

FREQUENCY OF PERIPHERAL NERVE INJURIES IN ATHLETES OF CERTAIN SPORTS CLUBS IN THE CITY OF ZADAR

Luka Androja¹, Josip Miočić¹, Žarko Bilić¹ & Milica Komšo²

¹Aspira University College, Split, Croatia

²Zadar General Hospital

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Abstract

Peripheral nerves in athletes are susceptible to injury due to an increase in physiological requirements in the training process to neurological structures and to the soft tissues that protect them. The training process is conditioned by the rank and level of competition and its implementation largely depends on the education of professional staff. Common mechanisms of injury are pressure, sprain, strain, ischemia, and sports injury. Seddon's original system of dividing nerve injuries based on neurophysiological changes is most widely used in medicine. The initial stage of nerve injury is neuropraxia, the second stage is axonal degeneration, and the third stage is nerve cutting. Peripheral nerve injuries are more common in the upper extremities than in the lower extremities. They have specifics related to a particular sport, in this case, football and basketball, and often have a biomechanical component in the making. Early detection allows an appropriate rehabilitation program to be initiated and biomechanics changed before the nerve injury becomes permanent. Recognizing nerve injury requires an understanding of peripheral neuroanatomy, knowledge of common nerve injury sites, and awareness of the types of peripheral nerve injuries that are common and specific to a particular sport. Rehabilitation programs in the field of kinesiology can be read through FMS protocols. Electrodiagnostic tests (electromyography), somatosensory evoked potentials, magnetic resonance imaging, and ultrasound are used to diagnose peripheral nerve injuries. Proximal peripheral nerve injuries have a slightly poorer prognosis in terms of neurological recovery in athletes. The survey determined the frequency of injuries in the subjects and that there is a misunderstanding among the athletes themselves, which is a peripheral nerve injury. The survey also found that peripheral nerve injuries occur due to acute injuries, while chronic injuries are excessive, resulting in damage to muscles and joints, and rarely as a result of inappropriate sports equipment. Athletes' knowledge of what constitutes a peripheral nerve injury itself and how this type of injury should be given more importance in further general prevention has also been established.

Keywords: *peripheral nerves, injury, training process, recovery*

Introduction

Injuries are an integral part of the life of athletes and are even more common in professional athletes who, due to exposure to greater effort and more difficult conditions of the training process (Miočić, Špralja & Jurinić 2019). Injury is generally considered to be tissue damage that has occurred over a limited and specific period. In contrast, as the name suggests, sports injury in a broader sense includes all injuries that occurred during kinesiology, and sports injury in a narrow sense implies an injury specific to the mechanism of occurrence and frequency for a particular sport (Horvat, 2019). Peripheral nerve injuries occur during the implementation of the training process, which includes sports training or competition (Rotim, 2018). According to Hirasawa and Sakakida, peripheral nerve damage accounts for less than 0.5% of sports-related injuries, while the prevalence of peripheral nerve injuries represents 1.3% -2.8% of a sports activity (Hirasawa and Sakakida, 1983). Peripheral nerve injuries for the

purposes of this study may be demonstrated by sensory, motor, or movement performance disorders in basketball and soccer players. In medicine, peripheral nerve injuries are categorized as neuropraxia, axonotmesis, and neurotmesis (Seddon, 1943). Neuropraxia as a temporary rupture, i.e. the inability to deliver a nerve impulse, occurs by demyelinating the nerve at the site of injury without permanent nerve rupture. Complete recovery is achieved by remyelination, which can take up to 12 weeks. Axonotmesis represents axonal rupture and degeneration distal to the site of injury and proximal to the next Ranvier node. Axon regeneration takes place from the site of injury to the peripheral organs, at a rate of 1 mm/day. Neurotmesis is a complete interruption of nerve continuity without the possibility of spontaneous recovery of function (Seddon, 1943).

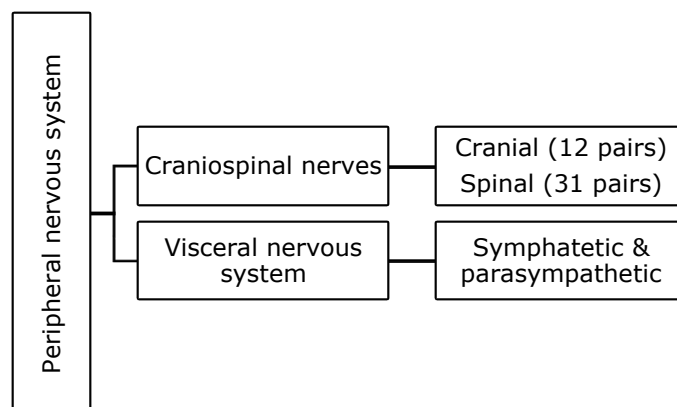
Peripheral nerve injuries are classified as acute, subacute, and chronic. Acute injuries are the result

of instantaneous forces of pressure, stretching, or stretching on the nerve. Subacute and chronic nerve injuries are the result of the excessive injury. Excessive injury is a term used for various conditions that cause discomfort or pain in the muscles, joints, tendons, nerves, and soft tissues of the human body, or for the purposes of this work of athletes. Mitchell's research states that excessive injury develops as a result of a number of factors such as constant repetition of one and the same movement, permanent or overemphasized contraction or muscle strain, and inappropriate movement biomechanics (Mitchell et al., 2014). Thus, the syndrome of excessive injury leads to gradual damage to the peripheral nerves, which may be a consequence of the inadequate training process carried out by an unprofessional person. The mechanism of the development of excessive injury in basketball and football players includes the athletic training regime, equipment and trainers, and the periodization of the training process itself. The term periodization implies the systematic planning of the training process with cyclically encompassed peak performance in training and with appropriate rest intervals (Lorenz, et al., 2010). In order to determine the frequency of injuries in athletes themselves, it is necessary to conduct education on the subject of peripheral nerve injury and to perform permanent control of the training process itself.

Peripheral nervous system

The peripheral nervous system includes all nerves outside the central nervous system (brain and spinal cord). The cerebral nerves, which connect the head and face directly to the brain, the nerves that connect the eyes and nose to the brain, and all nerves that connect the spinal cord to the rest of the body are part of the peripheral nervous system (Weis, 1994). The brain is connected to most of the body by over 31 pairs of spinal nerves coming out of the spinal cord. Peripheral nerves are bundles of nerve fibers. Some are very small (less than 0.04 cm in diameter) and some are quite large (more than 0.6 cm in diameter). Larger fibers transmit messages that activate muscles (motor nerve fibers) and sensations of touch and position (sensory nerve fibers). Smaller sensory nerve fibers transmit sensations of pain and temperature (autonomic nervous system). Schwann cells envelop each nerve fiber and create multiple layers of adipose tissue called the myelin sheath. Peripheral nerve dysfunction can occur due to damage to the nerve fiber itself, the nerve cell body, the Schwann cell, or the myelin sheath (Hertel, 2000).

Figure 1. The peripheral nervous system is represented by a horizontal multilevel hierarchy



Symptoms of peripheral nerve injury

Since there are millions of nerves in the body, peripheral nerves generally resemble branches on trees that spread everywhere and bring information to major reservoirs - the brain and spinal cord (Safran, 2004). When everything is in order, the brain receives the necessary information so the person can control their muscles, recognize pain, and the internal organs work optimally. Peripheral nerve damage ("Peripheral neuropathy") is a poor function of peripheral nerves and can disrupt sensation, muscle activity, or the function of internal organs. Symptoms can occur singly or in combination (Kuntzer, 1997). For example, muscles supplied by a damaged nerve can weaken and Kinoshita's research states that pain, numbness, tingling, swelling, and redness can develop in different parts of the body (Kinoshita, 2006), and can occur after damage to a single nerve (mononeuropathy) or two or more nerves (multiple mononeuropathies). or at the same time many nerves throughout the body (polyneuropathy).

Diagnoses of peripheral nerve injury

Diagnosis of peripheral nerve injuries is based on history and clinical examination with a good knowledge of the anatomy of specific regions of the body. It is very important to define the location of the injury so that I can distinguish between sensory and motor impairments (Radić, et al., 2018). Acute injuries of the peripheral nerve are usually the result of direct mechanical action resulting from the training process, such as stretching due to dislocation or bone fracture or tearing. Subacute and chronic injuries are the result of repeated training operators, which causes disorders of the joint-muscle structure (Krivickas, 1997). To distinguish the main types of damage that can be represented through: complete loss of axons (neurotmesis); partial loss of axons (axonotmesis); and demyelination (neurapraxia), electrodiagnostic tests and somatosensory evoked potentials, magnetic resonance and ultrasound are used (Berković-Šubić et al., 2017). Diebal et al., state

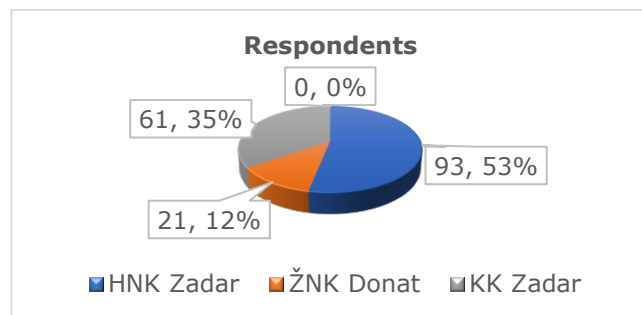
that in the diagnosis of neurotmesis, there is an established complete disruption of peripheral nerve continuity and autonomic denervation and severe damage to the vasa nervorum (Diebal, 2011). In the diagnosis of axonotmesis, complete muscle denervation occurs with preserved nerve continuity and part of autonomic functions, as well as neural micro vascularization. In the diagnosis of neuropraxia, nerve demyelination is determined, where spontaneous recovery is expected with the necessary physical rehabilitation (Medved, Kasović, 2007). It should also be emphasized that in addition to the above types of damage that there are degenerative and regenerative phases, which are manifested through the determination of the evoked muscle response and loss of sensitivity in distant parts of the nerve.

Methods

For research purposes, survey methods and in-depth interview methods were used. A survey is a form of research through which different attitudes and opinions (satisfaction) of the participants of the program are collected. The diagnosis of peripheral nerve injuries in sports is based on the history of the disease and clinical examination with a good knowledge of the anatomy of specific regions of the body and the specifics and requirements of each sport. Therefore, in-depth interviews are essential for the purposes of this paper. An in-depth interview is a method by which the attitudes, observations, and opinions of experts from appropriate fields for the purposes of this paper in kinesiology and medicine are determined. The sample of respondents consists of 175 members, of which 93 athletes from the Croatian Football Club Zadar, 21 athletes from the Women's Football Club Donat, and 61 athletes from the Basketball Club Zadar s.d.d. The paper analyzes the results of a questionnaire, which included 175 athletes of all ages. The survey questionnaire was constructed and tested on a group of 5 participants from all clubs participating in the survey and then completed by all other participants in the survey. The survey questionnaire consists of 12 questions grouped into two units, a general and a research unit. After the implementation of the survey method, the completed survey questionnaires in the printed form were entered into the LimeSurvey program and then exported to a specialized statistical program

for data processing SPSS for further statistical processing.

Graph 1. Respondents



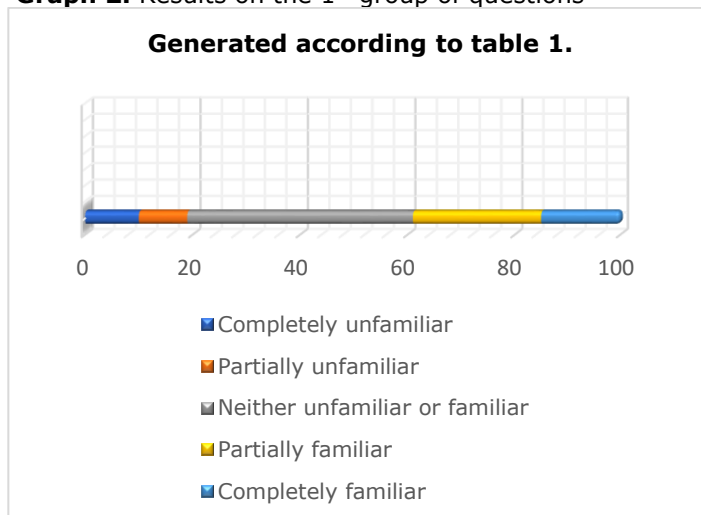
Results and discussion

After the survey, the analysis of the answers received by the athletes - respondents. The results showed that more men (85%) than women (15%) participated in the study and that the predominance of respondents was between 16 and 20 (60% of respondents) years of age. The results of the respondents by gender and age are expected, given the sports and clubs represented in the survey and their membership. A group of questions related to the knowledge of the respondents about the very concept of peripheral nerve injury, crystallized the answer that "neither unfamiliar or familiar" which leads to the conclusion that the respondents themselves are not sufficiently familiar with this, as seen in the example (Table 1) "How much do you know about the term - peripheral nerve injury?" The largest number of 42% of respondents believe that they are neither unfamiliar or familiar, 24% of them are partially familiar. While a significantly smaller percentage of respondents (15%) believe that they are completely familiar, partially unfamiliar (9%) and that they are completely unfamiliar (10%) of respondents. Knowledge or ignorance of the mentioned problems can be explained by the fact that, until the mentioned population encounters injuries of peripheral nerves, they do not show interest in the mentioned topic at all. Such data implies the need for education of respondents by sports coaches and physicians in this area.

Table 3. Results on the 1st group of questions - How well do you know the term - peripheral nerve injury?

Completely unfamiliar	Partially unfamiliar	Neither unfamiliar or familiar	Partially familiar	Completely familiar
10%	9%	42%	24%	15%

Graph 2. Results on the 1st group of questions



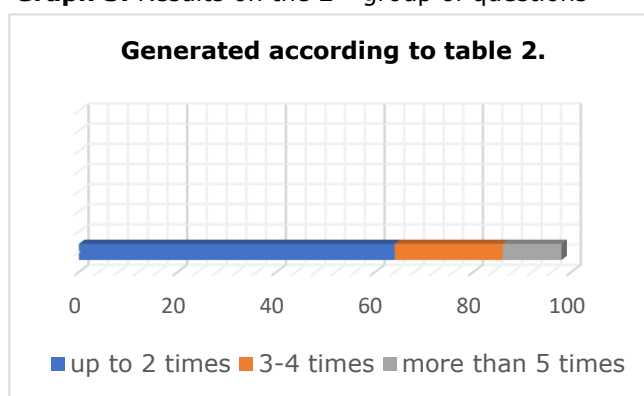
Then, in the group of questions related to the quantitative number of peripheral nerve injuries in the subjects, the answer crystallized to the greatest extent (Table 2) that the subjects had up to 2 injuries in a five-year period (64%) and 3 to 4 times, respectively (22%) or more than 5 times (14%). This group of questions crystallized the

answers obtained, however, doctors in the field of neurology and specialists in this type of injury warn of the fact about the level of knowledge of sports injuries by the respondents. So it should be taken into account that the answers of the respondents from individual clubs differ with regard to their age and interval of playing sports.

Table 2. Summary results of the 2nd question group - How many times have you had a peripheral nerve injury in the past period (5 years)

Up to 2 times	3 – 4 times	More than 5 times
64%	22%	14%

Graph 3. Results on the 2nd group of questions



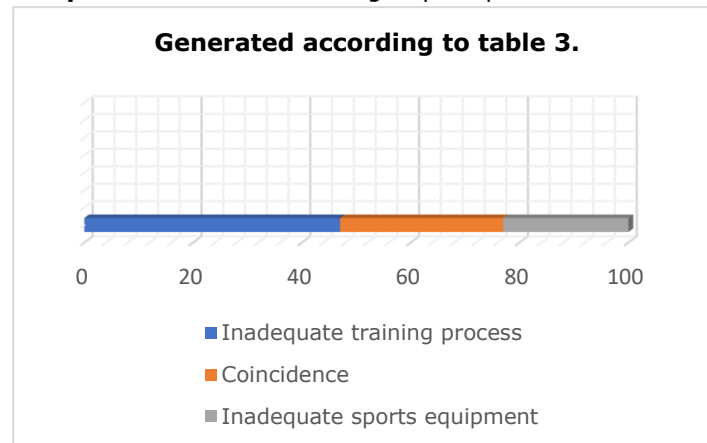
In the group of questions related to the cause of peripheral nerve injury in the respondents, the answer was crystallized to the greatest extent (Table 3), inadequate training process (47%), i.e., a combination of coincidences (30%) and inadequate sports equipment (23%). The answers to the questions point to specific conclusions about the

quality of the training process conducted by sports clubs and to the competencies by sports coaches

who conduct training processes. It must be clearly emphasized that the players of the Zadar Basketball Club state the training process to a significantly lesser extent, but state the sports equipment and hygiene of the surface for maintaining the training process. The answers of the basketball club's respondents are expected, given the status of the respondents in the sports system and the conduct of the training process by an adequate professional.

Table 3. Results of the 3rd group of questions - In your opinion, what caused the injury?

Inadequate training process	Coincidence	Inadequate sports equipment
47%	30%	23%

Graph 3. Results on the 2nd group of questions

In the sub-questions related to the position and role within the sports team, results were obtained that clearly indicate that injuries occur more in certain positions in sports teams, which is also caused by the anthropological status of the respondents. Also, the survey found that injuries to the peripheral nerve are significantly more reflected on the upper torso. Therefore, injuries were found to be more common in soccer goalkeepers and basketball centers compared to other players .

Conclusion

Injuries to peripheral nerves in sports in athletes from the Croatian Football Club Zadar, Women's Football Club Donat, and Basketball Club Zadar, which were a sample of respondents for a previous scientific statement, are not overly pronounced. In relation to the percentage of respondents and their affiliation to a particular sport, injuries are more common in the upper extremities than in the lower extremities, and it is important to emphasize that they have features related to a particular sport and bio-mechanical component in the injury. The questionnaire was used to determine that they occur due to acute injuries, while chronic injuries are excessive. Muscle and joint damage is rarely the result of inappropriate sports equipment. Diagnosing and recognizing peripheral nerve injuries requires an understanding of peripheral

neuroanatomy, knowledge of common nerve injury sites, and awareness of the types of peripheral nerve injuries that are common and unique to each sport in this case football and basketball. As a specific of the previous scientific communication, the importance of certain roles within the sport is emphasized (football goalkeeper, player, the basketball player who plays the position of the center, etc.). Treatment of the aforementioned injuries includes physical therapy, analysis of nerve injury mechanisms, and occasional surgical treatment. It is important to note the necessity and need for the constant active presence of a professional in the implementation of the training process and that there is a misunderstanding among athletes - respondents in this study, which in sports generally represent peripheral nerve injuries. Whether the occurrence of injuries correlates statistically significantly with knowledge of the injury itself, inadequate infrastructure, sports equipment, or just a combination of circumstances, remains for the authors to determine in some future research. The above indicates the need and importance of investing society and the local environment in sports facilities and infrastructure, which will improve the quality of life of its citizens, with the prospect of changing this to the satisfaction of society as a whole (Miočić, Androja & Hoti, 2020).

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Corresponding information:

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Correspondence to: *Luka Androja*

University: *University College Aspira, Split, Croatia*

Phone: +385955061065

E-mail: *luka.androja@aspira.hr*
