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Original article

PROBLEMS OF FIRST AID TO VICTIMS ON RUSSIAN SKI RESORTS

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Abstract. *The purpose of the study is* to determine the measures necessary for effective first aid to victims in specific conditions of ski complexes (GC).
Materials and methods of research. When forming the general theoretical base of the scientific research, we used extensive analytical material devoted to certain aspects of the organization of first aid and medical assistance to victims at the scene of the event, contained in the works of Russian and foreign scientists. A comprehensive comparative analysis of normative legal acts on the problem under consideration is performed.
Research results and their analysis. The issues of first aid to victims in ski resorts of the Russian Federation are considered. Attention is drawn to the insufficient powers of employees of emergency rescue units (ASF) to provide effective first aid, as defined by the legislation of the Russian Federation and other regulatory legal acts.
The article highlights the specifics of providing first aid to victims on ski slopes, proposals to expand the permissible actions of rescuers are substantiated, designed to ensure the maximum effectiveness of first aid during the "Golden hour" before the arrival of emergency medical teams. The recommended additions to the powers of specially trained rescuers are divided into first aid actions directly on the slope and actions at the control and rescue point at the foot of the mountain while waiting for the arrival of the SMP team. The most significant proposals for expanding such powers include the possibility of infusion therapy, the use of general analgesics, and the installation of an air duct in the absence of consciousness of the victim.

Key words: *ambulance, extended first aid, first aid, "Golden hour", rescuers, ski resorts, victims*

Conflict of interest. The authors declare no conflict of interest

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Оригинальная статья

ПРОБЛЕМЫ ОКАЗАНИЯ ПЕРВОЙ ПОМОЩИ ПОСТРАДАВШИМ НА ГОРНОЛЫЖНЫХ КОМПЛЕКСАХ РОССИИ

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Резюме. *Цель исследования* – определение мероприятий, необходимых для эффективного оказания первой помощи пострадавшим в специфических условиях горнолыжных комплексов (ГК).
Материалы и методы исследования. При формировании общетеоретической базы научного исследования использовался обширный аналитический материал, посвящённый отдельным аспектам организации оказания первой и медицинской помощи пострадавшим на месте события, содержащийся в трудах российских и зарубежных учёных. Выполнен комплексный сравнительный анализ нормативных правовых актов по рассматриваемой проблеме.

Результаты исследования и их анализ. Рассмотрены вопросы оказания первой помощи пострадавшим на горнолыжных комплексах Российской Федерации. Обращено внимание на недостаточность полномочий сотрудников аварийно-спасательных формирований (АСФ) по эффективному оказанию первой помощи, определяемых законодательством Российской Федерации и другими нормативными правовыми актами. Отмечена специфика оказания первой помощи пострадавшим на горнолыжных склонах, обоснованы предложения по расширению допустимых действий спасателей, призванных в период «золотого часа» обеспечить максимальную эффективность оказания первой помощи до прибытия бригад скорой медицинской помощи (СМП). Рекомендуемые дополнения к полномочиям специально обученных спасателей разделены на действия по оказанию первой помощи непосредственно на склоне и действия в контрольно-спасательном пункте у подножия горы в ожидании прибытия бригады СМП. К наиболее существенным предложениям по расширению таких полномочий следует отнести возможность проведения инфузионной терапии, применения общих анальгетиков и установки воздуховода при отсутствии сознания у пострадавшего.

Ключевые слова: *горнолыжные комплексы, «золотой час», первая помощь, пострадавшие, расширенная первая помощь, скорая медицинская помощь, спасатели*

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Introduction. The scope of rendering first aid to injured is a subject of constant debate [1-3]. The order of the Ministry of Health and Social Development of Russia "On the approval of the list of conditions in which first aid is provided and of the list of first aid measures" limits the powers of persons obliged to provide first aid. When it is difficult and sometimes even impossible to ensure the access of medical workers to the injured immediately after an injury or an emergency incidence, the provisions of the order come into collision with the rule of the "golden hour" and may endanger not only the health, but also the life of injured [4].

Currently, professional rescuers are not legally authorized to perform such medical care actions as, for example, infusion therapy, installation of an air duct for asphyxia prevention, injection of analgesics. In case of a threatening condition, these measures should be performed as early as possible and, in accordance with the current regulatory framework, only by a medical worker. However, medical workers who are not certified to carry out emergency rescue operations are not allowed to enter into an emergency location.

In this regard, introduction of the concept of an "extended first aid", which may include some actions that are currently the prerogative of medical workers, is currently being actively discussed [2, 3]. Of course, each situation has its own specifics, and "extended" first aid measures should not go beyond reasonable sufficiency.

The aim of the study is to determine the measures necessary for an effective provision of first aid to injured in the specific conditions of ski resorts (SR).

Materials and research methods. When forming the general theoretical base of scientific research, extensive analytical material was used. The material, devoted to certain aspects of the first and medical aid organization at the scene of the event, has been found in the works of Russian and foreign scientists.

A comprehensive comparative analysis of regulatory legal acts – 3 federal laws, 4 orders of the Ministry of Health / Ministry of Health and Social Development of Russia, 2 GOSTs, as well as other bylaws of the Russian Federation was carried out. All of them regulate organization of safety of skiers and snowboarders, as well as the first aid provision to injured at SR.

Research results and their analysis. In the last decade, an active development of SR in the mountainous regions of Russia and around large cities takes place in the context of an acute lack of a regulatory framework on the use of ski slopes and their safety [5]. The legal foundations of the first aid and medical care for skiers and snowboarders who are injured or become acutely ill (in an emergency state) on the SR territory have not been regulated either. The largest representatives of the ski industry, on their own initiative, include units to provide first and, with an appropriate license, medical assistance to injured to their staff structure. However, at the federal level, the requirements for the competence and for the number of employees as well as for the mode of operation of such units are not formulated and are actually at the discretion of the SR management. In fact, the organization of the first and medical aid provision largely depends on the SR management. While the driving forces behind the decisions of the SR management are the competition for the consumer at the service market as well as the desire to get good reviews from guests about the work of the complex. Many SRs that do not have large budgets do not organize such units at all.

The issues of rendering assistance to skiers and snowboarders are discussed in GOST R 55881-2016 "Tourist

[1] Приказ Минздравсоцразвития России от 04.05.2012 №477н – Приложения №1, 2
[2] Федеральный закон «Об основах охраны здоровья граждан в Российской Федерации» от 21.11.2011 №323, ст. 32
[3] Федеральный закон «Об аварийно-спасательных службах и статусе спасателей» от 22.08.1995 №151-ФЗ, гл. 1, ст. 1.4

services. General requirements for the activities of ski resorts" and GOST 57279-2016 " Assessment of ski resorts' services". Unfortunately, these documents contain numerous terminological errors. For example, first aid there is referred to as "first pre-medical", then as "first medical" aid, which considerably reduces the legal significance of these regulatory acts. In addition, at present, GOSTs are not mandatory, but recommendatory in nature and cannot become the basis for a widespread inclusion of units designed to provide assistance to injured in the SR staff structure.

In the order of the Ministry of Culture of Russia "On approval of the procedure for the classification of objects of tourism industry, including hotels and other accommodation facilities, ski slopes and beaches, carried out by accredited organizations" dated July 11, 2014 No. 1215, Appendix 19 in the list of criteria required for classifying the difficulty level of the ski trail, the "provision of medical care" is mentioned, but without specifying volume, type, forms and conditions of its provision.

In the Federal Law "On Industrial Safety of Hazardous Production Facilities" dated July 21, 1997, No. 116-FZ, and in the Safety Rules for passenger cable cars and funiculars, cable cars are classified as hazardous production facilities. According to these regulations, an enterprise operating hazardous production facilities is obliged to conclude a service contract with a professional emergency rescue team (ERT) or to create its own professional ERT.

When certifying for the status of a rescuer, employees of professional ERT must study the basics of first aid. Thus, at present, according to the current regulations, the provision of first aid on the ski slope is the responsibility of the ERT employees who maintain the operation of the cable cars. However, the number and often the extraterritorial deployment of these ERTs does not imply, in the normal mode of their operation, a rapid provision of first aid by the ERT employees to all injured on the territory of the complex.

Medical assistance to skiers and snowboarders who are injured or seriously ill (in an emergency state), with rare exceptions, is provided by emergency medical teams (EMT) arriving on call. Exceptions to this rule are SRs that have their own medical forces or employ ambulance teams on a contractual basis for medical support during the operation of the cable cars.

Considering that the SRs in the vast majority of cases are located outside large municipalities, the time of arrival of an ambulance brigade can significantly exceed 20 minutes (on average 40-60 minutes). The 20 minutes span is mentioned in the Procedure for the provision of an ambulance, including a specialized ambulance, medical assistance. Its overrun contributes to the emergence of complications or of an emergency due to the late start of medical care provision or even endangers the life of injured.

The upcoming amendments to the Federal Law "On the Fundamentals of Health Protection of Citizens in the Russian Federation", designed to expand the range of first aid measures for certain categories of workers can become a solution to this issue. The authors analyzed, through interviews with employees of the SRs' rescue units of various regions of Russia and through analysis of foreign experience, which activities can expand the abilities of the SRs' employees in providing first aid to injured, taking into account the specifics of such facilities.

The main features of providing first aid to an injured person on a ski slope are:

- constant threat for an injured and for persons providing him/her with first aid, to collide with other skiers;
- exposure to low temperatures;
- high-altitude hypoxia;
- troubled full examination of an injured, who often has unclear symptoms in the vagueness of the incident's circumstances;
- need to transport the injured to the foot of the slope;
- remoteness from medical organizations (MO);
- prevalence of traumatic incidents.

Some of these features urge the need for certain clarifications and adjustments to the list and nature of first aid measures provided in SR.

Slope threat

An immutable rule and the first priority in providing first aid is to eliminate external threats. Unfortunately, this task cannot be fully accomplished on the slope. In mountainous terrain and on ski slopes such threats as possible collision with other skiers, avalanches, exposure to low temperatures and high-altitude hypoxia persist. These circumstances urge the need to minimize the volume of first aid measures on the slope, sometimes limiting them to life-saving actions and a rapid careful movement of the injured into a heated room – a control and rescue point (CRP) at the foot of the slope, which has accessible roads for the arrival of an ambulance brigade. With such transportation, carried out taking into account the relief of the slope as well as the severity of an injured person's condition, it is necessary to use special transport equipment – akyu (rescue sledges) or a snowmobile.

Exposure to low temperatures

Natural factors such as low temperature and high air humidity, strong wind, combined with an injury or an emergency and physical inactivity, contribute to the development of general hypothermia or frostbites of individual areas. In view of this, undressing the injured or exposing parts of his body, for example, for examination or providing wide access to the wound, on a slope increase the likelihood of cold injury and is permissible only in exceptional cases.

To protect the injured from exposure to low temperatures, it is necessary to use the entire range of means available at the scene. In the simplest version, it is the lining of a heat-insulating material, for example, ski gloves, under the body of the injured during examination and first aid, wrapping him/her up with a thermoregulatory material (woolen blanket, thermal insulation film, electric blanket) and the fastest possible transportation into the CRP. During the transportation of the injured, it is possible to use special heating elements, also by applying them to the body in the areas of projection of the main vessels. Transportation of the injured is performed mainly in the supine position. The methods of preventing hypothermia should also comprehend the storage of transport devices (akya, stretcher-drags) and of immobilization means in a warm room until they go to the injured.

Altitude hypoxia and altitude sickness

Symptoms of altitude sickness rarely occur at an altitude of less than 2 thousand meters above sea level, but almost always manifest themselves with a rapid ascent to an altitude of over 4 thousand or even more than 3 thousand meters above sea level. When climbing to a height, the human body

[1] Приказ Федеральной службы по экологическому, технологическому и атомному надзору «Об утверждении федеральных норм и правил в области промышленной безопасности. Правила безопасности пассажирских канатных дорог и фуникулеров» от 06.02.2014 г. №42

[2] Программы профессиональной подготовки, переподготовки и повышения квалификации спасателей МЧС России от 24.12.2013 г.

[3] Приказ Минздрава России «Об утверждении Порядка оказания скорой, в том числе скорой специализированной, медицинской помощи» от 20 июня 2013 г. № 388н, Приложение 2, п.6

[4] Федеральный закон «Об основах охраны здоровья граждан в Российской Федерации» от 21.11.2011 г. №323, ст. 31

acclimatizes to new conditions gradually – within about 10 days. However, often the SR guests are not ready to spend their time on full acclimatization to new conditions and start skiing on the first or second day after arrival. The risk of acute symptoms of altitude sickness is highest in the first few days. The onset of altitude sickness manifestations usually occurs after the first period of sleep and reaches a maximum after 72–96 hours. The most common symptomatology manifests itself as headache combined with increased fatigue, dizziness, sleep disturbance and weakness, nausea and vomiting, decreased concentration while skiing on a slope, as well as exacerbation of chronic diseases. In severe cases, rapidly increasing pulmonary or cerebral edema appear. Particularly dangerous is the combination of this condition with an injury upon falling on a slope. Oxygen inhalation helps to cope with the symptoms of high-altitude hypoxia. Thus, the possibility of using the simplest oxygen equipment is a required competence among the employees of the SR rescue units.

Transportation

Transporting of the injured from the slope often require: a repeated transfer – from snow to the spinal shield, to the akyu, to the couch in the PCB, to the gurney of the ambulance brigade, etc .; moving on slopes of varying steepness; changes in the speed and direction of the vehicle. The transportation itself, depending on the location of the incident, can last 30–40 minutes or more. In such cases, the issue of transport immobilization is one of the key ones. Rescue teams at SR extensively use vacuum splints, collars and mattresses. Less comfortable, but sometimes irreplaceable, are the Kramer's flexible tires. In cases of femur fracture (shock injury), distraction splints such as KTD (Kendrick traction device) and STS (Slishman-traction-splint) are used, which allow skeletal traction of an injured limb.

Spinal shields, short spinal splints (such as KED, Kendrick Extrication Device), bucket stretchers are used for shifting, extracting and transferring of injured over short distances. Experience shows that long-term fixation of an injured on a hard surface, for example, on a shield or a bucket stretcher, can undermine the transportation safety. Therefore, these devices are mainly used to retrieve an injured from a hard-to-reach place and to transfer him to another device. For immobilization and transportation, vacuum mattresses are an optimal solution.

If it is necessary to move an unconscious injured person in the supine position on the slope, the task of maintaining patency of the upper airway becomes significant. In situations where it is impossible to use a stable lateral position of an injured, a very popular manipulation is the installation of an epiglottis duct by rescuers, which currently is not within their competence, since it is not authorized by relevant regulatory documents.

Stopping bleeding

Stopping an external bleeding at the scene of the event in case if it is accessible through an incision in clothing is carried out in most cases by applying a roller pressure bandage onto the wound. Cutting clothes, exposing a part of a body on a slope is often inappropriate due to low ambient temperatures. However, in case of severe external bleeding, a good alternative and addition to a pressure bandage is the use of local hemostatic agents based on physical and chemical methods, for example, of agents based on zeolites and chitosan – powders, bandages and tampons from Ellarga, Celox, Hemostop [6]. This allows sometimes to avoid an imposition of a hemostatic tourniquet – a manipulation that is more dangerous in conditions of low temperatures and high-altitude hypoxia.

For injuries associated with a large loss of blood, with polytrauma, in order to prevent and to arrest hypovolemic shock on a ski slope and during medical evacuation, it is advisable to use an anti-shock suit of "Kashtan" ("Chestnut") type. The operation principle of the suit consists in controlled external pneumatic compression of the body lower half, leading to a redistribution of blood flow to the overlying organs and to the brain. The design of the suit includes a soft stretcher and distraction splints for the lower extremities. External compression helps to stop external and intra-abdominal bleeding and to immobilize lower extremities and pelvis. Thus, the suit makes it possible to enhance anti-shock measures in polytrauma with dominant abdominal, skeletal and spinal-spinal injuries, to stabilize systemic hemodynamics and to extend the "golden hour" time.

Resuscitation measures

Ensuring the continuity of cardiopulmonary resuscitation (CPR) complex while organizing the descent of an injured from the slope is a complex task [7]. Currently, at the SRs in our country and abroad, this problem is solved in two ways: by placing a rescuer conducting continuous CPR together with an Injured on a vehicle (akya) while moving or by alternating short "non resuscitation" descents with long stops to resume the execution of the complex CPR. The first option is technically feasible on relatively gentle slopes with the transport equipment having appropriate characteristics – an akya should have a flat solid bottom, allow an injured to be placed in full growth and the rescuer to be placed with a footrest on the side or above the injured. The second option is used on steep slopes in the absence of a possibility of safe placement of a rescuer together with an injured.

The possibility of use of a hand-held breathing apparatus such as an Ambu bag, as well as of use of an automatic external defibrillator, are in great demand for rescuers when CPR is needed, especially considering the length of time it takes to move along the slope and to wait for the arrival of an ambulance team to the SR territory.

Continuing first aid at the control and rescue point

At the control and rescue point, where an injured is transported from the slope, while waiting for the arrival of an ambulance team, it is often necessary to continue and to increase the scope of activities begun on the slope. If there are a shock injury, as well as signs of massive blood loss and of hypovolemic syndrome, it is highly desirable to start infusion therapy using intraosseous access as early as possible. To identify the Indications for this, rescuers should be able to measure blood pressure (BP) level and to conduct pulse oximetry. In our opinion, the possibility of using injectable painkillers is required in similar situations, too.

When providing first aid to an injured person at the SR, until he/she is handed over to an ambulance brigade, the ERT employees need to release the injured from his/her equipment – take off his/her ski or snowboard boots, helmet, etc. This procedure should be carried out indoors, not on a slope. It should be noted that untrained employees of a hospital emergency room, who do not know the specifics of such equipment, can inflict additional injury on the injured when he/she is released from the equipment. Practice shows that in many ski areas, even with an established interaction and cooperation with the ambulance service and with the nearest medical hospital, only employees of the SR rescue service can properly remove ski and snowboard equipment from an injured. In our opinion, the permission for the SR employees to carry out this manipulation should also be formalised in regulatory documents.

Conclusions

1. 1. Under specific conditions of ski resorts, the scope of first aid measures provided for by the order "On approval of the list of conditions in which first aid is provided and the list of first

aid measures" is insufficient to ensure adequate assistance to injured and, thus, should be expanded.

2. It is advisable to supplement the powers of the SR rescue service employees to provide first aid on the ski slope with the following:

- use of oxygen equipment in conditions of high-altitude hypoxia;
- installation of a supraglottic air duct to prevent asphyxia during transportation of an injured from the slope;
- use of local hemostatic agents;
- use of a hand-held breathing apparatus;
- use of an automatic external defibrillator.

3. At the control and rescue point, before the arrival of emergency workers, first aid measures should be supplemented with:

- measuring of blood pressure and pulse oximetry;
- use of infusion therapy with crystalloid solutions through intraosseous access;
- use of injectable anesthetics;
- removal of ski and snowboard equipment from an injured.

4. After making appropriate amendments to the legislation and regulations, training in the above mentionned skills should be included in training programs for rescuers, either as a basic course, or as an additional training course for working at ski resorts.

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