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Specificity and spectrum of injuries among volleyball players

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Abstract:

Volleyball is one of the most popular sports around the world. Due to its non-contact nature, it is considered as one of the safer team sports. The specificity of contusions in volleyball players is related to the type of performed and repeated movement patterns. The aim of the study was to describe the issue of injuries among volleyball players - most common anatomical locations, mechanisms, risk factors, methods of prevention. The article was created on the basis of a literature review. The most common type of injury found in volleyball players is ankle sprain. Overuse injuries most often affect the knees and shoulders. Blocking and spiking are elements of the volleyball game most closely related to contusions. Risk factors include position / role on the court, history of previous injuries and adaptive changes in the musculoskeletal system. The basic form of prevention is education regarding the development of an appropriate game technique and correct movement patterns. An important part of the training of volleyball players should be adequate warm-up, mobilization exercises and stretching. Further research should focus on understanding more precisely and describing the etiology of injuries. This could translate into the development of specific prophylaxis in the future, especially in relation to the areas of the body of volleyball players most affected by contusions. The effectiveness of injury prevention methods should be tested by carrying out large and well-designed scientific studies to provide data with high evidence strength.

Keywords: volleyball; injuries among volleyball players; acute injuries; overuse injuries

1. Introduction

Volleyball is one of the most popular sports around the world - NCVA (Northern California Volleyball Association) data shows that over 800 million people play this sport at least once a week [1]. It is considered one of the safer team sports (compared to football or ice hockey) due to its non-contact nature [2,3]. The motorics of movements of volleyball players are concentrated around repeated sequences of jumps and landings, as well as accelerations and decelerations [4]. Physical activity is based on periods of intense effort alternated with breaks and periods of low intensity. The element of frequent arm movements above the head level (overhead) while playing volleyball is also important [4]. The etiology, mechanisms and types of injuries are closely related to this specific movement pattern in both professional and recreational volleyball players.

The aim of the study was to present the problem of injuries among volleyball players. The analysis included risk factors, anatomical location, types and methods of injury prevention. The article is a review of the literature available in the Google Scholar and PubMed databases. Search terms included "injuries among volleyball player", "knees / shoulder / most common injuries in volleyball" and "prevention of injuries in volleyball".

2. Types of injuries in volleyball

The literature describes the division of injuries in sport into 2 basic categories: acute injuries and overuse injuries. The first group includes open wounds, sprains and dislocations in the joints [5]. The most common location of acute injuries (and all injuries in general terms of anatomical location) in volleyball players are the ankles [2,6-8], and sprain is the most common mechanism [3,9-12], relatively often associated with contact of the lower limbs with another player [2,3]. In the second place in this category are fingers and thumbs, injuries of which are related to contact with a flying / moving ball [2]. Sprain of the first metacarpophalangeal (MCP) joint is the most common and it is a characteristic type of finger injury [3]. An example of a serious acute injury to the knee is an anterior cruciate ligament (ACL) rupture, which often is related to landing on one leg following an attack without touching another player's legs [3,13]. This type of damage is rarely observed in volleyball players [3].

The group of overuse injuries includes inflammation and chronic pain conditions, bursitis, tendinitis, deformities and weaknesses in the musculoskeletal system [5]. These type of injuries appear to be typical of non-contact sports such as volleyball and beach volleyball, where repetitive movement patterns are performed [5,14]. They are associated with repeated loads, which is why, especially in their case, the assessment of utility technique seems to be important in order to diagnose the etiology and source of health problems [15]. It is possible that overuse injuries are more common among women, but no clear reason for this relationship has been identified [5]. The most common anatomical location of this type of injury among volleyball players is the knee, and the most common mechanism is patellar tendionopathy / patellar tendon injury [9-11]. This pathology, also known as "jumper's knee", occur more often in volleyball than in any other team sport [4]. Shoulders are also relatively often affected by overuse injuries [11,14]. They are common in volleyball in this anatomical region due to the dominant type of activity involving overhead movements, especially during

an attack / spiking [4]. Another often indicated location of overuse injuries is the lower back [14,16], accompanied by pain in the lumbosacral spine [6].

Some studies comparing the incidence of injuries show that acute-onset injuries are more frequent than those caused by overuse [6,16], but there are also scientific papers pointing to the reverse order [11,15].

It is highly probable that volleyball is a relatively safe sport (also at the highest, international level) - most injuries are mild and moderate compared to severe injuries [2-4,6,17]. The incidence of injury in many studies is converted to 1000 hours of play. Bere et al. estimated this ratio at level of 10.7 for all types of injuries, 3.8 for time-loss injuries and about 0.3 for serious injuries causing exclusion from the game for over 4 weeks [2].

3. Risk factors

In the literature it can be found descriptions of potential risk factors for the development of injuries among volleyball players. However, many of them appear to have limited statistical evidence in scientific studies, as it has been described in the example of shoulder injuries [18]. Nevertheless, it is pointed out that some of them have logical bases and should be taken into account while estimating the risk of injury.

When it comes to the player's position on the court, the liberos (second-line players, specializing in defense) are the least likely to be injured, and injuries are the most common in the middle blockers / hitters [2]. It shows that the position in the first line (closer to the net) may be a potential risk factor for more frequent injuries [3,13,17]. Many authors agree that contusions are the most often associated with attempts to block the ball [4,6,17]. In the case of injuries of ankle joints, then contact with the legs of the opponent or teammate occurs [2,3,10]. This was reflected in the analysis of official videos provided by the FIVB (Fédération Internationale de Volleyball; an international sports organization associating volleyball federations from all over the world) carried out by Skazalski et al. [19]. The second sequence of movements in the context of the risk of developing injuries is spiking (attacking in volleyball) [4,8,12]. In this case, the contact damage mechanism is different depending on the starting position of the attack - in the first line it is usually the result of contact with the opposing team player's legs, in second line attacks it was often associated with landing on a teammate from the first row [19].

An interesting relationship is the pattern of the most frequently sustained injuries depending on the position taken on the court. Liberos have a statistically lower frequency of ankle sprains, with a higher frequency of finger and thumb injuries, which is associated with the digging (falling to the floor with the hands out in front of defender, in order to defend the ball) and attempts to receive the opponent's attack with their hands raised above the head [2,3]. Setters are slightly more likely to suffer chronic injuries to the lower back, and attackers are more likely to suffer from shoulder injuries [2,4]. This confirms that the player's role on the court may be a risk factor for the development of injuries in particular anatomical regions of the body.

Formal character of the game can also influence the frequency of contusions. Data from scientific studies show that a greater percentage of injuries occurs during matches than under training conditions [2,4,7,11,13]. Referring to that second type of volleyball game, Pimenta et al. in their article indicate that an additional extension of training by an hour may

significantly increase the risk of injury. On the other hand, an additional training session may significantly reduce this risk [11]. Based on these data, it could be concluded that more frequent and shorter workouts are safer than less frequent and longer workouts.

The history of previous injuries and pains in various anatomical regions of the body also seems to be important from the point of view of the development of injuries [9,11,14]. This relationship is particularly strongly described for ankles - it is considered to be the most important risk factor [3,9,16]. For this reason, it seems appropriate to proceed to implement the methods of increased supervision and prevent recurrence of injuries in players with a past injury in this area [9,16]. The 6-month period following ankle sprain may be significantly associated with an increased risk of recurrence, therefore it is recommended to use external ankle braces for at least 6-12 months after the injury [20].

A large study of FIVB ISS (Injury Surveillance System) data indicates that injuries more often affect seniors at the international level than juniors at competitions up to the U-23 level (Relative Risk: 2.04; CI 1.29 - 3.21), which may result from greater dynamics of the game and higher velocities of hitting balls in senior competitions [2]. The analysis also showed that the overall injury rate does not differ significantly between genders, between sets of a match, or between a losing and a winning team [2]. According to data from some other studies, men may be predisposed to more frequent injuries regardless of their location or mechanisms [11]. It seems that for some specific types of injuries, gender may be one of the potential risk factors - for example, anterior cruciate ligament (ACL) ruptures have been described more often in women than in men [3,9,13].

Referring to shoulder and back / spine injuries, a review by Seminati et al. [14] indicates the following potential risk factors:

- Anatomical and biomechanical conditions (abnormal mobility, asymmetry and muscle disproportion) and a history of pain for shoulder injuries,
- Anatomical and biomechanical conditions for back injuries - the location of the body's center of gravity, body posture,
- Common to shoulder and back injuries - utility technique, role on the court, level of game, exposure.

Anthropometric measurements in the group of teenage volleyball attackers in the movement ranges of the shoulder joint showed specific adaptive changes in them [21]. These changes included a decreased range of internal rotation and acromiohumeral distance (AHD), and an increased range of external rotation. A review by Challoumas et al. indicates an identical pattern of biomechanical adjustments in the dominant shoulders of volleyball attackers [22]. The authors also state that these players develop muscle imbalance, which is a risk factor for shoulder pain. For this reason, exercises to strengthen external rotators in combination with stretching and mobilization should be considered [22].

Biomechanical adaptive changes may also predispose to other types of trauma, including the most common in volleyball players, which is ankle sprain. Hadzic et al. suggest that a reduction in the range of dorsiflexion motion and a higher strength of the plantar flexors of the foot may impede safe landing, and thus constitute a risk factor for the development of an injury in this anatomical region [23]. The first of the before mentioned adaptive changes in the ankle joint in volleyball players significantly increases the risk of the most common overuse injury, which is patellar tendinopathy [24]. The study by Malliaras et al. shows that

the increased value of the waist-hip ratio (WHR) in male volleyball players can also be considered as a significant risk factor for this specific type of injury [25].

4. Methods of prevention

Detailed knowledge about the etiology of injuries may translate into the development of effective forms of prevention [7]. The consequence of a small amount of strong evidence on risk factors is the low prevalence and availability of useful prophylaxis methods. This problem has been especially emphasized for shoulder injuries [7]. Further research into effective prevention and early interventions in injuries among volleyball players is desirable in order to generate new recommendations [5]. Nevertheless, several general forms of prevention have been developed and defined, which do not raise doubts as to their legitimacy of application.

The most basic form of prophylaxis should be a multi-stage education on the correct technique of volleyball, with an emphasis on developing appropriate movement patterns, in particular with regard to the execution of block elements and the attack [9,17,19]. Mastering the element of the game, which is landing after a jump, is extremely important, because then the forces are transferred and the loads affect the joints and tendons of the player [4]. It is suggested that improvement of safety may also come from introducing changes to the rules of the game with a tightening of the midline rule. It is associated with the fact that most of the injuries in this border zone of the court occur despite the lack of violation of the rule in its current formula [19].

Another elementary method of preventing injuries is adequate warm-up [14], which is the preparation of the musculoskeletal system for more intense physical activity. For this reason, research has been conducted on a program called "VolleyVeilig" aimed at recreational volleyball players in the Netherlands. It contained a base of 50 different warm-up exercises, and its single execution was supposed to last 15 minutes [26]. Preliminary surveys before implementing the project showed that it is positively assessed by volleyball players and coaches in terms of usefulness [27]. This year's scientific publication allowed for a more accurate insight into the effectiveness of the program - the acute injury incidence rate was lower by 21% in the study group compared to the control group, and the difference for overuse injuries and the difference in the severity of injuries proved to be statistically insignificant between the groups [28].

A properly worked preparation period (pre-season) has great importance in preventing the development of injuries for professional players and people who regularly practice this sport. It is extremely important for athletes to rely on very well developed training plans [10, 21]. In everyday training, an important place should be taken by motor coordination exercises, exercises that stabilize and mobilize the joints, as well as stretching individual muscle parts [14,22]. These types of exercises are designed to develop and maintain proper muscular sensation and muscle control, as well as an adequate distribution of muscle strength and distribution of loads generated during the game [14]. Physical therapy and massage as forms of muscle relaxation after intense exercises also seem to have a positive effect on the health and condition of athletes. Reducing the frequency and severity of injuries can also be achieved through the use of appropriate equipment, such as ankle braces and knee pads [3].

5. Summary

As a team sport, volleyball has a low injury rate among players, and the severity is usually mild to moderate. The safety of the game is largely related to its non-contact nature. Nevertheless, the most common type of injury among volleyball players, sprains of the ankle joint, most often occur as a result of contact of the lower limbs with another player. The specificity of injuries is related to the type of performed and repeated movement patterns. For this reason, learning the technique of the game and working on mastering the various elements of the game, especially block and attack followed by landing, is considered as the primary form of prevention, as research links these movement sequences with the highest percentage of injuries. An important part of the training of volleyball players should be adequate warm-up, mobilization exercises and stretching. Risk factors include position / role on the court, history of previous injuries and adaptive changes in the musculoskeletal system. Scientific evidences on prevention methods and risk factors are limited. The subject of further interest in this field should be to better understand and describe the etiology of injuries. Based on this knowledge, the next step should be to develop methods of preventing injuries, the effectiveness of which should be tested in large, well-designed scientific studies.

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