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Features of Traumatic Factors During High-Intensity Sports Training: Prevention and Medical Care

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ABSTRACT

The article investigates the features of traumatic factors during high-intensity sports training. The author notes that sports injuries in the inter-competitive period represent damage to the body caused by intensive training. The variants of injuries are different, but each of them may have a sharply negative impact on the athlete's health in the future. In order to exclude the occurrence of such injuries, as well as to minimize their impact on the athlete's body, it is necessary to carry out appropriate preventive medical work with both athletes and the coaching staff, explaining the possibilities of organizing the training process in the safest mode for the athlete's health.

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INTRODUCTION

Introduction. Musculoskeletal injuries are common among athletes, both amateurs and professionals. The nature of these injuries varies in different sports, but most of them are often the result of a combination of factors, and sometimes it is difficult to establish a specific mechanism that leads to injury.[1]

Epidemiological studies in sports show that the level of injury in athletes ranges from 10% to 65%, and for this reason, one of the main goals of sports physiotherapists and other specialists in sports is to prevent injuries. A key step in evidence-based injury prevention is to identify possible injury risk factors. Risk factors such as strength, balance, joint mobility, biomechanics are often of interest because they are amenable to change, while other factors such as age and previous injury cannot be attributed to this category.

Understanding modifiable risk factors is necessary to develop effective targeted risk reduction strategies. This can lead to the development of accurate and reliable tests to study risk factors, which is a necessary tool for screening athletes, monitoring athletes over time and determining the effectiveness of injury prevention programs.

Materials and methods. When writing the paper, the work of specialists in the field of the presented topic was studied, the materials obtained were subjected to comparative as well as analytical research methods.

Results. Experts describe a number of injury risk factors and injury mechanisms. Internal risk factors that may predispose an athlete may include:

- age;
- biological gender;
- constitution;
- health level;
- level of physical fitness;
- features of anatomy;
- features of psychology.

KEYWORDS:
High-intensity training, Injury prevention, Medical care traumatic factors.

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Under the influence of external risk factors, the athlete becomes susceptible to injury. External risk factors include:

- Sports factors;
- Protective equipment;
- Environment.[2]

When a provoking event occurs, the athlete is injured. Provoking events should include such as the game situation, the behavior of the player or opponent, etc.

A separate group of researchers focused on internal and external injury risk factors and developed a dynamic recursive model of the etiology of sports injuries. This injury prevention model highlights the fact that "adaptation occurs in the context of sports (both in the presence and absence of injuries) that alter risk and affect etiology in a dynamic, recursive way." It is proposed to look further than the initial risk factors preceding the injury and consider how these risk factors may have changed during different training or participation cycles.[3]

Obviously, there are many factors associated with the risk of injury, and the interaction between these factors can increase the risk. The researchers provide a detailed list of these factors:

I. Modifiable factors

1. Factors related to training:
   - training volume, load, intensity;
   - type of training;
   - training and competition schedule.
2. Motor control factors
   - posture;
   - movement patterns;
   - muscle tone;
   - sports equipment.
3. Psychological factors
   - religion;
   - fears;
   - survival strategies;
   - self-efficacy;
   - emotional state (stress, depression, anxiety).
4. Health-related factors
   - diet;
   - taking medications;
   - general state of health;
   - fatigue level;
   - sufficient sleep.

II. Unmodifiable factors

- gender;
- age;
- constitution;
- genetics;
- previous injuries, etc.[4]

The authors also pay attention to environmental factors, conditioning factors, household factors, etc.

Experts illustrate the complexity and multilevel nature of these factors that affect the occurrence of injuries by building certain hierarchies, which helps to determine the degrees of influence of such factors.

The mechanism of injury can also be called a "stimulating event". From a biomechanical point of view, taking into account the properties of the tissue and the characteristics of the load, the injury will be the result of the transfer of energy to the tissue, and the mechanical load will exceed the permissible load of the tissue. The Consensus Group on the Epidemiology of Injuries and Diseases of the International Olympic Committee defines injury as "tissue damage or other impairment of normal physical function in connection with sports as a result of rapid or repetitive transfer of kinetic energy".[5]

Here it is necessary to pay attention to the differences for each type of fabric and the type of load, the speed of the load, the frequency and magnitude of the load. The key points to keep in mind when considering the biomechanical point of view are that biomechanics should explain how the injury is the result of a mechanical load exceeding the permissible load of the tissue, or how the mechanical load has reduced the level of tissue tolerance to a level at which normal mechanical loads cannot be sustained.

When considering the epidemiological model, the load and load tolerance are influenced by the main elements of the model – internal risk factors, external risk factors and a provoking event.

It is important to have an accurate description of the mechanism of injury or "provoking event". This information can be used to develop specific injury prevention measures for specific types of injuries and even for specific sports. The description of the mechanism of injury may include information at different levels. These levels may include aspects such as the sports situation, team action, skills, athlete behavior, interaction with the opponent, etc.[6]

Sports physiotherapists and professional athletes should know that each type of injury has its own typical patterns, and the same applies to sports. For professionals working with athletes in all specific sports, it is important to keep up to date by following the evidence-based literature.

Discussion. Researchers in the field of sports medicine have developed a fundamental conceptual model for the prevention of sports injuries, which has since evolved and adapted to many sports and specific types of injuries. The four steps of action in this model are as follows:

- determining the scale of the problem (prevalence and frequency of injuries);
- identifying the cause and mechanism of injury;
- development and implementation of injury prevention strategies;
- evaluation of the effectiveness of the intervention.[7]

Individual researchers focused on internal and external injury risk factors and developed a dynamic recursive model of the etiology of sports injuries. In this model, it is proposed to look further than just a snapshot of the initial predisposing factors to injury, and take into account that these factors change and adapt in the context of sports.

The proposed TRIPP model took into account the context of interventions and the behavior of athletes and sports professionals. The TRIPP structure included two additional steps that are necessary to translate the effectiveness of

injury prevention strategies into real life. Two additional steps included understanding the real world for which a specific intervention is being developed and evaluating this intervention in real conditions.

A new model of injury prevention in team sports was also proposed: the Injury Prevention Cycle in team sports (TIP). The three key stages in this model are as follows: to overestimate, not to identify, to intervene. At the same time, an important role is played by timely screening to prevent injuries in one or another athlete.

Musculoskeletal screening is usually practiced in several sports. For many years, the goal of screening has been to identify athletes at risk of injury and to introduce injury prevention programs for these athletes. Screening cannot predict whether an athlete will get injured, but screening can help in identifying predisposed athletes. The presence of a predisposition to a certain injury does not mean that the athlete will be injured. In addition, if an athlete does not have a predisposition to injury, this is also not a guarantee that the athlete will not get injured. Athletes become vulnerable to injury when they are exposed to stress and provoking events.

There are different views on screening and its use in athletes. Screening cannot predict which athlete will get injured, but screening has many advantages.

One of the main factors of injury risk is a previous injury. Applying a traditional predictive diagnostic test to the data to determine whether a previous injury is a predictor of a new injury.[8]

In medicine, screening is a strategy for detecting an unrecognized disease in people with or without symptoms. In relation to sports, the idea would be to determine if an athlete is injured. However, the goal of injury prevention is to intervene before injury occurs, and this changes the context of screening in sports and identifying elements (risk factors) that can lead to injury. When screening for injury risk factors, they look for an athlete with certain traits that may predispose an athlete to injury. However, the paradigms commonly used in screening have limitations that sports professionals do not always take into account.

Trauma occurs when various external and internal risk factors interact with the timely mechanism of injury. These phenomena are complex, multifactorial and unpredictable. When selecting athletes, it is necessary to take into account this complex and unpredictable reality, otherwise the selection process may be meaningless.

Risk factors do not stand still and change over time. Often screening is done at a set point in time (i.e. pre-season screening, baseline screening) and then injury rates are investigated over the next season or period. However, if the screening test was conducted regularly, the results will change over time, as this will be influenced by the requirements of training and matches. In addition, the risk factors identified in athletes during pre-season screening are likely to be eliminated, and thus the risk of injury will be reduced. Therefore, screening should be a time-based approach with repeated measurements, not a snapshot in time.

It should be noted that the deficit of internal rotation of the shoulder joint (GIRD) is observed in athletes engaged in basketball. Thus, it was noted that the loss of internal rotation by 20 degrees and the loss of the overall range of motion by 5% increase the risk of injury by half. If the latter indicator is more than 25%, then we can say that this is a prognostic sign of arm injury in such athletes.[9]

Another group of researchers notes that the presence of scapular dyskinesia may increase the risk of shoulder injury, but the results of their study were not statistically significant. It can be assumed that scapular dyskinesia can be a significant risk of shoulder injury only when other factors associated with the risk of sports injury are present (for example, training load, etc.).

Sports injuries are multifactorial. The researchers proposed a comprehensive systematic approach to sports injuries, which focuses on recognizing the nature of injury rather than identifying risk factors. They claim that studies of the etiology of sports injuries use a reductionist view, when "the phenomenon is simplified to units and analyzed as the sum of its main parts." This approach uses statistical data representing correlation and regression analysis, and despite efforts, it is still difficult to identify or isolate predictive factors of injuries.

We should consider a comprehensive systematic approach in which athletes are considered in a complex (like most human health conditions), and injuries are the result of a complex interaction of a network of determinants (biomechanical, behavioral, physiological, psychological).

Sports injuries are complex in nature and are the result of the interaction of various factors, which can create a risk of injury and an emerging injury model. To prevent sports injuries, it is necessary to define risk profiles, and this entails a transition from simple identification of risk factors to a more complex approach to recognizing risk models. Clinicians should be well informed about the interaction between risk factors in order to plan effective preventive intervention.

Stress during training and competitions are also a risk of injury. This relationship between stress and injury can be further analyzed with the help of intermediaries and moderators. Mediators can be seen as steps explaining the relationship between a variable and a result. ("Why can a change in workload lead to injuries?") For example: handball players with jumps in running load (determined by the ratio of acute and chronic load) are at increased risk of non-contact injury. The mediator in this scenario may be neuromuscular fatigue, since increased workloads cause a higher level of fatigue, which may predispose an athlete to injury.

Moderators change the effect of a variable on the result and allow you to answer the question: "What characteristics make some athletes more resilient or prone to injury under these workloads?". For example, high aerobic fitness protects against workload spikes. Thus, aerobic training mitigates the effect of workload, reducing the risk of its rapid increase.

Individual risk factors are important; however, their summation within a complex individual over a period (complexity and temporality) should be taken into account.[10]

Very important in the field of prevention of sports injuries is their medical prevention. Let's consider the features of prevention in the context of injuries such as concussion.

Primary prevention strategies are aimed at healthy people who participate in sports or recreational activities. Interventions aimed at primary prevention have shown significant changes in reducing the risk of concussion.

To reduce the frequency, severity and negative impact of concussions on the health of players, the following protocols and recommendations should be included:

- raising awareness about the risks of concussion during sports and recreation;
- informing athletes about the causes, signs and symptoms of concussion, safe treatment of concussion, concussion modifiers and how to protect yourself from injury.

The strategy of secondary prevention is no less important, it is aimed at early diagnosis and prevention of recurrence of concussion through assessment before injury. Athletes who have suffered a concussion often have mild or variable symptoms that are difficult to detect or identify. As a result, it is useful to have some objective data before the injury to use as a point of comparison. Pre-season baseline tests can help identify minor violations and can help the clinician make an individual decision about returning to the game (by comparing with the results before the injury). The results of these tests should be used to support team doctors in their decision-making process.

In terms of secondary prevention, the goal of implementing concussion treatment protocols (including early detection and standardized initial treatment through recovery) is to reduce the risk of early concussion recurrence after athletes are allowed to resume concussion risk activities.

Strategies for secondary prevention after concussion include:

- raising awareness of the signs and symptoms of concussion;
- assistance in how to recognize a suspected concussion;
- follow the recommendations for physical, cognitive and emotional rest in concussion treatment protocols, allowing you to gradually return to the game and to learning in order to promote full recovery.

In the context of tertiary prevention, the focus is on rehabilitation strategies to prevent the long-term effects of concussion. From a public health perspective, although primary concussion prevention in youth sports is aimed at reducing the number of concussion cases, it is also important to think about secondary and tertiary intervention strategies that include different goals to reduce the risk and consequences of concussion.

Conclusion. Thus, sports injuries in the inter-competitive period represent damage to the body caused by intensive training. The variants of injuries are different, but each of them may have a sharply negative impact on the athlete's health in the future. In order to exclude the occurrence of such injuries, as well as to minimize their impact on the athlete's body, it is necessary to carry out appropriate preventive medical work with both athletes and the coaching staff, explaining the possibilities of organizing the training process in the safest mode for the athlete's health.

AUTHOR CONTRIBUTIONS

All authors contributed in reviewing the final version of this paper.

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