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 vessels, except capillaries, the pre-capillaries sphincters and metarterioles. 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 tension, 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 vessels (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. The analysis of the HRV 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-inhibition, had also found simpatoexcitação after manipulation of the C1 to C7 segments and a simpatoexcitação after manipulation of T1 to L3 segments (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.

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.

Materials and Methods
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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 Brailian Society of Cardiology.

As 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 orhastotic 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 raising 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 4th 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.

After this, 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 statistically 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/HF, that corresponds to the sympathetic 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.

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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 quiropractic 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 alteration 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 subjects, 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 sinus 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. Maruyama 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.

Gaillo, 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 bradycardia 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 efferente way, leading to an interaction with the sympathetic nervous system. This could explain the fact of the sympathetic reply to the orthostatic test had increased after the maneuvers of vagal stimulation in our study.

References
Influência de manobras terapêuticas manuais sobre o sistema nervoso autônomo de indivíduos hipertensos por meio do análise de variabilidade cardíaca: estudo inicial

RESUMEN

Rapport des manœuvres therapeutiques manuelles sur le système nerveux des individus avec hypertension arterielle selon la societé Bresilienne de Cardiologie, subis á des analyses de la variabilité cardiaque, controle de la tension arterielle et application de 4 manoeuvres therapeutiques dans le trajet du systeme nerveux autonome ( SNA ). Aprés application des manoeuvres on a pu constater une diminuition de la moyenne de pression des individus, qui a atteint le seuil statistique seulement dans la tension diastolique. Predominance sympathique, caractéristique des individus avec hypertension, avant et aprés les manoeuvres, diminution dans le moment d'exection des manoeuvres, augmentation du test debut aprés manoeuvres. On peut conclure que ces manoeuvres peuvent influencer dans la diminuition de la tension arterielle diastolique.

MOTS CLES :- TensionArterielle , Variabilité Cardiaque , Therapie Manuelle

Influência de aplicação de maniobras terapêuticas manuais em el sistema nervioso autônomo de indivíduos hipertensos através da análise da variabilidade cardíaca: estudo piloto

RESUMEN

La presión arterial es captada por mecanorreceptores situados en el parois de aorta y de las carótidas. En la hipertensión los mecanismos reguladores del PA se quedan con menos sensibilidad, diminiendo los reflejos, ocurriendo una menor potencialis acciones de los nervios depressores. La variabilidad Cardíaca reflete 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 influencia de la aplicación de maniobras terapêuticas manuais en el sistema nervioso autônomo 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 Cardiologia”, pasando por la analize da variabilidad cardíaca, verificação de la PA e aplicação de 4 maniobras terapêuticas 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 diminuiu durante la aplicación, y creció en resposta ao ortostate realizado después de la aplicación. Es posible decir que las maniobras son capazes de influenciar para bajar la PA diastólica.

PALABRAS-CLAVE: pressión arterial, variabilité cardiaque, terapia manual

Influência da aplicação de maniobras terapêuticas manuais sobre o sistema nervoso autônomo de indivíduos hipertensos através da análise da variabilidade cardíaca: estudo piloto

RESUMEN

A Pressão Arterial é detectada por mecanorreceptores situados na pared 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 autonómico central pela atividade simpática ou parasimpática. Esse estudo teve como objetivo analisar a influência da aplicação de maniobras terapêuticas manuais sobre o sistema nervoso autônomo e a PA de indivíduos hipertensos. A amostra constituí 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 aplicação de 4 maniobras terapêuticas no trajeto do SNA. Após a aplicação das maniobras 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 maniobras, sendo observado que essa predominância diminuiu no momento da aplicação, porém aumentou em resposta ao ortostate realizado após aplicação. Pôde-se afirmar que essas maniobras são capazes de influenciar na diminuição da PA diastólica.

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