ACCURACY OF BLOOD PRESSURE MEASURING DEVICES AND MEASURING ACCURACY

OF IPKA - INTEGRATED PROGRAM OF KASR ALAINY STUDENTS

STUDY QUESTION

HOW ACCURATE ARE BLOOD PRESSURE MEASURING DEVICES AND MEASURING ACCURACY OF IPKA STUDENTS.

BACKGROUND

Blood pressure (BP) measurement is one of the most commonly performed screening tests in clinical practice. Its accuracy is vital to the early diagnosis and effective management of hypertension. The process of measurement needs definite criteria in order to be accurate, one of which, an important one, is the equipment used, the validity as well as the accuracy of the device used to measure BP. BP devices should be checked regularly to ensure that their calibration remains within ±3 mmHg divergent. (1,2,3)

In addition, it is recommended that regular calibration assessments be carried out to ensure that devices conform to the European Standard specification of having a leak rate within 4 mm Hg per min. and a pressure scale accurate to within ±3 mm Hg for any part of the pressure range.(3) According to a study made on site at St Thomas' Hospital (London, UK) 2008 , over a 3-month period following the recommendations of the European Standard, quarter of sampled BP devices tested at a tertiary care teaching hospital were found to be unacceptable. (4)

This study showed the importance of assessing the pressure scale of all BP measurement devices regularly once they enter clinical use. It remains important to procure only those devices that are clinically validated according to a recognized protocol.

Small over- and underestimations of pressure can have a substantial impact on diagnoses. It has been suggested that overestimation of systolic BP by as little as 3mmHg increases the number of patients in a population classified as hypertensive by 24%. Equivalent underestimation causes 19% of the patients with systolic hypertension to be missed.

The mercury sphygmomanometer has always been regarded as the gold standard for clinical measurement of blood pressure, but this situation is likely to change in the near future.The design of mercury sphygmomanometers has changed little over the past 50 years, except that modern versions are less likely to spill mercury if dropped. In principle, there is less to go wrong with mercury sphygmomanometers than with other devices, and one of the unique features is that the simplicity of the design means that there is negligible difference in the accuracy of different brands, which certainly does not apply to any other type of manometer. However, this should not be any cause for complacency. One hospital survey found that 21% of devices had technical problems that would limit their accuracy, whereas another found >50% to be defective.

Most sphygmomanometer surveys report high rates of inadequate calibration, particularly in aneroid sphygmomanometers. Automatic electronic sphygmomanometers produce systematic errors in some patients, so, all sphygmomanometers should be checked regularly and calibrated by an accredited laboratory at least annually. (5)

EHS is committed to improve Egyptian physician knowledge and attitudes regarding hypertension. Providing proper and free service to a large section of hypertensive Egyptian patients, little is known about the types and calibration errors of blood pressure devices used in clinical practice.

STUDY OBJECTIVES

Primary objectives

1. We aim to evaluate the accuracy of blood pressure measuring devices of IPKA students.
2. Identify which type of BP device is most subject to calibration errors .
3. evaluating accuracy of students blood pressure measurement technique.

Secondary objectives

1. Establish a validated calibration center .
2. Increase awareness of the importance of using validated devices and to provide an easily identifiable means of checking whether or not a device is validated to a recognised standard.
3. implementing a yearly program with specific objectives

PLAN OF ACTION

- Study design:

1. Study Design and sites

This is a cross –sectional analytical study ,150 devices will be Calibrated.

1.2. Equipment required for Blood Pressure Monitor Calibration

DigiMano Digital Pressure/Vacuum Meter, Netech Model 2000 (range: 0-300 mmHg). Blood Pressure Calibration Kit (syringe; silicone tubing; T adapter; Luer-lock; Velcro tape; valve cap) Microlife 3MC1-PC_IB Oscillometric Blood Pressure Monitor ADULT and LARGE ADULT blood pressure cuffs Testing Protocol, calibration will be performed according to the manufacture recommendation (R)

-Time table of schedule survey

1. **Study duration**

   3 months

2. **Proposed date for start the study**

The project will start by December 2017 to feb. 2018, finishing calibration of every own device of APICA medical Students.

- Data entry and Statistical analysis:

Using SPSS program for Data analysis and management of the data

- Ethical committee approval:

- Collection of Data:

Project teams

1. Field force team
2. Data Entry team
3. Statistics team

Criteria of Choice:

1. Medical field
2. One year experience at specialized field

3. Certified for measurement from EHS" & "well qualified for calibration from National Institute of Calibration
4. Time allocated for work.

REFERENCES:

1. O'Brien E, Petrie J, Littler W, de Swiet M, Padfield PL, Altman DG et al. The British Hypertension Society protocol for the evaluation of blood pressure measuring devices. J Hypertens 1993; 11(Suppl 2): S43–S62.

2. O'Brien E, Pickering T, Asmar R, Myers M, Parati G, Staessen J et al. Working Group on Blood Pressure Monitoring of the European Society of Hypertension International Protocol for validation of blood pressure measuring devices in adults. Blood Press Monit 2002; 7(1): 3–17.

3. European Standard EN 1060-1:1996. Specification for non-invasive sphygmomanometers. Part 1: General requirements. European Commission for Standardisation. Rue Stassart 36, B-1050, Brussels, 1996.

4. de Greeff a, Lorde I, Wilton a, Seed P, Coleman a J, Shennan a H. Calibration accuracy of hospital-based non-invasive blood pressure measuring devices. Journal of Human Hypertension (2010) 24, 58–63.

5. Martin J, Catherine S, Noel B. Sphygmomanometer calibration Why, how and how often? Australian Family Physician Vol. 36, No. 10, October 2007.

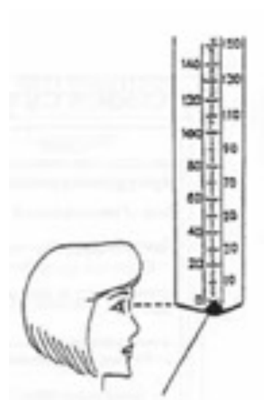
APPENDI CES

How to calibrate:

SPHYGMOMANOMETER CALIBRATION:

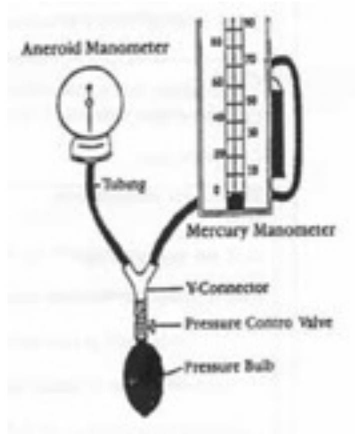
The blood pressure equipment you use should be checked regularly.
If using the mercury manometer, check it with every use.
If using the aneroid manometer, check it every 6 months against a mercury manometer.

1. Mercury Manometer:
   - Set the manometer flat on a table.
   - At your eye level, looking at the level of the mercury, the top of the meniscus should be at (0).
   - If the top of the meniscus is above or below zero (0), send for service.



2. Aneroid Manometer: (Using the Y-Connector)

- Connect the aneroid gauge and the mercury manometer with a Y-connector.
- Pump the mercury to 250, 200, 150, 100, 50mm Hg
- Observe if aneroid gauge readings differ from mercury gauge readings.
- If aneroid differs by 4 mm Hg or more, send for service/repair.
- If the aneroid differs by 2 mm Hg (more or less) from the mercury gauge, note this on the aneroid, and this "correction factor" should be used with every reading.



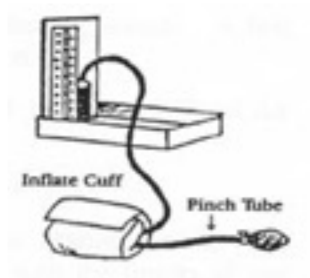
3. Aneroid Manometer: (Using a Cuff)

Step I

- Disconnect aneroid gauge.
- Put rest of apparatus aside.

Step 2

- Place mercury manometer at your eye level.
- Roll cuff loosely around itself.
- Pump some air into cuff (to about 50 mm Hg.)
- Pinch tubing that connects bulb to cuff so air does not escape from cuff.



Step 3

- Remove bulb after pinching tubing.
- Insert aneroid gauge where bulb was.
- Release pinched tubing. Pressure will rise in both gauges simultaneously.
- Squeeze rolled-up cuff to raise pressure to both gauges and observe reading on both mercury manometer
- and aneroid simultaneously (e.g. 250, 200, 150, 100, 50 mm Hg).
- Observe if aneroid gauge reading differs from mercury gauge reading.
- If any difference is noted, the amount (in mm Hg) that the aneroid is off is to be added (or subtracted) to any future readings of the aneroid gauge: i.e., if aneroid reads 60, 80, and 140 when mercury gauge reads 62, 82, 142 it is short 2 mm. Hg and when used in the future 2 mm HG should be added to every reading.

  This "correction factor" should be noted on the aneroid gauge. If aneroid differs from mercury gauge by 4 mm Hg. or more, send for service/repair.

Appendix 2: Questionnaire

Tech ID: ______ FI Cuff: ______ FI Monitor: ______ Test Date: ______ Cuff: ADULT or LARGE ADULT

Visual Check

• TUBE HAS CRACKING?	Y	N	NO MATCHING TUBING
• TUBE HAS HOLES?	Y	N	NO MATCHING TUBING
• CUFF HAS WORN OUTER CLOTH OR VELCRO?	Y	N	NO MATCHING CUFF
• TUBE LEAKS?	Y	N	NO MATCHING TUBING
• CUFF HAS LEAKAGE OF CUFF BLADDER?	Y	N	NO MATCHING CUFF

• *COMMENTS:* ______________________________

Calibration Check with Pressure-Vacuum Meter

Observed pressure values on the Digimano Pressure-Vacuum Meter and the Microlife from 280 to 20 (± 2) mmHg in approximate decrements of 20 (± 2) mmHg.

MEASUREMENT NUMBER	DIGIMANO	MICROLIFE
1 (280)	☐☐☐.☐ mmHg	☐☐☐ mmHg
2 (260)	☐☐☐.☐ mmHg	☐☐☐ mmHg
3 (240)	☐☐☐.☐ mmHg	☐☐☐ mmHg
4 (220)	☐☐☐.☐ mmHg	☐☐☐ mmHg
5 (200)	☐☐☐.☐ mmHg	☐☐☐ mmHg
6 (180)	☐☐☐.☐ mmHg	☐☐☐ mmHg
7 (160)	☐☐☐.☐ mmHg	☐☐☐ mmHg
8 (140)	☐☐☐.☐ mmHg	☐☐☐ mmHg
9 (120)	☐☐☐.☐ mmHg	☐☐☐ mmHg
10 (100)	☐☐☐.☐ mmHg	☐☐☐ mmHg

Appendix 3 : evaluation sheet.

candidate will be evaluated during blood pressure measurment according to the following items which has to be fullfilled

Ø Indtrodue him/her self to patient

Ø Ensure that the device is valid

Ø Correct cuff size

Ø Bladder of the device is evacuated

Ø No caffiene or cigarrete

Ø Remove clothing

Ø Patient position

Ø Observer position

Ø Arm position

Ø Device position

Ø Stetoscope position

Ø Cuff position

Ø Accurate inflation

Ø Accurate deflation

Ø Avoid reinflation

Ø Palpatory methode

Ø Avoid talking

Ø Measurment in both arms

Ø Inform the patient about reading