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Opinion

The real-time information provision problem in assessing rehabilitation needs among athletes with overtraining syndrome

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Abstract

One of the biggest challenges in sports medicine is the return-to-play decisions, making or breaking athletic careers. Since there are no protocols to guide team physicians and consultants for athletes with fatigue syndrome, illness, injury, or overtraining syndrome, real-time monitoring plays a crucial role in such cases. By monitoring a combination of performance (e.g., maximal lactate concentration, maximal heart rate at lactate threshold), physiological (e.g., resting heart rate and maximal heart rate), biochemical (e.g., glucose) and hormonal (e.g., cortisol) variables, there should be objective indices determining eligibility or disqualification for the ill or injured athletes, allowing rehabilitation practitioners to improve and adjust their plan accordingly on a real-time information provision basis.

Introduction

The presence of hormonal, immunologic, neuromuscular and psychologic disorders in athletes who are heavily trained without appropriate rest leads to overtraining syndrome, which is an extreme condition. The most notable symptoms are fatigue, decreased performance, mood disturbance, sleeping disorders and enhanced probability of developing illness and injuries. Since the symptoms of overtraining syndrome are nonspecific, it is of high importance to identify athletes at risk or even suffering from it [1]. The question is how long each athlete with overtraining syndrome needs to recover and return to previous optimal levels of performance and which is the safest training load at each stage of rehabilitation. Since there is no single validated diagnostic test or biomarker for overtraining syndrome, it is a challenge for coaches and sports medicine doctors to monitor athletes suffering from it.

Discussion

Currently, there is no clear documentation as to which strategies are employed for ensuring safe participation in exercise, or what factors influence these practices. There is also a conspicuous lack of data relating to the most effective method of identifying conditions predisposing to exercise-related sudden cardiac death and exercise-induced complications [2]. It appears that there is great variability, mainly since all screening strategies are applied in laboratory settings and athletes are not examined in the field during maximum effort or competition.

Having athletes being monitored on a real-time basis during training and competition via the use of sensitive measures to monitor an athlete's health can lead to early detection of symptoms and signs of health disorders, diagnosis and appropriate intervention. Moreover, assessment of non-invasive monitoring of the levels of electrolytes, which decrease during perspiration, can provide an innovative monitoring aspect to such approaches. For example, low potassium can be a cause of leg cramps in athletes, exercise-induced nausea, arrhythmias, and cardiac arrest, while hyponatremia may lead to confusion, seizures, brain herniation, pulmonary edema and death. The severity of these adverse effects highlights the necessity of close monitoring of the levels of electrolytes during exercise, which should be provided on a real-time basis.

There are several methodologies and techniques for the estimation of blood lactate levels and researchers are trying to develop devices that make the lactate analysis easier and

faster and the measurements valid and reliable [3]. Lactate level estimations in the field and not in the laboratory, in a noninvasive and easy way should also be investigated, to help coaches to adjust exercise characteristics and training loads aiming to increase athletic performance, according to each athlete's profile. This will guide physicians, physiotherapists and coaches to subscribe to the appropriate exercise rehabilitation program for each athlete after infection, illness, injury, or overtraining syndrome.

Finally, advancing the performance of current wearables in terms of their intrinsic characteristics and functionalities and the connectivity between devices and between different wearables' data networks is essential. This will provide the first wave of technologies specifically created for wearables, especially in the burgeoning segment of physiological monitoring of athletes. Insights into fitness via precise real-time tracking, quantification, and prediction of athletic performance on the basis of a multimodal set of physiological and biological parameters, as well as personalized prediction of exercise-related complications (hyponatremia, hypoglycemia, arrhythmias, or even sudden cardiac death) and personalized estimations of rehabilitation time are now more than ever required. Complementing this by psychological behavioral aspects and model effects associated with overtraining, e.g. like the one in [4] will further facilitate the prevention of adverse situations in athletes. Therefore, further optimization, characterization and effort to establish real-time monitoring a prerequisite in monitoring and evaluating athletic performance during routine exercise and training, following injury, and during or following rehabilitation, should be pursued.

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