111 - INFLUENCE OF MANUAL THERAPEUTICAL MANEUVERS APPLICATION ON THE AUTONOMIC NERVOUS SYSTEM OF HIPERTENSIVE SUBJECTS THROUGH THE HEART RATE VARIABILITY ANALYSIS: PILOT STUDY

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Introduction

Arterial Pressure (AP) can be defined as the force that a blood column exerts on the arterial walls, expressed in mmHg, that will depend on the height of the column and the surface where the pressure is exerted (DOUGLAS, 2002). The AP is detected by mechanoreceptors situated in the Aorta and Carotid Arteries walls. These fibers, called pressoreceptors, have cellular bodies situated in parasympathetic ganglia which emerge axons that incorporates to Vagus e Glossopharyngeal nerves, finishing in the solitary tract nucleus. The neurons of this nucleus have two targets which act in antagonistic way: the two nuclei of the Vagus nerve and the Bulbar nerves of sympathetic control. When the PA increases, there is a stimulus of the solitary nuclei, following of an activation of the vagal pre-ganglionar neurons and simultaneously there is an inhibition, through inter-neurons, of the Bulbar nuclei which control the sympathetic pre-ganglionar nerves (LENT, 2002).

In the heart, the parasympathetic autonomic nervous system innervates the sinoatrial and atrioventricular nodes to block both with the increase of the K+ conductance, which causes hyperpolarization of the cellular membrane. The sympathetic one innervates all the heart, with norepinephrine, that increases the Na+ and Ca++ conductance. The peripheral circulation receives only sympathetic innervation that goes for all the vases, except capillaries, the pre-capillaries sphincters and metarteriols. The small arteries answer for the change of the blood flow and the great veins for the change in the blood volume. The normal sympathetic vasoconstrictor tonus contributes with 50% of total vascular tonus, therefore, a sympathetic blockade can reduce the AP until 50% (CITOW; MACDONALD, 2004).

Studies have demonstrated that the capacity of autonomic modulation of the cardiovascular system is present in various illnesses that reaches the heart. In the Sistemic Arterial Hypertension (SAH) the regulating mechanisms of the AP are less sensible, diminishing the reflexes, having a lesser number of action potentials of depressors nerves. First, displace the action threshold of the pressoreceptors to higher levels of AP and then, the small pressure variations are hindered, attenuating the reflex capacity of the vagal system on the heart rate variability and increasing the sympathetic on the vases (FILHO; BARBOSA; CORDOVIL, 2002).

The sympathetic activity or the vagal efferent is a product that results of the vasomotor center activity, respiratory center, the peripheral oscillations of the arterial pressure and the respiratory movement. The Heart Rate Variability (HRV) reflects the state and function of the central oscillators and peripheral response to autonomic work for the sympathetic or parasympathetic activity. Registering continuously the contractions through the HRV system, the sympathetic and parasympathetic neural control on the sinusal node can be reflected, which does not happen with an short term analysis as in the conventional electrocardiogram. The knowledge that the cardiac fluctuations reflect the interaction between these systems came to offer a window for autonomic nervous system study (EINGORN; MUHS, 1999; ACHARYA et al., 2005; RIBEIRO; SON, 2005).

The analysis of the HRV according the study of Discroll and DiCicco, 2000, verifies in the electrocardiogram the QRS wave, which corresponds to the ventricular contraction and determines the time between each R-R intervals. The wave amplitude in function of the frequency is calculated, being each specter divided by the total one. The normalized components between 0.15 and 0.4Hz are called high-frequency component (HF), this band is related with the efferent vagal activity that modulates the activity of the sinusal node. The ones located between the 0.04 band and 0.15Hz are considered of low frequency (LF) characterizing an increased sympathetic activity. The relation between high and low frequency is computed then as an index of sympathetic-vagal balance. Dividing the low frequency component for the high frequency one, values bigger than 1, indicates sympathetic predominance, minors than 1, parasympathetic predominance and value 1 indicates balance between these systems.

Some techniques of manual therapy can influence in the control of the autonomic nervous system, studies had found autonomic reactions as the increase of skin temperature, after the manipulation of T2 to T5, indicating a sympathetic-inibition, had also found simpatoinbição after manipulation of the C1 to C7 segments and a simpatoexcitação after manipulation of T1 to L3 segments (SILVA *et al*, 2004).

Nicolas and Oleski (2002) in their study cites that the maneuver called "rib rasing" applied adjacent to the thoracic vertebrae can be used in the treatment of viscero somatic reflexes. For diminishing the sympathetic activity, also being able to be applied for postoperative pains.

There is manual maneuvers that are capable to intervene on the autonomic nervous system not only when applied on the adjacent roots to the spine. The manual therapy also includes techniques that act on the parasympathetic nervous system approaching the way or the origin of the Vagus Nerve, for example, the maneuver of the 4° ventricle and the mobilization of the larynx. This technique enclosed in the cranial therapy or cranio sacral, named maneuver of 4º ventricle, acts on the parasympathetic system which relaxes sympathetic tonus (CHAITOW, 2001; HEBGEN, 2005).

The aim of this study, therefore, was to analyze the influence of the application of manual therapeutical maneuvers on the autonomic nervous system of controlled hypertensive individuals.

Materials and Methods

The present study is a quantitative, experimental, field, observational, evaluation research. The sample was constituted of 6 subjects, 49 to 76 years age, average of 60 years and 6 months, that fit, according to Brazilian Society of Cardiology, in the stages of hypertension with Arterial Pressure > 140/90 or pre-hypertension, reached for some control process, with AP>120/80 and < 140/90. It was determined that the hypertension diagnosis must have been done at least one year later, excluding the hypothesis of a masked hypertension or white apron hypertension.

Initially, through an evaluation, all subjects had been questioned regarding its age, how much time discovered to be hypertensive, which control medicine or the form of control, has how much time manages this control, if has some physical or health compromise associated. At a second moment the AP was collected with manual sphygmomanometer following the described orientations of the Brazilian Society of Cardiology.

After that the subject was submitted to the evaluation of its HRV through a computerized, automatic and non-invasive system named *Nerve Express*, connected to a cardiac frequency monitor - polar type. This evaluation is made using an orthostatic test where the subject remains lying and when uprising it is seen the capacity of the autonomic nervous system in adapting the body position change.

Then the subject lay down in a stretcher, in supine position. The maneuvers applied had followed the following procedure:

- Continuous monitoring of the HRV during the application of the three maneuvers.

- Application of rib rasing with therapist in the lateral of the stretcher, hand in shell with the fingers tips under the costovertebral junction (rib-vertebral) to the level of T4 to T9 vertebrae, where the sympathetic ganglia is located, the therapist carried through movements of metacarpo-phalangeal and inter-phalangeal flexion and extension, as in Shrun *et al*. (2001), mobilizing the region per 2 minutes and then inverting the side for the other lateral of the stretcher.

- Application of the larynx mobilization, with the patient in dorsal decubitus and therapist in upright position in the lateral of the stretcher, therapist fixed the jaw with the thumb, pointer and average finger. The average, indicating finger and thumb of the caudal hand rest above the clavicles, on the trachea carry through lateral translations, while the cranial hand fixed the jaw. Once the muscles and fascia relax, instead of fixing, the cranial hand can be used to mobilize alternating it with the caudal hand. The mobilization does not have to be violent, but it must be enough mobilize the larynx and deep cervical fascia taking a positive effect on the vascular-nervous complex, including the Vagus nerve (HEBGEN, 2005)

- Application of the 4º ventricle maneuver with the therapist in the headboard of the stretcher, interlaced fingers, hands in shell, patient lying down the head in a way that the thenar eminences are lateral in relation to the external occipital lump and medial in relation to the lateral angles of the occipital scale. During the expiration that corresponds to the occipital extension the application starts medially with a light and persistent pressure. This continues during 4 minutes and after that one of the sides is liberated so that the jugular foramen is free per 2 minutes and thus following the same procedure for the opposing side.

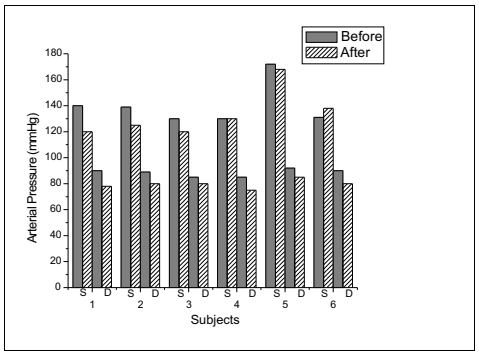
After this, a new HRV evaluation through the orthostatic test and a new gauging of the arterial pressure were done.

Then, it was carried through a comparative analysis between the observed results in the analysis of HRV before and after the application of the maneuvers, as well as the variance between each technique, registering itself possible variations to the level of the Autonomic Nervous System. Still, It was compared the Arterial Pressure before and after the application of the maneuvers.

The collected data had been analyzed statisyically through Microsoft Excel 2003 and Microcal Origin 6.0 Softwares. The relation between the variables was made through pared Test *t-student*, with index of significance of 5%.

Results

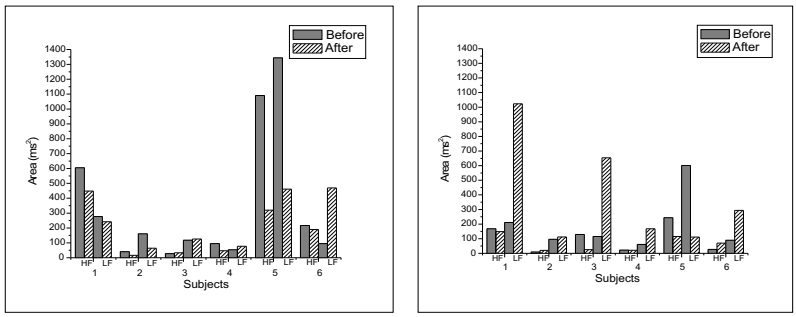
Initially, the values corresponding to Arterial Pressure had been analyzed, in mmHg, breaking up systolic AP to the diastolic, effectuating the statistical calculation of significance from interval between these values before and after the application of the maneuvers, as it can be seen in graph 1.



Graph 1 - Arterial Pressure of all subjects, before and after the maneuvers application. (S: systolic; D: diastolic).

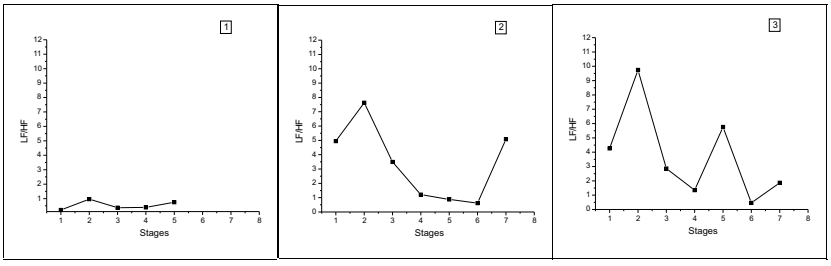
In the systolic AP could be seen a average reduction of 6,83 mmHg, one of the subjects had reduction of 20 mmHg, however did not have significant difference in the pared test, with a *p* value of 0,14. The diastolic AP presented an average reduction of 8,83 mmHg, a very significant index for this population, with *p* value of 0,0003.

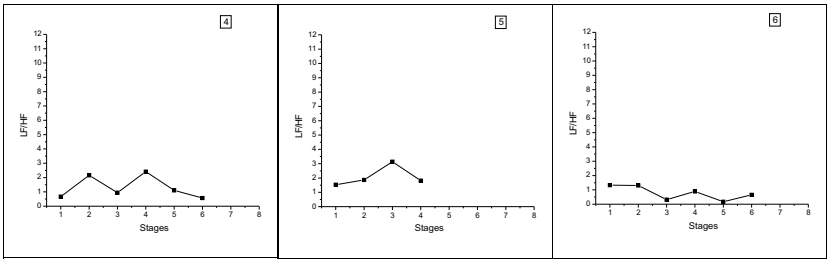
The second analysis corresponds to the values of HF, high frequency, corresponding to vagal activity, LF, low frequency, corresponding to the sympathetic activity and index LF/H, that corresponds to the sympathhetic and parasympathetic autonomic control of the heart, and determines the predominance of each system. The values of HF and LF can be seen in graph 2. These data had been collected during the orthostatic test before and after the application of the maneuvers.



Graph 2 - Values of HF and LF before and after maneuvers application, in supine position (A) and upright (B).

In the analysis of LF/HF index, resultant of the orthostatic test application before and after the maneuvers could be seen that in supine, it had a predominance of the sympathetic nervous system, > 1, with a light increase in the second measure, without statistical significance. The LF/HF indexes in orthostatic position were also predominant in sympathetic system, before and after the maneuvers, being still more predominant after the application, however without statistical difference.





Graph 3 - LF/HF **values of** HRV monitoring during maneuvers application of each subject.

Discussion

In this pilot study, it was seen the systolic and diastolic pressures had reacted in a disproportionate way, once the diastolic diminished significantly after the maneuvers while the systolic did not. In a study of case carried through by Plaugher and Bachman in 1993, with a hypertensive subject, with low lumbar pains complaints and collateral effect of hypertension control medicines, it was presented that applying quiropratic treatment of spinal adjustment, a normalization of AP was observed, with the suspension of control medicines, in a period of two months of treatment. Although this study has been done in an isolated case, it has evidence that maneuvers carried through on the spine are capable to influence the autonomic control of AP. It regards that patient submitted to this type of treatment are followed by AP monitoring.

There are a few reports that approaches the influence of the manual treatment in hypertensive subjects, which takes the results away from a consensus. Another study of case, carried through by Driscoll and Hall (2000), analyzed the HRV and AP in a non-hypertensive patient, submitted to an osteopathic treatment during 6 weeks, making a total of 10 sessions. Although they have perceived constant variations in LF/HF, and alternation of sympathetic and parasympathetic domains during the sessions, the AP did not have significant variation. The fact that these studies had an individual approach of the patient and had distinct results, it agrees to the present study, which observed different reactions to the maneuvers between subjects, considering the fact to have been applied only one time.

There is a recent study that describes as cause of hypertension in some subjectss, the bad alignment of the first vertebra atlas, associated to the ischemia, where the manipulation and alignment of it reduced the AP significantly, similar to the effect caused for medicines. The present study had the objective to improve the circulation setting free the jugular vein foramen in the base of the skull, leaving of the same principle (BAKRIS et al., 2007).

Spectral components of QRS interval are bigger in hypertensive subjects when compared to non-hypertensive ones. In his study Piccirillo (2002) observed that hypertensive subjects have a bigger LF/HF index of HRV and that varies inside of normalized indices, when compared with non-hypertensive subjects indicating a vagal-sympathetic disequilibrium. Then, this author concluded that the hypertension leads to an abnormal increase of the cardiac repolarization to the level of the sinusal node, what would be associated with an increase of the sympathetic modulation and a reduction of the vagal modulation. This study tried to stimulate the vagal modulation through techniques that approached the way of the Vagus nerve until the heart.

When observed, the pressoreceptors activity, the arterial pressure and the central venous pressure, a study carried through by Maruyama and col. in 2005, saw that after medicine administration indicated to low the negative pressure of the body of 5 to 10mmHg, the sympathetic activity increased as also seen in the present study, the central venous pressure diminished significantly while there were no have significant alteration in the arterial pressure, wich agrees partially to the present study where only the systolic pressure did not oscillate significantly. Maruyma cites that had an unexpected reply of the activity of the SNA once that, this would diminish in result of the regulation of the pressoreceptors activity with the medicine, and that this reply is opposite to several other studies.

Gaillot and col., in 2005, had studied the sympathetic reply after the vagal electric stimulation in 7 born embryos of delayed gestation, in condition of control, and perceived an increase in the speed of fetal cardiac recovery after the bradicardy by stimulation, what suggests that a sympathetic reply occurs after vagal stimulation. This if would happen once the vagal stimulation occurs such in an afferent direction as in the eferente way, leading to an interaction with the sympathetic nervous system. This could explain the fact of the sypmathetic reply to the orthostatic test had increased after the maneuvers of vagal stimulation in our study.

References

CITOW, J. S.; MACDONALD, R. L. **Neuroanatomia e Neurofisiologia** - Uma Revisão. São Paulo: Editora Santos, 2004.

CHAITOW, L. **Teoria e prática da Manipulação Craniana - Abordagem em tecido ósseo e mole.** São Paulo: Editora Manole, 2001.

DOUGLAS, C. R. **Tratado de Fisiologia Aplicado à Fisioterapia.** São Paulo: Editora Robe, 2002.

DRISCOLL, M.D; HALL, M. J. Effects od Spinal Manipulative Therapy on Autonomic Activity an the Cardiovascular System: A Case Study Using the Eletrocardiogram an Arterial Tonometry. **Journal of Manipulative and Physiological Therapeutics**, 2000, 23 (8): 545-550.

EINGORN, A. M.; MUHS, G. J. Rationale for Assessing the Effects of Manipulative Therapy on Autonomic Tone by Analysis of Hear Rate Variability. **Journal of Manipulative and Physiological Therapeutics,** 22 (3): 1999.

FILHO, J. B.; BARBOSA, P. R.; CORDOVIL, I. Modulação autonômica do coração na Hipertensão Arterial Sistêmica. **Arquivo Brasileiro de Cardiologia**, 2002, 78(2): 181-8.

GAILLOT, T. Ifluence of simpatic tone on heart rate during vagal stimulation and nitroprusside induced hypotension in ovine fetus. **Autonomic neuroscience: Basic and Clinic**, 2005, 123: 19-25.

HEBGEN, E. **Ostéopathie Viscérale: Principles et techniques**. Paris: Maloine, 2005.

JOAQUIM, L. F.; SALGADO, H. C.; JÚNIOR, R. F. Variabilidade da pressão arterial e freqüência cardíaca, e sensibilidade do barorreflexo, em animais geneticamente manipulados. **Revista Brasileira de Hipertensão**, 2005, 12(1): 36-40.

LENT, R. **Cem bilhões de neurônios - conceitos fundamentais de neurociência**. Rio de Janeiro: Atheneu, 2002.

MARUYAMA, M. Effect of pimobedan on cardiopulmonary baroreflex control of sympathetic nerve activity in healthy young men. **Autonomic Neuroscience: Basic and Clinical,** 2005, 122:100-106.

PICCIRILLO, G. et al. QT- interval variability and autonomic control in hyertensive subjects with left ventricular hypertrophy. **Clinical Science**, 2002, 102: 363-371.

PLAUGHER, G.; BACHMAN, T.R. Chiropratic Management of a Hypertensive Patient. **Journal of Manipulative and Physiological Therapeutics**, 1993, 16(8): 544-549.

SILVA, R.B.X.; SALGADO, A.S.I. Efeitos agudos da Manipulação Vertebral do Tronco Simpático Dorsal sobre as Impressões Plantares visualizadas pelo exame Baropodométrico. **Revista Brasileira de Fisioterapia Ortopédica, Traumatológica e Desportiva**. Vol. 1, n. 03, p. 124-128. mai/jul, 2004.

SHRUM, K *et al.* Sinusitis in children: the importance of diagnosis na treatment. JAOA. Vol 101. N 05. maio 2001.
V Diretrizes Brasileiras de Hipertensão Arterial - **Sociedade Brasileira de Cardiologia, Sociedade Brasileira de Hipertensão, Sociedade Brasileira de Nefrologia**. - 2006. Disponível em: http://departamentos.cardiol.br/dha/vdiretriz/vdiretriz.asp

INFLUENCE OF MANUAL THERAPEUTICAL MANEUVERS APPLICATION ON THE AUTONOMIC NERVOUS SYSTEM OF HIPERTENSIVE SUBJECTS THROUGH THE HEART RATE VARIABILITY ANALYSIS: PILOT STUDY

ABSTRACT

The Arterial Pressure is detected by mechanoreceptors situated in the Aorta and Carotids walls. In the hypertension the regulating mechanisms of the arterial pressure are less sensible, diminishing the reflexes, having a lesser number of action potentials of the nerve depressors. The Heart Rate Variability reflects the state and the function of the central oscillators and peripheral reply to the central autonomic work for the sympathetic or parasympathetic activity. This study had as objective to analyze the influence of manual therapeutic maneuvers application on the autonomic nervous system and the arterial pressure of hypertensive subjects. The sample constituted of 6 subjects, with average age of 60 years, classified as pre-hypertensive and hypertensive, as the Brazilian Society of Cardiology, submitted to a heart rate variability analysis, arterial pressure monitoring and the application of four therapeutic maneuvers in the autonomic nervous system way. After the maneuvers application, it was observed a reduction in the pressure average of the individuals, however with statistical significance only in the diastolic. There was a sympathetic predominance, a hypertensive subjects characteristic, as much as after and before the maneuvers, being observed that this predominance reduced at the moment of the application, however increased in reply to the orthostatic test carried through after application. It can be affirmed that these maneuvers are capable to influence in the reduction of the diastolic arterial pressure.

KEYWORDS: arterial pressure, heart rate variability, manual therapy.

RAPPORT DES MANOEVRES THERAPEUTIQUES MANUELLES SUR Lê SYSTEME NERVEUX AUTONOME DES INDIVIDUS AVEC HIPERTENSION ARTERIELLE MESURE PAR L'ANALISE DE LA VARIABILITé CARDIAQUE :- ETUDE DE CAS

RESUME

La pression arterielle est verifié par mecanocepteurs situés dans le parois d'aorte et des carotides. Dans l'hipertension les mecanismes regulatrices de la tension arterielle restent moins sensibles, les reflexes sont diminués, avec un nombre plus bas de potenciels d'action dans les nerfs depressifs . La variabilité cardiaque montre l'etat et la fonction des oscilations centrales et reponse periferique au travail autonome central par l'activité simpathique ou parasympathique. Le but de cet etude a été d'analiser l'influence de l'aplication des manoevres therapeutiques manuelles sur le systeme nerveux autonome et tension arterielle des individus avec hipertension. L'étude a été fait avec 6 individus , avec l'age moyenne de 60 ans e demie, classifiés comme pré- hiper tension et hipertension arterielle selon la societé Bresilienne de Cardiologie, subis á des analyses de la variabilité cardiaque, controle de la tension arterielle et aplication de 4 manoeuvres therapeutiques dans le trajet du systeme nerveux autonome (SNA). Aprés aplication des manoeuvres on a pu constaté une diminuition de la moyenne de pression des individus, qui a atteint le seuil statistique seulement dans la tension diastolique. Predominance sympathique, caracteristique des individus avec hipertension, avant et aprés les manoevres, diminuition dans le moment d'execution des manoevres, augmentation du test debout aprés manoevres. On peut conclure que ces manoevres peuvent influencier dans la diminuition de la tension arterielle diastolique.

MOTS CLES :- Tension Arterielle , Variabilité Cardiaque , Therapie Manuelle

INFLUENCIA DE LA APLICACION DE MANIOBRAS TERAPEUTICAS MANUALES EN EL SISTEMA NERVIOSO AUTONOMO DE INDIVIDUOS HIPERTENSAS POR MEDIO DEL ANALISE DE LA VARIABILIDAD CARDIACA: ESTUDO INICIAL

RESUMEN

La presión arterial es captada por mecanos receptores de la pared de la aorta e de las carótidas. En la hipertensión los mecanismos reguladores del PA se quedan con menos sensibilidad, diminuyendo los reflejos, ocurriendo una menor potenciáis acciones de los nervios depresores. La variabilidad Cardiaca reflecte el estado y la función de los osciladores centrales y respuesta periférica al trabajo autonómico central por la actividad simpática o parasimpática. Ese estudio tiene como objetivo analizar la influenza de la aplicación de maniobras terapéuticas manuales en el sistema nervioso autónomo y la PA de individuos hipertensos. La muestra fue compuesta por 6 individuos, con media de 60 años y medio, clasificados como pré hipertensos y hipertensos de acuerdo con la “Sociedade Brasileira de Cardiología”, pasando por la analice da variabilidad cardiaca, verificación de la PA y aplicación de 4 maniobras terapéuticas en el trayecto del SNA. Después de la aplicación de las maniobras, la presión media de los individuos se bajó, más con valor estadístico apenas en la PA diastólica. La predominancia simpática, característica de individuos hipertensos, antes y después de las maniobras, observa-se que la predominancia diminuía durante la aplicación, y creció en respuesta al ortoteste realizado después de la aplicación. Es posible decir que las maniobras son capaces de. influenciar para bajar la PA diastólica.

PALABRAS-CLAVE: presión arterial, variabilidad cardiaca, terapia manual

INFLUÊNCIA DA APLICAÇÃO DE MANOBRAS TERAPÊUTICAS MANUAIS SOBRE O SISTEMA NERVOSO AUTÔNOMO DE INDIVÍDUOS HIPERTENSOS ATRAVÉS DA ANÁLISE DA VARIABILIDADE CARDÍACA: ESTUDO PILOTO

RESUMO

A Pressão Arterial é detectada por mecanorreceptores situados na parede da aorta e das carótidas. Na hipertensão os mecanismos reguladores da PA ficam menos sensíveis, diminuindo os reflexos, havendo um menor número de potenciais de ação dos nervos depressores. A variabilidade Cardíaca reflete o estado e a função dos osciladores centrais e resposta periférica ao trabalho autonômico central pela atividade simpática ou parassimpática. Esse estudo teve como objetivo analisar a influência da aplicação de manobras terapêuticas manuais sobre o sistema nervoso autônomo e a PA de indivíduos hipertensos. A amostra constituiu de 6 indivíduos, com idade média de 60 anos e meio, classificados como pré hipertensos e hipertensos conforme a Sociedade Brasileira de Cardiologia, submetidos a análise da variabilidade cardíaca, monitoramento da PA e a aplicação de 4 manobras terapêuticas no trajeto do SNA. Após a aplicação das manobras houve diminuição na média pressórica dos indivíduos, porém com significância estatística apenas na PA diastólica. Houve predominância simpática, característica de indivíduos hipertensos, tanto antes quanto depois das manobras, sendo observado que essa predominância diminuía no momento da aplicação, porém aumentou em resposta ao ortoteste realizado após aplicação. Pode-se afirmar que essas manobras são capazes de influenciar na diminuição da PA diastólica.

PALAVRAS-CHAVE: pressão arterial, variabilidade cardíaca, terapia manual.