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CLINICAL-FUNCTIONAL PROFILE AND CORRELATION THE TIME OF INJURY WITH GAIT IMPAIRMENT IN CASES OF MYELORADICULOPATHY DUE TO NEUROSCHISTOSOMIASIS IN THE STATE OF SERGIPE

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ABSTRACT

Schistosoma affects about 200 million of poor people worldwide, with *Schistosomamansoni* being the leading cause of myeloradiculopathy syndrome that induces paraplegia, sexual and bladder dysfunction. In this context the weakness and muscular spasticity of the lower limbs directly affect the gait. Thus, the objective of this study was to present clinical-functional profileand to correlate the time of injury with gait impairment in cases of Myeloradiculopathy due to Neuroschistosomiasis in the State of Sergipe. It was a cross-sectional study between March 2017 and February 2018 of the seropositive cases for neuroeschistosomiasis diagnosed between 2010 and 2015 in a reference laboratory in Sergipe / Brazil. Of all individuals, ten (n = 10) agreed to redo the serology and clinical-functional exams linked to the gait. The clinical-neurological, neurovegetative, and functional variables were: American Spinal Cord Injury Association (ASIA); Functional Independence Measure (FIM per individual) and Functional Independence Measure (enviro FIM-motor tasks^{TM}); Physical Activity Scale for Individuals with Physical Disabilities (PASIPD) with measurement of metabolic expenditure; and Ashworth Scale for spasticity. A descriptive analysis of the volunteers was used and Spearman's test R was applied for correlation. It was considered $p < 0.05$ as significant in the values of r. As a result, adults were found 51.33 ± 11.88 years, with 4.2 ± 1.64 years of injury and 2.74 ± 1.56 years of positive serology for schistosomiasis. In ASIA, most were classified as incomplete lesions (ASIA D and E), and the clinical findings were 20% in Esficterian, 40% in sexual intercourse, 20% involuntary movement, 40% in heel knee, and patellar reflexes and Aquileo, both in 20%. In the functional evaluation of FIM, the mean and standard deviation were 125.4 ± 23.01, enviro FIM-motor tasks^{TM} was 3.6 ± 0.84, Ashworth in the lower limbs as severe spasticity (3.5 ± 0.52), general PASIPD of 8.17 ± 9.10 and PASPD walking of 4.19 ± 4.18. When the correlation was made, it was verified that the lesion time was strongly influencing the increase of spasticity ($r = 0.88$, $p = 0.009$) and moderately the enviro FIM-motor tasks^{TM} for walking ($r = -0.68$; $p = 0.009$). Thus, the individuals assisted by this laboratory present impaired walking associated with the time of injury, demonstrating chronicity of the lesion and indirect metabolic alteration. In this way it is necessary to direct these individuals to the clinical-neurofunctional treatment specific to their needs.

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INTRODUCTION

Schistosoma parasite infection affects about 200 million poor people worldwide. More than 2.5 million people are at risk of contracting the disease, and 2.5 to 6 million people have been infected (BRAZIL, 2015; TAPAN *et al.,* 2010). Sergipe and other states such as Bahia, Pernambuco and Minas Gerais are in the condition of high endemicity (Gomes *et al.,* 2016). Specifically, in the State of Sergipe, it is located in 51 cities in the regions of Wood Zone and Coast, still presenting, in the last 10 years, a public health problem (LIMA *et al.,* 2018). *S. mansoni* is the primary cause of spinal cord disease among all species of *Schistosoma* (Carod-Artal, 2008). Neurological symptoms result from an inflammatory response with Severe

immunogenic and reactions may result in brain tissue necrosis with granuloma formation and eventually lesions fibrotic (Vale *et al.,* 2012). The main neurological syndromes described include: a flaccid and acute paraplegia with a thoracic sensory level and sphincter dysfunction (transverse myelitis). A progressive myeloradiculopathy with weakness in the lower limbs also presents pain and paresthesia in the lumbosacral dermatomes. Lumbar pain and paresthesia in the lower limbs are the most frequently reported initial symptoms (TAPAN *et al.,* 2010, HÄRTER *et al.,* 2014). A large amount of muscles is affected due to decreased nerve conduction, preventing muscle contraction leading to hypotrophy. The main affected muscle groups are in the upper body, hip and lower limbs, preventing the patient from maintaining the posture of sedation and orthostatism, consequently there is a significant loss of walking speed due to muscle weakness and decrease in cardiorespiratory fitness, increasing the energy expenditure to perform their basic functional activities (TAKAMI *et al.,* 2012). This work is important since there has never been an evaluation of clinical findings with functionality in Brazilian individuals with schistosomal myeloradiculopathy (MRE). Thus, the purpose of this study was to present clinical-functional profile andto correlate the time of injury with gait impairment in cases of Myeloradiculopathy due to Neuroschistosomiasis in the State of Sergipe.

MATERIALS AND METHODS

Type of study and casuistry: The research was characterized in a cross-sectional study from March 2017 to February 2018. The research contacted all the positive cases registered in the Laboratory of Biomedicine of the Tiradentes University (UNITLab) between 2010 and 2015 that remained with the address accessible. Of these, n = 10) agreed to retake the laboratory tests for the positive diagnosis of neuroesychosomiasis and in sequence to perform the functional evaluations. The research was released by the Research Ethics Committee (# 2,961,422).

Clinical-Functional Evaluation Protocol: The clinical evaluation performed by the present study on MRE was made through a general neurological examination, which was performed both in the segmental (lower limbs) and systemic (in the lower limbs). In a broad way, the clinical examination included, at first, a brief collection of identification, followed by assessment of posture, balance, involuntary movement, myothetic reflexes, and sensory-motor functions in lower limbs: reflexes, balance. In addition, patients were questioned about neurovegetative elements such as sleep pattern, feeding, sphincter function and sexual function. On the other hand, functional evaluations were performed using protocols such as: ASIA with Complete Injury (A) to Incomplete Injury: Motor and sensory functions are normal (E); FIM with scores from 1 to 7 and by enviro FIM-motor tasks^{TM} with scores from 0 to 10 for walking activity; PASIPD with measured metabolic expenditure at rest of the last seven days; and Ashworth Scale with scores of 1 to 4.

Statistical analysis: The Graph Pad Prism 6.01 software and the SPEARMAN R Test were used for the r value to determine weak correlation (0-0.39), moderate correlation (0.4-0.6) and strong correlation (0.7-1,0). The correlated variables were time of lesion with FIM of the individual, by enviro FIM-motor tasks^{TM} in lower limbs to walk; Scale of Ashworth in lower limbs; and PASIPD. The value of $p < 0.05$ was considered significant.

RESULTS

The evaluated group was part of the positive cases evaluated for diagnosis of neuroeschistosomiasis treated at the Reference Center of the State of Sergipe / Brazil. Of the 40 positive cases 10 individuals accepted to participate. Mean and standard deviation of mean age was 51.33 ± 11.88, lesion time was 4.2 ± 1.64 years, positive serology was 2.74 ± 1.56 and incomplete lesion classified by ASIA in 20% type C, 40% type D and 40% type E (Table 1).

Table 1- Frequency and mean of the demographic findings and classification of the lesions of the reactive cases in schistosomiasis in the State of Sergipe attended by UNIT Lab between 2010 and 2015

Searched Variables	Mean±SD
Age	51,33± 11,88
Lesion time (years)	4,2±1,64
Positive sorology	2,74±1,56
Classification - Asia	%
Type C	20
Type D	40
Type	40

According to the clinical data obtained through the neuro-organic evaluation of the patients, sleep disorders were observed in 60%, sphincter control in 20%, sexual activity in 40%. However, no changes in feeding pattern, body balance and posture were detected. Among the cases of patients studied, it was observed the evaluation of the lower limbs alteration of muscular spasms in 20%; with altered pattern (hypoerreflexia) knee-heel test (40%), Patellar and Achiless reflex (20%, respectively) and absence of changes in tactile and painful sensitivity (Table 2).

Table 2. Frequency of the general neuro-organic findings and the MMII of the reactive cases in schistosomiasis in the state of Sergipe attended by UNIT Lab between 2010 and 2015

Clinical findings and in MMII	Absent (%)	Present (%)	Standard Change (%)	No Change
Sleep	00	100	60	40
Feeding	00	100	00	100
Esfincterian control	00	100	20	80
Sexual activity	00	100	40	60
Body balance	00	100	00	100
Posture	00	100	00	100
Involuntary movement	80	20	20	00
Heel-knee test	00	100	40	60
Tactical sensitivity	00	100	00	100
Painful sensitivity	00	100	00	100
Patellar reflection	00	100	20	80
Achilles reflection	00	100	20	80

From the analysis of the variables related to the neurofunctional profile of the reactive cases in schistosomiasis studied, the mean scores of the lesions with FIM of the individual of 125.4 ± 23.01, enviro FIM-motor tasks^{TM} for walk of 3.6 ± 0.84, Ashworth scale in lower limbs of 3.5 ± 0.52, general PASIPD of 8.17 ± 9.10 and PASIPD walk of 4.19 ± 4.18. The walking activity classified as mild was chosen because of its value of metabolic expenditure in PASIPD, METs-1 <3 (Table3). The correlation between the injury time and the variables was presented as weak FIM per individual (r = -0.28), weak general PASIPD (r = 0.20) and PASIPD weak gait (r = 0.20), but without significance.

Table 3. Mean scores of the variables linked to the neurofunctional profile of the reactive cases in schistosomiasis in the state of Sergipe attended by UNIT Lab between 2010 and 2015. Mean and Std. deviation (SD), Functional Independence Measure (FIM), Ashworth Scale, Physical Activity Scale for Individuals with Physical Disabilities (PASIPD)

Searched Variables	Mean±SD
FIM per individual	125,4±23,01
Enviro FIM-motor tasks™ for walk	3,6±0,84
Ashworth Lower Limb	3,5±0,52
PASIPD general	8,17±9,10
PASIPD walk	4,19±4,18

The significant correlations were FIM per individual and for enviro FIM-motor tasks™ for walk, with moderate and negative correlation (r = -0.68) and for spasticity, strong correlation, measured by the Ashworth Scale in lower limb (r = 0.88) (Table 4).

Table 4. Correlation of Lesion Time with Functional Independence Measure per individual and enviro motor tasks for walk; Ashworth scales on lower limbs; Physical Activity Scale for Individuals with Physical Deficiency general and for walk the question of the reactive cases in schistosomiasis in the state of Sergipe attended by UNIT Lab between 2010 and 2015. SPEARMAN R test; R value showed weak correlation (0 - 0.39), moderate correlation (0.4 - 0.6) and strong correlation (0.7 - 1.0); Value of p <0.05

Lesion time	*r*	*p value*
vs. FIMper individual	-0,28	0,33
vs. enviro FIM-motor tasks™for walk	-0,68	0,009
vs. *Ashworth Scale* in lower limb	0,88	0,009
vs. PASIPDgeneral	0,20	0,58
vs. PASIPDwalk	0,20	0,58

DISCUSSION

Neuroschistosomiasis is still a public health problem. Their findings bring neurofunctional disorders to the infected and untreated individuals prior to MRE lesions. According to Santos *et al.* (2001), the involvement of neuroeschistosomiasis in the CNS can present a great variety of complications, resulting in difficulties in relation to its diagnosis. This diversity of clinical features makes it difficult to standardize the complications. The classification, according to ASIA, presented this difficulty, since individuals presented sexual and Esficterian changes that would decrease this classification (ASIA C); and, nevertheless, in the motor impairment they were classified as ASIA D and E. In the present study, of all individuals evaluated, CNS-related changes were observed between 20 and 40%. Lower limb involvement was hyperreflexia (patellar and Achilles), involuntary movements and heel-knee test, demonstrating chronic CNS involvement. Lambertucci *et al.* (2007) in their studies presented findings of acute lesions such as hypoesthesia (98%) and paraparesis of the lower limbs (97%). It was still found in the individuals of the present study, sexual, esficterian and sleep disorders 40, 20 and 60%, respectively), as well as involuntary and heel-knee movements (20 and 40%, respectively). Yet Lambertucci *et al.* (2007) in their studies found much more alteration in sexual dysfunction, 74% of the individuals evaluated. In the evaluation of the spasticity found, in the current study, severe spasticity with the time of injury was shown, influencing the tonic impairment. It was observed, in the present study, another correlation that was injury time with enviro FIM-motor tasks™ for walk; demonstrating that the pathogenicity time induces greater severity in the findings related to the execution of activities. Similar studies were not found for comparisons of results. This strong and significant correlation is justified by the lack of metabolic expenditure observed in the PASIPD of the individual and when he / she performs walking activity, this activity is performed with more time that induces greater consumption of the MET^{-1} produced for this activity. This amount of $METs^{-1}$, measured at rest, measured in hours, for seven days, corresponding to the maximum daily score for each activity of a healthy person (182.3 $METs^{-1}$) and in the current study did not take into account the age of the patient and neither time of injury, since the published works consider only the expenditure of $METs^{-1}$. However, individuals spent a lot of $METS^{-1}$ on walking, since walking is considered a mild activity and the healthy individual only catches up to 3 mETs-1 per day. However, the metabolic expenditure by contractile capacity in spastic muscles is not yet explained, since spastic muscles undergo structural changes (SMITH *et al.,* 2009). In this sense, the study by Robinson *et al.* (2013) indicated that there is reduction of the mitochondria in the pre-synaptic nerve endings and increase of the postsynaptic space, which justifies the decrease of their muscular activity. Smith *et al.* (2012), suggested that increased extracellular matrix volume was associated with an increase in its passive stiffness in muscle tissue, here found with the severity of the function for tone and ASH. This demonstrates an inverse correlation between stiffness and metabolic activity, that is, the greater the muscular rigidity (muscle spasticity) the lower the metabolic activity. Still for Robinson *et al.* (2013) there is negative correlation rigidity and metabolic activity, i.e., the greater the muscular rigidity, also known as muscle spasticity, the lower the metabolic activity. On the other hand, the reduction of metabolic expenditure during exercise in the spastic muscles is due to type II glycolytic fibers responsible for rapid contractions and to initiate contraction. While the normal muscle recruits primarily type I fibers, which in their reduction leads to a decrease in oxidative metabolism and a low resistance to aerobic exercise. Alternatively, the high energy cost presented by the spastic hemiplegic individual during daily life activities can contribute to fatigue, dyspnea and muscular weakness, leading to a sedentary lifestyle, depression, anxiety and deconditioning (de GROOT et al, 2016).

Conclusion

As a conclusion, neurological impairment was observed in Lower limb, and in neurovegetative functions, especially sleep, sexual activity and sphincter function, patellar hyperreflexia and Achilles, in most of the individuals evaluated. It was also verified the impaired walking associated with the metabolic alterations in an indirect way. In addition to the influence of injury time with spasticity and gait activity, demonstrating chronicity of the lesion. In this way it is necessary to direct these individuals to the clinical-neurofunctional treatment specific to their needs.

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