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The Structure of Injuries and the Relevance of Physiotherapy for Prevention and Rehabilitation for Medial Tibial Stress Syndrome in Cadets

Struktura urazów i znaczenie fizjoterapii w prewencji i rehabilitacji przyśrodkowego zespołu stresu piszczelowego u kadetów

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SUMMARY

Aim: The purpose of the study was to substantiate the relevance of the introduction of physiotherapy for prevention and rehabilitation for medial tibial stress syndrome in cadets by analyzing of their injuries experience.

Materials and Methods: 256 cadets took part in the retrospective study. The study was conducted in a survey form. The specially prepared questionnaire included questions about injuries and pain syndromes with an emphasis in the manifestation of symptoms of medial tibial stress syndrome.

Results: 59.5% of respondents reported on the occurrence of injuries and pain syndromes during training in higher military educational institutions. The first year was pointed out as the most traumatic by the cadets of all year of studying. Out of all respondents 62% of the first year cadets, 37.8% of the second years, and 32.2% of the third years pointed the first year as the most traumatic. 83.2% of respondents indicated having an experience of injuries and pain syndromes in the lower limbs during training. It was found that 13.6% of injuries and pain syndromes in cadets occur in the lower limbs; among them 62.1% have the localization of pain on the medial surface.

Conclusions: The highest number of injuries and pain syndromes in cadets occurs in the first year of studying. The most common are injuries and pain syndromes of the lower limbs, a third part of which are the injuries of the tibiae area. More than half of all injuries and pain syndromes of the lower limbs are localized on the medial surface, which means the risk of development of MTSS. The obtained results determine the relevance of research on the development and analysis of the effectiveness of using physiotherapy interventions to prevent and treat the MTSS in cadets

Key words: overuse injuries, exercise therapy, chronic disease, lower limb, shin splints

Słowa kluczowe: urazy przeciążeniowe, terapia ruchowa, choroba przewlekła, kończyna dolna, przyśrodkowy zespół stresu piszczelowego

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INTRODUCTION

In the context of the eighth year of armed hostilities in Ukraine, the issue of treatment, rehabilitation and high quality training of military in the Armed Forces of Ukraine is relevant. Injuries of head and lower limbs, which equal 19.44 – 20.87% and 17.37 – 18.61%, respectively [1], prevail in the military members of the Armed Forces of Ukraine. In addition to combat injuries, a high percentage of militaries get injured during regular and mission training. However, there are no statistics of injury in Ukrainian cadets in higher military educational institutions (HMEI).

Based on the statistics of the Colchester Garrison Sports Injury and the Rehabilitation Centre British Army the most common injuries and pain syndromes in recruits are lumbar pain (22.2%) and lower limb injuries (55.8%). It is mentioned

that military training, particularly, excessive physical activity, in 35.2% of cases results the described conditions [2]. Recovery after getting such injuries is usually prolonged and may lead to significant breaks in training and, as a result, decreasing of the training efficiency and force performance [3].

In Ukraine, the main focus is on the analysis of the causes and prevention of acute and severe injuries in cadets, on implementation of effective safety rules` system for organizing their educational process [4]. However, data on the quantity of injuries cumulative and/or chronic of the lower limbs that are caused by excessive physical activity, are not enough. Such injuries include compartment syndrome, stress fractures and MTSS [5]. Researchers pay great attention to the causes, ways of prevention, approaches to treatment and exercise therapy in the case of MTSS [6-8].

AIM

Substantiation of the relevance of the physiotherapy introduction for prevention and rehabilitation for medial tibial stress syndrome in cadets by analyzing of their injuries experience.

MATERIALS AND METHODS

The research was conducted on the basis of the Hetman Petro Sahaidachnyi National Army Academy (Academy) in May 2021.

256 cadets took part in the research: 79 cadets were of the first year study, 90 – second years and 87 – third years. The average age of cadets of all three years at the time of the study equaled 19.73 ± 2.53 years.

The study was conducted by questioning cadets of mechanized and tank troops, whose training and professional activities in comparison with other types of the Ground Forces (in particular, cadets of rockets and artillery troops) mainly goes with more physical loading. The design of research was retrospective cohort study.

For the survey, a special questionnaire form was developed. It consisted of 3 sections containing (1) general questions, (2) questions about injuries and pain syndromes that arose in the period of studying at the academy, (3) questions about the experience of injuries and pain syndromes of the lower limbs with an emphasis on the symptoms of MTSS.

According to the requirements of European bioethics and bio-rights approved by the Helsinki Declaration of the World Medical Association (2008), all cadets were acquainted with the aim and objectives of the study, informed about their

rights (in particular, the right to refuse to participate in the study). The cadets confirmed observance of the principles of respect for the autonomy and dignity of the individual in accordance with the provisions of the Constitution of Ukraine, by signing an informed consent of using the survey results in a scientific study. Processing and analysis of the results were carried out confidentially, in accordance with the Article 32 of the Constitution of Ukraine.

RESULTS

The survey was conducted in cadets of the Faculty of Combat Arms. From all number of first year cadets took part in the survey 59% cadets, from second year studying – 76.3% and third year – 57% cadets. Among the respondents, 20% of cadets had experience of previous military service; 63.3% indicated the presence of bad health habits (namely, smoking).

Answers to the question: “During which years and semesters did you have the most troubling pain or injury?” are presented in Table 1. Out of 256 respondents, 138 (53.9%) people indicated the time of the severest injury as their study period; 118 (46.1%) people did not answer this question.

The experience of the severest injury and the occurrence of pain syndromes during training in cadets through semesters is given in Table 2.

Most of injuries and pain syndromes in cadets occur in the first year of studying and mainly in the first semester, that is, in the first months of studying at the Academy (Figure 1).

It should be noted that 20.3% of cadets were suffering injuries, pain syndromes or their outcomes for several semesters.

Table 1. Number of responses provided by cadets of different studying year about their experience of injuries and pain syndromes

Answers	Cadets			
	1 year (n=79) n (%)	2 year (n=90) n (%)	3 year (n=87) n (%)	Total (n=256) n (%)
Presence of injury during study process	47 (59.5)	37 (41.1)	54 (62.1)	138 (53.9)
No answer	32 (40.5)	22 (58.9)	33 (37.9)	118 (46.1)

Table 2. Distribution of injury and pain syndromes experience in cadets by semesters of studying

Semester distribution	Total (n=138) n (%)	1 year		2 year		3 year	
		Cadets (n=47) n (%)	Number of answers	Cadets (n=37) n (%)	Number of answers	Cadets (n=54) n (%)	Number of answers
I semester	70 (50.7)	35 (74.5)	49	15 (40.5)	49	20 (37)	68
II semester	41 (29.7)	14 (29.8)		19 (51.4)		8 (14.8)	
III semester	25 (18.1)		9 (24.3)	16 (29.6)			
IV semester	12 (8.7)		6 (16.2)	6 (11.1)			
V semester	13 (9.4)			13 (24.1)			
VI semester	5 (3.6)			5 (9.3)			
Total number of cadets, who mentioned 2 or more semesters	28 (20.3)	2 (4.3)		12 (32.4)		14 (25.9)	

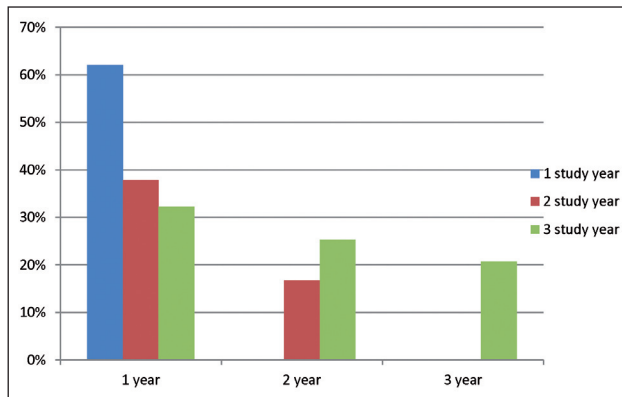


Figure 1. Indexes of injuries or pain syndromes occurring in cadets, depending on studying years

The most typical localization of injuries and pain syndromes of lower limbs in cadets was assessed by the following question: «During the whole period of training, did you have complaints of pain or injury in the indicated parts of the lower limbs?» The injured parts of lower limbs were then shown by cadets on the picture, to demonstrate the required parts.

In general, 83.2% of respondents indicated the presence of injuries and pain syndromes experience in the lower limbs during training (Table 3); only 16.8% of cadets did not give an affirmative answer to this question.

Table 4 represents the distribution of the number of injuries and pain syndromes in different parts of lower limbs in cadets during training.

The occurrence of injuries and/or pain syndromes indicated in 13.6% of cadets; from whom 37.9% complained of pain symptoms in both tibiae, 34.5% – only in the right, and 27.6% – only in the left one (Table 5).

From the total number of injuries and/or pain syndromes in the tibiae 62.1% are of the medial surface (Table 6). The injuries of the medial part of the lower limbs were mainly indicated by cadets of the first year of studying; 31% of the total number of respondents indicated the localization of injury and/or pain syndrome in different parts of the tibiae.

A total of 28.5% among all respondents answered the question: “Did you have any complain of pain in the lower limbs during the recent month of training?” affirmatively (Table 7).

Table 3. Distribution of cadets' answers about the experience of injuries and pain syndromes of the lower limbs

Answers	Year of studying			
	Total (n=256) n (%)	1 year (n=79) n (%)	2 year (n=90) n (%)	3 year (n=87) n (%)
Mentioned the injury during period of training/studying	213 (83,2)	72 (91,1)	68 (75,6)	73 (83,9)
No answer	43 (16,8)	7 (8,9)	22 (24,4)	14 (16,1)

Table 4. Distribution of injuries and pain syndromes number in different parts of lower limbs in cadets during training

Injuries/pain syndromes of lower limbs parts	Year of studying			
	Total (n=213) n (%)	1 year (n=72) n (%)	2 year (n=68) n (%)	3 year (n=73) n (%)
Coxofemoral joint, femur	9 (4,2)	4 (5,6)	0 (0)	5 (6,9)
Knee joint	62 (29,1)	21 (29,2)	19 (27,9)	22 (30,1)
Tibia	29 (13,6)	14 (19,4)	7 (10,3)	8 (11)
Tibial joint, foot	42 (19,7)	16 (22,2)	12 (17,7)	14 (19,2)
No complaints	96 (45,1)	27 (37,5)	35 (51,5)	34 (46,6)
Number of respondents, who chose ≥ 2 variants	25 (11,7)	10 (13,9)	5 (7,4)	10 (13,7)

Table 5. Distribution of tibial injuries and pain syndromes in cadets

Injury/pain syndrome localization	Cadets			
	Total (n=29) n (%)	1 year (n=14) n (%)	2 year (n=7) n (%)	3 year (n=8) n (%)
Right tibia	10 (34,5)	6 (42,9)	1 (14,3)	3 (37,5)
Left tibia	8 (27,6)	4 (28,6)	2 (28,6)	2 (25)
Both left and right	11 (37,9)	4 (28,6)	4 (57,1)	3 (37,5)

Table 6. Tibial injury/pain syndrome localization in cadets

Tibial part	Year of studying			
	Total (n=29) n (%)	1 year (n=14)	2 year (n=7)	3 year (n=8)
Anterior surface	5 (17,2)	-	2	3
Posterior surface	8 (27,6)	1	3	4
Lateral surface	7 (24,1)	4	1	2
Medial surface	18 (62,1)	11	4	3
More than one variant	9 (31)	2	3	4

Table 7. Number of complaints of pain in lower limbs in cadets during recent month of training

Answers	Year of studying/training			
	Total (n=256) n (%)	1 year (n=79) n (%)	2 year (n=90) n (%)	3 year (n=87) n (%)
Have complaints of pain in lower limbs	73 (28,5%)	31 (39%)	23 (26%)	19 (22%)
Have no complaint of pain	183 (81,%)	48 (18,8%)	67 (74,4%)	68 (78,2)

Table 8. Distribution of lower limbs` pain intensity in cadets during recent month of studying

Pain intensity	Cadets			
	Total (n=73) n (%)	1 year (n=31) n (%)	2 year (n=23) n (%)	3 year (n=19) n (%)
Mild	12 (16%)	-	8 (35%)	4 (21%)
Moderate	44 (60%)	22 (71%)	11 (48%)	11 (59%)
Severe	10 (15%)	6 (19%)	3 (13%)	1 (5%)
Intense	6 (8%)	3 (10%)	1 (4%)	2 (10%)
Intolerable	1 (1%)	-	-	1 (5%)

In 60% of cases, cadets, while answering the questions about the intensity of pain in the lower limbs that occurred during recent month of training, characterized it as "moderate" (Table 8).

DISCUSSION

The study of the prevalence of injuries and pain syndromes in HMEI cadets due to physical overuse during training and professional activity is a basis for numerous publications of foreign scientists [9]. In particular, it has been demonstrated that injuries of the musculoskeletal system are a serious burden in the UK armed forces [10].

Special attention is given to injuries that can be prevented by taking into account the risk factors of their occurrence [11]; by an appropriate planning of physical exercises and their progression [12]; by implementing a physical therapy [13]. The injuries described before also include medial tibia stress syndrome. At the same time, in Ukraine there are not such statistical data available and, accordingly, any attention is paid to the prevention and rehabilitation after MTSS in cadets.

The retrospective study of the injuries and pain syndromes of the lower limbs experience in cadets enabled to obtain data on spreading of this kind of injury for the first time. It also

allowed to justify the relevance of introduction of physical therapy for its prevention and rehabilitation in Ukraine.

In particular, 59.5% of respondents mentioned the occurrence of any types of injuries and/or pain syndromes during their studies at the HMEI. This index is significantly higher than the detected level of injuries in English cadets, studied by J. Sharma (2013), which equaled 48.65%. In these cadets, overuse injuries were most typical than acute and chronic [10].

The first year of studying Ukrainian cadets mentioned as the most traumatic: from the total number of respondents, 62% first year cadets, 37.8% - second years, and 32.2% third years had answered this question affirmatively. In addition, 74.5% of first year cadets noted the first semester as the period of highest risk of injury and occurrence of pain syndromes; almost 40.5% of second years and 37% of third years also indicated the first semester as the most traumatic. This equaled 50.7% of all respondents. Such data are agreed with foreign studies that indicate that most of the overuse injuries of the lower limbs occurred in the first 13 weeks of training/studying [10]. It should be noted that the tendency of decreasing the number of injuries and pain syndromes is observed in each following semester of training. 29.7% of respondents indicated the second semester as the most

traumatic period of studying; 18% of cadets named it as the third, 8.7% chose the fourth, 9.4% - the fifth and only 3.6% mentioned the sixth semester as the most traumatic.

Injuries and/or pain syndromes of the lower limbs occurred in 83.2% of the respondents and mostly in cadets of the 1st year (91.1%). The lowest index of MTSS and injuries was in cadets of the 2nd year (75.6%). This is exactly the same as in study of J. Sharma (2013), which indicates an injury prevalence in 82.34% of cadets [10].

It was established that the highest number of injuries and pain syndromes in cadets befall to knee joints (29%), ankle-joints, feet (19.7%) and tibiae (13.6%). Almost 12% of the total number of cadets indicated injuries and pain syndromes of different parts of the lower limbs. Among the injuries and/or pain syndromes, 62.1% of respondents indicated localization on the medial surface.

The biggest number of cadets of the first year of studying (39%) experienced pain in the lower limbs during recent month of training. The intensity of pain in 71% of cases was indicated as moderate, in 19% - severe, and 10% - intense. Cadets of the second and third years in 48% and 59% of cases, respectively, indicated the intensity of pain at moderate.

Pain in the medial part of tibia is one of the clinical signs of MTSS, which is indicated as frequent injury in cadets. Medial tibial stress syndrome (MTSS) (M76.80 according to the ICD-10) is an overuse injury of the lower limbs [14]. This pathology mostly occurs in sportsmen, in particular, athletes (from 13.6% to 20%) and military members (from 7.2% to 35%) and can significantly limit their ability to perform professional physical activities [15].

Development of MTSS has two, supposedly interdependent, yet, inconclusive final etiological theories. The first is hyperextension (under the influence of a physical overuse) of places of attachment of the tibial muscles (sartorius muscle, gastrocnemius muscle, plantar muscle) to the tibia, resulting in their micro-damage and overtension of their attachment places with microtraumatization of the periosteum, which exceed the limits of recovery and lead to its inflammation. [16]. The second is a direct injury of the tibia, under the influence of excessive tension, which leads to bending/distortions of the tibia with the subsequent development of periostitis and pain syndrome [17].

The main clinical manifestations of MTSS is a diffuse pain in the middle and distal part of the tibia, concentrated on the posterior surface. In the case of the first manifestations of the syndrome, pain occurs and increases at the beginning of physical activity and through it; the pain may disappear without any manifestations during rest time. For a difficult course, it is typical the pain does not disappear during the entire tension/activity period, increases and maintains during rest time [16, 18].

The risk of getting the MTSS is particularly high in the military members of the first year of service, who also include the cadets from HMEI [11]. It has been determined that the course of primary military training can lead to periostitis of the tibia in 10% of cadets and 60-80% of all injury cases are associated with musculoskeletal overuse [19].

Individuals who have this syndrome are prone to relapses of the disease; without proper treatment and rehabilitation there is a risk of developing of a chronic form, which leads to limitation of functioning. MTSS can also become a trigger to a stress fracture, an injury that requires longer treatment and recovery period [6-8].

Unfortunately, the recovery time after the MTSS, as a rule, is also long. Studies demonstrate that full recovery can be achieved on average in the period from 102 to 118 days [20]. All this negatively affects the process of professional training of military members, in particular, reduces the level of their theoretical knowledge and practical skills, and also leads to significant spending for treatment and recovery.

It has been proven that MTSS can be prevented by implementing a physiotherapy [21]. Means of physiotherapy are the main intervention for the prevention and rehabilitation for MTSS among servicemen of the foreign armed forces, because they reduce the risk of its occurrence, significantly decrease the recovery period and prevent complications [12, 13].

All the above determines the relevance of using means and methods of physiotherapy in prevention and treatment of MTSS in servicemen of the Armed Forces of Ukraine.

LIMITATION

Given the design of the study is retrospective, part of data may have been incomplete. Lack of requirements to diagnose and practice to record overuse injuries and pain syndromes in the medical service of the academy, made it impossible to carry out a statistical analysis of such data.

CONCLUSIONS

The results of the study indicate the prevalence of injuries and pain syndromes of the lower limbs in Ukrainian cadets, that were indicated by 83.2% of people.

The biggest number of injuries occurs in the first year of training. The main part of injuries and pain syndromes that occurred in the lower limbs is registered in the first semester of training - this is the time when cadets are the least prepared for a heavy physical exertion.

Among other injuries and pain syndromes of the lower limbs, 13.6% occur in tibiae. Often, their medial surface is affected (62.1%), which means a risk of developing MTSS. The main outcomes of this injury in cadets are serious functional limitations and risk of complications, which prolongs the time of treatment and recovery, and therefore leads to decreasing in training efficiency and level of force performance.

Thus, research on finding ways to introduce physiotherapy for the prevention and rehabilitation after medial tibial stress syndrome in cadets is relevant.

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Conflicts of interest:

The Authors declare no conflict of interest

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