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MANAGEMENT FOR INTER-ARM VARIATION OF BLOOD PRESSURE AND PULSE RATE TO PREVENT MISDIAGNOSIS.

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Abstract:

Background: Sphygmomanometer, blood pressure instrument, measure blood pressure of one side of arm at one time, consists of an inflatable cuff to collapse and then release the artery under cuff in a controlled manner. 0 to 30 mmHg points or more variation of blood pressure and pulse rate occurs in human beings in inter-arm. Blood pressure of normal adult is approximately 120/80mmHg and pulse rate is 70-80/minute. Blood pressure and pulse rate variation may lead to misdiagnosis of hypertension and hypotension.

Method: Apparatus used are digital sphygmomanometers. Blood pressure and pulse rate is measured of both arms turn by turn and simultaneously by using two digital sphygmomanometer, thrice, the concordant readings are considered and noted for this purpose of blood pressure and pulse rate, in different age groups persons and average real variability method is also used to estimate blood pressure and pulse variation. Data is collected from different rural areas by gathering people, on some fixed places, or by visiting in different rural areas.

Result: Total Persons of different age groups investigated = 1765, Males = 834(47.25%), Females = 931 (52.75%). SBPV persons in 0-10 mmHg= 76.99%, 11-20mmHg= 21.42%, 21-30mmHg = 1.59%. DBPV in persons with variation from 0-10mmHg = 92.18%, 11-20mmHg= 7.14%, 21-30mmHg = 0.68%, PV in persons from 0-10mmHg= 95.86%, 11-20mmHg = 3.68%, 21-30mmHg= 0.45%. Diseased persons = 22.38% (Hypertension, diabetic mellitus type I and type II, hypotension, kidney diseases, chronic and obstructive pulmonary diseases), Normal Persons= 77.62%.

Conclusion: Variation in inter-arms in systolic blood pressure and diastolic blood pressure and pulse is observed when detected with sphygmomanometer, thrice in each arm turn by turn or by using two instruments simultaneously in both the arms, concordant readings are considered and average real variability method is also used to estimate blood pressure and pulse variation. Variation in blood pressure and pulse rate in inter-arms observed in different age groups, ranged from 0-10mmHg to 21-30mmHg. Maximum persons have variation in 0-10mmHg in systolic blood pressure, diastolic blood pressure and pulse which is not showing significant diseases and persons in 11-20 and 21-30mmHg variations show cardiovascular diseases or have probabilities.

Keywords: Digital sphygmomanometer, systolic blood pressure, diastolic blood pressure, pulse rate, cardiovascular diseases.

Introduction:

Sphygmomanometer is blood pressure instrument used for measurement of the blood pressure of one side of the arm at one time, consists of an inflatable cuff to collapse and then release the artery under the cuff in a controlled manner.[1] It may be manual and digital, manual is used in conjunction with a stethoscope whereas digital without any conjunction. In normal human adults, the blood pressure is approximately 120/80 mmHg.[2] Pulse pressure is due to cardiac output which is difference between measured systolic and diastolic blood pressure. To avoid under diagnosis of the hypertension or hypotension, blood pressure and pulse rate of both arms have to be measured.[3] The misdiagnosis of hypertension and hypotension can be prevented by measuring the blood pressure and pulse rate of inter-arms.[4] The new clinical guideline for hypertension from the National Institute for Health and clinical Excellence considers less than 10mmHg inter-arm difference as normal and attributes more than 20 mm Hg to underlying vascular disease.[5] An inter-arm difference in blood pressure of 10-20 mm Hg, suggesting 15% of the population with hypertension.[6] The recent European Guideline on Hypertension gives a more precise description of this by stating that in the event of a significant (>10 mmHg) and consistent Systolic Blood Pressure difference in inter-arm, the arm with the higher Blood Pressure values should be used.[7] Blood pressure variability and pulse variation represent a strong and independent risk factor for cardiovascular diseases[8,9] and it also represent the hypertension-related mortality and morbadity[10]. Blood pressure variation may lead to the damage of the target organs like blood vessels, kidneys and heart.[11,12] Variation of blood pressure and pulse variation influences autonomic, neural, humoral, vascular and environmental mechanisms.[13] Average real variability method is common method to estimate blood pressure variation which is average of the absolute differences between consecutive blood pressure readings[14]. Coefficient of variation is another parameter which is the standard deviation divided by the corresponding mean[15]. Majority of studies on blood pressure variation and pulse variation have focused on the results of 24-hours ambulatory blood pressure monitoring. Dynamic factors like drug related, behavioral, environmental and dependent on cardiovascular regulatory mechanisms show the complex interactions in fluctuation of blood pressure[16, 17].

Material and Method:

Apparatus used are digital sphygmomanometers. Blood pressure and pulse rate is measured of both arms turn by turn and simultaneously by using two digital sphygmomanometer, thrice, the concordant readings are considered and noted for this purpose of blood pressure and pulse rate, in different age groups persons and average real variability method is also used to estimate blood pressure and pulse variation. Data is collected from different rural areas by gathering the people, on some fixed places, or by visiting in different rural areas by following the COVID-19

governments' guidelines and the verbal consents are taken. The cuff is tied in the upper region, about 2-3cm above from elbow, of the arms and the instrument is put on the level of the chest.

Result:

Total Persons of different age groups investigated = 1765, Males = 834(47.25%), Females = 931 (52.75%). SBPV persons in 0-10 mmHg= 76.99%, 11-20mmHg= 21.42%, 21-30mmHg = 1.59%. DBPV in persons with variation from 0-10mmHg = 92.18%, 11-20mmHg= 7.14%, 21-30mmHg = 0.68%, PV in persons from 0-10mmHg= 95.86%, 11-20mmHg = 3.68%, 21-30mmHg= 0.45%. Diseased persons = 22.38% (Hypertension, diabetic mellitus type I and type II, hypotension, kidney diseases, chronic and obstructive pulmonary diseases), Normal Persons= 77.62%.

Discussion:

Total persons whose blood pressures and pulse rates are detected with the help of digital sphygmomanometer are 1765 out of which 834 (47.25%) are males and 931(52.75%) are females, in different age groups. The normal persons are 1370 (77.62%) and the diseased persons are 395 (22.38%) which are suffering from hypertension, diabetes and hypertension with diabetes. Systolic blood pressure variation (SBPV) persons in the range 0-10 mmHg is 1359, in 11-20mmHg is 378 and in 21-30 mmHg is 28. The diastolic blood pressure variations (DBPV) in the range 0-10mmHg is in 1627, in 11-20mmHg is in 126 and 21-30 mmHg in 12. The pulse variation (PV) in the range 0-10mmHg is in 1692, in 11-20 mmHg is in 65 and 21-30 mmHg is in 8.Various diseases significantly influence the increase in Blood Pressure that an inter-arm Systolic Blood Pressure difference is common and associated with a significant increased risk for future cardiovascular events, even inter-arm difference is modest. The variation in blood pressure may occur in different age groups. Maximum variation occurs in mid-aged people as these people suffer with cardiovascular diseases more as compare to other age grouped persons.

Management:

a. It is recommended that digital sphygmomanometer should be made for measurement of the blood pressure of inter-arms on the same time to avoid the error of variation of blood pressure and pulse rate. The accuracy of the readings is detected. The apparatus may have two cuffs to tie both sides of arms and should be attached to a single instrument. The readings of blood pressure and pulse, on the monitor, should be different for both arms with one conclusive reading on the screen. The conclusive reading of blood pressure and pulse rate should be considered for the diagnoses for hypertension or hypotension. There is need of amendments in the existing sphygmomanometers. In case of digital automatic blood pressure instruments, the readings may be detected on the monitor easily but in case of non-digital instruments where stethoscope is requisite for the measurement of the blood pressure problems may be arisen to manage the measurement of the blood pressure by using the cuff in both the arms.
b. Concordant readings of blood pressure are considered of inter-arms to avoid the misdiagnosis.

c. Average of the absolute differences between consecutive blood pressure readings is called Average Real Variability method which is the advantage of taking into account the temporal order of blood pressure measurements and therefore the blood pressure time series variability.
d. Coefficient of variation is another method, which is the standard deviation divided by the corresponding mean.
e. With the intention to quantify the extreme of blood pressure excursions, to calculate the difference between maximum and minimum blood pressure values, which has the advantage of being independent from the mean.
f. The results of 24-hour ambulatory blood pressure monitoring are considered to avoid blood pressure variation.

Conclusions:

The variation in inter-arms in systolic blood pressure and diastolic blood pressure and pulse is observed when detected with digital sphygmomanometer, thrice in each arm turn by turn and by using two instruments simultaneously in both the arms, concordant readings are considered and average real variability method is also used to estimate blood pressure and pulse variation. Variation in blood pressure and pulse rate in inter-arms observed in different age groups from 0-10mmHg to 21-30mmHg. More variation may show the cardiovascular disease in individual. 77.62% persons are normal whereas 22.38% are suffering with hypertension, diabetes, hypertension with diabetes and hypotension, cancer, kidney diseases etc. Maximum persons have variation in 0-10mmHg in systolic blood pressure, diastolic blood pressure and pulse which is not showing significant diseases and persons in 21-30mmHg variations, cardiovascular diseases or have probabilities. The management of variation may be done by using digital sphygmomanometer which should have two cuffs to tie in both arms and one conclusive reading should be generated.

Conflict of interest:

No conflict of interest.

Source of Funding:

Self.

Ethical Clearance:

No experiment has been done on any animal or human beings. This manuscript is ethically clear.

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Table 1: Inter-Arms Systolic Blood Pressure Variation, Diastolic Blood Pressure Variation and Pulse Variations in different persons of different age groups:

Total Persons of different age Groups		1765	Males		834	47.25%
			Females		931	52.75%
Particulars of Persons	Persons in 0-10 mmHg variation	Persons in11-20 mmHg variation	Persons in21-30 mmHg variation	Total Persons	Diseased Persons/ Percentage	Normal Persons/ Percentage
Systolic Blood Pressure Variations (SBPV)	1359	378	28	1765	395 (22.38%)	1370 (77.62%)
Diastolic Blood Pressure Variations (DBPV)	1627	126	12	1765		
Pulse Variations (PV)	1692	65	8	1765		