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REVIEW

Exercise associated muscle cramps: Discussion on causes, prevention and treatment

Crampes musculaires associées à l'exercice : discussion sur les causes, la prévention et le traitement

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Summary
Objective. — To discuss the causes, prevention and treatment of exercise associated muscle cramps (EAMC) according to the level of evidence of the available literature, in order to present some evidence-based guidelines for athletes, coaches and health professionals.
News. — Since it appears fundamental for sports medicine physicians and sports health professionals to be able to manage and prevent EAMC, although pathophysiology and causes of EAMC are discussed, clear understanding of EAMC causes seems important in order to treat and prevent EAMC.
Perspectives and projects. — The present review evaluated the available literature on EAMC based on their level of evidence to present some evidence-based guidelines for sports professionals. Fifty articles were selected: 24 after full-text reading and 26 articles after screening selected articles references. Level of evidence was from 1 ($n = 3$), 2 ($n = 8$), 3 ($n = 10$), 4 ($n = 13$), and 5 ($n = 16$).
Conclusions. — The ''Altered neuromuscular control theory'' seems to be the most scientifically acceptable theory, and suggests that EAMC are caused by an imbalance between increased afferent activity (e.g. muscle spindle, Ia) and decreased inhibitory afferent activity (e.g. Golgi tendon organs, Ib) which leads to increased α-motor neuron activity and muscle cramping, especially with muscle contraction in a shortened position. EAMC prevention measures should

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take into account the preparation of muscle to exercise (adapted training) and the respect of muscle fatigue during exercise (warm-up before exercise, well-controlled effort and rest during exercise). EAMC treatments should be non-pharmacological and should play a role on neuromuscular control (rest and/or stretching).

MOTS CLÉS
Crampes musculaires ;
Fatigue musculaire ;
Prévention de la blessure en sport ;
Exercice

Résumé
Objectif. — Discuter les causes, la prévention et le traitement des crampes musculaires associés à l'exercice (EAMC) selon le niveau de preuve de la littérature disponible, afin de présenter des recommandations basées sur des preuves pour les athlètes, les entraîneurs et les professionnels de santé.
Actualités. — Comme il semble fondamental pour les médecins du sport et les professionnels de santé en milieu sportif d'être en mesure de gérer et de prévenir les EAMC, bien que la physiopathologie et les causes des EAMC soient discutées, la compréhension claire des causes des EAMC semble être important afin de traiter et de prévenir les EAMC.
Perspectives et projets. — Cette revue de littérature a évalué les articles disponibles sur les EAMC en fonction de leur niveau de preuve afin de présenter des recommandations pour les professionnels du sport. Cinquante articles ont été sélectionnés : 24 après la lecture de texte intégral et 26 articles après la recherche de proche en proche à partir des articles sélectionnées. Le niveau de preuve était de 1 ($n = 3$), 2 ($n = 8$), 3 ($n = 10$), 4 ($n = 13$), et 5 ($n = 16$).
Conclusions. — La « théorie du contrôle neuromusculaire altéré » semble être la théorie la plus scientifiquement acceptable, et suggère que les EAMC sont causées par un déséquilibre entre l'activité afférente augmenté (par exemple : des fuseaux neuromusculaires, Ia) et la diminution de l'activité afférente inhibiteur (par exemple : l'appareil de Golgi des organes tendineux, Ib) ce qui conduit à une augmentation de l'activité des neurones α-moteur et des crampes musculaires, en particulier avec la contraction des muscles dans une position raccourcie. Les mesures de prévention des EAMC devraient prendre en compte la préparation des muscles à exercer (entraînement adapté) et le respect de la fatigue musculaire lors de l'exercice (échauffement avant l'exercice, effort bien contrôlé et observer des récupérations pendant l'exercice). Les traitements des EAMC doivent être non pharmacologique et devraient jouer un rôle sur le contrôle neuromusculaire (repos et/ou étirement).

1. Introduction

Exercise associated muscle cramps (EAMC) is a particular muscle cramps associated with exercise [1,2]. It represents a common health problem for athletes. Indeed, in a study following 12 years of the Twin Cities Marathon, Roberts [3] reported an incidence of EAMC of 1.2 cases per 1000 racers, and EAMC represented 6.1% of medical encounters. It represents 6% to 67% of complaints in endurance exercises (triathlon or marathon) [3—6], and 30 to 50% in team sports [7—9]. EAMC leads to pain and musculo-skeletal dysfunction that could induce a decrease in performance [10] and could also lead to muscle damage. Thus, it appears fundamental for sports medicine physicians and sports health professionals to be able to manage and prevent EAMC.

EAMC is defined as: ''painful spasmodic involuntary contraction of skeletal muscle that occurs during or immediately after muscular exercise'' [1]. Since muscle cramps is a symptom which can occur in many clinical conditions (metabolic dysfunction, neurologic conditions, pregnancy, or exercise) [2,11—13], diagnosis of EAMC should be performed by eliminating through medical examination of other muscle cramps aetiologies (e.g. symptomatic cramps [neurological, muscular, or cardiovascular diseases], or idiopathic cramps [familial, sporadic or others]...) [1,2,11,14,15]. Although pathophysiology and causes of EAMC are discussed, clear understanding of EAMC causes seems important in order to treat and prevent EAMC.

In this context, the aim of this study was to discuss the causes, prevention and treatment of EAMC according the level of evidence [16] of the available literature, in order to present some evidence-based guidelines for athletes, coaches and health professionals.

2. Methods

With this aim, a systematic search was performed in May 2014 on PubMed database for articles about EAMC published using the following keywords combination: (''Muscle Cramp''[Mesh] AND ''Exercise''[Mesh]) OR (''Exercise associated muscle cramps''). Only articles in English were selected. Articles were included if they deal about EAMC and/or muscle cramps occurring in relation to exercise. Articles were firstly selected on the basis of the title, then on the abstract, and then full articles were read. References of selected articles were screened for other appropriate articles, using the same inclusion criteria: articles in English dealing about EAMC and/or muscle cramps occurring in relation to exercise.