Serial Blood Pressures Versus a Single Repeat Blood Pressure in a Family Medicine Clinic

Ann M. Philbrick, PharmD[1]; Caroline S. Carlin, PhD[2]; Christopher Fallert, MD[2]
[1] University of Minnesota College of Pharmacy
[2] University of Minnesota Medical School

Abstract
Purpose. The best method to measure blood pressure (BP) in a clinic setting is debatable. This study was conducted to compare serial BPs to a single repeat BP after an initial elevated reading. *Methods*. For this quality improvement process, instead of obtaining a second BP measurement after an initially elevated BP, medical assistants (MA) obtained serial BP readings two minutes apart. Rooming BP was compared to the first serial BP reading (current process), and to the average of the last two BP readings. *Results*. Seventy-eight patients were included. The average rooming BP was 155.5 ± 15.3 mmHg systolic (mean ± standard deviation) and 88.7 ± 11.8 mmHg diastolic, which decreased to 146.05 ± 18.2 mmHg systolic and 85.7 ± 11.8 mmHg diastolic for the first BP and 147.5 ± 16.2 mmHg systolic and 86.9 ± 12.1 mmHg diastolic for the average BP. Compared to the rooming BP, both readings were significantly decreased (first BP: p<0.001 SBP, p=0.006 DBP; average BP: p<0.001 SBP, p=0.011 DBP), but results were not significant when first BP was compared to average BP (p=0.756 SBP, p=0.278 DBP). A total of 26.9% and 23.1% of patients reached a BP goal of <140/90 mmHg with the first BP (p<0.001), and average BP (p<0.001), respectively. *Conclusion*. In patients presenting to an outpatient clinic with an initial elevated BP reading, simply repeating a single BP measurement shortly after completing the rooming process resulted in significantly reduced BP readings, and was equal to obtaining serial readings. In a busy clinic or pharmacy setting, healthcare providers can be reasonably confident that a single repeat blood pressure is an accurate reflection of a patient's true BP.

Keywords: Blood Pressure, Serial vs. Single Repeat

Background

An accurate blood pressure (BP) is necessary to diagnose and treat. It is well established that 24-hour ambulatory BP monitoring (ABPM) is the most accurate method to diagnose hypertension,[1] however its use is limited. In lieu of ABPM, the American Heart Association recommends the average of two or more unattended BP readings, measured on a validated automated office blood pressure (AOBP) machine, on two or more occasions be used in the diagnosis of hypertension.[2]

To address the practical issue of how many BP measurements, and over what time frame is best, studies have assessed the optimal number of AOBP readings needed to compare accurately with ABPM, and whether a rest period is necessary. In one study, AOBP was measured at baseline and then every 2 minutes thereafter over 15 minutes for a total of 8 measurements. They then analyzed what combination of intervals provided the best correlation with daytime ABPM. The results showed the best correlation occurred with the average of readings two and three, taken within the first six minutes.[3] Another study examined whether a five-minute rest was necessary prior to three AOBP readings at one minute intervals.[4] Mean systolic AOBP readings were slightly, but significantly lower in the group with a 5 minute rest than those without (126.5 ± 16.2 mmHg vs 130.0 ± 17.77 mmHg, respectively, p=0.05).[4] The results of these two studies seem to indicate that the best method of obtaining AOBP measurements in a patient with hypertension may be averaging the last two of three readings over 6 minutes after 5 minutes rest.

Based on these studies, and previous research undertaken by this team[5] the authors investigated whether a change in how blood pressure was measured in our clinic setting was warranted. The primary purpose of this study was to implement the methods these two studies reported to see if it resulted in lower BP measurements than the current process at a single clinic.

Methods

This quality improvement process was implemented in a single clinic center in an urban, underserved, diverse family medicine clinic on a random selection of patients of three medical assistants (MA) trained on the serial BP process. Under the standard clinic procedure, BP is obtained towards the end of the rooming process using an appropriately sized cuff and after the patient has rested for approximately 5 minutes. If a reading >140/90 mmHg is obtained, the MA repeats this measurement after 1 to 2 minutes.

For this quality improvement process, instead of obtaining a second BP measurement, the MAs were instructed to obtain serial BP readings. A validated AOBP machine (Welch-Allyn Connex® Spot Monitor) was programmed to obtain three serial BP readings, each two minutes apart. MAs were instructed to

Corresponding Author:

Ann M. Philbrick, PharmD, FCCP, BCACP
University of Minnesota
College of Pharmacy. Minneapolis, MN
Email: philb020@umn.edu

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wait for the first reading to ensure the BP cuff did not malfunction, and then leave the room for readings two and three. After approximately five minutes, the MAs returned to the room to record all three serial BP readings, and average the last 2 readings.

All readings were presented to the medical provider and the average of the last 2 readings were recorded in the electronic health record (EHR). Comparisons were made between the rooming BP, the first serial BP reading [first BP], representing the current process, and the average of the last two BP readings [average BP]. A BP goal of <140/90 was chosen based on recommendations from the American Academy of Family Physicians,[6, 7] as well as state-based quality measures. This study was deemed non-human subjects research by the University of Minnesota Investigational Review Board.

Statistical Analysis

Differences in the mean BP from rooming to the first BP measurement and from rooming to the average of the BP readings were identified using paired t-tests. The probability of gaining blood pressure control (<140/90 mmHg) from rooming to first BP and to average BP readings was modeled with linear probability models. Statistical significance was determined based on a p-value less than 0.05.

Results

Seventy-eight patients were included in the analysis. Descriptive statistics are listed in Table 1 and are a fair representation of the clinic population. The average rooming BP was 155.5 ± 15.3 mmHg systolic (mean ± standard deviation) and 88.7 ± 11.8 mmHg diastolic. This decreased to 146.05 ± 18.2 mmHg systolic and 85.7 ± 11.8 mmHg diastolic for the first BP and 147.5 ± 16.2 mmHg systolic and 86.9 ± 12.1 mmHg diastolic for the average BP measurement (Table 2).

When compared to the rooming BP, both of these readings were statistically significantly decreased (first BP: p<0.001 SBP and p=0.006 DBP; average BP: p<0.001 SBP and p=0.011 DBP), but the results were not statistically significant when first BP was compared to average BP (p=0.756 SBP and p=0.278 DBP). A total of 26.9% of patients reached a BP goal of <140/90 with the first BP (p<0.001), and 23.1% reached this goal with the average BP (p<0.001) (Table 2). While a comparison of the individual SBP and DBP measures at first BP versus average BP were not statistically significantly different, the overall rate at which patients achieved a blood pressure of <140/90 was statistically significantly higher at the first BP measure than the average BP measure (p<0.001).

Discussion

The results of this study show that in patients with an initial rooming BP of >140/90 mmHg, more than 20% of patients will be under 140/90 mmHg if the BP is repeated within a short time during the clinic visit, which is a clinically meaningful improvement. Additionally, the results showed that a single repeat blood pressure resulted in an average blood pressure reduction of 8.33 mmHg systolic and 3.08 diastolic, which was comparable, if not better than similar studies.[3,4] The results also indicate that a single repeat BP reading yields at least an equal BP reduction in comparison to the mean of two serial readings. In a primary care clinic or pharmacy patient care setting, visits can be complicated and limited on time, but an accurate blood pressure reading is necessary in order to make medication therapy decisions. These findings are practically valuable in that repeating a single blood pressure reading in patients with an initial BP reading over 140/90 mmHg is clinically meaningful and relatively simple to implement.

The primary limitation of this study is that it was conducted at a single clinic with a relatively small number of patients. While a strength of the study is that patients in this study represented multiple races and ethnicities, they do not match the US population as a whole. Additionally, a blood pressure goal of <140/90 was selected based on uniformity and convenience but may not have matched the patient's individual patient goal. Finally, there was no power analysis performed as this was originally a quality improvement project.

Conclusion

A single repeat BP taken shortly after an elevated rooming BP resulted in significantly reduced BP readings, and was similar to obtaining serial BP readings. Healthcare providers can be reasonably confident that this simple process results in an accurate reflection of a patient's true BP.

Conflict of Interest: None

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Table 1. Demographics and Results

Demographic	Value (n [%])
Sex Female Male Other/missing	 39 [50.0%] 37 [47.4%] 2 [2.6%]
Race/ethnicity Asian Black Latino/Hispanic White	 30 [38.5%] 27 [34.6%] 1 [1.3%] 20 [25.6%]
Language English Preferred Other Language Preferred	 48 [61.5%] 30 [38.5%]

Table 2. Change in Blood Pressure

	Systolic (mean [SD])	Change from Rooming BP	Diastolic (mean [SD])	Change from Rooming BP	<140/90 (%)
Rooming BP	155.5 [15.3]	—	88.7 [11.8]	—	0.00%
First BP	146.0 [18.2]	-8.79, p<0.001	85.7 [13.2]	-3.06, p=0.0062	26.90%
Average BP	147.5 [16.2]	-8.33, p <0.002	86.9 [12.1]	-1.83, p=0.0108	23.10%

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