

MBBS Students' Knowledge and Skill of Blood Pressure Measurement

Suresh Singh¹, Manoj Khattri², Rahul³, Arya Desh Deepak⁴, Mayank Agarwal⁵

ABSTRACT

Introduction: Blood Pressure (BP) measurement is a routinely performed examination in the clinical setup. Accurate and precise measurement of BP is required to manage and diagnose hypertension, whose prevalence is on the rise worldwide. National Medical Council has implemented competency of BP measurement in the first year of medical education. Bachelor of Medicine and Bachelor of Surgery (MBBS) students tend to forget the skill of BP measurement as they proceed further in their medical education. Study objective was to assess the knowledge and skill of MBBS students in their third professional year for BP measurement by the manual auscultatory method.

Material and methods: 67 MBBS students (42 males and 25 females) in their third year of medical education completed the study. They were assessed by a competency or skill chart prepared by a physiologist, a pathologist, and a physician. All necessary types of equipment were provided to the student in an isolated room. MBBS students recorded the BP of the subject provided in the presence of an examiner who certified the various steps in the competency chart for BP measurement by the auscultatory method. Also, students needed to answer five multiple-choice questions (MCQs) within five minutes regarding the BP measurement.

Results: Most of the students performed unsatisfactorily in the competency and in MCQs too.

Conclusion: MBBS students tend to forget the necessary skills to record BP accurately and precisely as they progress towards the third year of their medical education. BP measurement competency certification should be enforced at a regular interval throughout the MBBS curriculum.

Keywords: Blood Pressure, Competency, MBBS

INTRODUCTION

The prevalence of hypertension is rising, and the value of BP to classify hypertension is decreasing.^{1,2} A clinician must accurately measure BP for diagnosis and management of hypertension.² Accurate and precise BP measurement by auscultatory technique is a complex procedure requiring multiple skills and observations.³ The examiner must know the normal range of BP, proper posture of the subject, adequate cuff size and its placement, the instrument's accuracy, and sufficient rest-time provided before BP measurement. The examiner must possess hand-eye coordination for proper inflation and deflation rate, ability to precisely hear and interpret the Korotkoff sounds, sharp visual acuity to record BP, patience to remain silent during the procedure, and cognitive and intellectual power to take all the precautions and avoid terminal digit preference (i.e.,

rounding the BP recording in multiples of 10, for example, 136 mmHg recorded as 140 mmHg).^{2,3}

Traditionally in India, medical students are taught to measure BP in the Physiology laboratory during the first professional year of medical school using the auscultatory method by a manual sphygmomanometer. The National Medical Council of India has made it compulsory for first-year medical students to pass the competency of BP measurement.⁴ However, it has been seen that later students tend to forget a few skills and knowledge for adequate BP measurement due to a lack of practice.

The present study aims to assess the knowledge and skill of third professional MBBS students regarding accurate and precise BP measurement.

MATERIAL AND METHODS

Sixty-seven MBBS students in their third professional year from two different medical colleges of India participated in the study. The institutional ethical committee of State Medical College, Saharanpur, Uttar Pradesh, India, approved the present cross-sectional study. All the participants signed an informed consent, which clearly stated that the participation in the study is voluntary and the participant's identity would not be disclosed. However, the data would be used for publication. The study took place from September 2019 to December 2020.

Participants were required to answer five multiple-choice questions (MCQs) within 5 minutes to assess their knowledge regarding BP. To evaluate the participant's skill, a male subject was provided to them for BP measurement in an isolated room, and an examiner verified the various

¹Assistant Professor, Department of Pathology, Autonomous State Medical College, Pratapgarh, Uttar Pradesh, ²Assistant Professor, Department of Medicine, Autonomous State Medical College, Pratapgarh, Uttar Pradesh, ³Associate Professor, Department of Physiology, Autonomous State Medical College, Pratapgarh, Uttar Pradesh, ⁴Principal, Department of Biochemistry, Autonomous State Medical College, Pratapgarh, Uttar Pradesh, ⁵Assistant Professor, Department of Physiology, Autonomous State Medical College, Pratapgarh, Uttar Pradesh, India

Corresponding author: Manoj Khattri, Department of Medicine, Autonomous State Medical College, Pratapgarh, Uttar Pradesh, India – 230502

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skill points required (competency) for BP measurements. The competency (shown in table 1) and MCQs (shown in table 2) of BP measurement were prepared jointly by a Physiologist, a Pathologist, and a Physician considering the recommendations of the American Heart Association. BP measurement session was for one hour from 1 AM to 2 PM. The subject was asked to comply with the instructions given

to them by the MBBS students. At the time of competency certification, only the subject, examiner, and the MBBS student were present in the room. The subject was further instructed to be talkative, wear a loose sleeve shirt, and if asked for the history, he should answer that he had not visited any doctor for BP measurement in the past 2-3 years. Further, the subject was instructed to sit on a stool if not

Points in BP measurement for competency certification	Number and (%) of students performed it correctly	Number and (%) of students not performed it or did it incorrectly
1. Washed/sanitized hands?	49 (73%)	18 (27%)
2. Asked subject to sit in the chair with back supported and both feet flat on the floor?	17 (25%)	50 (75%)
3. Introduction		
a. Introduced self?	30 (45%)	37 (55%)
b. Confirmed the identity of the subject?	24 (36%)	43 (64%)
c. Explained procedure and gained consent?	29 (43%)	38 (57%)
d. Asked the subject to remain silent during the examination?	63 (94%)	4 (7%)
4. History		
a. Asked about previous BP check-ups?	29 (43%)	38 (57%)
b. Asked if the subject rested for 5 minutes?	21 (31%)	46 (69%)
c. Asked about medication history?	20 (30%)	47 (70%)
d. Asked about the emptiness of the bladder?	0 (0%)	67 (100%)
e. Asked about exercise, smoking, or caffeine/ tea consumption?	20 (30%)	47 (70%)
5. Preparation		
a. Checked sphygmomanometer?	45 (67%)	22 (33%)
b. Checked stethoscope?	54 (81%)	11 (16%)
c. Clean the diaphragm/bell and earpiece of the stethoscope with the alcohol wipe?	12 (18%)	55 (82%)
6. Cuff wrapping		
a. Asked the patient to expose the arm?	66 (99%)	1 (1%)
b. Ensured that air is not present in the cuff before tying?	38 (57%)	29 (43%)
c. Rested the subject's forearm on the table?	58 (87%)	9 (13%)
d. Palpated the brachial artery?	19 (28%)	48 (72%)
e. Arrow on the cuff (midpoint of the cuff) aligned with the approximate position of the brachial artery?	57 (85%)	10 (15%)
f. Tied cuff 2-3 cm above antecubital fossa?	65 (97%)	2 (3%)
g. Checked for tightness of the cuff tied by inserting finger/s?	42 (63%)	25 (37%)
7. Palpatory method		
a. Inflated the cuff slowly while palpating radial artery?	50 (75%)	17 (25%)
b. Noted SBP?	42 (63%)	25 (37%)
c. Done for both arms?	21 (31%)	48 (69%)
8. Auscultatory method		
a. Gave at least a minute gap after the palpatory method?	53 (79%)	14 (21%)
b. Inflated the cuff 20-30 mmHg higher than the SBP recorded during the palpatory method?	42 (63%)	25 (37%)
c. Placed the diaphragm or bell of the stethoscope on the brachial artery?	65 (97%)	2 (3%)
d. Correctly placed the earpiece of the stethoscope in the ears?	57 (85%)	10 (15%)
e. Deflated cuff at the rate of 2-4 mmHg/sec?	55 (82%)	12 (18%)
f. Noted SBP and DBP?	42 (63%)	25 (37%)
g. Repeated procedure after at least a minute to take 2nd reading?	53 (79%)	14 (21%)
h. Done for both arms?	21 (31%)	46 (69%)
9. Documentation (on the paper)		
a. Wrote the subject's name, age, gender?	13 (19%)	54 (81%)
b. Mentioned a brief history or chief complaints?	10 (15%)	57 (85%)
c. Final SBP and DBP values were documented from the arm with higher values?	21 (31%)	46 (69%)
d. No terminal digit preference?	42 (63%)	15 (37%)
e. Mentioned the arm from which they were taken?	7 (10%)	60 (90%)
f. Mentioned the patient's position at the time of BP measurement?	7 (10%)	60 (90%)
g. Signed the document with the date?	0 (0%)	67 (100%)
10. Washed/sanitized hand after the procedure?	37 (55%)	30 (45%)

Table-1: Skill required by the participants for BP measurement

asked otherwise and cross his legs after sitting on the stool. MBBS students were provided with a table, a chair with arm and back support, a stool, Dr Trust aneroid sphygmomanometer with a universal adult-sized cuff (22-42 cm) with an arrow mark indicating the part of the cuff that should be above the brachial artery, locally available stethoscope with double earpiece, pen, and paper. It was made sure that students are accustomed to the use of an aneroid manometer. Sanitizer and alcohol wipes were placed on the table.

Microsoft excel 2019 was used for statistical analysis to express the results in percentage.

RESULTS

42 male (63%) and 25 female (37%) MBBS students in their third professional year of medical education were involved in the study. The age range of the students was from 22 years to 27 years. Most students performed unsatisfactorily in the competency, and none performed all the steps correctly (Table 1). The performance of the students was better in MCQs as compared to competency. However, many students could not answer more than three MCQs correctly (Table 2). 15 students answered all the MCQs correctly.

DISCUSSION

The present cross-sectional study was done to explore

the knowledge and skill of MBBS students in their third professional year of the medical college in India for the measurement of BP. The result indicates that most students do not have adequate skills to measure BP by the manual auscultatory method. Our study closely resembles the study by Rakotz et al.^{3,5} but the results are not comparable due to differences in competency chart, participant characteristics, and study protocol.

In the clinical setup, the physician usually measures BP, though they are switching to an automated BP monitor. Still, the practice to measure BP by manual auscultatory method continues. Error/s in the technique of manual BP measurement leads to falsely high BP recording that can prove harmful as a patient a normal patient may be labelled as a stage 1 hypertensive.

Many students did not perform hand hygiene before and after the examination. Hand hygiene or sanitization is an effective way to control the spread of infection.⁶ Teachers, while instructing students for BP measurement, should put more emphasis on hand sanitization.

Most students did not ask the subject to sit on the chair with back supported and keep the feet flat on the surface. Measuring BP without back support and legs crossed causes falsely high systolic blood pressure (SBP) and diastolic blood pressure (DBP) recordings.^{7,8}

The introduction part of the competency was highly

MCQs	Number and (%) of students answered correctly	Number and (%) of students answered incorrectly
According to 2017 American College of Cardiology/American Heart Association guidelines, BP of 130/80 mmHg on more than 2 occasions should be classified as: A. Normal B. Elevated C. Hypertension stage 1* D. Hypertension stage 2	18 (27%)	49 (73%)
The rubber bladder present inside the BP cuff should cover what % of the patient's mid-arm circumference: A. 75%–100% in length and 37%–50% in width* B. 50%-75% in length and 25-50% in width C. 100% for both length and width D. 50% for both length and width	50 (75%)	17 (25%)
Using a small-sized cuff will cause: A. Underestimation of BP B. Overestimation of BP* C. No effect of BP estimation D. Can be all of the above	47 (70%)	20 (30%)
How much interarm difference in SBP or DBP is considered clinically significant? A. >5 mm Hg B. >10 mm Hg* C. >15 mmHg D. >20 mmHg	33 (49%)	44 (51%)
Which phase of Korotkoff sound is considered as SBP and DBP? A. Phase 1 and Phase 3 respectively B. Phase 1 and Phase 4 respectively C. Phase 1 and Phase 5 respectively* D. Phase 1 and Phase 6 respectively	49 (73%)	18 (27%)

Table-2: MCQs to be answered by the participants. The correct response is marked with an asterisk.

unsatisfactory, as more than half of the students neither introduced themselves nor confirmed the subject's identity. Moreover, students skipped the explanation of the procedure and gaining informed consent from the subject. Introducing oneself to the patient/subject and confirming the subject's identity is not only courteous but also builds rapport.⁹ Gaining informed consent is necessary as, in the process, the health care provider educates the patient about the risks (tightness or feeling of pain during cuff inflation), benefits (diagnosis or management of hypertension), and alternatives of procedure (other methods if available).¹⁰

Most students either skipped or took an incomplete history of the subject. By knowing the history, healthcare providers can decide whether to measure BP in one arm or both arms. If the patient is getting their BP checked for the first time or after a long gap, then it is recommended to measure BP in both arms. For subsequent visits arm with higher BP recording should be preferred.¹¹ An interarm difference of >10mmHg in SBP or DBP should be considered clinically significant.¹² The urinary bladder of the subject should be empty, at least 5 minutes of rest should be provided, cardiac stimulants should be avoided 30 minutes before the procedure, and neither subject nor the healthcare provider should talk while the BP measurement to prevent the falsely high BP recording.^{2,13}

Most students did the preparation incompletely. Students checked the stethoscope and aneroid sphygmomanometer for proper functioning, but most forgot to sanitize the earpiece and chest piece of the stethoscope with an alcohol wipe.

The midpoint of the rubber bladder present inside the BP cuff should coincide with the brachial artery. Hence, it is recommended for a novice to first palpate the brachial artery and estimate the midpoint of the rubber bladder (sometimes marked as an arrow by some manufacturers). To provide space for the placement of the chest piece of the stethoscope, the lower end of the cuff should be tied 2-3 cm above the antecubital fossa. BP cuff bladder length should be 75%-100%, and width should be at 37%-50% of the subject's arm circumference. A small-sized cuff will result in falsely high BP recording, while an oversized cuff will lead to falsely low BP recording. The cuff should be wrapped such that only one finger can be freely inserted in it from the top and bottom. It is recommended to place the BP cuff over the bare skin; however, if the shirt sleeves are tight, they should not be rolled up to avoid the tourniquet effect.^{2,14,15} The cuff should be tied at the heart level as there is a 0.77 mmHg/cm increase or decrease in BP below and above the level of heart level, respectively.¹⁶ Hence it is preferred to rest the forearm on the table, making an almost 45-degree angle at the elbow.

Many students skipped the palpatory method for BP measurement. Initially, SBP should be recorded by palpatory method to avoid auscultatory gap.¹⁷ If an auscultatory gap is present in the subject and was not eliminated by the palpatory method, then it may lead to the recording of falsely low SBP.¹⁵

Many students used the wrong technique for the auscultation of Korotkoff's sound. Too rapid inflation or deflation affects BP. If the deflation rate is faster than 2-4 mmHg/sec, then

the perception of Korotkoff sound might not be accurate, leading to underestimation of SBP and overestimation of DBP. A very slow rate of deflation will result in elevation of DBP. SBP is taken as phase 1 of Korotkoff's sound, and DBP is taken as phase 5 of Korotkoff's sound.^{2,15,17} An average of two readings should be taken, but if the difference between 2 readings is more than 5 mmHg, a third reading is also required. At least a minute of rest should be provided before taking the second reading to prevent vasospasm.¹⁷ Few students placed the earpiece of the stethoscope incorrectly. The earpiece of the stethoscope should be directed medially, forwards, and downwards.

Most of the students performed very poorly while documenting the BP recordings. Also, most of the students were unaware of current guidelines for normal blood pressure. American Heart Association and American College of Cardiology 2017 guidelines say that a BP of <120/80 is normal, 120-129/ <80 is elevated, 130-139 SBP or 80-89 DBP is stage 1 hypertension, and SBP≥140 or DBP≥90 is stage 2 hypertension.²

The study faced several limitations, primarily being the sample size. Due to the COVID-19 pandemic, the time for completion of the study was extended still the anticipated sample of 200 students was not reached. Examiner bias cannot be eliminated while certifying the competency. Students could have discussed BP measurement competency and MCQs given to them as only two to three students per week were involved in the assessment. Inclusion of competency by the National Medical Council is new for both faculty and students; hence the competency chart prepared by us might not be an ideal one. The performance of MBBS students might vary with the medical college, and hence, the involvement of multiple medical colleges throughout India is required for the validity of our study results.

CONCLUSION

The study results indicate that third-year medical students considerably lack the necessary skills to accurately measure BP by the manual auscultatory method. Though the National Medical Council has implemented the certification of BP measurement competency, there is an imperative need to recheck students for the competency at a regular interval of time.

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