Are stroke patients’ reports of home blood pressure readings reliable? Cross-sectional study

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Background. Home blood pressure (BP) monitoring is gaining increasing popularity among patients and may be useful in hypertension management. Little is known about the reliability of stroke patients’ records of home BP monitoring.

Objective. To assess the reliability of home BP recording in hypertensive patients who had suffered a recent stroke or transient ischaemic attack.

Methods. Thirty-nine stroke patients (mean age 73 years) randomized to the intervention arm of a trial of home BP monitoring were included. Following instruction by a research nurse, patients recorded their BPs at home and documented them in a booklet over the next year. The booklet readings over a month were compared with the actual readings downloaded from the BP monitor and were checked for errors or selective bias in recording.

Results. A total of 1027 monitor and 716 booklet readings were recorded. Ninety per cent of booklet recordings were exactly the same as the BP monitor readings. Average booklet readings were 0.6 mmHg systolic [95% confidence interval (95% CI) –0.6 to 1.8] and 0.3 mmHg diastolic (95% CI –0.3 to 0.8) lower than those on the monitor.

Conclusions. This group of elderly stroke patients were able to record their BPs reliably at home. Any bias was small and would be unlikely to affect management. Since BP readings in a GP surgery are often a poor indication of true BP, GPs might consider using hypertensive patients’ records of home BP monitoring to help guide treatment decisions.

Keywords. Home blood pressure monitoring, hypertension, stroke, transient ischaemic attack.

Introduction

In an increasingly health and technology aware world, GPs are regularly faced with patients who present with a detailed knowledge of their blood pressure (BP) based on readings taken at home. Home BP measurements have a number of potential advantages over office BP readings, notably the ability to take a number of measurements over a period of time, reduction in white coat hypertension, patient involvement and good prognostic value and reproducibility. Importantly, in a meta-analysis of randomized trials, home BP monitoring has been shown to yield improved hypertension control when compared with office monitoring although a recent pragmatic trial found limited benefit. Although telemonitoring may offer advantages in terms of reliability of downloaded readings, a cheaper, simpler and more practical approach is to ask patients to record readings manually. However, this will only be useful if patients record their measurements accurately. Potential sources of error might include patients selecting favourite data points to tell the doctor or making active or unwitting transcription errors.

It is particularly important that BP is adequately controlled in patients who have had a stroke since BP reduction significantly reduces the risk of a further cerebrovascular event. Doctors and nurses in stroke units frequently recommend home BP monitoring to hypertensive stroke patients, but there are no data on the reliability of home monitoring in this group. If stroke patients can record their BP accurately despite any disabilities, home BP monitoring may be widely applicable to the general hypertensive population.

In the present study, conducted by three consecutive Foundation Year 2 research doctors (JS, YA-G, SS), we aimed to find out if a predominantly elderly population of patients who had suffered a stroke or transient ischaemic attack (TIA) were able to record their own BP reliably at home.
Methods

Participants
Patients were participating in the St George’s Home Blood Pressure Monitoring Trial in southwest London, an ongoing randomized control trial in which 381 patients have been randomly allocated to home BP monitoring or usual GP care. Patients had suffered a stroke or TIA within the last 9 months and were recruited from outpatient clinics and wards of three local hospitals. Patients were eligible for the main trial if they were hypertensive (BP > 140/85 mmHg or on anti-hypertensive therapy) and did not have severe illness and were not already using a home BP monitor. Those who did not speak English or had severe cognitive impairment [abbreviated mental test score (AMTS) <7] were excluded. We reviewed the BP measurements of 39 consecutive intervention patients who had been given home BP monitors. Patients were excluded if they reported that someone else had used the monitor (39% at 1 month and 6% at 12 months) or if they had not recorded any reading in the booklet in the last month (2% at 1 month and 35% at 12 months).

Intervention
Patients were asked to check their BP using an Omron M6 Upper Arm BP monitor and to record the BP in a booklet. They were instructed to record three BPs in the booklet daily for the first week of the trial and subsequently three BPs taken on one occasion once a week. After 1 month, the patients were visited by the research nurse who checked their technique.

Data collection
At 1 month or 12 months after starting the trial, we asked the patients if we could swap their monitor for a new one so we could look at the data on the monitor. We chose these time points as this was when the trial team visited the patients. For all patients, we reviewed the most recent month’s data. The readings from the monitor were downloaded manually and compared with readings recorded in the patient booklets. No patient contributed data at both time points.

Statistical analysis
We compared data from the memory of the BP monitors and the patient booklets using Stata. BP recordings from the booklet were matched by date with the results from the monitor. We investigated the number of readings in the patient booklet, which had no corresponding monitor value on the same day. In addition, we reviewed the number of readings in the monitor memory, which were not recorded in the booklet.

We also compared mean monitor systolic and diastolic BP for each patient over the 1-month period with the corresponding mean values in the booklets, to see if there was any bias in the data recording. For each patient, we calculated the mean systolic and diastolic recorded booklet values and subtracted these from the patients’ monitor values, allowing us to adjust for variability between patients in average BP. We calculated 95% confidence intervals (95% CIs) for the mean difference using the cluster option in Stata allowing for clustering within patient and used the Bland Altman method to calculate limits of agreement between the two sets of readings.

Results
Twelve patients provided data at 1 month and 27 at 12 months. The mean age of the patients was 73 years (range 40–87), 19 (49%) were female, 16 (41%) had some limitation of daily activities due to stroke (Rankin disability score ≥2) and 11 (28%) had suffered a TIA and the remainder a stroke. Twelve patients (34%) took their BP with the help of a relative, friend or other carer. The majority of the patients (85%) were of white ethnicity. There were 644 sets of readings where booklet readings matched the monitor data. Eight patients’ booklets matched completely with the monitor data, with no additional monitor or booklet values.

Unsupported booklet data
Patients recorded 33 values in the booklets for which a corresponding monitor value for that day could not be found. One patient had 17 additional booklet readings at the start of the series; it may be that she/he accidentally deleted those readings from the monitor memory. In addition, there were 39 pairs of monitor/booklet readings, which showed a small error of 0.9 mmHg (95% CI –1.2 to 2.3) difference in systolic BP (Table 1). These readings represented 10% of the total readings (72 of 716 readings).

Additional monitor data
Patients also tended to take extra readings with the monitor in addition to the three daily readings recorded in the booklet. Twenty-seven patients took a total of 344 extra readings, 200 of which were taken on the same day as booklet readings and 144 on other days. The additional booklet and monitor readings are summarized in Table 1. When patients took extra readings on the same day, there was a tendency to select lower readings to write in the booklet, but the difference was not statistically significant. The differences in the systolic readings were 3.4 mmHg (–3.7 to 10.6) and 1.4 mmHg (–1.5 to 4.3) in the diastolic reading.
Figure 1 shows the difference between the mean systolic monitor and booklet values for each patient. A positive value indicates that the monitor BPs were higher than the recorded BPs, in other words that a given patient tended to document lower values in the booklet. Limits of agreement between mean booklet and mean monitor readings were 0.9 mmHg (95% CI –6.2 to 7.9) and 0.3 mmHg (95% CI –3.2 to 3.8).

Discussion

Summary of main findings
Elderly patients with a history of recent stroke or TIA were conscientious and reliable in their collection of home BP values. Over 90% of results recorded in the booklets were supported exactly by monitor readings. Patients tended to take more readings with the monitor than they were required to. Although there was a non-significant tendency to report the lower values, the overall effect was small and unlikely to affect management.

Strengths and the limitations of this study
The patients in this study were elderly and had suffered a stroke or TIA. This is a population who are traditionally considered as less technically literate, but for whom BP control is of vital importance. Participants are likely to be reasonably representative of hypertensive stroke patients since 80% (243/302) eligible clinic patients agreed to take part in the study. Of 931 stroke patients seen in clinic, 44% (n = 414) were excluded because they were not hypertensive and only 11% (n = 104) were excluded due to severe cognitive impairment or co-morbidity. As patients in the UK tend to report their BPs to GPs verbally or on paper rather than via a remote data download, our approach is more likely to reflect current practice. Manual download also facilitates the use of simpler BP machines than those required for an electronic download. Being part of a validation study within a randomized control trial, the patients in this study were not being instructed to concentrate on accurate reporting but rather on following trial protocol to check BP weekly. This improves the likelihood that the study reflects how accurately patients might record their readings outside a trial.

The study is limited by the small number of participants. This was due in part to time constraints but also to the need to exclude patients who reported sharing their monitors. We also excluded patients who had not recorded any readings in the past month who may be less reliable. We have also assumed that all additional readings found on the monitor belonged to the patient; in the most discrepant case, we believe that the additional readings may belong to another person. Thus, we may have underestimated the degree of agreement. Finally, as the patients were taught to use the monitor in their own homes, supported by intermittent research nurse phone calls, they had more technical support than the general population.
Comparison with existing literature
Reliability of home BP monitoring has been assessed by several authors with conflicting results but none have been done in stroke patients. In a recent study by Van den Hoeven, a 58% of younger nondisabled hypertensive patients took unscheduled readings, but any reporting bias did not affect overall average BP. The limits of agreement in this study were very similar to ours with difference likely to affect management occurring in 10% of patients. Other earlier studies in the general hypertensive adult population have shown slightly less accuracy in recording, with mean differences between monitor and booklet values of up to $+/-11$ mmHg systolic and 5 mmHg diastolic.

We are not aware of previous literature looking at validity of home BP recording in patients who are elderly and have suffered a stroke or TIA. The patients in this study performed in a broadly equivalent way to their younger less disabled counterparts in the literature. Although 46% of patients had at least one inaccurate reading, these represented <10% of the total number of readings taken. There was no evidence of digit preference or that patients were consistently recording high or low values.

Implications for future research or clinical practice
We have shown that patients who are more elderly and more disabled than a general hypertensive patient population are able to monitor their own BP, at least as well as younger hypertensive patients in other studies. We do not yet know if monitoring BP at home in this population is helpful in terms of controlling their BP, and we await the results of our trial for this. However, regular home monitoring is known to give GPs a much better idea of a hypertensive patient’s true BP than 6–9 monthly readings in surgery. This should help doctors to make better decisions on appropriate hypertensive treatment.

The study suggests that home BP monitoring may be a valid and effective way to keep track of patients’ BP control and that patients’ reports of their readings are likely to be reliable and can be used in their management. We hope that this will lead to greater patient engagement in the management of their hypertension, better BP control and enhanced concordance in the doctor–patient relationship.

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Declaration
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Ethical approval: Wandsworth Research Ethics Committee (06/Q0803/223).
Conflicts of interest: none.

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