

## ORIGINAL ARTICLE

# Apparently less value of blood pressure among healthy people: is the cuff width responsible?

T. PRAMANIK, S. SHRESTHA, A. GHOSH

Department of Clinical Physiology, Nepal Medical College, Jorpati, Kathmandu, Nepal

## Key words

Blood pressure • Normotensive • Borderline hypertension

## Summary

*Blood pressure in normal adults in the present study population in Nepal is found to be less in comparison to that recorded in Framingham study, USA. To find out the cause of variation of blood pressure values, this study was designed. Blood pressures of healthy young subjects were recorded by mercury sphygmomanometer having standard Riva-Rocci cuff. The mid-arm-circumference of the same subjects were measured by a measuring tape. Blood pressure for male and female subjects was found to be 115/77 mmHg and 107/73 mmHg respectively. Mid-arm-circumferences of male and female volunteers were recorded approximately 25 cm and 23 cm respectively. As*

*per rule, width of the cuff should be 40% of the mid-arm-circumference. Nevertheless, the calculated value of 40% of the mid-arm-circumference was found to be less than 12 cm. The calculated value of 40% of mid-arm-circumference for male and female volunteers was found to be approximately 10 cm and 9 cm respectively in this study population. So, the width of the cuff is relatively more than what it should be, for this study population. This may be the cause of less value of blood pressure in normotensive population in this study. Cuff size should be considered carefully to avoid misinterpretation of borderline hypertensives as normotensives.*

## Introduction

Normal range of blood pressure as per the report of recent study in Framingham USA is  $122 \pm 5/78 \pm 5$  mmHg in males and  $122 \pm 5/77 \pm 6$  mmHg in females [1]. Nevertheless, while recording the blood pressure of students and staff of our college, with utter surprise lower value of blood pressure was noted although there was no clinical symptoms of hypotension among them and all were absolutely normal. Naturally, the question arises, whether the normal blood pressure is relatively less in this study group or some problem lies in the instrument of blood pressure measurement – the sphygmomanometer? The present study was undertaken to answer this question.

## Materials and methods

Healthy students and staff of our Medical college (age 18-35 years) having normal body mass index i.e., 18 to 25 ( $n = 91$ ; male 41, female 50) participated as volunteers in this study. Subjects were allowed to sit comfortably with a back-rest and allowed to take rest for 5 minutes before the measurement [2]. Blood pressure of each subject was recorded on both the hands using mercury sphygmomanometer and mean was taken. Systolic pressure was recorded at the point at which Korotkoff sound became audible whereas diastolic pressure was measured at the point at which the sound disappeared [3]. Blood pressure was measured between 10:00 to 11:00 AM when ambi-

ent temperature was 13-16 °C. Mid-arm-circumference of them were measured by a measuring tape.

## Result

Blood pressure of male volunteers was found to be  $115.12 \pm 12.26/76.82 \pm 8.94$  mmHg and that of the female counterpart was recorded  $107.08 \pm 9.79/73.52 \pm 7.50$  mmHg. Mid-arm-circumference of male volunteers was recorded  $25.35 \pm 2.43$  cm whereas that of female ones was  $22.94 \pm 1.92$  cm.

## Discussion

It is well established that stress, obesity, smoking, heavy consumption of salt etc are some of the predisposing causes of high blood pressure [4]. Although the Body Mass Index (BMI) of the normotensive women of Framingham study were within the normal range, the male participants were slightly obese (BMI:  $26.0 \pm 3.3$ ) whereas, BMI of all our participants were within the normal range, none of them was obese. In the Framingham study, 42% males and 36% females were smokers. In addition, some of them (2% among the male and 2% among the female volunteers) were also diabetic, as per the report [5]. In our study group all the participants were non-smokers and healthy normal. Besides that among the Americans, salt intake is generally more – about 8 to 10 gm/day; although as per the recommen-

dation of the “Dietary Guidelines Advisory Committee” and “American Heart Association”, salt intake should not be more than 6 gm/day [6]. Salt consumption by the participants of the present study was relatively low – less than 6 gm/day. Although all these aforesaid factors might be responsible for the apparently low blood pressure among our normotensive volunteers; yet, the width of the Riva Rocci cuff appears to be more important factor for the same.

Existing literature indicates that, the size of the Riva-Rocci cuff is very important in blood pressure measurement [7, 8]. It has been suggested that the width of the cuff should be 40% of the arm circumference. If a narrower cuff is used to wrap the arm the recorded blood pressure will be falsely high [9]. Pahlsson et al. also showed that the toe blood pressure were found to be 18 mm Hg higher if measured with 2 cm compared to a 2.5 cm wider cuff [10]. Though 23 x 12 cm cuff is considered as standard cuff [11], yet in most of the cases the width 12 cm is not exact of 40% of the mid-

arm-circumference. Calculated values of 40% of mid-arm-circumference for male and female subjects in the present study were found to be 10.14 cm and 9.17 cm respectively. Wider the cuff, lesser will be the value of blood pressure recorded. This may be the cause of less blood pressure recorded in this study population. It would be better if the cuff width of various sizes can be available to the physicians and they can choose the optimum sized cuff according to the subjects’ mid arm circumference to avoid misinterpretation of borderline hypertensives as nor motensives.

## Acknowledgement

Authors are thankful to Prof Paresh Roychowdhury, Head, Department of Clinical Physiology and Dr S.B. Rizyal, Founder Principal of Nepal Medical College, Kathmandu, Nepal for their kind co-operation and support.

## References

- [1] Camm AJ. *Cardiovascular disease*. In: Kumar P, Clark M, eds. *Kumar and Clark's Clinical Medicine*. Edinburgh: WB Saunders 2002, p. 818.
- [2] Garg J, Messerli AW, Barkis GL. *Evaluation and treatment of patients with hypertension*. *Circulation* 2002;105:458-61.
- [3] McMurray J, Northridge D, Bradbury A. *The cardiovascular system*. In: Muro JF, Campbell IW, eds. *McLeods clinical examination*. Edinburgh: Churchill Livingstone 2000, p. 86.
- [4] Schoen FJ. *Blood vessels*. In: Kumar V, Abbas AK, Fansto N, eds. *Robbins and Cotran pathologic basis of diseases*. Philadelphia: Saunders 2004, p. 528.
- [5] Vasan RS, Larson MG, Leip EP, Evans JC, O'Donnell CJ, Kannel WB, et al. *Impact of high normal blood pressure on the risk of cardiovascular disease*. *N Eng J Med* 2001;345:1291-7.
- [6] Kotchen TA, Kotchen JM. *Nutrition diet and hypertension*. In: Shils ME, Olsen JA, Shike M, Ross AC, eds. *Modern nutrition in health and disease*. Baltimore: Williams and Wilkins 1999, p. 1225.
- [7] Ganong WF, (editor). *Review of Medical Physiology*. 20<sup>th</sup> ed. Boston: McGraw Hill 2002, p. 567-68.
- [8] Parati G, Mendis S, Abegunde D, Asmar R, Mieke S, Murray A, et al. *Recommendations for blood pressure measuring devices for office/clinic use in low resource settings*. *Blood press Monit* 2005;10:3-10.
- [9] Timmis A, Mills P. *The cardiovascular system*. In: Swash M, ed. *Hutchison's Clinical Methods*. Edinburgh: WB Saunders 2002, p. 86.
- [10] Pahlsson HI, Jorreskog G, Wahlberg E. *The cuff width influences the toe blood pressure value*. *Vasa* 2004;33:215-8.
- [11] Russel AE, Wing LM, Smith SA, Aylward PE, McRitchie RJ, Hassam RM, et al. *Optimal size of cuff bladder for indirect measurement of arterial pressure in adults*. *J Hypertens* 1989;7:607-13.

■ Received on November 11, 2006. Accepted on March 12, 2007.

■ Correspondence: Arijit Ghosh, Department of Clinical Physiology, Nepal Medical College, P.O. Box 13344, Jorpati, Kathmandu, Nepal. Tel. +977 1 4478562 – E-mail: arijit\_g@yahoo.com