

Short Communication

Level of Mercury Manometer With Respect to Heart: Does it Affect Blood Pressure Measurement ?

Raj Kapoor^{1*}, V. K. Roy², S. Manna¹ and M. Bhattacharjee¹

¹Department of Physiology,
VMMC and Safdarjung Hospital, New Delhi

²Department of Physiology,
SGT Medical College, Gurgaon, Haryana

Abstract

Measurement of blood pressure is an integral part of clinical examination. Over the years various types of instruments have been used to measure blood pressure but till date the mercury sphygmomanometer is regarded as the gold standard. However, there is a myth prevalent among health professionals regarding the level of the manometer in relation to heart at the time of measuring of blood pressure. Many professionals insist that it has to be placed at the level of the heart. We argue that the limb from which pressure is measured must be at the heart level rather than the manometer. We conducted a study in which we measured the blood pressure in adults by placing the manometer at three different levels with respect to the heart. The values of blood pressure obtained at all levels were similar and did not show any statistically significant difference. We therefore conclude that the level of sphygmomanometer per se does not affect blood pressure measurement.

Introduction

Measurement of blood pressure (BP) is one of the most important parts of clinical examination. BP is classically measured using a mercury sphygmomanometer. In recent years however the use of this apparatus has been discouraged due to environmental hazard associated with mercury. However, it is still considered as the gold standard in the opinion of many. The standard procedure for recording blood pressure has been extensively

reviewed (1, 2, 3 and 4). Reeves (5) has given an elaborate description on how various factors with respect to the examiner, examinee and instrument may affect the blood pressure report. In spite of the available guidelines there is misconception associated with the technique; that is regarding the placement of the mercury manometer. Surprisingly none of the literature that we consulted has specifically mentioned this point. The body and arm position however has been described in detail (2, 6). It has been observed that many examiners insist on placing the manometer at the level of the heart rather it at the level of the eye of the examiner as mentioned in the standard method. The basis of this practice is not clear.

It is a well known fact that blood pressure is affected

***Corresponding author :**

Dr. Raj Kapoor, Department of Physiology, VMMC and Safdarjung Hospital, New Delhi, Email: rajkapoor272@yahoo.com
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by a factor of 2 mm Hg for every inch above or below the heart level (2). These differences can be attributed to the effects of gravity. All references have mentioned that the limb from which blood pressure is measured and hence the Riva rocci cuff should be at the level of the heart. This is justified due to the aforementioned effect of gravity. It has also been suggested that in the supine position the arm should be supported with a pillow and in the sitting posture the arm be rested on a table to maintain the arm at the level of the right atrium which is the reference point (2, 6). Also, these references have specifically mentioned that the manometer should be at the level of the eye so as to avoid parallax errors while taking the reading. There is no instruction to keep the manometer at the level of the heart as well. However, in Hutchison's clinical methods 19th edition (7), it has been mentioned that the mercury manometer should be placed so as to be at the same level as the cuff on the patient's arm and the observer's eye. In the 21st and 22nd edition of the same book (8), the section on blood pressure measurement is very brief and there is no mention regarding the position of the manometer with respect to heart. The 23rd edition (9), mentions that "the manometer should be at the same level of the cuff on the patient's arm and the observer's eye". The rationale for this statement is not clear. In our opinion the level of the mercury manometer per se should not affect the blood pressure record as long as the limb from which BP is recorded is at the level of the heart. Placement of the manometer at the level of the eye of the examiner seems to be more appropriate. Sood et al (10) in their letter to British medical journal, "A myth about measuring Blood pressure" have opined that an erroneous notion has emerged over the years about the placement of the mercury manometer while recording blood pressure. The authors expressed surprise that even Hutchison's clinical methods describes that the mercury manometer should be placed so as to be at the same level as the cuff.

We decided that it will be worthwhile to address this issue by conducting a simple study to see the effect of the position of manometer on blood pressure record.

Aim

To investigate whether the level of sphygmomanometer in relation to heart affects the measured value of blood pressure.

Objective

To measure blood pressure by keeping the mercury manometer at different levels with respect to the heart.

Method

After obtaining ethical clearance from the institutional ethical committee, 50 medical students in the age group of 18-24 years were recruited for the study, informed consent was taken. Blood pressure from the upper limb was measured by the same observer by keeping the sphygmomanometer at 3 different levels with respect to the heart while the subject was in supine position on a couch. The anterior axillary line in supine position was considered as reference level of the heart. The level of the manometer was changed with the help of an indigenously designed manometer stand which enabled shifting of manometer to various levels at 3 different positions: i) at the level of the heart, ii) 16 inches above and iii) 16 inches below the level of the heart. These three positions of manometer were chosen for this study. Due to the fixed length of the manometer tube (about 24 inches), we were able to comfortably adjust the height of the manometer up to a maximum value of 16 inches above and below the heart. Same mercury manometer was used for every subject and the Riva-rocci cuff was wrapped around the arm according to standard guidelines.

Results

The mean values \pm standard deviation of the systolic and diastolic blood pressure obtained with mercury manometer at the level of heart were 119.8 ± 8.3 mmHg and 78.2 ± 7.1 mmHg, with the manometer at 16 inches above heart level the values were 120.1 ± 8.6 mmHg and 79.0 ± 7.4 mmHg, and with manometer at

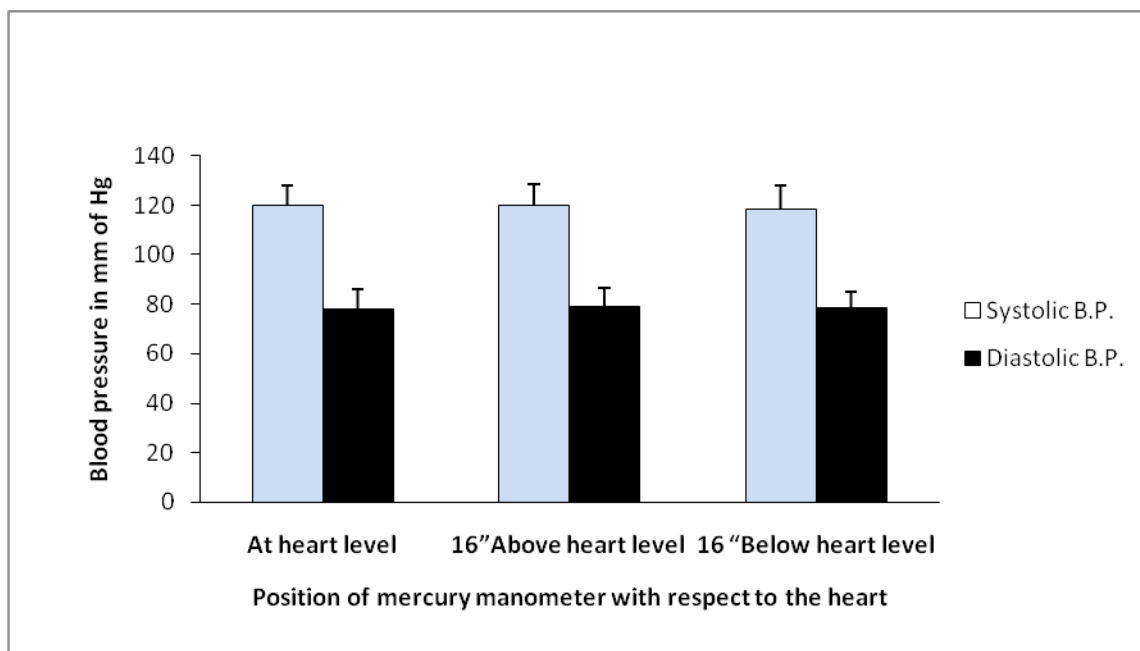


Fig. 1 : The figure depicts the systolic and diastolic blood pressure obtained while recording the same by placing the manometer at the level of the heart, 16" above and 16" below the heart.

16 inches below heart level were 118.1 ± 9.9 mmHg and 78.3 ± 6.7 mmHg respectively.

The values obtained at the heart level were compared with those obtained above and below the heart using paired 't' test and did not reveal any statistically significant difference. The data is represented graphically in Fig. 1.

Discussion

This study was conducted to bring to the notice of the medical fraternity a redundant if not erroneous notion about the placement of sphygmomanometer prevalent among many doctors and paramedical staff. The results of the study were as expected and just strengthened our idea that the position of the manometer with respect to heart per se is immaterial as long as the limb used to measure blood pressure is at the level of the heart. The guidelines (2,4) recommend that the limb and hence the cuff should

be at the level of the heart and the manometer be at the level of the examiners eye. Hutchison's text book on Clinical Methods (7) mentions that the manometer should be at the level of cuff and the eye of the observer. However, it may be difficult at times to achieve these two goals simultaneously. In that event, we suggest that one must pay attention to the position of the cuff rather than that of the manometer as the manometer position does not seem to affect the blood pressure reading as per our findings. It appears that the practice of placing the manometer at the level of the heart in addition to the cuff has probably originated from an over enthusiastic interpretation of the methodology described in the clinical methods. We just want to emphasize on the fact that it is very important to follow each step in a described technique with great care and the rationale for every step must be clarified before learning any procedure. We must promote independent thinking among medical students and encourage them to critically analyze all procedures rather than blindly following them.

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