58 - INFLUENCE OF DIABETIC NEUROPATHY ON SENSITIVITY AND HANDGRIP STRENGTH

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INTRODUCTION

Diabetes mellitus (DM) belongs to a group of metabolic diseases which is characterized by hyperglycemia resulting from a deficit in insulin action, absence of insulin secretion or both. DM belongs to two categories: type I DM, with complete deficiency of insulin due to the destruction of pancreatic beta cells and type II DM, with predominance of insulin resistance (MOREIRA and OLIVEIRA, 2009). In this context, the American Diabetes Association defines the pathology when fasting blood glucose rate is above 125 mg / dl (REIS and MORO, 2009).

According to Lima and Freitas (2012), 50% of individuals with DM have some case of neuropathy, and peripheral diabetic neuropathy (PDN) is the most common, occurring in both type I and II diabetes, affecting components of the peripheral and autonomic nervous system.

In PDN, there is a decrease in nerve conduction velocity, which is also associated with decreased activity of the sodium-potassium pump of the affected nerve, and this change also causes metabolic and ischemic disorders (BORGES and CARDOSO, 2010).

Assessing sensitivity is very important for the diagnosis and treatment of lesions of the peripheral nerves, thus avoiding the permanent or progressive loss of the nerve function (LEITE, et al. 2010). According to Andreazzi et al (2007), normal sensitivity requires that nerves and thin skin nerve endings are intact, as lesions in the nerves and / or nerve endings cause loss of sensitivity.

According to Oliveira and Moreira (2009), handgrip strength test has been indicated to measure the strength of diabetic patients for being a safe and inexpensive method, and with decreased muscle strength, the motor function is impaired, which leads individuals to reduced autonomy in the performance of activities of daily living (ADLs). This author reports that the most important function of the hand is to hold things, highlighting the manipulation of objects, making it increasingly important to understand changes in muscle strength, since poor handgrip strength significantly affects ADLs. Thus, the aim of this study was to evaluate the influence of diabetes mellitus on sensitivity and handgrip strength.

METHODOLOGY

This was a descriptive study that included 25 Caucasian female subjects with DM participants of the Diabetic Association of Foz do Iguaçu, Paraná, Brazil (ADIFI), aged 18-70 years randomly selected. Data were collected during monthly meetings held at ADIFI between May and August 2014. Prior to the study, all participants signed the informed consent form. Pregnant women, those with traumatic neuropathy, leprosy, neurological diseases or those who had undergone some surgery for less than six months in the upper limbs were excluded from the study.

Cutaneous sensitivity was verified in a randomized way by checking the sensitivity level of the ulnar and median nerves of the hand. Figure 1 shows the points of the ulnar and median nerves of the hand, which followed the protocol proposed by (REIS and MORO, 2012).



Figure 01 - Hand sensitivity verification - Source: Authors

During hand sensitivity verification, the individual remained sat with the dominant hand on a table and being placed inside a container with open bottom to seal the patient's vision, so that the patient could feel only the monofilaments. They were applied for two seconds on the palmar surface in accordance with the nerve branch evaluated, and with an interval of one second and a half between applications, and the test was repeated three times consecutively starting with monofilament of 0.05 g, then successively with monofilaments of 0.2g, 2.0g and 4.0g until the individual perceived the stimulus and responded with "yes", so the result was recorded. The stimuli were randomly applied on the median and ulnar nerve, avoiding areas with presence of calluses, scars and ulcers.

Figure 2 shows the Semmes-Weinstein SORRI® monofilaments, where filaments present the following specific pressures for hands: green (0.05g); blue (0.2 g); violet (2.0g) and dark red (4.0g) (BRASIL, 2008; REIS and MORO, 2012).

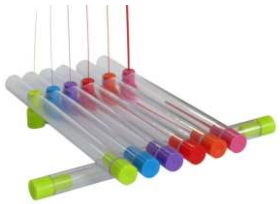


Figure 2 – Semmes-Weinstein SORRI® monofilaments used to assess hand sensitivity - Source: (REIS and MORO,

2012).

Muscle strength was assessed by handgrip strength using a Jamar® manual dynamometer, with individual remaining sat on a chair in a neutral position with one hand resting on the thigh and the dominating hand at 90 ° of elbow flexion. Each participant performed three series of five seconds of maximal isometric contraction at intervals of thirty seconds between them, according to procedures recommended by the American Society of Hand Therapists (ASHT) (HARKONEN, PIIRTOMAA & ALARANTA, 1993; REIS and MORO, 2012).



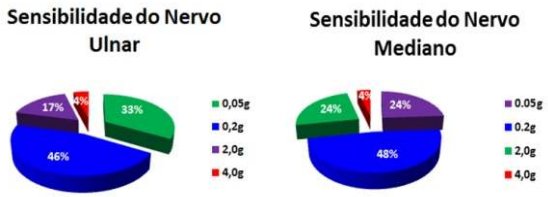
Figure 3 - JAMAR® dynamometer. - Source: (REIS AND MORO, 2012).

The study was approved by the Ethics Research Committee of the Universidade Paulista -UNIP through the Brasil Platform and protocol number 29308614.2.0000.5512. Statistical data were performed using Excel for Windows and BioEstat 5.0 software and descriptive statistics and Pearson correlation.

RESULTS AND DISCUSSION

Data on sensitivity and handgrip strength will be firstly presented and discussed, then, data regarding the correlation between the level of sensitivity of the median and ulnar nerves with handgrip strength will be presented and discussed.

Graph 01 presents the evaluation of the ulnar nerve sensibility, where it can be seen that 67% of diabetic individuals showed loss of sensitivity, among them 21% had significant loss of 2.0g. In assessing the sensitivity of the median nerve, it was found that 76% of patients had loss of sensitivity, of these, 28% had significant loss of 2.0g.

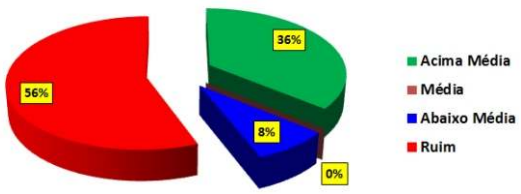


Graph 01 - Sensitivity of the Ulnar and Median Nerve

Still on sensitivity, there was loss of sensitivity in both ulnar and median nerves. Mizusaki et. al (2011) evaluated the hand sensitivity of patients with diabetes through the PSSD instrument (Pressure-Specified Sensory Device) and found that diabetic patients had no tactile cutaneous sensitivity of the median and ulnar nerves compared with non-diabetic patients. According to results, it was observed that the loss of sensitivity of the median and ulnar nerves occurred similarly in diabetic subjects. Borges and Cardoso (2010) conducted a study on sensitivity, comparing non-diabetic and diabetic groups and observed a difference in sensitivity between groups, corroborating this study that identified loss of sensitivity of the hands of individuals with the disease. In this sense, this study confirmed that diabetic neuropathy influences on sensitivity, as it is characterized by impairments of the peripheral and autonomic nervous system, which involve loss of sensory and motor functions (GAGLIARDI 2003).

PDN has great responsibility for most peripheral amputations in diabetic patients, and the main cause of these amputations is the lack of metabolic control; in many cases, patients' sensitivity is affected, with higher risk of lesions due to the lack of guidance and care, which can worsen and lead to amputations (ALENCAR and ARAUJO, 2009). Accordingly, Sacco et. al (2007) evaluated sensory losses - foot and ankle motor losses due to diabetic neuropathy and found decreased sensitivity in diabetic patients with neuropathy, which could result in loss of protective sensation, leading to the occurrence of accidents, since these injuries will lead to loss of ability to distinguish between hot and cold.

A study carried out by Martin et. al (2012) evaluated the causes for the appearance of ulcers in the feet of diabetic patients and found that 93.3% of participants showed somatosensory tactile insensitivity, assessed by Semmes-Weinstein monofilaments. Thus, it was found that the verification of sensitivity in diabetic subjects through Semmes-Weinstein monofilaments is an essential, reliable and low-cost tool in the prevention and recovery of diabetic neuropathy.



Graph 02 – Handgrip Strength Result

Handgrip strength was assessed with the Jamar® dynamometer. Thus, graph 02 indicates the results in which 56% of patients with diabetes showed poor handgrip strength level, which may affect ADLs. Rodini (year) reported that HGS of fingers is an important clinical indicator of upper limb function because the deficit of innervation in the median and ulnar nerves will decrease HGS, affecting the flexion of the affected limb. Reis and Moro (2012) reported that in a condition of loss of nerve function, all muscles involved will be affected, compromising all basic functions of ADLs, work, and leisure, sometimes progressing to total loss of function of the affected limb.

In addition to sensory disorders, DM can present in more severe cases, musculoskeletal disorders such as muscle weakness, which may result from insufficient innervation. In this sense, muscle strength is essential for the individual's physical performance, likewise, its deficiency causes functional limitations (OLIVEIRA and MOREIRA, 2009). In this context, Moreira et. al (2003) reported that studies on hand functionality are aimed at assessing hand strength, because strength is the main indicator of function and is also one of the easiest and fastest to measure, i.e., the functional integrity of this limb is determined through handgrip strength assessment.

	Força de Preensão X Sensibilidade do Nervo Mediano	Força de Preensão X Sensibilidade do Nervo Ulnar
n (pares) =	25	25
r (Pearson) =	0.6224	0.4942
IC 95% =	0.30 a 0.82	0.12 a 0.74
IC 99% =	0.18 a 0.86	-0.01 a 0.80
R2 =	0.3873	0.2443
t =	3.8132	2.7266
GL =	23	23
(p) =	0.0009	0.0120
Poder 0.05 =	0.9619	0.8148
Poder 0.01 =	0.8627	0.5849

Table 01 - Correlation between Handgrip Strength and sensitivity of Median and Ulnar nerves

Table 01 shows the correlation between handgrip strength and median and ulnar nerves. It is noteworthy that the sample was composed of diabetic women only. The data reported a moderate correlation between handgrip strength and loss of sensitivity of the median nerve (Pearson r = 0.62) and ulnar nerve (Pearson r = 0.49). Thus, it was possible to verify that the loss of strength does not have a strong correlation between diabetic neuropathy and loss of handgrip strength; however, although moderate, the study indicated that there is a relationship between diabetic neuropathy and handgrip strength. In a similar study, Figueiredo et. al. (2007) pointed out that factors such as weight, height, sex and age may interfere with handgrip strength. This result was corroborated in a study by Sayer, Dennison and Syddall (2005) with 1,391 diabetic individuals of both sexes and found that handgrip strength is lower, and males were the most affected. However, in another study by Lima and Freitas (2012) that evaluated the maximum handgrip strength of 13 individuals with diabetes and 13 healthy individuals, matched for age and sex, an opposite result was obtained, in which there was no difference between groups, but both had decreased handgrip strength.

According to the results of this study, it was statistically evidenced that diabetic neuropathy influences the loss of handgrip strength. These results are in line with those reported by Reis and Moro (2012), who reported that although subjects were not diabetic, but with nervous compression coming of repetitive work; both showed a deficit of nerve conduction, loss of sensitivity and decreased grip strength. Thus, it was observed that the loss of nerve conduction influences handgrip strength.

CONCLUSION

From the analysis of data collected in the evaluation of sensitivity and handgrip strength in diabetic individuals, it could be inferred that both protocols showed statistically significant results in relation to the loss of sensitivity of the median and ulnar nerves and loss of handgrip strength.

It was concluded that the Semmes-Weinstein monofilaments is an inexpensive and reliable tool that can be used to verify sensitivity. Thus, it was found that the evaluation of the hand sensitivity is important to assess the functionality of the upper limbs in diabetic subjects. Thus, impaired sensitivity of the median and ulnar nerves will also lead to loss of strength and functional integrity of the affected limb.

Further studies should be carried out with emphasis also on the lower limbs, highlighting the diabetic foot, always with the aim of verifying functioning and disability in diabetic subjects.

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INFLUENCE OF DIABETIC NEUROPATHY ON SENSITIVITY AND HANDGRIP STRENGTH

ABSTRACT

Diabetes Mellitus (DM) is a disease whose deficit absence of insulin secretion, this disease may present alterations in the sensitivity of the hands that may result in loss of grip strength (FPM), affecting the realization of life activities daily (ADL'S). Thus the aim of this study was to evaluate the influence of diabetes mellitus in sensitivity and grip strength. 25 diabetic females were evaluated. The sensitivity was evaluated by the Weinstein Monofilament Semmens-. The handgrip strength was assessed using the JAMAR ® dynamometer. The results showed loss of sensitivity of the ulnar nerve with 67%, and 76% of the median nerve. FPM in 56% of evaluated had disabilities. In the correlation between the loss of sensitivity and FPM Data reported a moderate correlation between the median nerve (Pearson r = 0.62) and the ulnar nerve (Pearson r = 0.49) which is . Concludes Diabetes Mellitus affects the sensitivity and grip strength.

KEYWORDS: Diabetes, Sensitivity, Nerves, Gripping Force Manual

INFLUENCE DE LA NEUROPATHIE DIABÉTIQUE DANS LA SENSIBILITÉ ET LA FORCE DE ATTENTE MANUEL

RÉSUMÉ

Le diabète sucré (DM) est une maladie dont l'absence de sécrétion d'insuline déficit, cette maladie peut présenter des altérations de la sensibilité des mains qui peuvent entraîner une perte de la force de préhension (FPM), affectant la réalisation d'activités de la vie quotidienne (AVQ). Ainsi, le but de cette étude était d'évaluer l'influence du diabète sucré dans la sensibilité et la force de préhension. 25 femelles diabétiques ont été évalués. La sensibilité a été évaluée par les Weinstein monofilament Semmens-. La force de préhension a été évaluée à l'aide du dynamomètre JAMAR®. Les résultats ont montré une perte de sensibilité du nerf ulnaire avec 67% et 76% du nerf médian. FPM dans 56% des évalué avait handicapées. Dans la corrélation entre la perte de sensibilité et FPM données rapporté une corrélation modérée entre le nerf médian (Pearson r = 0,62) et le nerf ulnaire (Pearson r = 0,49) qui est . Conclut diabète sucré affecte la sensibilité et la force de préhension.

MOTS-CLÉS: diabète, la sensibilité, les nerfs, Manuel Force de serrage

INFLUENCIA DE LA NEUROPATÍA DIABÉTICA EN SENSIBILIDAD Y FUERZA DEL MANUAL DE ESPERA

RESUMEN

Diabetes Mellitus (DM) es una enfermedad cuyo déficit ausencia de secreción de insulina, esta enfermedad pueden presentar alteraciones en la sensibilidad de las manos que pueden resultar en la pérdida de la fuerza de agarre (FPM), que afecta a la realización de actividades de la vida diaria (ADL'S). Así, el objetivo de este estudio fue evaluar la influencia de la diabetes mellitus en la sensibilidad y la fuerza de agarre. Se evaluaron 25 mujeres diabéticas. La sensibilidad fue evaluada por los Weinstein monofilamento Semmens-. La fuerza de prensión se evaluó mediante el dinamómetro JAMAR®. Los resultados mostraron la pérdida de la sensibilidad del nervio cubital con el 67% y el 76% del nervio mediano. FPM en el 56% de los evaluados presentaban discapacidades. En la correlación entre la pérdida de sensibilidad y FPM de datos informado de una correlación moderada entre el nervio mediano (Pearson r = 0,62) y el nervio cubital (Pearson r = 0,49), que es. Concluye Diabetes Mellitus afecta a la fuerza de sensibilidad y agarre.

PALABRAS CLAVE: Diabetes, la sensibilidad, nervios, Manual de sujeción Fuerza

INFLUÊNCIA DA NEUROPÁTIA DIABÉTICA NA SENSIBILIDADE E FORÇA DE PREENSÃO MANUAL

RESUMO

O Diabetes Mellitus(DM) é uma doença que tem como déficit a ausência da secreção de insulina, esta patologia pode apresentar alterações de sensibilidade das mãos que podem acarretar na perca da força de preensão manual (FPM), afetando a realização das atividades de vida diária (AVD'S). Assim o objetivo deste trabalho foi avaliar a influência do Diabetes Mellitus na sensibilidade e força de preensão manual. Foram avaliados 25 diabéticos do gênero feminino. A sensibilidade foi avaliada através dos Monofilamentos Semmens- Weinstein. A força de preensão manual foi avaliada através do dinamômetro JAMAR ®. Os resultados apresentaram perda de sensibilidade do nervo ulnar com 67%, e nervo mediano de 76%. Na FPM 56% dos avaliados apresentaram deficiência. Na correlação, entre a sensibilidade e perca da FPM, Os dados relataram uma correlação moderada com o nervo mediano (r Pearson= 0,62) e com o nervo ulnar (r Pearson= 0,49). Conclui-se que Diabetes Mellitus, afeta a sensibilidade e força de preensão manual.

PALAVRAS-CHAVE: Diabetes, Sensibilidade, Nervos, Força de Preensão Manual.