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Validation of BIOPAC for Measurement of Blood Pressure

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ABSTRACT — Blood pressure is a crucial measure to evaluate the peril of coronary heart disease. The aim of this study was to validate BIOPAC as an instrument to measure blood pressure. Blood pressure was measured on 30 subjects aged 20-30 years with auscultatory technique using both mercury sphygmomanometer and BIOPAC. Software Acqknowledge version 3.7.1 was used to evaluate the graphs of the subjects acquired through BIOPAC. Data was expressed in means and standard deviation. Paired sample t-test was used to compare the means. Coefficient of correlation was taken to find the association between the measurements taken by both devices. Statistical analysis was performed using SPSS 17.0. The association between the systolic blood pressure obtained by both mercury sphygmomanometer and BIOPAC was 0.95($p<0.001$) and for diastolic blood pressure the correlation was 0.98 ($p<0.001$). This study ascertained that BIOPAC can be used as an instrument to measure blood pressure. BIOPAC as a device to measure blood pressure can be more practicable due to its automatic and large data storage capacity.

Keyword — BIOPAC, Diastolic blood pressure, sphygmomanometer, Systolic blood pressure

INTRODUCTION

Blood pressure (BP) is defined as the lateral pressure exerted by the column of blood on the walls of the arteries, it usually means arterial pressure [1]. A person's BP is usually expressed in terms of the systolic blood pressure (SBP) and diastolic blood pressure (DBP). Systolic pressure provides an estimate of the work of the heart and of the strain against the arterial walls during ventricular contraction. Diastolic pressure provides an indication of peripheral resistance or of the ease with which blood flows from the arterioles into the capillaries [2]. Elevated Blood pressure is a widespread and independent risk factor for developing Coronary Heart Disease (CHD) and stroke [3, 4]. Therefore it is crucial to accurately measure the blood pressure of an individual. The mercury sphygmomanometer has been considered as the gold standard for measurement of blood pressure [5]. It works on the principle of auscultatory method which means diagnostic monitoring of the korotkoff sounds. The sounds detected during blood pressure measurement are referred to as Korotkoff sounds and were first identified by Russian surgeon Nicolai Sergeivich Korotkov in 1905 [6]. However with time many other advanced techniques and devices have been developed for blood pressure measurement [5], many of which have automatic data storage facility for each case which makes them feasible to use in field and laboratory settings where large data is required. BIOPAC is an instrument that helps to take various physiological functions concurrently. This study was made with an attempt to calibrate and establish BIOPAC as a device to measure blood pressure with accuracy.

MATERIALS AND METHODS

Blood pressure of 30 subjects aged 20-30 years was measured with auscultatory technique using mercury sphygmomanometer and BIOPAC. Blood Pressure on each subject was measured with BIOPAC and subsequently with manual sphygmomanometer on their left hands.

Blood pressure was measured with mercury sphygmomanometer through the standardized technique. SBP is determined by the onset of the auscultated pulsation or first Korotkoff sound and DBP is recorded at the point, at which the Korotkoff sound disappears [5].

It basically changes analog signals acquired from body to digital signals. For this study BIOPAC MP100 was used which has TEL100C as main amplifier. TEL100C consists of three main components- a. TEL100D, CB117 and TEL100M. Blood pressure measurement with BIOPAC also works on the principle of auscultatory method. For the measurement of blood pressure transducers, SS19 (Pressure cuff) and SS17 (microphone for measuring Korotkoff sounds) were used [6]. Software used to evaluate measurement by BIOPAC was Acqknowledge version 3.7.1. After the calibration, pressure cuff was wrapped around subject's upper arm.

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Microphone was placed over the brachial artery. Blood pressure measurement was taken by analyzing the graph.
Statistical analysis was executed using SPSS 17.0. Data was expressed in means and standard deviation. Paired sample T-test was used to compare the means. Coefficient of correlation was taken to find the association between the measurements taken by both devices.

RESULTS

Figure 1 and 2 shows graphical representation of acquisition and selection of area used for measuring blood pressure using BIOPAC acknowledge software.
Table 1 shows that there was no difference in the means of SBP and DBP when measured with both mercury sphygmomanometer and BIOPAC. The mean differences of both SBP and DBP were found to be statistically non-significant. Measurement of SBP and DBP by both mercury sphygmomanometer and BIOPAC had correlation of 0.98 and 0.95 respectively. The associations were statistically significant at $p<0.001$.

Figures and Tables

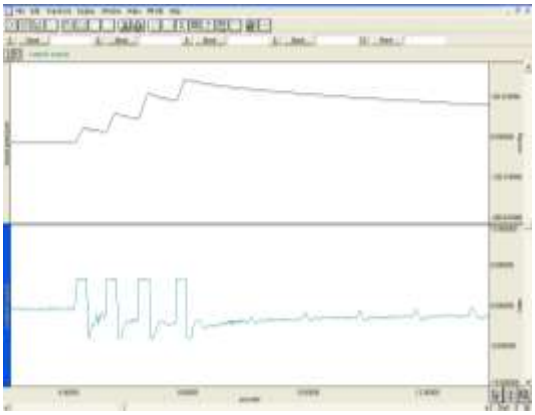

Figure 1. Acquisition of blood pressure

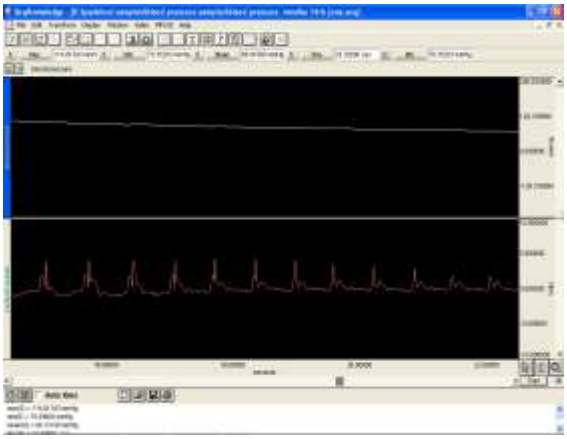

Figure 2. Shows selected area for measuring blood pressure

Table 1. Mean differences and association between the measurements taken by the two devices

Variables	Mean ± SD		t-test	r
	Mercury Sphygmomano-meter	BIOPAC		
SBP (mmHg)	105.6±12.37	106.0±10.92	0.79	0.98***
DBP (mmHg)	74.8±7.51	75.1±8.35	0.59	0.95***

CONCLUSION

This study established that BIOPAC can be used as a tool to measure blood pressure. Since a very strong association was found between SBP and DBP values when taken on the same subjects with both mercury sphygmomanometer and BIOPAC in tandem. In a field setting and laboratory settings where large number of subjects needs to be measured, mercury sphygmomanometer can be time consuming whereas BIOPAC can proved to be very helpful in such settings because it has data storage capacity which not only saves time but also minimizes recording error. Another advantage of using BIOPAC to measure blood pressure is that several other physiological measurements can be simultaneously measured with it. Therefore it is more feasible to use BIOPAC in such scenario.

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