

Balance and motor coordination in abstinent alcoholics

Equilíbrio e coordenação motora em alcoólicos abstinentes

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ABSTRACT

Introduction: Alcoholism is defined as a chronic, multifactorial syndrome. It is commonly associated with cerebellar degeneration and polyneuropathy, resulting in coordination and balance dysfunctions that represent the most disabling consequences associated with alcohol consumption. **Objective:** to describe the profile of abstinent alcoholics who participate in a center for living and to investigate the association between alcohol consumption and disorders of balance and motor coordination. **Methods:** Demographic data were collected followed by assessment of patients' balance and motor coordination. Descriptive statistics was used to present the variables studied. The relationship between alcohol consumption and balance was investigated by means of multiple linear regression and the relationship between alcohol consumption and coordination was analyzed using the Mann-Whitney test and independent sample T-test. **Results:** Patients were mostly men; some also used other psychoactive drugs. There was no significant association between alcohol consumption and balance or between alcohol consumption and motor coordination ($p>0.05$). Although it was not the objective of this study, the regression model revealed a significant association between age and balance. **Conclusion:** Findings show the prevalence of chronic alcohol use in men and the concomitant use of other psychoactive drugs. The lack of association between alcohol consumption and deficits in balance and motor coordination may be due to brain plasticity subsequent to abstinence.

Key words: Alcoholism; Motor Skill Disorders; Postural Balance.

RESUMO

Introdução: o alcoolismo é definido como síndrome crônica e multifatorial. Comumente, associa-se à degeneração cerebelar e polineuropatia, principais responsáveis pelas alterações de coordenação e equilíbrio que representam as consequências mais incapacitantes associadas ao consumo de álcool. **Objetivo:** descrever o perfil dos alcoólicos em abstinência frequentadores de um centro de convivência e investigar a associação entre consumo de álcool e transtornos do equilíbrio e coordenação motora. **Métodos:** foram coletados os dados demográficos e, em seguida, avaliados o equilíbrio e a coordenação motora dos pacientes. Estatística descritiva foi utilizada para a apresentação das variáveis estudadas. A relação entre consumo de álcool e equilíbrio foi investigada por meio de regressão linear múltipla e a relação entre consumo de álcool e coordenação foi analisada por meio do teste Mann-Whitney e do teste T para amostras independentes. **Resultados:** os pacientes eram, principalmente, homens, usuários, inclusive, de outras drogas psicoativas. Não houve associação significativa entre consumo de álcool e equilíbrio ou entre consumo de álcool e coordenação motora ($p>0,05$). Apesar de não ter sido objetivo deste estudo, o modelo de regressão revelou associação significativa entre idade e equilíbrio. **Conclusão:** os achados mostram a predominância do uso crônico do álcool em homens e do uso

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concomitante de outras drogas psicoativas. A falta de associação entre consumo de álcool e déficits de equilíbrio e coordenação motora pode ser devida à plasticidade cerebral subsequente à abstinência.

Palavras-chave: Alcoolismo; Transtornos das Habilidades Motoras; Equilíbrio Postural.

INTRODUCTION

Alcoholism is a major concern in public health.¹ In Brazil, it affects approximately 12.3% of the population, almost four times more among male than female individuals.² According to the World Health Organization (WHO), disorders related to alcohol abuse come second (5.5%) in the list of 20 diseases that entail more years living with disability in the 15-44 years age group.³ As a consequence, it produces direct and indirect costs to the public health system.⁴

Alcoholism is defined as a chronic, multifactorial syndrome that determines physical, mental, and social impairment.⁵ It is commonly associated with neurological disorders, mainly triggered by lesions to the peripheral nervous system (PNS) and in the central nervous system (CNS).⁶

The PNS is affected in a multiple and simultaneous manner⁷ with inflammatory degeneration of the nerves. Pain, paresthesia, and weakness are typical signs of early symptoms. In severe cases, symmetrical distal motor disabilities are found and might evolve into significant muscle atrophy.⁷

Lesions in the CNS can affect all brain structures, especially the cerebellum. Degeneration of the cerebellar cortex occurs, mainly, in upper and anterior vermis, due to the death of Purkinje cells. The direct toxic effect of alcohol and its metabolites, especially acetaldehyde, has been regarded responsible for this pathogenesis.⁷ This degeneration is different according to gender and age⁸, and its effects on the nervous system are boosted in case of concomitant consumption of alcohol and other psychoactive drugs.⁹ It is also important to consider that the severity level of alcohol use is influenced by its consumption pattern, i.e., exposure time and number of drinks ingested on a daily basis.¹⁰

PNS and CNS lesions associated with chronic alcohol consumption are characterized by various degrees of gait and trunk ataxia.⁶ Additionally, they are responsible for balance and motor coordination dysfunctions, some of the most disabling consequences associated with alcohol consumption. The former predisposes the individual to falling, increases the

risk of bone fractures and, as a consequence, may cause fear of falling again and the tendency to stay still.¹¹ The latter affects manual dexterity and hinders the ability to perform daily activities, affecting functional independence.¹²

Balance and motor coordination dysfunctions have strong functional impact on the life of an alcoholic person, since they can contribute to difficulties in professional activities, unemployment, and loss of social independence.¹³ Furthermore, they can lead to dependence on others for basic activities of daily living and instrumental activities, since they limit movement, change one's lifestyle, and directly influence quality of life.^{14,15}

Thus the present study aims at describing the profile of abstinent alcoholics who attend a community support center in the city of Betim, state of Minas Gerais, investigating the association between alcohol consumption, balance, and motor coordination.

METHODS

This is a transversal, descriptive, and exploratory study, approved by the Committee of Ethics in Research of the Pontifícia Universidade Católica de Minas Gerais (CAAE 0270.0.213.000-08). Volunteers were first informed of the nature and objectives of the study. They agreed to participate and agreed to the disclosure of research data.

The recruitment of subjects and data collection were performed in March-April 2009, in a community support group for alcoholics. There was no restriction as to sex, age, time of exposure to alcohol, time of abstinence or associated use of psychoactive drugs. At the time of the assessment, subjects were expected to have been in alcohol abstinence for over two months. Subjects with neurological and/or orthopedic diagnoses that could contribute to existing balance and/or motor coordination disorders were excluded from this study.

Participant assessment was split into three moments (subsequently and on the same day), performed by three different evaluators when the subject was in the community support center. First, demographic data were collected: age, sex, marital status, use of psychoactive drugs, abstinence and exposure time, daily consumption of alcohol. Then, the examiner assessed balance and, finally, motor coordination.

The Berg Balance Scale (BBS) was used to describe quantitatively the static and dynamic balance: it is a valid and reliable tool consisting of a list of 14 rou-

tine tasks the subject is asked to perform.^{16,17} Scoring can range from 0-56. The higher the score, the better the prognosis. According to Carr and Shepherd,¹⁸ the cutoff score is 46.8, which means that balance below this value is functionally affected.

To assess motor coordination, finger-to-nose and forearm pronation-supination tests were used. The first consists of requesting subjects to place their forefingers on their nose alternately and repeatedly, keeping shoulders abducted for one minute, at least. The test is performed with first eyes open and later closed. In the second test, subjects are asked to make alternating movements of supination and pronation of the forearm, as fast as they can.¹⁹

The normality of the collected data was analyzed using the Kolmogorov-Smirnov test. Descriptive statistics (mean and standard deviation) was used to present the study variables. To research the relation between alcohol consumption and balance, multiple linear regression was performed (adjusted to the confusing factors: sex, age, and use of psychoactive drugs). The relation between alcohol consumption and motor coordination was assessed using the Mann-Whitney test (consumption vs. alternating pronation-supination) and T-test (consumption vs. normal pronation-supination/ finger-to-nose with eyes open and closed).

To assess the interference of volume of alcohol consumed over time of alcoholism in balance and motor coordination, a variable was created based on the following formula: number of daily doses vs. days per year of alcohol use vs. years being an alcoholic, which represents the number of drinks consumed over the time the subject considers himself to be an alcoholic.

The statistical software used for data analysis was the Statistical Package for the Social Sciences (SPSS), version 15.0, considering a significance level of $\alpha = 0.05$.

RESULTS

A total of 42 alcoholics were included in this study, six of which were female (14.3%) and 36 male (85.7%). Mean age was 53 ± 10.3 years, ranging from 29 to 76 years of age.

Regarding the use of alcohol, mean exposure time was observed to be 23.4 ± 9.29 years, ranging from 7 to 43 years, and mean consumption rate to be 6.1 days per week ± 1.8 , and mean drink consumption on a daily basis was 159.11. Most of the subjects reported preference for distilled beverages (97.61%).

Sugar cane spirits (cachaça) was the most consumed drink (88.09%). The use of psychoactive drugs was combined with alcohol for 30 (71.43%) of the 42 alcoholics interviewed. The drugs most mentioned were tobacco (64.28%) and marijuana (19.05%).

At the time of the interview, all individuals were in alcohol abstinence for over two months, and the mean time of abstinence was of 13.67 ± 9.9 years.

As for motor coordination assessment, the finger-to-nose test with eyes open was positive for 26.19% of the respondents and for 54.76% of them with eyes closed. The forearm pronation-supination test was positive for 21.42% and the alternated pronation-supination for 88.09% of the respondents. Out of the subjects in the evaluation, 7.14% suffered from balance disorders evidenced by the Berg Balance Scale, 51.4 ± 2.92 points being the mean score.

The forearm pronation-supination test with eyes open was positive in 21.42%, and with eyes closed, in 85.71% of the respondents.

There was no significant association between alcohol consumption and balance assessed by the Berg Scale ($R=0.117$ $p=0.46$) or between alcohol consumption and motor coordination (finger-to-nose with eyes open $p=0.294$; finger-to-nose with eyes closed $p=0.411$; normal pronation-supination $p=0.421$; alternate pronation-supination $p=0.426$).

Despite not having been the main objective of this study, the regression model found a significant association between age and balance ($p=0.042$).

DISCUSSION

The results of this study match those found in the literature regarding the predominance of chronic alcohol consumption among male individuals. According to Carlini *et al.*,²⁰ one out of every six men exposed to alcohol becomes dependent on it. Among women, this ratio stands at one out of 17. The differences between the genders as to alcohol consumption may be related to biological, social, economic, and cultural issues.^{21,22} Despite the influence of sociocultural changes in the last decades on the incidence of alcohol consumption among women, frequency of use among men is still higher.

Concomitant use of alcohol and psychoactive drugs was observed in this study, tobacco being the most frequent drug. That association is well described in literature.²³ Berggren *et al.*²³ reported high pre-

valence (80-90%) of tobacco consumption among alcohol-dependent individuals. Several studies showed genetic associations between smoking and alcoholism^{24,25} that support hypotheses that smoking can be the gateway to many cases of alcohol dependence.²⁶ It is important to emphasize that the effects of alcohol on the nervous system are boosted by the association with psychoactive drugs.⁹

The present study described the performance of abstinent alcoholics in specific tests of motor coordination and functional balance. Results show that only three (7.14%) of the subjects assessed presented a score lower than the cutoff score in the functional balance test,¹⁸ and there was no association between alcohol consumption and balance. This result could be explained by the fact that data was collected in a community environment, which may have determined a natural selection considering that a substantial balance disorder would limit social participation. Therefore, the functional balance test results cannot be considered for the population of abstinent alcoholics in general. It is important to highlight that quantitative scientific data on balance disorders of this specific population are scarce, which makes it impossible to compare the findings in the study.

There was no significant association between alcohol consumption and motor coordination. In spite of that, a high rate of positivity was found in the coordination tests among alcoholics (over 50% of the subjects showed positive results in at least two of the four tests), especially in the pronation-supination test with alternating movements of both forearms. This may suggest more difficulty in performing elaborate activities that would demand more coordination ability.

Additionally, positivity for the finger-to-nose test performed with eyes closed was predominant in relation to the same test with eyes open. The explanation for this result may be the absence of peripheral afferent inputs to the cerebellar control, with the purpose of mediating coordinated movement (visual feedback).²⁷ Both results (in the alternate pronation-supination test and in the finger-to-nose test with eyes closed) suggest, even if not in a statistically significant manner, impairment of the nervous system caused by chronic alcohol use.

In this study, a significant association between functional balance and age was found, which means that chronological age may be a determining factor for the occurrence of this disorder in alcoholics. Age is an isolated risk factor for neuronal degeneration, and is linked to physiological changes, such as brain atro-

phy²⁸ and increased sensitivity to alcohol.²⁹ Aging is associated with increased blood alcohol concentration (BAC) due to reduction in body water content³⁰. Age also affects the body's ability to metabolize alcohol.²⁸

Since this was a study conducted with subjects in alcohol abstinence, the relevant implications for this population during this period should be taken into account. Studies show that the neurological decline associated with alcohol consumption commonly requires that subjects have a history of at least five years of alcohol consumption, and mean consumption equal to or higher than 25 weekly drinks.^{31,32} Despite the representative probability of neurological damage in chronic users, several studies have reported regeneration and proliferation of cells in various brain regions after weeks to months of alcohol abstinence,^{33,34} with considerable growth of lost brain volume,³⁵ investigated by magnetic resonance. Therefore, alcohol abstinence promotes neuromotor improvement, including gait and balance,^{29,36} and this is what might have happened to the patients in this study.

Despite the inconclusive results, this study provides complementary information for future research, since publications reporting neuromotor changes related to chronic alcohol consumption are scarce.

CONCLUSION

Findings in this study show the predominance of chronic alcohol consumption and use of other psychoactive drugs in male individuals. There was no significant association between chronic alcohol consumption and balance and motor coordination. One of the hypotheses is that brain plasticity, enabled by the alcohol abstinence of the assessed patients, contributed to those results. Despite not being the objective of this study, age was significantly associated with balance and coordination, which may represent an isolated risk factor for the occurrence of functional balance disorders in alcoholics.

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