age, sex, ethnicity, BMI, smoking status, intake of high-fat foods, physical activity, and family history of cardiovascular disease, the difference in mean arterial pressure from baseline to exit was –2.8 mm Hg among patients receiving home service and 1.1 mm Hg among those receiving usual care. (No CIs were provided for this measurement.) Medication changes were much higher in the home-service group (33.3%) than in the usual-care group (6.6%); however, changes in type of antihypertensive medication were not statistically significant.

Conclusion. A telecommunication service can be efficacious in reducing mean arterial pressure of patients with established essential hypertension.

Commentary

Only 27% of hypertensive patients have well-controlled blood pressure. The reasons for this are probably multifactorial, yet there is an urgent need to improve these numbers. Although home monitors are being used more frequently to improve blood pressure control and treatment compliance, little is known about the actual impact of these devices. A recent study by Johnson suggested that up to 20% of patients do not self-report blood pressure readings accurately [2].

This study by Rogers et al is the first randomized controlled trial examining home monitoring devices that uses 24-hour ABPM to take baseline and outcome measurements. The intention-to-treat analysis and few patients lost to follow-up are among the study's strengths. Numbers needed to treat (NNT) were also provided; this helps to demonstrate the magnitude of treatment effect, although size of reductions in either SBP or DBP was not given. Some results, although statistically significant, were modest. For example, the percentage of readings that were above target values for DBP and SBP decreased by only 6.3% and 8.1%, respectively, among intervention patients. Moreover, some positive effects of the intervention could have been achieved through greater patient compliance.

Several weaknesses are evident in this study. Statistical power was lacking in some areas, which was reflected by large CIs and CIs that crossed 1 (eg, changes in mean arterial pressure among patients with angina). These wide CIs probably resulted from relatively small numbers of adverse events. Although Rogers and colleagues note that JNC guidelines were used to treat usual-care patients, the authors do not provide information on how closely guidelines were followed or what steps were taken to ensure guideline compliance. Certain patient characteristics that may affect blood pressure control (eg, salt intake, presence or absence of obstructive sleep apnea) were not measured; this may have introduced a selection bias if the prevalence of these variables differed between treatment groups. Some study results are also confusing. In particular, reasons why data adjusted for clinical variables were provided for mean arterial pressure but not for SBP or DBP remain unclear.

Applications for Clinical Practice

The use of home blood pressure monitors that can transmit data directly to physicians may positively influence delivery of care to hypertensive patients. Results of such measures, however, may be modest. Studies involving multiple centers and different practice settings should be conducted to determine if Rogers and colleagues' findings are reproducible on a larger scale. Also, it is unclear if this type of intervention is feasible in a "normal" clinical environment; in the study, many measurements had to be obtained, and only the monitoring device used by the authors would be able to easily achieve such a high number of readings. Until results from further studies are available, home monitoring cannot be recommended as standard treatment to improve blood pressure control.

References

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2. Johnson KA, Partsch DJ, Rippole LL, McVey DM. Reliability of self-reported blood pressure measurements. Arch Intern Med 1999;159:2689–93.