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STUDY OF THE RELATIONSHIP BETWEEN THE OSCILOMETRIC AND AUSCULATORY METHODS IN THE ASSESSMENT OF BLOOD PRESSURE

Medical Science

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ABSTRACT

Hypertension is a chronic disease that most of the time has no symptoms, being predominantly silent that affects the population and has serious repercussions on public health. The present study aims to evaluate the oscillometric method in relation to the auscultatory method in the aid, diagnosis and control of arterial hypertension. Quantitative research of integrative revision with data collection realized from primary sources by means of bibliographical survey. Absolute frequency (n), percentage (%) and organization of data by similarity were used to describe the selected studies. Twelve articles dealing with this topic were selected and analyzed, with 1 talk about neonates, 5 from children to adolescents and 6 from adults and the elderly. It was concluded that the studies did not present significant differences between the auscultatory and oscillometric method, on the contrary, the results showed a positive correlation between the measurements made with the related methods.

KEYWORDS

Blood Pressure; Methods; Measurement of blood pressure; Oscillometric.

INTRODUCTION -

Systemic arterial hypertension (SAH), often called high blood pressure, is a multifactorial clinical condition characterized by elevated and maintained blood pressure (BP) levels, and as a result, the vessels in which the blood circulates contract in a way that damages its layer fine and delicate. The vessels become hardened and narrowed, and may, over the years, occlude or rupture. It is often associated with functional and structural changes in target organs such as vessels, heart, kidneys and brain and metabolic changes, resulting in an increased risk of fatal and nonfatal cardiovascular events. All of these situations are very serious and can be diagnosed by regularly checking blood pressure[2].

SAH has a high prevalence and low control rates. It is considered one of the main modifiable risk factors (RF) and one of the most important public health problems[1].

The detection, treatment and control of SAH are fundamental for the reduction of cardiovascular events. The measurement of BP is the most performed procedure by health professionals in a direct and indirect care situation, as it portrays the functional conditions of the circulatory system, which should result in an unmistakable precision in its measurement[1].

This need for brevity has been a major challenge since the first measure of the pressure exerted by Stephen Hales to this day. In an attempt to reduce errors introduced in relation to the technique of blood pressure measurement.

Currently, there are two general methods for blood pressure measurement in health practice, the invasive and non-invasive method. Invasive monitoring will not be contextualized in this study, since it involves other less common techniques, values and situations, but it is important to emphasize that it is the most effective technique of invasive monitoring. gauge capable of demonstrating the exact value of the individual's BP

The indirect or non-invasive method, subdivided into two forms: auscultatory or traditional technique and oscillometric or automatic technique.

The first noninvasive method uses an aneroid or mercury column sphygmomanometer, both calibrated, in addition to the stethoscope for auscultation. This type of measure requires knowledge and constant updating of the health professional, as well as an accurate and precise auscultation. The mercury column device has been less commonly used in practice because of mercury toxicity to the environment[3].

The second model uses automatic and semi-automatic arm or wrist devices validated by AAMI protocols (Association for Advancement of Medical Instrumentation)[4] e BHS (British Hypertension Society)[5]. This method lacks palpation, auscultation accuracy and prior technique for correct BP measurement.

Regarding the oscillometric method of blood pressure measurement, the scientific community has been apprehensive because it is a relatively recent electronic technique of blood pressure gauge, judging that new studies on its functionality, its use in practice and fidelity of their blood pressure results.

Considering the above context, this study is based on the evaluation of the oscillometric method in relation to the auscultatory method, being appropriate, in context, since the automatic devices are occupying a prominent position, with the appearance of several brands and models of monitor digital blood pressure, consequently increasing without economic market and has been increasingly used by health professionals and laypersons, in an attempt to circumvent as limitations imposed by the conventional method, not using the palpatory and auscultatory pathway

METHOD -

This is a quantitative research of integrative review with data collection performed from primary sources through a bibliographic survey.

In order to prepare the present integrative review, the following steps were taken: definition of the guiding question (problem) and research objectives; establishment of inclusion criteria and exclusion of publications (sample selection); search in literature; analysis and categorization of studies, presentation and discussion of results.

To guide the research, the following question was asked: does the oscillometric method have the same reliability as the auscultatory method for blood pressure measurement?

The research was conducted from January 2016 to November / 2016 in the following databases: Nursing Database (BDENF), Latin American and Caribbean Health Sciences Literature (LILACS), Electronic Electronic Library Online (SciELO) and Online System of Search and Analysis of Medical Literature (MEDLINE).

For the search strategy the following descriptors were used: Blood Pressure; Oscillometry; Determination of Blood Pressure; Methods.

Inclusion criteria were: studies that investigated noninvasive methods of blood pressure measurement published in Portuguese, English or Spanish. The studies in foreign language were translated by the authors themselves; in the form of articles, dissertations and theses; published in the period from 2006 to 2016.

As exclusion criteria: papers that do not have full abstracts in the searched databases and library, duplicate articles.

The abstracts were evaluated, and the productions that met the previously established criteria were selected to compose the sample of this study, and read in full.

RESULTS -

We found 299 original studies written in Portuguese, English or Spanish from 2006 to 2016. After exclusion, only 12 articles were analyzed for this study, which were read in their entirety. In the exclusions 280 studies were off topic, 7 studies within the theme that were repeated in more than one location. The following shows an overview of the selected publications.

Regarding the year of publication, there was a predominance of studies in the year 2010 with 4 (33.3%) studies, followed by 2009 and 2011 with 3 (25.0% and 25.0%) studies each. The highest incidence of publication was reported in the periodicals Arquivos Brasileiros de Cardiologia, with 5 (41.7%) studies.

Regarding the methodological outline 1 (8.3%), there are descriptive, quantitative, non-experimental studies, being 9 (75.0%) longitudinal and 2 (16.7%) transversal. It is considered that these studies do not present strong evidence for clinical application. The classification of the articles regarding the level of the studies and the degrees of recommendation were obtained: 75% of articles with level of study II, 16.7% with level of study III, 8.3% with level of study V, 75% with degree of recommendation B and 25% with degree of recommendation C.

In relation to the country of origin of the publication, a higher incidence of studies in Brazil was identified, with 10 (83.3%). Of these studies analyzed, 11 (91.7%) were published in the Portuguese language.

Considering the different parameters used to measure blood pressure in neonates, children and adolescents when compared to the values of adults from 18 years of age, the authors separated the presentation of the results and discussion according to age groups in order to provide more reliable results.

To facilitate the reading and analysis of the results found, we coded the studies from 1 to 12 as described below.

DISCUSSION -

Study 1[6] is a cross-sectional study comparing non-invasive methods (Doppler, automatic oscillometry, pulse oximetry and flush) to measure systolic blood pressure in preterm and preterm newborns with stable and unstable clinical signs and showed that all methods tested showed good correlation with Doppler, with flush pulse oximetry (which is the way to measure how much oxygen in the blood is carrying) the best correlation. Automatic oscillometry is the most commonly used method in NICUs (Neonatal Intensive Care Unit) because of its ease and speed in measuring BP. However, the study showed that this technique overestimated Doppler values (it is a special function of ultrasound studies that allows the detection and evaluation of moving structures, especially of blood flow) in the lower pressure range, besides did not measure PA in 12% of the patients, being considered an unreliable technique due to its imprecision. Therefore, the flush method and pulse oximetry are more concordant with Doppler for the diagnosis of hypotension. This technique proved to be unreliable due to its imprecision, since no oscillometric monitor had its validation for use in neonatology.

Study 2[7]investigates the reliability of BP measurement between the auscultatory method and a Tech Line WS-50 digital oscillometric wrist device in the brachial and radial arteries in children aged 4 to 13 years. The measurements obtained with the conventional method were compared with those obtained by the automatic method in the same artery. A difference was observed in the SBP and DBP, regardless of the measurement site, between the oscillometric method and the conventional method, which reached statistical significance, however, this difference is not clinically significant. Regarding the mercury column, the automatic device obtained values, in averages, of 1.38 mmHg higher, in the values obtained in the SBP, showing a strong positive correlation between the two measurements, reaching statistical significance. However, in relation to the values obtained in the PAD, the mercury apparatus obtained an average of 1.22 mmHg higher than the digital apparatus, and also showed a strong positive correlation between the two measurements, reaching statistical significance. These differences do not contradict the apparatus for practical use, as the differences were "within the margin of error that the manufacturer refers to (3mmHg)." Scholars[7], concluded that the digital instrument proved to be suitable for use, and suggested that "measuring blood pressure in children is part of the routine of a physical examination and basic care."

In study 3[8], less recent, the same monitor (Omron HEM 742) was shown to be valid for blood pressure measurements in adolescents. 150 adolescents between the ages of 10 and 16 participated in the study. The Omron HEM 742 automatic monitor was Y-connected with mercury column auscultatory equipment, and three simultaneous evaluations were performed. There were no statistical differences for the SBP and DBP values that compromised the use of the device. The device showed good reliability, sensitivity and specificity in the diagnosis in relation to the pressure levels of individuals of this age group, reaching grade A, according to the criteria suggested by the British Hypertension Society.

Study 4[9] tested the validity of a digital pulse monitor against a gold standard mercury sphygmomanometer in a convenience sample of adolescents. Blood pressure was measured twice using two different sphygmomanometers: a digital OMRON pulse apparatus is a BD mercury tabletop apparatus. The data show that the digital monitor provides accurate data on systolic blood pressure but overestimates diastolic pressure, so the use of correction equations may be an alternative for studies using this digital pulse monitor in adolescents.

However, in study 5[10] used the HEM 742 automatic oscillometric device as a study material for measuring blood pressure in children aged 6 to 11 years. The study was with 50 children, the oscillometric device was connected simultaneously with the mercury column sphygmomanometer, Missouri. The study shows a significant correlation, but the device has low agreement between the measurements for systolic and diastolic blood pressure, respectively. Thus, it can be concluded that the results overestimate the values of blood pressure in children causing a result that may contain error, and is not, therefore, a reliable measurement method in this population. In addition, only two models of oscillometric devices were validated until the present study for use in pediatrics, and were not used in the study.

Study 6[11] compared the blood pressure measurements obtained with the auscultatory and oscillometric methods, verifying agreement between them, in order to validate the oscillometric method. The measurements were taken in 40 patients and we tried to avoid biases, with calibration of the devices, training of the researcher in the calibration, as well as his annotation and pilot test. Additionally, the same measure was repeated three times and the respective arithmetic mean was considered, avoiding the occurrence of underestimation of the value obtained in relation to the real value. The use of the two methods, auscultatory and oscillometric, allowed us to verify that the reproducibility between the measurements obtained was considered excellent for SBP and good for DBP. Due to the high level of agreement for SBP, the use of the digital apparatus is recommended for the monitoring of variations of this pressure in the same individual given the ease of its use. However, the good agreement obtained in the determination of PAD allows to conclude that the digital apparatus is

reliable, but new studies would need to be performed to better understand the disagreements that occur in the measurement of PAD.

Study 7[12] evaluated three non-invasive AP devices: aneroid sphygmomanometers, mercury column (considered gold standard) and electronic device (Omron 705-CP, Japan). The project was based on the random measure of PA of randomly chosen volunteers aged 18 to 70 years, in order to verify the reliability of the intermittent BP measurements in the usual clinical routine and to compare them with each other. The results showed a good correlation between the three different methods, with a higher correlation between aneroid and automatic devices for both SBP (r = 0.81) and DBP (r = 0.85). The lowest coefficient r was found between the mercury sphygmomanometer and digital, for SBP (r = 0.62) and for DBP (r = 0.62). In this study, the greatest difference between the mean values measured for PAD was observed between the mercury apparatus and the digital apparatus. There is a significant variation between the means of the SBP and / or PAD measures obtained by the three different calibration equipment, despite the relative correlation observed. The study suggests that each patient should have their BP always checked by the same type of device, whether digital (previously validated), aneroid or mercury column, thus minimizing possible errors in subsequent medical conduct.

Study 8[13] carried out a cross - sectional study with the objective of evaluating the agreement between two methods of AP evaluation (auscultatory vs. oscillometric) in elderly subjects submitted to resisted exercise sessions. In the pre-intervention period there was good agreement between the systolic (SBP) and diastolic (DBP) measurements obtained by both methods, and there was also a high overall agreement after the sessions. The auscultatory and oscillometric methods were concordant before and after the control and exercise sessions. However, there were larger differences between DBP and SBP, the latter being very similar between methods. Therefore, the oscillometric method with the Omron HEM-431 monitor may be considered useful, particularly in performing SBP measures at rest in the elderly, in which it is associated with increased cardiovascular risk and target organ damage.

Study 9[14] aimed at validating the Missouri aneroid apparatus for measuring blood pressure in cancer patients according to the protocol of the European Society of Hypertension. Thirty-three patients aged over 30 years, hospitalized or in outpatient follow-up at the Cancer Institute of the State of São Paulo were evaluated. Nine sequential measurements of blood pressure were performed by three trained and blinded observers, and the measurements were interleaved with the mercury and aneroid column apparatus. When analyzing the correlation between the mean values of the pressure measurements with the Missouri test apparatus and the mercury test apparatus, a strong correlation was observed for SBP (r = 0.972, p = 0.00) and moderate for PAD (r = 0.887, p = 0.000). The results obtained confirm the validity of the Missouri aneroid apparatus to measure blood pressure in cancer patients, since it was approved in all the evaluation criteria required by the ESH validation protocol.

The study 10[15] developed different techniques to estimate the MAP in an automated way, and from the waves recorded by oscillometry, compared with the auscultatory method, which would be the gold standard of noninvasive BP measurement. The study was performed with 55 healthy individuals, of both sexes, aged between 20 and 74 years. Six different oscillometric techniques were used for calibration, which were distinguished by the place of use of the automatic device. The analysis of variance showed that different techniques resulted in significant differences in the estimation of MAP values. The mean differences between the oscillometric techniques and the auscultatory technique were significant. Linear regression analysis showed that the correlations between the six automated MAPs and the auscultatory MAP were significant. There were small differences in PD of paired differences, but not for the order between oscillometric techniques. The mean MAP differences compared to the auscultatory technique were less than 5mmHg, the systematic mean difference between different oscillometric techniques was up to 5.5mmHg. They concluded that different automated MAP measurement techniques depend on the waveform produced, with different results, and the technique associated with the peak of the polynomial curve (from one of the techniques used in the study) was shown to have the smallest differences compared to the manual auscultatory technique.

The study 11[16] had the objective of evaluating the accuracy of the Omron HEM-705 VP oscillometric device compared to the auscultatory method with sphygmomanometer in the context of a large epidemiological study. Three auscultatory measurements were obtained, followed by two measurements with the Omron device in 1,084 individuals. The results showed that the Omron HEM 705 CP overestimated systolic blood pressure by 1.8mmHg and underestimated the diastolic pressure by 1.6mmHg when compared to the auscultatory method using a mercury sphygmomanometer. Although statistically significant, these differences are very small and should have little impact on the clinical setting or epidemiological studies. In conclusion, the results show that the Omron HEM-705 CP device can be used to measure blood pressure and detect hypertension in large epidemiological studies without compromising the validity and accuracy of the study.

Study 12[17] evaluated the correspondence between the AP measurement by the auscultatory method with the mercury column apparatus and the AP measurement by the automatic digital method performed simultaneously, with the same cuff. Through a "Y" connection, they coupled a cuff to a validated automatic digital device (ONROM 705IT) and a mercury column sphygmomanometer, allowing simultaneous measurement of BP by two methods in 423 individuals. This study demonstrated that the pressure values obtained through the digital automatic method are in agreement with the values measured by the conventional auscultatory method with the mercury column apparatus, reinforcing the safety, reliability and value of the diagnosis and the adequacy of HA treatment.

Most of the studies showed that, although the blood pressure values are statistically significant in relation to the auscultatory method, these differences are very small, that is, between the expected standard deviation in patients from 4 years of age. Good agreement with the conventional auscultatory method is presented, being clinically acceptable among the methods, without compromising the validity and accuracy of the study, and it can be used to aid in the diagnosis and control of arterial hypertension (AH). In this way the automated form prevents the tendency of manipulation of the results to lower values by the patient or the lack of ability to handle the monitor, also provides final values very close to those obtained by the traditional methodology with the mercury sphygmomanometer. The only caveat noted in the studies was the position of the arm at the moment of the measurement, but this is easily corrected provided that the instruction of the manufacturer itself is followed.

Regarding the oscillometric method in newborns, the method tested showed good correlation with Doppler, but less concordant to detect hypotension, being considered an unreliable technique due to its imprecision and no oscillometric monitor having its validation for use in neonatology. Although, it is the most used method in NICU (Unit of Neonatal Intensive Care).

The studies show that the monitor can be a possible adjunct to the monitoring of blood pressure, since patients have their systemic blood pressure always checked with the same device / method (previously validated according to the BHS and AAMI protocol), to the reduction of this variability.

FINAL CONSIDERATIONS -

SAH is diagnosed by the detection of persistent high and sustained BP levels. The BP measurement should be performed in any assessment by any healthcare professionals.

Pressure measurement procedures are simple and easy to perform, however, they are not always performed properly. Pipes that can avoid errors are, for example, the appropriate preparation of the patient using standardized technique and calibrated equipment.

After the discovery of Stephen Hales came several other forms of BP measurement among them the automatic method, which came about to improve the way to check blood pressure, with the challenge of being more precise. In an attempt to reduce the errors introduced during the measurement by the observer, by the client and by the instrument used.

No significant differences were found between the auscultatory and oscillometric methods, showing a positive correlation between the measurements made with the aneroid and automatic equipment, to the point that it can not be said that the results indicated by the two equipments were statistically different from each other.

It is concluded that the BP measurement can be performed by the indirect method with auscultatory technique using sphygmomanometers properly calibrated, or with oscillometric technique by the automatic or semi-automatic devices also calibrated. Emphasizing that this method requires knowledge for the monitoring of blood pressure, besides being able to distinguish the moments that are suitable for its use.

Therefore, it is believed that this study has much to collaborate with the academic and scientific areas, but mainly with hypertensive individuals and health professionals, who for lack of knowledge of the majority believe that the automatic method is not adequate in the measurement of blood pressure and end up believing in possibly altered results of the AP, compromising the promotion, prevention and treatment as a whole.

Thus, it is suggested to carry out future studies that bring to the fore the investigation of the field of the digital apparatus since there are few studies on this subject, besides seeking to develop a sphygmomanometer with greater sensitivity, so that it meets several age groups without compromising the diagnosis, and can provide greater safety to health professionals and users. Invest in surveys using the automatic meter in hospitals and clinics, for their greater trustworthiness and reliability in evidence-based clinical practice in health and decision making.

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