

Full Length Research paper

Reliability of blood pressure measurements in public hospitals: a case report

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Though simple, blood pressure measurement is prone to errors, which may mislead a doctor in the detection, monitoring and treatment of hypertension. In public hospitals, consultants tend to rely on measurements made by other health care providers in the assessment of patients. This report is being presented to highlight the danger patients might be exposed to, when physicians consistently delegate their duties. A physician, who is a known hypertensive, was the subject of this study. His blood pressure was measured by an observer group (control) and an experimental group (hospital staff) independently and compared. There was a significant difference between the two groups of measurement. It is therefore recommended that physicians should measure blood pressures during clinics and ward rounds in order to have a better assessment of their patients. Nurses and junior doctors should be trained in the act of blood pressure measurements and screened periodically for visual and auditory defects.

Keywords: Measurement, blood pressure, and Public hospitals

INTRODUCTION

It has been observed by some patients of Nigerian public hospitals, that some doctors especially consultants do not take a single blood pressure measurement from the time of their admission to discharge. Yet the physicians monitor the patient's progress with records by nurses on shift duties, read out by nursing sisters during ward rounds. The Hippocratic Oath specifies that physicians must not act on results they have not personally verified. Though apparently simple, measurement of blood pressure with a sphygmomanometer is prone to errors, which may mislead a physician in the diagnosis and treatment of hypertension. This study was therefore carried out to determine whether the results of blood pressure measurements by nurses were consistent and accurate enough to be used for diagnosis, treatment and evaluation of hypertensive patients by consultants and senior doctors. It is also to highlight the dangers patients are exposed to in the course of treatment for hypertension.

MATERIALS AND METHODS

This study was carried out in a tertiary hospital for a duration of 15 days. The patient was a known hypertensive male patient admitted for leg ulcer. The control blood pressure measurements were carried out by four well-tutored and proficient health care providers (control group) in blood pressure measurement. The experimental blood pressure measurements were carried out by six nurses, (experimental group) who were on night shift during the period of the study. They were not aware that a study was going on.

The control blood pressure monitor was assigned to measure blood pressure of the patient within 30 minutes of measurement by the experimental group. All measurements were made between 7a.m and 8a.m in the morning before the day's ward round.

Data analysis was done with the aim of comparing records obtained by experimental and control groups and finding out if there was any significant difference between both groups. P-values were calculated with graph and pad software written by John Pezullo of Georgetown University center.

The protocol for the research project has been approved by the Ethics Committee of the Ambrose Alli University and it conforms to the provisions of the Declaration of Helsinki (as revised in Edinburgh, 2000).

RESULTS

Results of blood pressure measurements by control and experimental groups are as shown below in Tables 1, 2 and 3.

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Table 1. Control and experimental systolic blood pressure records for 15 days

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B.P															
Control	120	130	110	110	120	120	110	110	110	100	120	110	90	80	60
Experimental	150	160	130	140	150	140	140	150	140	120	130	150	150	140	120
Deviation From control	30	30	20	30	30	20	30	40	30	20	10	40	60	60	60

Table 2. Control and experimental diastolic blood pressure records for 15 days

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B.P															
Control	100	100	70	70	80	70	70	70	60	60	70	60	50	50	30
Experimental	120	120	110	100	90	90	90	90	90	80	100	90	90	80	80
Deviation from control	20	20	40	30	10	20	20	20	30	20	30	30	40	30	50

Table 3. Deviation of Blood pressure Measurements from Control and Statistical Significance

Measurement	Mean deviation	Standard deviation	t-value	p-value
Systolic blood Pressure	34mmHg	15.49 mmHg	8.5	<0.00001 Extremely significant
Diastolic blood Pressure	27.33mmHg	10.33mmHg	10.25	<0.00001 Extremely significant

DISCUSSION

Blood pressure is the lateral pressure exerted by the column of blood on the walls of the arteries (Bijlani, 1997) and is calculated as the product of cardiac output and peripheral resistance. Peripheral resistance is determined by viscosity of the blood and caliber of the resistance vessel. Cardiac output increase may elevate blood pressure transiently but sustained hypertension is usually due to increased peripheral resistance.

Hypertension is a sustained elevation of arterial blood pressure. The average systolic and diastolic blood pressures gradually rise with age. Generally accepted 'normal' blood pressures are as follows (McLeod, Edwards and Bouchier, 1988)

140/90 mmHg at 20 years

160/95 mmHg at 50 years

170/105 mmHg at 75 years

Exercise, anxiety, discomfort and unfamiliar surroundings can lead to a transient rise in blood pressure and measurements should be repeated under

conditions in which the patient is resting and relaxed until consistent readings are obtained. Hypertension may be primary or secondary. Primary hypertension is also called essential hypertension. Its cause is unknown. 90% of hypertension is of this type. Initially, blood pressure elevation is often intermittent and there is exaggerated response to stimuli such as cold and excitement. This suggests the sympathetic system is overactive. Overactive sympathetic reflexes cause arteriolar spasm, which increases peripheral resistance and therefore blood pressure. Later, blood pressure elevation becomes sustained. The baroreceptor mechanism is reset so that blood pressure is maintained at elevated level. Spasm of arterioles leads to hypertrophy of their musculature and there is some organic narrowing of the vessel. At this stage even a normal rate of sympathetic discharge is associated with an elevated blood pressure (Gannong, 1999). High salt intake has been mentioned as a cause of hypertension. However some people are salt sensitive and others are not. Essential hypertension is common, where there is a high salt intake (McLeod *et al*, 1988).

Secondary hypertension is due to a known cause. This component forms about 10% of hypertension. Common causes of secondary hypertension include coarctation of the aorta, renal diseases such as acute glomerulonephritis, polycystic kidney, and renal artery stenosis, endocrine disorders such as pheochromocytomata, Cushing syndrome, Primary aldosteronism, and hormone therapy such as oral contraception and estrogen therapy. Pregnancy induced hypertension is a form of secondary hypertension.

Malignant hypertension is an accelerated form of hypertension, which may be due to renal damage. Features of malignant hypertension include papilledema of small arterioles of the retina, cerebral symptoms, and progressive renal failure.

All types of hypertension may lead to complications, which include cerebro-vascular accident (Stroke), cardiovascular accident (Heart attack), cardiac failure and renal failure, all of which are economically and socially devastating to the affected persons and their families. Hypertension is controllable but not curable. It is therefore necessary that policies be put in place for the detection and control of hypertension. One of these is training of health care providers in the use of simple and inexpensive instruments for the detection of elevated blood pressure.

Blood pressure may be measured by direct and indirect methods. The direct method of blood pressure measurement involves catheterization of an artery and connection to a manometer or any other pressure sensitive device from which a graphical record can be obtained. This method is invasive and cannot be used for everyday practice. The indirect method, sphygmomanometry is non invasive and can be easily learnt and practiced in both rural and urban areas in developing countries.

The sphygmomanometer consists of an inelastic cuff, which consists of an inflatable rubber bag connected to two tubes. One tube connects the bag to a manometer and the other tube is connected to a bulb fitted with a valve, which may be used for inflating or deflating the rubber bag. The cuff is snugly placed around the arm 3-4 cm above the elbow joint. The cuff pressure is raised to a level at which the arterial pulse cannot be felt anymore. A further increase in cuff pressure stops all the blood flow through the brachial artery. Then the cuff pressure is gradually brought down. The blood starts flowing into the brachial artery as soon as the cuff pressure falls just below the systolic arterial pressure. Appearance of the first soft tapping sound denotes the systolic pressure. As the cuff pressure falls, the character of the sound changes and finally sounds stop. Korotkoff divided the sounds into four phases as reported by Paskalev et al, 2005.

✚Phase I. Tapping sound appears as systolic pressure and becomes louder with a fall of about 10mmHg.

✚Phase II. Sound changes into a murmur during the next 15mmHg fall of pressure.

✚Phase III. Murmur becomes louder during the next 15mmHg of fall of pressure.

✚Phase IV. During the last 4-6mmHg fall of pressure, the sound becomes muffled and then stops completely. The pressure at which the sound just disappears is taken as the diastolic pressure (Carney, 1997).

Blood pressure may be recorded with mercury, aneroid, or electronic sphygmomanometer. The most commonly used of these in Nigeria is the mercury sphygmomanometer. Ambulatory blood pressure measurements (Carney, 1997) have not been introduced into the Nigerian public hospitals.

Results obtained from measurement of blood pressure with a sphygmomanometer depends on factors that vary with the application of the cuff to the arm, the point on the arm the diaphragm is positioned, the level to which the cuff is inflated before deflation and the auditory and visual capacity of the health care provider. An improperly placed cuff tends to give an erroneous result and a distracted and non-attentive health attendant may fail to read the meter at the points, when sounds are heard at the first time and when they disappear. A health attendant who has visual defects will read the wrong result. The same applies to a partially deaf attendant. Some health attendants may place the stethoscope around the neck and yet record results! These faults are quite common among health care providers but they may be unknown to the hospital authority as they are usually alone with the patients when these errors occur. Hence, the results may be interpreted as the correct results based on the level of training, the health care provider has had. The assessment of health care providers at the point of employment is usually based on certificates acquired and not on demonstration of skill.

When a patient is admitted into the hospital ward, regular checks are made by the nursing staff and recorded. These records are often used by consultants and senior doctors to determine the well-being of their patients. The multiple sources of errors enunciated above give the impression that it may be foolhardy for any doctor to base his prescriptions or assessments on results obtained by another health attendant except the health attendant has been retrained and accredited in the art of blood pressure measurement.

In this study, there was a significant difference between results obtained by the control and the experimental groups. It is obvious that a patient that continued to take hypotensive drugs even when the blood pressure was normal, though recorded as high would have developed complications. Such was the case in the subject of this experiment, which became partially deaf after the last record of 60/30 mmHg! It was only then, blood pressure was checked by a doctor, who confirmed a low blood pressure and recommended that hypotensive drugs be

suspended, while monitoring continued.

Let's assume that the control record was wrong all the time. The magnitude of difference between results obtained by both groups, who are supposedly well-trained health care providers, indicates that physicians should be wary of using records, they are not sure of their validity.

Consultants during ward rounds should make effort to take blood pressures before making prescriptions or insisting on their use. This will reduce the incidence of adverse effects on patients and increase patient's confidence in the treatment being administered. Nurses and doctors should be given short training in the act of blood pressure measurements before exposing them to patients. Blood pressure measurements are usually taken for granted by hospital staff. A study should be done by hospitals to find out the proportion of hospital staff, who measure blood pressure correctly. This will enable such hospitals to organize training programs on the measurement of blood pressure.

The use of electronic monitors may be seen as a panacea to the intra and inter observer errors but results can be very misleading when the battery is weak and unknown to the observer. Defects in the monitor can also give misleading results. They are also not cost effective in the Nigerian environment because they are prone to defects, when there are multiple users. Testing of the auditory and visual capacity of hospital staff should be done to detect those staffs that are not capable of recording valid blood pressure and other parameters that require high level of visual and auditory acuity.

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