

Intra- and Inter-rater Reliability of Peripheral Arterial Blood Flow Velocity by Means of Doppler Ultrasound

Elaine Caldeira de Oliveira Guirro, PT, PhD, Gabriella de Paula Marcondes Ferreira Leite, PT, Almir Vieira Dibai-Filho, PT, Nathalia Cristina de Souza Borges, PT, and Rinaldo Roberto de Jesus Guirro, PT, PhD

ABSTRACT

Objective: Although it is possible to find studies that analyze the velocity of blood flow in different arteries, the reliability of Doppler ultrasound on peripheral arteries has not yet been completely established. Our objective was to evaluate intra- and inter-rater reliability of the measurement of blood flow velocity by Doppler ultrasound of brachial, radial, popliteal, and posterior tibial arteries.

Methods: Fifty healthy individuals of both genders, aged between 18 and 45 years, were included in the study. For the evaluation of arterial blood flow velocity, a portable Doppler ultrasound device was used to measure the mean and maximum blood flow velocity of posterior tibial, popliteal, brachial, and radial arteries. Two examiners performed assessments of the same volunteers independently and twice, with an interval of 1 week between them.

Results: We found good to very good reliability for measuring the mean and maximum blood flow velocity of the arteries evaluated. The intraclass correlation coefficients ranged between 0.501 and 0.866, standard error of measurement ranged between 0.81 and 9.45 cm/s, and minimum detectable change ranged between 2.25 and 26.13 cm/s.

Conclusion: The assessment of mean and maximum blood flow velocity of the brachial, radial, popliteal, and posterior tibial arteries by means of Doppler ultrasound presents acceptable reliability values, which supports the use of this evaluation method in research and clinical practice. (*J Manipulative Physiol Ther* 2017;40:236-240)

Key Indexing Terms: *Blood Flow Velocity; Reproducibility of Results; Arteries*

INTRODUCTION

The evaluation of peripheral blood flow is extremely important in clinical practice for the diagnosis of circulatory system changes.¹ The decrease in the blood flow velocity indicates a reduction in the caliber of the vessels, which may suggest the occurrence of stenosis or vascular lumen obstruction.²

In this sense, determining the blood flow velocity of peripheral arteries is a procedure that has been employed with various purposes, such as the detection of peripheral artery

diseases; classification of the risk of a patient developing ulcers, gangrene, and amputation³; diagnosis of circulatory dysfunctions after surgeries^{2,4}; and assessment of effects of the therapeutic resources on blood circulation.^{5,6}

Doppler ultrasound is a noninvasive method for the evaluation of blood circulation. The transducer is placed on the site to be evaluated using gel as a conductor, with an approximate angle of 30°, and the ultrasonic waves are emitted and projected obliquely to the blood flow, being reflected by erythrocytes and producing spectral analysis and calculation of the hematological profile found.⁷ Although Doppler ultrasound is widely used for this purpose, it is known that absolute measurements of arterial blood flow depend on several factors, such as the examiner, patient, equipment, protocols, and environment of application.^{4,8,9}

Even considering a possible variability of results, few studies have focused on reliability and reproducibility of the blood flow velocity variable identified by the Doppler ultrasound device. However, studies on hepatic,¹⁰ ophthalmic,¹¹ uterine,¹² and brain¹³ arteries reveal that, with standardization of evaluations, Doppler ultrasound has good reliability of results, both in terms of the time and examiners.

Based on these considerations, and although studies have investigated the behavior of the blood flow in different

Postgraduate Program in Rehabilitation and Functional Performance, Department of Biomechanics, Medicine, and Rehabilitation of the Locomotor Apparatus, Medical School of Ribeirão Preto, University of São Paulo, Ribeirão Preto, SP, Brazil.

Corresponding author: Elaine Caldeira de Oliveira Guirro, PT, PhD, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Curso de Fisioterapia, Avenida dos Bandeirantes, 3900, Monte Alegre, Ribeirão Preto, SP, Brasil, CEP 14049-900. (e-mail: ecguirro@fmrp.usp.br).

Paper submitted August 25, 2015; in revised form November 18, 2015; accepted April 5, 2016.
0161-4754

Copyright © 2017 by National University of Health Sciences.
<http://dx.doi.org/10.1016/j.jmpt.2017.02.007>

arteries, such as the brachial,¹⁴ femoral,¹⁵ and popliteal,¹⁶ the reliability of Doppler ultrasound on peripheral arteries has not yet been completely established. Thus, the present study aimed to evaluate the intra- and inter-rater reliability of the measurement of the blood flow velocity by means of Doppler ultrasound in the brachial, radial, popliteal, and posterior tibial arteries. The hypothesis of this study was that the evaluation of blood flow velocity has acceptable reliability values for its use in research and in clinical settings.

METHODS

Sample

The sample size was based on the guidelines for the evaluation of measurement properties,¹⁷ in which at least 50 participants would be necessary to evaluate the reproducibility and validity of the construct.¹⁸ Thus, 51 volunteers were recruited by means of verbal invitation and posters in the university community of Ribeirão Preto (SP, Brazil). In this study, we included volunteers without health issues that could compromise analyses (healthy individuals) of both genders and aged between 18 and 45 years.

As exclusion criteria, we adopted the presence of circulatory or metabolic diseases, systemic diseases that affect the circulatory system, neurologic or neuromuscular diseases, use of drugs that affect the circulatory system, and treatment with physical therapy or physical activity during the data collection period. In the face of these eligibility criteria, there was sample loss of 1 volunteer as a result of nonattendance in the second session, and thus the final sample was composed of 50 individuals.

This study was approved by the Research Ethics Committee of Clinics Hospital of the Medical School of Ribeirão Preto of the University of São Paulo under protocol number 313882/2013.

Doppler Ultrasound

For the evaluation of arterial blood flow velocity, a portable Doppler device SONAR/tek (Nicolet Vascular, Natus, San Carlos, CA) was used with spectral analysis and data about components of the flow profile. The volunteers were examined after 10 minutes of rest in the dorsal decubitus position in an air-conditioned room at 23°C and humidity of 50%. The evaluations were performed in dominant lower and upper limbs. Two examiners captured Doppler signals from posterior tibial and radial arteries with a probe of 8 MHz and from popliteal and brachial arteries with a probe of 4 MHz, which were used as a parameter the mean and maximum velocity of the arterial blood flow (in cm/s). Three collections for each artery (each windowing with 10 seconds) were carried out, considering the mean for statistical calculations. The order to measure the arteries was randomized.

Evaluation Procedure

Signal processing was performed with SONARA/tek software, considering the entire period of collection. The evaluations of velocity in arteries were conducted by 2 examiners previously trained in use of the Doppler ultrasound. The examiners performed evaluations with the same volunteers independently and twice, with an interval of 1 week between them,¹⁹ thus enabling the measurement of intra- and inter-rater reliability.

Statistical Analysis

The intraclass correlation coefficient (ICC_{3,2}) was used to determine the intra- and inter-rater reliability, with their respective 95% confidence intervals, standard errors of measurement (SEM), and minimum detectable change (MDC), according to Tucci et al.²⁰ The interpretation of ICC values was based on that suggested by Weir.²¹ For values ranging from 1.00 to 0.81, the reliability was considered excellent; from 0.80 to 0.61, very good; from 0.60 to 0.41, good; from 0.40 to 0.21, reasonable; and finally, from 0.20 to 0.00, poor. All the statistical analysis was performed using the Statistical Package for Social Sciences software, version 17.0 (SPSS Inc., Chicago, IL).

RESULTS

The sample of the present study was composed of 50 individuals of both genders (40 women, 10 men) and 43 right-handers, with mean age of 25.10 years (standard deviation [SD] = 4.18) and mean body mass index of 22.89 kg/m² (SD = 3.72). The values of mean and maximum velocity of arterial blood flow obtained by both examiners are described in [Table 1](#).

[Table 2](#) presents the values of intrarater reliability from the measurement of mean velocity of arterial blood flow, and good to very good reliability was noted, with ICC values ranging between 0.510 and 0.722, SEM values ranging between 1.17 and 2.67 cm/s, and MDC values ranging between 3.25 and 7.37 cm/s. With regard to the inter-rater reliability from the measurement of mean velocity of arterial blood ([Table 3](#)), very good reliability was noted, with ICC values ranging between 0.700 and 0.780, SEM values ranging between 0.81 and 2.10 cm/s, and MDC values ranging between 2.55 and 5.82 cm/s.

The values of intrarater reliability from the measurement of maximum velocity of arterial blood flow are in [Table 4](#). Good to very good reliability was noted, with ICC values ranging between 0.539 and 0.659, SEM values ranging between 3.80 and 9.41 cm/s, and MDC values ranging between 10.50 and 26.13 cm/s. With regard to the inter-rater reliability from the measurement of maximum velocity of arterial blood ([Table 5](#)), good to very good reliability was noted, with ICC values ranging between 0.595 and 0.866, SEM values ranging

Download English Version:

<https://daneshyari.com/en/article/5564144>

Download Persian Version:

<https://daneshyari.com/article/5564144>

[Daneshyari.com](https://daneshyari.com)