Evaluation of arterial pressure measurements comparing traditional and gold standard methods

Avaliação das medidas de pressão arterial comparando o método tradicional e o padrão-ouro

Luciano Elias E Silva[1]
Ruth Ester Assayag Batista[1]
Cássia Regina Vancini Campanharo[1]
Ricardo Baladi Rufino Pereira[1]
Gilmar Fernandes do Prado[1]

Abstract

Objective: Evaluating arterial pressure measurements comparing the traditional and the gold standard methods in an emergency public service.

Methods: Cross-sectional study, in which arterial systolic, diastolic, mean and pulse pressure measurements obtained by nursing professionals by means of the traditional method were compared with those obtained using the gold standard technique.

Results: Study participants were 229 patients, 69% were women and the mean age was 50 years. The comparison between the two methods showed that the mean value of the arterial systolic, diastolic, mean and pulse pressures was higher using the gold standard technique.

Conclusion: Divergences were found between the measurements obtained using the recommended technique and the risk classification.

Resumo

Objetivo: Avaliar as medidas de pressão arterial comparando o método tradicional e o padrão-ouro em um serviço público de pronto atendimento.

Métodos: Estudo transversal no qual as medidas das pressões arteriais sistólica, diastólica, média e de pulso aferidas pelos profissionais da enfermagem pelo método tradicional foram comparadas com aquelas realizadas de acordo com o padrão-ouro.

Resultados: Foram incluídos 229 clientes, 69% do sexo feminino e a média de idade foi de 50 anos. A comparação entre os dois métodos mostrou que o valor médio das pressões sistólica, diastólica, média e de pulso foi maior utilizando-se a técnica padrão-ouro.

Conclusão: Houve divergências entre as medidas realizadas pela técnica recomendada e pela classificação de risco.

Corresponding author
Ruth Ester Assayag Batista
Napoleão de Barros street, 754, Vila Clementino, São Paulo, SP, Brazil. Zip Code: 04024-002
ruth.ester@unifesp.br

Introduction

The need to evaluate the accuracy of the arterial pressure measurement, according to the criteria of the Brazilian Society of Hypertension, emerged from the observation of health professionals who execute it routinely in emergency services. The technique used in this procedure implicates the obtainment of more accurate values, which are determinant in the development of the clinical condition of the patients. Hence, it is possible to increase the safety of the users and, if necessary, to establish strategies to improve the accuracy of this procedure and to provide reliability to the diagnosis of arterial hypertension.

Uncontrolled systemic arterial hypertension is an important risk factor for cardiac and cerebrovascular diseases. An international study observed that an increase of ten mmHg in the diastolic arterial pressure corresponds to twice the risk, both for the occurrence of coronary arterial disease and stroke. Being a chronic disease of slow evolution, it is almost always diagnosed rather late, and considered one of the most critical Brazilian public health problems and an important multisystemic risk factor. It affects approximately 17 million Brazilians, representing 35% of the population over 40 years of age.[1]

The main purpose of the antihypertensive therapeutics is reducing morbimortality due to cardiovascular diseases. Although systemic arterial hypertension may be controlled by means of pharmacological and non-pharmacological strategies, only one third of hypertensive patients have their arterial pressure under control, which is inferior to the expectations of health professionals involved in the process.[2,3]

In this sense, the early it is investigated and diagnosed, the more effective and efficient the therapeutic measures instituted with the purpose to control arterial hypertension will be, thus reducing rates of mortality and complications.[3]

The nurse must develop safe and effective interventions based on scientific evidence. Thus, these care practices improve the quality of the nursing care, as well as contribute to acknowledge the importance of his/her actions at any level of complexity, since this professional has specific competences to guide the care of individuals with arterial hypertension.[4]

It is understood that alerting nursing professionals regarding the importance of monitoring the quality of the arterial pressure measurement is essential for the quality of care and safety of the patient.

The proper technique for the arterial pressure measurement is fundamental to obtain a reliable result and to contribute effectively in the clinical diagnosis of the patient.

The purpose of this study was to evaluate arterial pressure measurements comparing the traditional and gold standard methods in an emergency public service.

Methods

This observational cross-sectional study was developed in the emergency unit of São Paulo university hospital, a public institution in the southeast region of Brazil. The emergency unit of this institution assists, on average, 500 patients daily by spontaneous demand and with risk classification.

According to the institutional protocol, patients who seek care in the unit are classified by a nurse in order to prioritize cases of greater severity. After this primary approach, the patient is sent to a medical visit with estimated waiting time as per the urgency of the clinical situation determined in this evaluation.

Study participants were 229 patients assisted between August and October of 2009. The calculation of the sample size considered the prevalence of systemic arterial pressure in the adult Brazilian urban population, which varies between 15% and 30%.[5]

$$N = \frac{I^2.P(1-P)}{E^2}, \text{ in with:}$$

N = number necessary to contemplate the study;
P = population affected by the illness;
1 = total percentage of the population;
E = minimum sampling error of 5%;
I for confidence interval of 95% = 1.96.

Therefore, the number necessary to meet the study population is 196 studied people. Inclusion criteria were: patients aged 19 years and over, who were assisted by the nursing team in the risk classification. Exclusion criteria were: being pregnant, patients under 19 years of age, showing any level of pain at the time of the evaluation or who were not assisted in the risk classification, and patients who reported ingesting alcoholic drinks or coffee or practicing physical activity at least 30 minutes prior to the procedure.

The gold standard technique to measure arterial pressure was performed as per the recommendations of the Brazilian Society of Hypertension.[2] Initially, the participant was interviewed and instructed to empty the urinary bladder and not to cross the limbs. Three consecutive arterial pressure measurements were obtained in an interval of two minutes between each of them, resulting in the registration of the mean value. Arterial hypertension was considered when the mean of the three pressure measurements was equal or higher than 140 x 90 mmHg.[2] All measurements were obtained in the right arm using a Missouri®sphygmomanometer with a mercury column, which is monthly calibrated according to the rules established by the National Institute of Metrology, Standardization and Industrial Quality - Inmetro.

The accuracy test was used to compare the traditional and the gold standard methods.

Data were expressed in absolute values, percentages, means and standard deviations, and the software WINSTAT® Statistics for Windows v. 3.1 was used in the statistical treatment of the data.

The study was developed in compliance with national and international ethical guidelines for studies involving human beings.

Results

Study sample included 229 patients with a prevalence of female individuals (69%) with the mean age of 50 years. The most frequent comorbidities presented by the patients in the study were: hypertension 136 (59.4%), cardiopathies 174 (75.9%) and type 2 diabetes 39 (17.0%) (Table 1).

Table 1. Comparison of the arterial pressure values

Measurements	gSAP/ rSAP	gDAP/ rDAP	gMAP/ rMAP	gPP/ rPP
Maximum	239.3/ 240.0	152.0/ 140.0	172.2/ 170.0	139.3/ 110.0
Minimum	63.4/ 80.0	39.0/ 60.0	40.6/ 60.0	8.0/ 20.0
Mean	142.9/ 133.0	93.1/ 85.8	109.2/ 102.1	50.8/ 47.0
Standard deviation	31.8 / 28.0	17.4/ 16.9	20.0/ 20.6	22.0/ 16.8

Legend: gSAP/rSAP – gold standard systolic arterial pressure / risk classification systolic arterial pressure; gDAP/rDAP – gold standard diastolic arterial pressure / risk classification diastolic arterial pressure; gMAP/rMAP – gold standard mean arterial pressure / risk classification mean arterial pressure; gPP/ rPP – gold standard pulse pressure / risk classification pulse pressure; values expressed as numbers (mmHg)

Table 2 evidences that the mean value of the differences between the arterial pressure measurements obtained with the gold standard technique and in the risk classification is statistically significant (p < 0.05). The measurements obtained in the risk classification are, on average, inferior to those obtained with the gold standard technique.

Table 2. Distribution of the paired differences

Paired differences	Mean of the differences	SD	Under	Over	p-value
Differences between the SAP measurements	9.86	19.69	12.44	7.30	0.001
Differences between the DAP measurements	7.31	15.19	9.30	5.32	0.001
Differences between the MAP measurements	7.10	16.50	9.25	4.96	0.001
Differences between the PP measurements	3.70	17.46	5.98	1.41	0.002

Legend: Paired normality t-test

Table 3 shows that, at the analysis of hypertensive patients, the simple paired t-test revealed that the mean value of the differences between the arterial pressure measurements was higher in the gold stan-

dard technique, except for the pulse pressure, which was lower.

Table 3. Differences according to gender

SAH Men	Mean	Standard deviation	p-value
gSAP-rSAP	7.12	14.97	0.001
gDAP-rDAP	8.28	12.34	0.001
gMAP-rMAP	6.98	14.14	0.001
gPP-rPP	0.48	14.37	0.749
SAH Women	Mean	Standard deviation	p-value
gSAP-rSAP	11.76	22.25	0.001
gDAP-rDAP	6.57	16.90	0.001
gMAP-rMAP	7.19	17.97	0.001
gPP-rPP	6.60	18.84	0.001

Legend: Simple paired t-test; gSAP-rSAP – difference between the means of systolic arterial pressure in the gold standard and risk classification techniques; gDAP-rDAP – difference between the means of diastolic arterial pressure in the gold standard and risk classification techniques; gMAP-rMAP – difference between the means of mean arterial pressure in the gold standard and risk classification techniques; gPP-rPP – difference between the means of pulse pressure in the gold standard and risk classification techniques; values expressed as numbers (mmHg)

Discussion

The limitation for the generalization of the findings resulted from that fact that the study sample was obtained in a single service. This study evidenced the importance of the use of the protocol for arterial pressure measurement by nursing professionals in the clinical practice. In addition, the adjustment of the measurement method is extremely important for the quality of the nursing care and in the early detection of hypertension, since the mean values of the measurement obtained with the gold standard method were higher than those measured with the risk classification, demonstrating the importance of the implementation of work processes to evaluate this procedure regularly so that the mean values are reliable; to increase the degree of safety of the patients, and to determine appropriate treatments and conducts for the disease. The main purpose of the health team must be the early detection of arterial hypertension, as the most effective means to prevent complications.

This study allowed to observe that, in the studied group, 69% of the participants were female, the mean age was 50 years and 59.4% confirmed they were hypertensive. The greater female demand (69%) seems to result from the fact that women are more inclined to seek health care services spontaneously.[5] This population profile agrees with the results of other national studies, which demonstrate a prevalent age range between 14 and 54 years and between 35 and 64 years.[6,7] The most prevalent comorbidities verified in the study patients were type 2 diabetes with 17.0%, hypertension 59.4% and cardiopathy 75.9%. These results were higher than those of a study whose rates for diabetes mellitus, hypertension and cardiopathy corresponded, respectively, to 7.3%, 20.9% and 5.1%.[6]

The comparison between the techniques showed that the mean values of systolic, diastolic, mean and pulse pressure were higher using the technique recommended by the Brazilian Society of Hypertension. The accurate arterial pressure measurement is fundamental, since arterial hypertension is an important risk factor for cardiovascular diseases, among other complications.[7] In this context, it characterizes one of the greatest causes for the reduction of quality of life and life expectancy of the individuals.[8] Despite being simple and easy to perform, once measuring principles are followed, the incorrect measurement of the arterial pressure may lead to a misdiagnosis and to inadequate medical conduct in more than half of the cases, with consequences of great impact.[9] Therefore, it is necessary to comply with the recommendations regarding the equipment, the observer, the patient, the environment and the technique in order to obtain the correct measurement of the arterial pressure and, consequently, to establish the hypertension diagnosis. [5,10] The dissatisfactory knowledge of health professionals regarding these aspects influences the arterial pressure measurement.[11] In this sense, it is important to institute the gold standard method for pressure measurement as the only method capable of decreasing the divergences between the techniques and improving the quality of the nursing care.

Conclusion

The results indicate a divergence in the arterial pressure measurements obtained with the traditional and the gold standard methods, determining the superiority and quality of the latter.

Collaborations

Silva LE contributed to the conception and elaboration of the project, data analysis and interpretation, study writing and relevant critical interpretation of the intellectual content. Batista REA and Campanharo CRV contributed to the study writing and critical interpretation of the intellectual content. Pereira RBR collaborated with the theme conception and project elaboration. Prado GF contributed to the final approval of the study to be published.

References

1. Arcuri EA, Rosa SC, Scanavini RM, Denzin GS. Arm and forearm blood pressure measurements as a function of cuff width. Acta Paul Enferm. 2009;22(1):37-42.

2. Sociedade Brasileira de Cardiologia. VI Diretrizes Brasileiras de Hipertensão Arterial [Internet]. 2010[citado 2013 28Mar]. Disponível em: http://publicacoes.cardiol.br/.../2010/Diretriz_hipertensao_associados.pdf

3. Pierin AM. Nursing and research in arterial hypertension. Acta Paul Enferm. 2010;23(5):vii-viii.

4. Guedes NG, Moreira RP, Cavalcante TF, Araujo TL, Lopes MV, Ximenes LB, et al.Nursing interventions related to health promotion in hypertensive patients. Acta Paul Enferm. 2012;25(1):151-6.

5. Monteiro Júnior FC, Anunciação FA, Salgado Filho N, Silva GM, Barbosa JB, Ferreira PA, etal. Prevalence of true hypertensive crises and appropriateness of the medical management in patients with high blood pressure seen in a general emergency room. Arq Bras Cardiol. 2008;90(4):247-51.

6. Oliveira GN, Silva MF, Araújo IE, Carvalho Filho MA. Profile of the population cared for in a referral emergency unit. Rev Latinoam Enferm. 2011;19(3):548-56.

7. Carret ML, Fassa AG, Paniz VM, Soares PC. [Characteristics of the emergency health service demand in Southern Brazil].Cien Saude Colet. 2011; 16 Suppl1:1069-79. Portuguese.

8. Cavagioni LC, Pierin AM. Hypertension and obesity among professional drivers who work transporting loads. Acta Paul Enferm. 2010;23(4):455-60.

9. Passos VM, Assis TD, Barreto SM. [Hypertension in Brazil: estimates from population-based prevalence studies]. Epidemiol Serv Saúde. 2006;15(1):35-45. Portuguese.

10. Almeida GB, Paz EP, Silva GA. Social representations of arterial hypertension and its care: a collective subject discourse. Acta Paul Enferm. 2011;24(4):459-65.

11. Jesus ES, Augusto MA, Gusmão J, Júnior DM, Ortega K, Pierin AM. Profile of hypertensive patients: biosocial characteristics, knowledge, and treatment compliance. Acta Paul Enferm. 2008;21(1):59-65