

Review

Role of Accurate Measurement of Blood Pressure in Management of Hypertension: A Case Study and Healthcare Delivery Challenges in Bangladesh

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Abstract

Accurate measurement of blood pressure is necessary for management of hypertension. This article reviews potential sources of error, and describes a case in which improper technique of measurement and interpretations of blood pressure variation caused unnecessary expense, anxiety, and improper change in medication. The challenges of healthcare delivery system in Bangladesh in this debacle are also discussed.

Keywords: Blood pressure; Measurement; Importance of proper technique; Bangladesh; Cardiology; Medicine.

Introduction

Hypertension is a major but modifiable risk factor for heart attack, stroke, renal failure and even has been associated with risk of dementia. Forouzanfar et al. have reported that in 25 years between 1990-2015, globally prevalence of systolic blood pressure of 140 mm Hg or higher have increased from 17 307 to 20 526 per 100 000 persons [1,2]. They have also reported that the estimated rate of annual deaths associated with systolic blood pressure of 140 mm Hg or higher has increased from 97.9 to 106.3 per 100 000 persons [3]. Blood pressure needs to be controlled to avoid deleterious consequences, but it begins with a reliable and accurate BP. Consequences of an untreated 5 mm Hg of excessive systolic blood pressure would be a 25% increase over current levels of fatal strokes and fatal myocardial infarctions for these individuals. Again, overestimating true blood pressure would also lead to a long list of complications, ranging from unnecessary economic burden to serious drug adverse effects [4]. Measuring blood pressure is the most commonly performed medical test worldwide, and to do so properly certain standards must be met [5]. The process requires a minimum level of training and expertise. Registered physicians, nurses and paramedics may be well trained and able to measure blood pressure accurately, but the same statement may not be held true for the general population. There are several non-invasive techniques for measurement of BP including:

1. Palpatory: only systolic blood pressure can be determined [6].
2. Auscultatory, it is the most commonly practised method, employed in conjunction with either a mercury or aneroid sphygmomanometer and a properly sized arm cuff, named after Scipione Riva-Rocci. The examiner has to listen closely for appearance and disappearance of Korotkoff sounds, named after Nikolai Korotkoff, a Russian military surgeon [7,8]. A certain level of training is necessary.
3. Oscillometric: may be suitable for less skilled general population and also for non-invasive monitoring as in ambulatory and home monitoring. However, several studies have shown that oscillometric devices tend to overestimate systolic blood pressure (SBP) and underestimate diastolic blood pressure (DBP) compared with sphygmomanometers. Also, inaccurate readings may be found in patients with arteriosclerosis, arrhythmia, preeclampsia, pulsus alternans, and pulsus paradoxus [9-14].

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There are discrepancies between the measurement methods, and one has to employ each of these techniques and devices wisely in the proper clinical contexts. The patient may be taught to measure his/her own BP, using any/some of the above techniques, but should be trained and counselled properly. It is understood that mixing modalities while making management decisions can lead to improper diagnosis and management.

A Case Study

A Bangladeshi Muslim male, 32 years old, came to an internist's office with a one-year history of mild hypertension for one year, under control until recently, together with some complaints of neck pain. His weight was 100 kg, height 5 feet 11 inches, and a clinical oscillometric BP of 150/100 mm-Hg. The patient had been following dietary advice, exercising for at least half an hour daily in open air, and was previously prescribed losartan potassium (25 mg) daily. His laboratory investigations including thyroid testing, blood glucose, serum creatinine, urine R/E (routine examination) and electrocardiogram (ECG) were all within normal ranges. Losartan potassium was increased to 50 mg daily, and he was advised to monitor BP on a regular basis (at least once a day). Paracetamol 500 mg tds was prescribed for his neck pain, which he did not take the medicines for fear of "damaging his kidneys". After 7 days, during his usual walk in the park, he encountered an untrained individual who was performing public blood pressures for a small fee. There his BP was reportedly 160/100 mm-Hg. When repeated in his internist's office his BP was 130/80 mm-Hg. He was assured that nothing was wrong, and was advised to continue an analgesic for his continuing neck pain. However, the following day, he again went to a pharmacy and the shopkeeper found his blood pressure to be 160/95 mm-Hg. He then sought advice from yet another internist, without informing his previous doctor, and was told his BP was normal, and he should continue his losartan 50 mg. Nonetheless, the patient bought an automatic oscillometric BP measurement machine, and at home he found his BP to be 145/80 mm-Hg. Home values were systolic, within the 140-150 mm-Hg range with diastolic values about 80 mm-Hg. Still dissatisfied, he followed the advice of friends and travelled to India, where he was found to have a 10 mm-Hg difference in systolic BP between his arms. His losartan was discontinued, and he was given metoprolol (25 mg) daily by an Indian doctor. He returned to Bangladesh, sought advice of a cardiologist who promptly discontinued the metoprolol and reinstated losartan 50 mg. By that time his neck pain resolved. He again consulted his first physician, apparently recovered from his doctor-shopping.

Discussion

Studying the case history in the case study section, the sequence of events was:

1. The patient found an unqualified and untrained stranger who measured his BP, and the findings were never congruent with the measurements made by the patient's physicians.
2. The patient also had his BP measured in a pharmacy. This time the shopkeeper (who is not a proper pharmacist and also lacked any sort of medical training or qualification) also found his BP was high.
3. The patient used an automatic machine, and although the machine showed quite normal diastolic BP, his systolic BP was always high. However, oscillometric devices tend to overestimate systolic blood pressure (SBP) and underestimate diastolic blood pressure (DBP) compared with sphygmomanometers [9-12].
4. Since there is no formal referral system in Bangladesh, the patient went physician shopping, consulted different doctors and even specialists, and when he was advised to take the same drug, he even left his country and went to India. There he was advised to take metoprolol, but still was not satisfied, and coming back to Bangladesh and resuming losartan 50 mg, he started to feel improvement. By this time his neck pain also resolved, because a few days before he had started taking a painkiller.
5. The patient a) did not follow directions after thorough counselling, b) engaged in jumping to unqualified opinions from strangers and friends, then to c) doctor shopping, d) was not adherent regarding medications, and e) showed poor judgment, prioritizing lay opinions over advice of licensed practitioners familiar with his case.

Due to the above, management of simple uncomplicated hypertension was made unnecessarily complex, falsely high measurements of BP were repeatedly done by unqualified non-medical personnel, causing further nonadherence.

Who Can Measure Blood Pressure?

Actually anyone can measure blood pressure provided they are taught and practice under supervision to master basic skills and avoid common pitfalls. The task of measuring blood pressure is not restricted to physicians, but other medical professionals as well. Patients are often encouraged to measure blood pressure at home. In fact, in a meta-analysis which included 15 studies, Clark et al found that nurse-measured blood pressure was 7/4 mmHg lower than the doctor-measured blood pressure, ascribed to white coat hypertension [15].

Variability in Measurement of Blood Pressure

Several factors may influence both systolic and diastolic blood pressure measurement, ranging from small as 1/2 to 50 mm-Hg. Handler elaborately described the factors which to be avoided, including talking or active listening (may raise systolic BP by 10 mm-Hg and diastolic BP by 10 mm-Hg), having a distended bladder (may raise systolic BP by 15 mm-Hg and diastolic BP by 10 mm-Hg), placing the cuff over clothing (may raise systolic BP by 5-50 mm-Hg), using a cuff too small for the arm size (may raise systolic BP by 10 mm-Hg and diastolic BP by 2-8 mm-Hg), smoking within 30 minutes of measurement (may raise systolic BP by 10-

20 mm-Hg), and using a paralyzed arm (may raise systolic BP by 2-5 mm-Hg) [16]. The position of both body and arm are very important for accurate measurement of BP [16]. Diastolic pressure in a sitting position is higher than supine position (by 5 mm Hg), although it is not always true in case of systolic pressure [17]. Similarly, systolic pressure has been found to be higher in supine position than in standing position [18]. If the back is not supported the diastolic pressure may be increased by 6 mm Hg [19]. Crossing the legs may raise systolic pressure by 2 to 8 mm Hg [20]. If the upper arm is below the level of the right atrium (like hanging down while in the sitting position), the readings will be too high, and if the arm is above the heart level, the readings will be too low due to the effects of hydrostatic pressure, and may be 10 mm Hg or more, or 2 mm Hg for every inch above or below the heart level [17,21,22].

Standard Techniques for Blood Pressure Measurement

Because there are many potential errors in BP measurement, standard techniques have been established to ensure proper reading of the BP. American Heart Association In 2005 The American Heart Association reviewed common measurement errors [22]. These have been updated in the recent American College of Cardiology/American Heart Association Task Force (ACC/AHA) Guideline recommending a six step checklist (properly preparing the patient, using proper technique for BP measurement, taking proper measurements, properly documenting BP, averaging the readings, and finally, providing the BP reading to the patient) [23]. Some of the key points about a patient's ideal position of the body and attitude while having BP measured are as follows [22,23]:

1. The legs should not be crossed.
2. The arm should be supported at heart level, and the bladder of the cuff should encircle at least 80% of the arm circumference.
3. Neither the patient nor the observer should talk during the measurement.
4. The patient should relax, sitting in a chair (feet on floor, back supported) for >5 min.
5. The patient should avoid caffeine, exercise, and smoking for at least 30 min before measurement.
6. The patient has emptied his/her bladder.
7. Neither the patient nor the observer should talk during the rest period or during the measurement.
8. All clothing should be removed covering the location of cuff placement.
9. Measurements made while the patient is sitting or lying on an examining table do not fulfil these criteria [23].

Although a detailed account of all recommendations made by American College of Cardiology/American Heart Association Task Force (ACC/

AHA) is beyond the scope of this article [23].

Bangladesh Perspective and Our Case

These ideal recommendations cannot be followed in settings other than health facilities or physician chambers, and under proper conditions in the patient's home. Patients need to be educated about this. Most patients can be taught to produce accurate home BPs. However, under no circumstances should BPs be attempted during casual activity, eg, during morning exercise, in parks, on the sides of roads, or by unknowledgeable lay people.

Challenges and Recommendations

Bangladesh has recently witnessed gross misuse of antibiotics have been reported, especially by non-medical, unregistered practitioners, culminating into increased resistance to many antibiotics [24,25]. In this example, the same type of such pseudo-practitioners are also interfering in the management of non-communicable disease such as hypertension. Our first recommendation is therefore to control this type of activity, basically to profit from uncertain patients who are worried. Though there is no study yet done in our country documenting the extent of the problem, there is little doubt about an increase in this activity. The individual practitioner can spend extra time in educating the patient, and also in teaching them how to measure BP themselves. The health system itself bears some responsibility in not assuring patients they are receiving proper treatment, and that in case of doubt, they should return to the prescribing physician rather than doctor-shop or worse. Finally, a formal referral system is of utmost importance. By strengthening the health system, patient respect for the profession and its advice will most certainly improve, and hopefully lower the probability the waste we report in our patient will be repeated.

References

1. Kaczorowski J, Dawes M, Gelfer M (2007) Measurement of blood pressure: new developments and challenges. *BC Med J* 54: 399-403.
2. Staessen JA, Richart T, Birkenhäger WH (2007) Less atherosclerosis and lower blood pressure for a meaningful life perspective with more brain. *Hypertens Dallas Tex* 1979 49: 389-400.
3. Forouzanfar MH, Liu P, Roth GA, Ng M, Biryukov S, et al. (2017) Global Burden of Hypertension and Systolic Blood Pressure of at Least 110 to 115 mm Hg, 1990-2015. *JAMA* 317: 165-82.
4. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R (2002) Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet Lond Engl* 360: 1903-13.
5. Jones DW, Appel LJ, Sheps SG, Roccella EJ, Lenfant C (2003) Measuring blood pressure accurately: new and persistent challenges. *JAMA* 289: 1027-30.

6. Deakin CD (2000) Accuracy of the advanced trauma life support guidelines for predicting systolic blood pressure using carotid, femoral, and radial pulses: observational study. *BMJ* 321: 673-4.
7. Ostchega Y, Hughes JP, Zhang G, Nwankwo T, Chiappa MM (2013) Mean mid-arm circumference and blood pressure cuff sizes for U.S. adults: National Health and Nutrition Examination Survey, 1999-2010. *Blood Press Monit* 18:138-43.
8. Roguin A (2006) Scipione Riva-Rocci and the men behind the mercury sphygmomanometer. *Int J ClinPract* 60: 73-9.
9. Weaver MG, Park MK, Lee DH (1990) Differences in blood pressure levels obtained by auscultatory and oscillometric methods. *Am J Dis Child* 144: 911-4.
10. Goonasekera CD, Dillon MJ (1995) Random zero sphygmomanometer versus automatic oscillometric blood pressure monitor; is either the instrument of choice? *J Hum Hypertens* 9: 885-9.
11. Whincup PH, Bruce NG, Cook DG, Shaper AG (1992) The Dinamap 1846SX automated blood pressure recorder: comparison with the Hawksley random zero sphygmomanometer under field conditions. *J Epidemiol Community Health* 46: 164-9.
12. Hasan MA, Thomas TA, Prys-Roberts C (1993) Comparison of automatic oscillometric arterial pressure measurement with conventional auscultatory measurement in the labour ward. *BJA Br J Anaesth* 70: 141-144.
13. O'Brien E, Asmar R, Beilin L, Imai Y, Mallion J-M, et al. (2003) European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement. *J Hypertens* 21: 821-48.
14. Hamzaoui O, Monnet X, Teboul J-L (2013) Pulsus paradoxus. *EurRespir J* 42: 1696-705.
15. Clark CE, Horvath IA, Taylor RS, Campbell JL (2014) Doctors record higher blood pressures than nurses: systematic review and meta-analysis. *Br J Gen Pract J R Coll Gen Pract* 64: e223-232.
16. Handler J (2009) The Importance of Accurate Blood Pressure Measurement. *Perm J* 13: 51-4.
17. Netea RT, Lenders JWM, Smits P, Thien T (2003) Both body and arm position significantly influence blood pressure measurement. *J Hum Hypertens* 17: 459-62.
18. Terént A, Breig-Asberg E (1994) Epidemiological perspective of body position and arm level in blood pressure measurement. *Blood Press* 3: 156-63.
19. Cushman WC, Cooper KM, Horne RA, Meydrech EF (1990) Effect of back support and stethoscope head on seated blood pressure determinations. *Am J Hypertens* 3: 240-1.
20. Peters GL, Binder SK, Campbell NR (1999) The effect of crossing legs on blood pressure: a randomized single-blind cross-over study. *Blood Press Monit* 4: 97-101.
21. Mitchell PL, Parlin RW, Blackburn H (1964) Effect of Vertical Displacement of the Arm on Indirect Blood-Pressure Measurement. *N Engl J Med* 9: 72-4.
22. Pickering TG, Hall JE, Appel LJ, Falkner BE, Graves J, et al. (2005) Recommendations for blood pressure measurement in humans and experimental animals: part 1: blood pressure measurement in humans: a statement for professionals from the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research. *Circulation* 111: 697-716.
23. Whelton PK, Carey RM, Aronow WS, Casey DE, Collins KJ, et al. (2018) 2017 ACC/AHA/ AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. *J Am CollCardiol* 71: e127-248.
24. Hasan P, Mozafzia KT-E, Hossain MZ, Rowan R (2017) Pattern of Antibiotic Usage in Rural and Sub-Urban Settings in Bangladesh: Experience From a Primary Health Care Facility. *Clin Infect Immun* 2: 19-26.
25. Hossain MZ, Naher A, Hasan P, Mozafzia KT-E, Tasnim H, et al. (2017) Prevalent bacteria and their sensitivity and resistance pattern to antibiotics: A study in Dhaka Medical College Hospital. *J Dhaka Med Coll* 26: 52-64.