55 - EFFECT OF POSTURAL CHANGE ACTIVE IN THE ADJUSTMENT OF CARDIAC FREQUENCY AND BLOOD PRESSURE OF POST-MENOPAUSE WOMEN WITH DIABETES MELLITUS TYPE 2

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doi:10.16887/88.a1.55

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is characterized by long duration, slow progression and premature mortality from all causes, in particular by coronary heart disease. The treatment of T2DM represents a high cost for the health system due to the progressive character of this disease that leads the patient to the development of other risk factors (NITA et al, 2012). The hospitalizations attributable to diabetes mellitus represent 9% of the hospital costs of the Unified Health System (SCHMIDT et al, 2009), and patients with diabetes use the health care system more frequently and for a longer period than those without this system condition (BORGES, FERRAZ & CHACRA, 2014).

Chronic hyperglycemia is associated with damage, dysfunction and failure of various organs, especially eyes, kidneys, nerves, heart and blood vessels (GROSS et al, 2002). Among non-communicable chronic diseases, diabetes mellitus stands out for its morbidity and mortality as a risk factor for circulatory diseases (MIELCZARSKI, COSTA & OLINTO, 2012). The greater survival of individuals with T2DM increases the chances of development of the chronic complications of the disease, such as macroangiopathy, retinopathy, nephropathy and neuropathies, which are closely associated with the time of exposure to hyperglycemia (SBD, 2015). Autonomic neural imbalance is a serious complication of long-term diabetes patients and may progress to diabetic autonomic neuropathy (NAD). As the symptoms are initially weak and uncharacteristic, the condition is often not diagnosed until late manifestations occur. Among the important symptoms, we can highlight postural hypotension, which can be evaluated by the active postural change test (MPA), and has relevant clinical significance in the assessment of autonomic function and in the diagnosis of autonomic neuropathic (FLEISCHER, 2012).

The change from the supine position to the orthostatic position generates a modification of the autonomic reflex activity in order to keep the blood pressure (BP) within a range that is adequate to the functioning of the organism (GUYTON & HALL, 2006). During this procedure, called orthostasis or Active Postural Change (MPA), there is accumulation of blood in the lower limbs and abdominal viscera, resulting in reduction of venous return and tendency to fall of BP. Through mainly the arterial baroreflex, sympathetic activation and vagal inhibition occurs, triggering an increase in heart rate (HR) and inotropism. These adjustments are directly related to the neural mechanisms of HR regulation and provide parameters to evaluate the autonomic control caused by the postural change (NETO, 2006).

The HR behavior tends to show a maximum tachycardia around the twelfth (possibly due to contraction of the abdominal and lower limbs muscles), followed by a relative bradycardia around the twenty-second of orthostatism, followed by a new but gradual increase, around the sixty-second. Maintenance of elevated HR appears to be due to predominant sympathetic stimulation, secondary to baroreceptor activation (CASTRO, NOBREGA & ARAUJO, 1992).

In summary, five responses of the healthy individual are pointed out, and should also occur in patients with heart disease due to hydrostatic deviations and reflex responses adaptive to MPA. They are: redistribution of blood from the lower extremities to the upper extremities of the body; reduction of cardiac output and systemic arterial pressure; activation of arterial and cardiopulmonary mechanoceptors; integration of central and peripheral nervous information (cardiorregulatory centers); activation of sympathetic efferent pathways and inhibition of parasympathetic efference to the cardiovascular system (MARÃES, 2010). Diabetics with autonomic neuropathy show only a gradual or no increase in heart rate after postural change, on the other hand systolic blood pressure drops, which characterizes orthostatic hypotension (EWING & CLARKE, 1982; EWING et al., 1985). In addition to DM2, the postmenopausal condition contributed to worsening of autonomic function, due to changes in estrogen metabolism (ERRNEST et al, 2008).

The analysis of the autonomic function through MPA in postmenopausal women with Type 2 Diabetics represents an important clinical tool to evaluate the control of the effect of DM2 on the integrity of the autonomic system, thus contributing to the management of the therapeutic strategies of this population. Thus, the objective of this study was to analyze the autonomic function through the adjustments of heart rate and blood pressure resulting from the active postural change (MPA) of postmenopausal women with Type 2 Diabetes.

METHODOLOGY

The sample consisted of women aged between 50 and 85 years, without menstruation for at least 12 months (SOULES et al, 2001), with diagnosis of Type 2 Diabetes for at least 3 years. We initially included in the study all patients diagnosed with Type 2 Diabetes with medical referral for the practice of Hydrogynastics to the Laboratory of Physical Evaluation and Sports Practice of Unimar (LAFIPE-UNIMAR). Patients with an inability to understand and respond to simple verbal command were not included in the study; amputations and / or prosthesis use in limbs; sequelae of stroke; Parkinson's disease; fractures in lower limbs and / or spine after age 60; severe coronary disease; incapacitating labyrinth; otitis; hydrophobicity; skin lesions; hypotension or severe hypertension; uncontrolled congestive heart failure; unstable angina; uncontrolled diabetes; unstable dysrhythmia; uncontrolled systemic arterial hypertension and foot deformity. The procedures used in this research obeyed Criteria of Ethics in Researches with Human Beings according to Resolution No. 466/12 of the National Health Council, being approved by the Research Ethics Committee of the University of Marília, under protocol No. 2,083,530/2017.

This is a cross-sectional observational study. The patients were submitted to an evaluation that consisted of anamnesis and history of diseases, anthropometry and active postural change test (MPA) of the autonomic function tests battery. Data were collected in two days, the first day being used for anamnesis and history of diseases and anthropometry with waist circumference (WC), body weight and height for calculating body mass index (BMI), for classifications of central and general obesity, respectively. The protocol for MPA analysis proposed by Ewing et al. (1980) used for the evaluation of autonomic function

and for the diagnosis of autonomic diabetic neuropathy. All volunteers were initially submitted to a record of the heart rate in the supine position for 20 minutes in a quiet environment in an air-conditioned room (23 ± 2 ° C), always performed in the morning, so that the related changes to circadian HR variations are minimized. To monitor HR, the instant R-R intervals were recorded with a Polar heart rate monitor (model RS800). The data was converted and analyzed in the Polar Pro Trainer software (version 5). The PA was measured with automatic device of the brand OMRON (model HEM-7113).

The volunteers were told not to move, talk or sleep. BP was measured after 20 minutes of supine rest, followed by the postural change maneuver. For the postural shift maneuver to standing position, the volunteer was raised as soon as possible in a time of 3 to 5 seconds and standing up for 5 minutes. In the standing position, the BP measurement was performed between 90º and 120º after the beginning of the maneuver (DIMITROPOULOS; TAHRAN; STEVENS, 2014). The MPA adjustments were analyzed by calculating the HR variation between the highest value around the 15th beat and the lowest value by 30º after lifting. For BP, the difference between the systolic BP (SBP) values measured in the two postures was calculated. The HR and BP results obtained during the MPA test were categorized according to the intervals and limit values proposed by Ewing & Clarke (1982) and Ewing et al. (1985), which classify the results into Normal, Borderline and Abnormal (table 1). Qualitative variables were described by the absolute and relative frequency distribution. Quantitative variables are described by the mean and standard deviation (SD). The percentage variation of the HR values was calculated by the equation% change HR = (HRmax-FCmin) * 100 / HRmin, and the percentage variation of the SBP by the equation% change in SBP = PAS standing up. SPSS software version 19.0 for Windows was used.

Table 1: Categorization of HR and SBP variation values for the MPA test.

Test and variable analyzed	Normal	Borderline	Abnormal
Active postural change: HR responses	≥1,04	1,01-1,03	≤ 1,0
Active postural change: SBP responses	≤ 10	11-29	≥ 30

Note: HR = heart rate; SBP = systolic blood pressure.

RESULTS

The mean age of the sample was 66.1 ± 8.3 years and the time of diagnosis of DM2 was 10.3 ± 7.3 years. A significant prevalence of comorbidities was observed in the sample, where 88% of the patients had systemic arterial hypertension, 84% central obesity (WC), 56% global obesity (BMI), 48% had dyslipidemia, 56% had arthrosis, 20% had osteoporosis, and 16 % rheumatoid arthritis. Regarding the number of risk factors, 4% had a risk factor, 36% had two risk factors, 40% had three risk factors and 20% had four risk factors.

Table 2: Descriptive analysis of heart rate (HR) adjustments and systolic blood pressure (SBP) to active postural change (MPA).

	Mean	SD
MPA maxHR (bpm)	86,4	14,2
MPA minHR (bpm)	78,6	13,9
% of HR variation	10,3	7,3
MPA supineSBP(mmHg)	125,2	18,6
MPA orthostatic SBP (mmHg)	126,2	17,4
%of SBP variation	-0,6	8,1

Note: active postural change (MPA); heart rate (HR); systolic blood pressure (SBP).

Table 3: Absolute (f) frequency distribution and relative classification of HR and SBP variation in the MPA test.

	Classification	*f*	%
MPA HR	Normal	22	88
	Borderline	3	12
	Abnormal	0	0
MPA SBP	Normal	21	84
	Borderline	4	16
	Abnormal	0	0

Note: Active postural change (MPA); heart rate (HR); systolic blood pressure (SBP).

DISCUSSION

The prevalence of risk factors in the type 2 diabetic sample of the study showed a marked presence of systemic arterial hypertension (88.0%) and central obesity by WC (84.0%). In a study by Rodrigues et al. (2016) found 82.6% of patients with systemic arterial hypertension and abdominal obesity (CC) and 30.4% with DM2 in a sample of 23 subjects (59.8 ± 5.9 years). Likewise, Petersen et al. (2011) found a prevalence of 92.1% of central obesity (WC), 83.8% of hypertensive individuals when studying a group of 204 individuals aged 64.2 + 11.5 years. Ferreira et al. (2010) with 418 elderly people (70.7 ± 7 years) observed 83.3% of central obesity (WC), 80.4% of arterial hypertension and 19.1% of DM2 in their sample. Observing the simultaneity of risk factors in the present study, 40% of the sample presented three factors and 36% presented two concomitant factors. Rodrigues et al. (2016) and Petersen et al. (2011) and found 56.5% and 85.0%, respectively, with a diagnosis of metabolic syndrome (more than three risk factors present), while Ferreira et al. (2010) pointed out 87.3% of the sample with two or more risk factors.

Observing the MPA, the maximum HR was 86.4 ± 14.2 (bpm) and the minimum was 78.6±13.9 (bpm), representing a 10.3 ± 7.3% increase when performing the maneuver, with no abnormal responses indicating parasympathetic autonomic dysfunction (88.0% normal). Likewise, when analyzing the adjustments of SBP to MPA, in the supine position was 125.2 ± 18.6 (mmHg) and in the orthostatic position of 126.2 ± 17.4 (mmHg), which represents normal pressure response to stimulate the maneuver.

Although the higher prevalence of CF and SBP adjustments were found to be normal in the sample, some patients presented borderline results (12.0% for HR adjustments and 16.0 %% for SBP), which indicates the presence of autonomic dysfunction in the early stages (DIMITROPOULOS, TAHRAN & STEVENS, 2014), indicative of autonomic neuronal damage, affecting baroreflex sensitivity (COLLIES et al, 2009, POP-BUSUI 2010), causing postural hypotension as a clinical symptom (FLEISCHER, 2012) and tachycardia related to the reduction of resting HRV (LIU et al, 2016).

These neural changes may precede the clinical diagnosis of CAP and are directly related to a worse prognosis (FREEMAN, 1991). Liao et al. (1995) Investigated 154 diabetics and 1,779 non-diabetic men and middle-aged women in the

ARIC (Atherosclerosis Risk in Communities) study, and found that diabetics had worse vagal modulation than non-diabetic patients.

In DM2, the main mechanism of injury to ANS is related to the deleterious effect of hyperglycemia in insulin-dependent tissues (FLEISCHER, 2012), thus inadequate glycemic control favors its progression (DIMITROPOULOS, TAHRANI & STEVENS, 2014). The presence of autonomic dysfunction in patients with T2DM may be related both to the longer exposure to hyperglycemia (FLEISCHER, 2012) and to the menopausal aging process that has a deleterious effect on cardiovascular regulation (EARNEST et al, 2008) .

CONCLUSION

Although the majority of the sample presented normal HR and SBP values, some individuals presented borderline responses suggesting autonomic dysfunction in the early stages, where neural changes precede clinical symptoms of changes caused by the impact of exposure to hyperglycemia and comorbidities.

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EFFECT OF ACTIVE SETTING CHANGE IN POSTURAL HEART RATE AND BLOOD PRESSURE OF POSTMENOPAUSAL WOMEN TYPE 2 DIABETIC

The objective of this study was to analyze the autonomic function through the adjustments of heart rate and blood pressure resulting from the active postural change (MPA) of postmenopausal women with type 2 diabetes mellitus (DM2). Twenty-five women between the ages of 51 and 83 years, with no menstruation at least 12 months and sedentary, participated in the study. The patients were submitted to anamnesis and history of diseases, anthropometry and active postural change test (MPA) of the autonomic function tests battery. A high prevalence of comorbidities was observed in the sample: systemic arterial hypertension, 84% central obesity (CC), 56% global obesity (BMI), 48% had dyslipidemia, 56% arthrosis, 20% osteoporosis and

16% rheumatoid arthritis. Observing the MPA, the maximum HR was 86.4 ± 14.2 (bpm) and the minimum was 78.6 ± 13.9 (bpm), representing a 10.3 ± 7.3% increase when performing the maneuver, with no abnormal responses indicating parasympathetic autonomic dysfunction (88.0% normal). Likewise, when analyzing the adjustments of SBP to MPA, in the supine position was 125.2 ± 18.6 (mmHg) and in the orthostatic position of 126.2 ± 17.4 (mmHg), which represents normal pressure response to stimulate the maneuver. Although the higher prevalence of CF and SBP adjustments were normal in the sample, some patients presented borderline results (12.0% for HR adjustments and 16.0 %% for SBP), which suggest autonomic dysfunction in the early stages, where neural changes precede clinical symptoms of changes caused by the impact of exposure to hyperglycemia and comorbidities.

KEYWORDS: Menopause. Nervous system. Neuropathy

EFFET DU CHANGEMENT POSTURAL SUR L'AJUSTEMENT DU RYTHME CARDIAQUE ET DE LA PRESSION SANGUINE CHEZ LES FEMMES DIABÉTIQUES DE TYPE 2 APRÈS LA MÉNOPAUSE

L'objectif de cette étude était d'analyser la fonction autonome à travers les ajustements de la fréquence cardiaque et de la pression artérielle résultant du changement postural actif (MPA) des femmes ménopausées atteintes de diabète sucré de type 2 (DM2). Vingt-cinq femmes âgées de 51 à 83 ans, sans menstruation au moins 12 mois et sédentaires, ont participé à l'étude. Les patients ont été soumis à l'anamnèse et l'histoire des maladies, anthropométrie et test de changement postural actif (MPA) de la batterie de tests de fonction autonome. Une forte prévalence de comorbidités a été observée dans l'échantillon: hypertension artérielle systémique, obésité centrale à 84%, obésité globale à 56%, 48% de dyslipidémie, 56% d'arthrose, 20% d'ostéoporose et 16% de polyarthrite rhumatoïde. En observant l'AMP, le HR maximum était de 86,4 ± 14,2 (bpm) et le minimum était de 78,6 ± 13,9 (bpm), représentant une augmentation de 10,3 ± 7,3% lors de la manœuvre, sans réponse anormale indiquant un dysfonctionnement autonome parasympathique (88,0% normal) . De même, lors de l'analyse des ajustements de SBP à MPA, dans la position couchée était 125.2 ± 18.6 (mmHg) et dans la position orthostatique de 126.2 ± 17.4 (mmHg), qui représente la réponse de pression normale pour stimuler la manœuvre. Bien que la prévalence plus élevée des ajustements de CF et SBP soit normale dans l'échantillon, certains patients ont présenté des résultats limites (12.0% pour les ajustements HR et 16.0 %% pour SBP), qui suggèrent un dysfonctionnement autonome dans les stades précoces où les changements neuraux précèdent les symptômes cliniques de les changements causés par l'impact de l'exposition à l'hyperglycémie et les comorbidités.

MOTS-CLÉS: Ménopause. Systèmenerveux.Neuropathie

EFECTO DELCAMBIO POSTURAL ACTIVO EN ELAJUSTE DE LA FRECUENCIA CARDÍACA Y PRESIÓN ARTERIAL DE MUJERES POST-MENOPAUSA DIABÉTICAS TIPO2

El objetivo delestudiofueanalizarlafunción autonómica a través de los ajustes de lafrecuencia cardíaca y presión arterial derivados del cambio postural activo (MPA) de mujeresposmenopáusicascon diabetes mellitus tipo 2 (DM2). Participarondelestudio 25 mujeresconedad entre 51 a 83 años, sinmenstruación a al menos 12 meses y sedentarias. Las pacientes fueron sometidas a anamnesis e historial de enfermedades, antropometría y prueba de cambio postural activo (MPA) de labatería de pruebas de función autonómica. Enlamuestra se observógranprevalencia de comorbilidades, siendoellas: hipertensión arterial sistémica, 84% obesidad central (CC), 56% obesidad global (IMC), 48% tenían dislipidemia, 56% artrosis, 20% osteoporosis y 16% artritis reumatoide. La FC máxima fue de 86,4 ± 14,2 (bpm) y la mínima de 78,6 ± 13,9 (bpm), representando un 10,3 ± 7,3% de aumento al realizar lamaniobra, no se observanrespuestasanormales que indiquendisfunción autonómica parasimpática (88,0% normales). De lamisma forma, al analizarlos ajustes de la PAS a la MPA, enlaposición supina fue de 125,2 ± 18,6 (mmHg) y enlaposición ortostática de 126,2 ± 17,4 (mmHg), lo que representa respuestapresórica normal al estímulo de lamaniobra. Aunquelamayorprevalencia de los ajustes de FC y PAS de lamuestra se mostró normal enlamuestra, algunos pacientes presentaron resultados limítrofes (12,0% para ajustes de la FC y 16,0% para PAS), que sugierendisfunción autonómica en etapas tempranas, donde lasalteracionesneuralespreceden a lossíntomas clínicos de loscambios causados por el impacto de laexposición a lahiperglucemia y lascomorbilidades.

PALABRA CLAVE:Menopausia. Sistema nervioso. Neuropatía

EFEITO DA MUDANÇA POSTURAL ATIVA NO AJUSTE DA FREQUENCIA CARDÍACA E PRESSÃO ARTERIAL DE MULHERES PÓS-MENOPAUSA COM DIABETES MELLITUS TIPO 2

O objetivo do estudo foi analisar a função autonômica através dos ajustes da frequência cardíaca e pressão arterial decorrentes da mudança postural ativa (MPA) de mulheres pós-menopausa com diabetes mellitus tipo 2 (DM2). Participaram do estudo 25 mulheres com idade entre 51 a 83 anos, sem menstruação à no mínimo 12 meses e sedentárias.As pacientes foram submetidas a anamnese e histórico de doenças, antropometria e teste de mudança postural ativa (MPA) da bateria de testes de função autonômica. Foi observado na amostra grande prevalência de comorbidades, sendo elas: hipertensão arterial sistêmica, 84% obesidade central (CC), 56% obesidade global (IMC), 48% possuíam dislipidemia, 56% artrose, 20% osteoporose e 16 % artrite reumatoide.Observando a MPA, a FC máxima foi de 86,4±14,2 (bpm) e a mínima de 78,6±13,9 (bpm), representando 10,3±7,3% de aumento ao realizar a manobra, não sendo observadas respostas anormais que indiquem disfunção autonômica parassimpática (88,0% normais).Da mesma forma, ao analisar os ajustes da PAS à MPA, na posição supina foi de 125,2±18,6 (mmHg) e na posição ortostática de 126,2±17,4 (mmHg), o que representa resposta pressórica normal ao estimulo da manobra. Embora a maior prevalência dos ajustes da FC e PAS da tenham se mostrado normais na amostra, alguns pacientes apresentaram resultados limítrofes (12,0% para ajustes da FC e 16,0%% para PAS), que sugerem disfunção autonômica em estágios iniciais, onde alterações neurais precedem os sintomas clínicos das alterações causadas pelo impacto da exposição à hiperglicemia e comorbidades.

PALAVRA-CHAVE: Menopausa. Sistema Nervoso. Neuropatia