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Original article

The importance of lactic acid in migraines and fibromyalgia[☆]



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ARTICLE INFO

Article history:

Received 20 February 2014

Accepted 17 February 2015

Available online 8 September 2015

Keywords:

Chronic migraine

Episodic migraine

Lactic acid

Fibromyalgia

ABSTRACT

Background: Lactic acid is a byproduct of both muscle metabolism and the central nervous system. Changes in metabolism are related to various physiological and pathological conditions. The aim of this study was to determine the relationship between migraine and fibromyalgia with the levels of lactic acid in the blood.

Methods: We study 93 patients divided into five groups: (1) patients with fibromyalgia ($n = 20$); (2) episodic migraine ($n = 20$); (3) chronic migraine ($n = 20$); (4) fibromyalgia and episodic migraine ($n = 13$); and (5) fibromyalgia and chronic migraine ($n = 20$), and 20 healthy subjects (control group). Blood levels of lactic acid were measured at four different time points: at rest, during aerobic exercise, during anaerobic physical activity and while resting after anaerobic exercise.

Results: Lactic acid increased in all groups during anaerobic physical activity without predominance for either group. During aerobic physical activity, all groups increased lactic acid levels, but the increase was more expressive in the chronic migraine group and the chronic migraine with fibromyalgia group without statistical significance.

Conclusions: We did not find abnormalities involving the metabolism of lactic acid in episodic and chronic migraine with or without fibromyalgia.

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[☆] The study was conducted at the Neurology, Cardiology and Rheumatology Services, Hospital de Clínicas, Universidade Federal do Paraná (UFPR), Curitiba, PR, Brazil.

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<http://dx.doi.org/10.1016/j.rbre.2015.08.012>

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A importância de ácido láctico na enxaqueca e na fibromialgia

R E S U M O

Palavras-chave:

Enxaqueca crônica
Enxaqueca episódica
Ácido láctico
Fibromialgia

Introdução: O ácido láctico é um subproduto do metabolismo muscular e do sistema nervoso central. As alterações no metabolismo estão relacionadas com diversas condições fisiológicas e patológicas. O objetivo deste estudo foi determinar a relação entre a enxaqueca e a fibromialgia com os níveis de ácido láctico no sangue.

Métodos: Foram estudados 93 pacientes, divididos em cinco grupos: 1) fibromialgia (n=20); 2) enxaqueca episódica (n=20); 3) enxaqueca crônica (n=20); 4) fibromialgia e enxaqueca episódica (n=13); e 5) fibromialgia e enxaqueca crônica (n=20), além de 20 indivíduos saudáveis (grupo controle). Os níveis sanguíneos de ácido láctico foram medidos em quatro momentos: em repouso, durante o exercício aeróbico, durante a atividade física anaeróbica e durante o descanso depois do exercício anaeróbico.

Resultados: O ácido láctico aumentou em todos os grupos durante a atividade física anaeróbica, sem predominância em qualquer grupo. Durante a atividade física aeróbica, todos os grupos apresentaram um aumento nos níveis de ácido láctico, mas esse aumento foi mais expressivo nos grupos de enxaqueca crônica e enxaqueca crônica com fibromialgia, sem significância estatística.

Conclusões: Não foram encontradas anormalidades que envolvessem o metabolismo do ácido láctico na enxaqueca episódica e crônica, na presença ou não de fibromialgia.

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Introduction

Migraine is a chronic neurological disorder with high prevalence and severe impact on a patient's quality of life. This disorder has genetic characteristics that modulate a dysfunction in brain electrical activity. This neurological condition is characterized by recurrent episodes of headache with unilateral throbbing characteristics of moderate to strong severity that worsens with physical activity. This worsening is associated with vomiting, nausea, phonophobia and photophobia.^{1,2}

Many biochemical changes can be observed during and between migraine attacks. Lactic acid levels, for example, may be altered, exhibiting an increase compared with patients with tension-type headache and healthy controls.³ These data suggest that migraine patients have an abnormality in mitochondrial metabolism. It was demonstrated that lactate levels within the visual occipital cortex is elevated in migraine patients during the inter-ictal period and could suggest the presence of anaerobic glycolysis in cortical regions.⁴ However, other studies have not confirmed these changes and, as a result, do not support this hypothesis.⁵

Lactic acid usually increases during high-intensity physical activity and is related to a decline in muscle strength and pain generation during exercise.⁶⁻⁸ Additionally, the increase in lactic acid observed during exercise has been shown to trigger migraine attacks with aura.^{9,10} Despite this causal relationship, lactic acid is not considered an algogenic substance.¹¹

Fibromyalgia is a chronic pain condition of unknown etiology characterized by widespread spontaneous muscle pain and tenderness to palpation. The diagnostic criteria used for fibromyalgia comes from the American College of Rheumatology 2009 and 2010.^{12,13} Fibromyalgia can also display co-morbidities, such as psychiatric disorders and other

pain syndromes. The correlation between fibromyalgia and migraine varies from 22 to 50% of cases.¹⁴ This association contributes to a decreased quality of life for patients and enhances the presence of co-morbidities. The pathophysiological relationship between these two disorders has not yet been established in the medical literature.

Patients with fibromyalgia may experience high levels of lactic acid at rest^{15,16} or during aerobic physical activity.¹⁷ However, other studies show that changes in glycolysis and lactic acid at rest or during physical activity were slight increased among fibromyalgia patients.^{18,19}

The ratio of lactic acid production in patients with migraine and fibromyalgia, as well as the influence of this metabolite in the pathophysiology of these diseases, is controversial or nonexistent. The goal of this study is to determine whether the metabolism of lactic acid changed in episodic migraine or chronic migraine, with or without associated fibromyalgia.

Patients and methods

We selected from out-patient headache clinic cases with chronic and episodic migraine who were also suffering from fibromyalgia and from the out-patient rheumatology clinic for patients with only fibromyalgia. All patients with chronic and episodic migraine met the criteria proposed by the International Headache Society Classification (IHS-2004).² The fibromyalgia patients fulfilled all of the criteria of the American Society of Rheumatology (2009 version).¹³ For the control group, we recruited employees belonging to the clinical staff of the Hospital de Clínicas da Universidade do Paraná. All patients and controls underwent a clinical and laboratory investigation to rule out silent diseases, such as diabetes, kidney failure, liver disease, lung disease and heart disease.

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