31st Pelikán's Seminar 2021 „ Medical Aspects in Mountaineering "

29.-31. 10. 2021, Chata Jiřího na Šeráku

On 29.-31.10.2021, the 31st Pelikan Seminar, a regular annual meeting of those interested in mountain medicine, took place in the Jiří Chalet at Šerák. The event was organized jointly by the Czech Society of Mountain Medicine and the Methodological Commission of the Czech Mountaineering Association. After an enforced break in 2020 and after moving the venue of this year's event from Tatranská Lomnica in Slovakia, both due to the epidemic of the COVID-19 disease, the event was still attended by over 70 participants.

Opening

Friday evening as usual belonged to the travel lecture of **Igor Hermann, MD**. This year the focus of his talk was ***Svanetia, the pearl of the Caucasus***, where he went on an expedition in the 1980s. In addition to describing the natural and cultural beauties of the place, he also described the case of a very difficult evacuation of one of the expedition members after a fall into a crevasse, during which, among other things, he suffered a head injury.

Pelikan's seminar was ***officially opened*** on Saturday morning, October 30. The President of the Czech Society of Mountain Medicine, **Lenka Horáková, M.D.,** and the Chairman of the Methodological Commission of the Czech Mountaineering Association, **Jiří Vogel**, gave the opening speech.

Insurance of Mountaineers

The first lecture of **JUDr. Jiří Žák** was on a very topical subject: ***Insurance, or a bit of context regarding the reimbursement of the costs of treatment of injuries***. The motivation for the lecture was the recent well-publicized case of climbers in Pakistan whose rescue operation was refused by the insurance company. Therefore, Jiří Žák repeated some basic rules of insurance. The basis is the so-called blue EHIC card, which provides the holder with treatment in a public health facility within the European Union (EU), under conditions and deductibles corresponding to the treatment of local citizens. Should the injured person be treated in a private medical facility, he or she must pay for the treatment locally, but the Czech health insurance company (ZP) will then reimburse the medical expenses. Outside the EU, again, the treatment is paid for by the person being treated, but on return, the Czech health insurer will reimburse the amount that the ZP would have given for treatment in the Czech health service. The problem is that EHIC insurance does not cover search and rescue. The alternative is commercial travel insurance, which covers rescue and search operations, plus a possible deductible for treatment. However, even commercial insurance has limits on coverage, e.g., strict limits on dental treatment, beware of limits on types of sports, including high-risk ones. The lists of conditions in the insurance contract under which the insurance company will not pay are key. One such situation is when local laws or rules are broken in a foreign country. Some insurance companies also offer certain benefits, such as covering repatriation costs, compensation for long-term consequences, etc. An interesting alternative to commercial insurance companies is travel insurance linked to a credit card. If an insured event already happens, it is important to contact the assistance service of the insurance company in time and follow its instructions

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MUDr. Kristina Höschlová continued with interesting ***case studies from mountain medicine***. First, she presented two case reports of ***frostbite***. ***The first one*** was a case of a young woman, a cross-country ski racer, who had completed a 60 km race in Italy in extreme cold. Unfortunately, during the race she did not perceive the effect of the big frost, which was probably due to the adrenaline of the race. After the race she discovered that her fingertips were white and numb. As a first aid measure, she immersed her hands in lukewarm water for an hour. According to the latest knowledge, this is not optimal, as lukewarm water causes micro-crystals to clump and further damage soft tissue. A better prognosis is obtained by those who immediately heat the frostbite in 40°C water for 30 to 60 minutes, which in practice means that the water must be continuously heated during this process. It is advisable to put a small amount of disinfectant in the water. The extent of the frostbite of the said runner corresponded to grade 2, which has no risk of amputation if further therapy is correct. While consulting such cases, Kristina typically encounters questions like: Can I continue racing? Will they amputate my fingers? The answer here is that amputation is unlikely, but racing should be postponed until after healing. In the Czech Republic, the victim was treated in a surgical ward where the blisters were perforated, which is not an optimal procedure too, but if performed under aseptic conditions, it does not significantly compromise the healing outcome. The bigger problem was covering the frostbite with tightened gauze dressings. It is preferable to use the so-called shredded gauze, i.e., shredded gauze that is only loosely fixed. She was given intravenous prostaglandin, low molecular weight heparin and antibiotics at a specialist hand surgery unit, a treatment protocol appropriate for up to grade 3 frostbite but should not be an explicitly harmful procedure for her. She also used Ruticelit, which is a preparation with a mixture of herbs and earthworm extract, among other things, as an adjunctive treatment at a distance. Kristina has already had a case of successful treatment of frostbite with this product and it can be used as an adjunct treatment. The last contact with the patient was on the 53rd day after frostbite, when she was still taking Acylpyrine and Pentoxyfylline daily, which is already an unnecessarily long administration, but the importance of the placebo effect must be taken into account.

The second case concerned a Tatra porter. This 40-year-old man spent 3 hours in a snow storm, upon arrival at the hut he suspected that he had suffered frostbite and therefore immediately dipped his fingers again only in lukewarm water for 25 minutes. Photographs taken the next day suggested that the frostbite was grade 3, but unfortunately, he was given inadequate treatment at the local clinic corresponding to grade 2: Ibuprofen, Aescin, Pentoxyfylline. No ATB or key prostaglandin was given. As he was already at risk of amputation at grade 3, he presented the international recommendations for frostbite treatment to his attending physician at the local surgical outpatient clinic, but continued to be treated according to the practice of the department. After 14 days, amputation had to be proceeded with, yet he was still off antibiotics, was given Pentoxifylline, Aescin and underwent several sessions in a hyperbaric chamber. Regarding the use of Pentoxifylline: this drug is no longer recommended to improve rheology, more important is the correctly indicated administration of prostaglandin. Unfortunately, even after the amputation he did not heal well; due to extensive necrosis, reconstructive surgery with graft harvesting from the forearm was necessary.

Dr. Höschlová summarized these two case reports in a few ***general conclusions***. First and foremost, it is necessary to continue to urge adherence to the latest recommendations, as especially in grade 3 and 4 frostbite, the first 48 hours are crucial. Furthermore, it is necessary to be constantly aware of the risk factors for frostbite, which include, among many others, high altitude and the associated effect of hypobaric hypoxia. In

the case of frostbite occurring in high mountains, descent to lower altitudes is part of the treatment, or simulation of such a descent using a Gamow bag or administration of oxygen. The method of warming the frostbitten areas is also important and currently a rapid heating in a water bath with disinfection at 40°C for one hour is preferred. Most importantly, management in the first 48 hours after injury is critical, including the correct indication for prostaglandin and antibiotic administration. There are also reports of very good therapeutic outcome in grade 4 frostbite when Illoprost is administered within 12 hours.

The third case report dealt with **vi*sual disturbances at heights***. Kristina Höschlová presented a case report describing visual disturbances in a young female climber 3 years ago. It was probably a case of high-altitude retinopathy during an expedition at 6000 to 7000 m above sea level, where the woman temporarily went completely blind. Now Kristina has presented a new case report of a man who has experienced symptoms of high-altitude sickness in the past. On his current expedition, he was transferred by helicopter to 3500 m, where he rested for 3 nights with acclimatization trips to 4000 m. He had milder symptoms of altitude sickness which started to subside on day 3. He then went to base camp (BC) located at 4800 m above sea level, which again caused him difficulties due to the high altitude compared to the first site, including headaches and drops in peripheral blood oxygen saturation (SpO_2) to 70 %. He spent 4 nights in BC and as he was a bit relieved on the last night, he went to the first altitude camp (C1) at 5700 m. The whole process was repeated when he went to Camp 2 (6300 m), where he was really very sick, but he still ascended to Camp 3 (6700 m), where he started to see badly. He had blurred vision, strabismus (squinting), and eye movement disorder. This man has a significant ophthalmological history: he has a congenital eye defect, poor distance vision, and has even undergone special vision correction. In addition to the ***high-altitude retinopathy***, he certainly had subclinical symptoms of high-altitude cerebral edema, with the eye flexors becoming a predilection site. The impairment of spatial vision was subsequently very dangerous during forced descent. He returned to Base Camp, but there was no improvement in his condition, so after 4 nights in BC he was evacuated by helicopter to Kathmandu, where his condition improved after a further 4 days. On return to BC, his eye examination showed only residual haemorrhages, and strabismus also persisted. The patient subsequently reported three other similar cases to Dr. Höschlová. On the same expedition to an eight-thousand-foot peak, another climber had a complete loss of vision, which subsided after administration of dexamethasone. On another expedition, another man suffered permanent visual impairment as part of a high-altitude illness, apparently due to ischemia of the n. ophtalmicus. The fourth man reported also had strabismus related to high altitude exposure, but this disorder did not resolve and became permanent.

These case reports also provide some very important information: disturbances of eye innervation can be a manifestation of the ***high-altitude cerebral edema***. Even retinopathy is etiologically close to the high-altitude cerebral edema, as there is congestion, overpressure in blood vessels, microthromboses and this causes local bleeding. Hyperviscosity of the blood, in which polycythemia and dehydration are involved, also plays a role. Again, in first aid, the main thing is the administration of oxygen and descent, including the use of a Gamow bag. After descent, the vision usually improves, but this is where it gets tricky as many climbers subsequently consider returning to high altitude. However, new exposure to hypoxia is very risky, leads to a return of symptoms, often even more severe symptoms, and in the worst cases can lead to permanent consequences. Last but not least, it is important to remember that visual disturbances are one of the symptoms of altitude sickness and can progress to cerebral oedema at altitude, so descent is crucial in first aid. The administration of dexamethasone may also be considered, but as we know, this drug is a good servant but a bad master. The administration of antiplatelet agents is also complicated as thrombotic and bleeding phenomena are often combined in

the pathophysiology of these conditions. If difficulties persist after descent, the administration of the aforementioned dexamethasone may be considered. A relapse of difficulties can be expected within a few days. Nevertheless, even after a longer period of time, typically after returning home from an expedition, it is possible to detect residues on ocular examination. With further exposure to hypobaric hypoxia, there is not only a risk of reappearance of symptoms but also a higher risk of more permanent damage.

The most recent case was a **helicopter accident in the winter mountains**. It was a commercial flight for winter tourism, with 5 people and the pilot on board. During the flight, powdery snow was apparently stirred up, the so-called *white darkness* effect was created, the pilot, after losing his orientation, jerked the tail of the helicopter and a controlled crash ensued. Although radio contact with the helicopter was immediately lost, for reasons not yet explained, this was not identified as a possible accident until 2 hours after the crash and it took 6 hours for help to physically reach the accident site. Of the 6 persons, only one was found alive, her dominant disability being frostbite. The author is aware of the autopsy result of one of the other victims of the crash, who according to the autopsy report suffered a fractured rib and chest contusion, which are not clearly fatal injuries. Moreover, given that the sole survivor had frostbite as the dominant disability, it is highly unlikely that the other passengers died as a result of trauma. In similar accidents, the mechanism of injury must be taken into account. Therefore, hypothermia should have been considered as a possible pathology, and the well-known adage applies: *nobody is dead until warm and dead*. And so, the questions remain: what chance did the others have of survival? What caused the long delay in starting the rescue operation? What was the real cause of death?

Education in mountain medicine – Diploma of Mountain Medicine

After a number of interesting case studies, **MUDr. Kristina Höschlová** presented her second lecture on ***Special Education in Mountain Medicine***. As the organizer of the very successful Mountain Medicine Courses, she summarized their course and possible perspectives for the future. The course scheduled for 2020 stretched until 2021, but despite the COVID-19 disease pandemic, 24 course participants from a number of European countries attended. A total of four editions of this course have been held, which has received recognition by the international organisations ICAR, ISMM and the UIAA Medical Commission. The first two courses corresponded to the internationally recognised Diploma in Mountain Medicine (DiMM) for doctors and professional rescuers. The third course was aimed at mountaineers and was characterized mainly by the high entry level of the participants. Its concept was presented to and received support from the aforementioned organisations (ICAR, ISMM, MedCom UIAA). The fourth and final course was unique in that it combined these two interest groups - i.e., the paramedics attended the course together with climbers and mountain guides. A total of 71 participants passed the courses, of which 48 were medical doctors who received the full DiMM diploma, the rest received a certificate with recognition from ICAR, ISMM and MedCom UIAA. Trends and future of mountain medicine courses internationally was the theme of the symposium of its organizers. Probably the biggest issue that was discussed is online vs. offline teaching. The author of the paper is of the opinion that mountain medicine courses are based on practical training, which cannot be imitated online; collaboration, interaction, and last but not least mutual respect are essential. Even in real-life situations, cooperation between medics, members of the mountain service, as well as mountain guides and other mountaineers is a given, and this sense of cooperation needs to be cultivated. In this Czech course it was also confirmed that it was possible to organise a full-time course with international participation even in a difficult pandemic period. Another question is what is the target group for such courses. A great interest is registered both among health workers and non-health workers, who also play a very important role in rescuing people in the mountains. Often these are leaders, guides and other mountaineers who have in the past had responsibility for others in the mountain environment. Those whom Kristina Höschlová had the opportunity to meet on the courses had already a very good medical education. That is why she also believes that the future of the courses lies in this hybrid format of health professionals with non-health professionals. At the same time, however, Kristina announced that she did not intend to continue to run the courses and therefore tried to outline further training opportunities in this area. There are currently 22 DiMM courses registered in medical mountaineering community, but not all centres are now active. In addition, the so-called DiMM Speciality Courses have emerged: 6 Terrestrial Rescue, 9 Wilderness and Expedition Medicine, 3 Alpine Helicopter Rescue. In general, the trend of DiMM courses is to upgrade the curriculum, introduce new accreditation rules and "refresh courses" (at the latest in 5 years) and organized training of organizers. Overall, this is a drive towards unification and accreditation, moving the course from enthusiastic volunteering to a world of uniform rules. The advantage is an uniform level of education, but it will be all the more difficult to deviate in any way from the set boundaries.

Performance in hypoxia – energy requirements

The next lecture was given by **MUDr. Vladimír Vinduška** and was devoted to the ***energy demand of performance in hypoxia***. Certainly, many climbers before an expedition to the mountains ask themselves whether ascents in hypoxic alpine environments are accompanied by increased energy demands. The author of this lecture addressed the same issues in 1986 in preparation for an expedition to the Pamir region, where he addressed this by adding maltodextrin to meals. It is known that oxygen and energy consumption increase linearly with heart rate, and this principle is also used in commercial sports watches. Estimation of energy expenditure during walking can be made using the formula: energy (kcal) = 0.5 x km x weight, the estimate for running corresponds to the value for walking multiplied by two. If we look at the human body as a machine during spiroergometry, its efficiency reaches only 20-25 %. At the same time, on a treadmill, it can be observed that the heart rate also increases linearly depending on the speed of movement. Dr. Vinduška also presented a sample of his own data from the ascent of Mt. Kilimanjaro, which showed that the achieved heart rates were not extremely high, according to the presented graph 90-130 bpm. If we compare the energy requirements for the ascent of the three different peaks calculated by the formula and derived from the achieved heart rate, then at the beginning of the ascent both values were similar, but the peak values are already different – the peak values are higher than predicted. This may be due to a higher basal metabolic rate, but this is only increased by 6-13 %, but the work of the cardiac and respiratory muscles also increases. Conversely, maximal oxygen consumption (VO_2max), which is a measure of fitness, decreases linearly with height. However, in the author's opinion, this probably has only a minor effect. In the same terrain, oxygen consumption is the same for everyone, because the values are based on weight. In the bicycle ergometer simulations, when subjects were given air with lower oxygen content, oxygen consumption was also the same as in normoxia. Thus, it is clear from the above that the same athletic performance requires the same amount of energy in hypoxia as in normoxia, and the amount of energy expended depends only on the level of exertion, not on the altitude itself. There is only a slightly increased basal consumption, but this is significantly lower than the total energy consumption. The wasting during expeditions is largely due to the inappetence that is typical for altitudes above 3600 m, but is present in all from 5000 m; food volume is typically reduced by 25-50 %. However, the negative energy balance can be overcome by an active approach to food

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COVID-19 disease & vaccination and high-altitude expedition

Barbora Veselá followed up on the issue of high mountain climbing with her contribution ***Experience with higher altitude after COVID-19 and vaccination or How it was impossible to climb Gasherbrum II.*** She presented the paper together with her husband Michal Veselý, who was the main actor of the story. First Michal presented his climbing history, including the first big expedition to Nanga Parbat with mountaineers Marek Holeček and Zdeněk Hrubý. Then he described his journey to Gasherbrum II via the Baltoro trek, which is said to be one of the most beautiful treks ever. The problem is that the target base camp for Gasherbrum I-III is located at a great altitude. Bára subsequently reiterated the pathologies of altitude sickness and the possibility of acclimatization to altitude. Michal also discussed the organizational difficulties in connection with the measures during the global pandemic of COVID-19. Michal himself had this disease in February 2021 with only a mild course, and in May he was vaccinated, which was a condition for the trip to Pakistan. A few days before departure, he developed chest pain after a minor heat stroke. He had a medical examination before departure, including a lung X-ray, but no pathology was

found and he left for the expedition. In Pakistan, chest pains reappeared and great fatigue set in. He decided to stop his ascent during the trek and stay for 3 nights at 4500 m, where neither the heart rate nor blood oxygen saturation readings suggested that lack of acclimatisation was a problem. However, he continued to have chest pain and an unusual cold sensation, with mild resting difficulties exacerbated by movement. He therefore decided to withdraw from the expedition and returned with the trekkers. In addition to acclimatization problems and altitude sickness,
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post-covid syndrome, which can be accompanied by chest pain in addition to fatigue, is suggested as a possible cause of the condition here. Recommendations published in High Altitude Medicine and Biology suggest that even those who have experienced Covid-19 disease with only mild symptoms at home should be screened before being at high altitude. Michal was examined again after his return from Pakistan, including a stress test, which showed excellent physical condition and a cardiac etiology of chest pain was ruled out

Workshops: ALUfoil, safe climbing

Saturday's programme after lunch was devoted to outdoor workshops. **Martin Honzík, DiS** prepared a ***workshop on ALUfoil – tips, tricks, magic and magic***, in which he introduced the participants to what can be done with this foil due to its high tensile strength. **Jiří Vogel** prepared a workshop ***How to increase safety when climbing***, where he discussed the most common mistakes not only in rock terrain. Some people interested in the surrounding nature went on a trip to the nearby peaks of Keprník and Vozka.

Accidental hypothermia

Saturday afternoon was dedicated to *hypothermia and avalanches* and the first lecture on this topic was given by **MUDr. Jana Kubalová:** ***Dealing with an emergency with a large number of (paediatric) patients with accidental hypothermia***. She first repeated a well-known case from Denmark in 2011, when a dragon boat capsized and there was a mass occurrence of patients with hypothermia, 7 of whom were connected to extracorporeal circulation. But now she presented a well-publicised case from March 2021 from Žamberk. Dr. Kubalová conceived the lecture interactively and let the participants vote on the steps of intervention. It was an initially uncluttered situation where a lady called 155 who met a little girl crying on the street of Žamberk, claiming that the ice on a nearby pond had broken through under her three children. It was not clear from the notification exactly how many people were affected. Eventually three children were pulled from the water with circulatory arrest. She repeated in a step-by-step interactive manner the recommendations for resuscitation of young children and arrest due to hypothermia.

The lecture was smoothly followed by **Mgr. Gabriela Hodková** with the topic ***Accidental hypothermia***. She introduced us to the basic concept of *Extra Corporeal Life Support (ECLS),* which includes *ECMO (Extra Corporeal Membrane Oxygenator)*. The

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General University Hospital in Prague treats 50-100 patients per year whose condition requires connection to ECMO, if we do not take into account the 2020/2021 emergency period and the COVID-19 pandemic. She presented a retrospective study over a period of 5 years, which included 28 patients with body temperature measured in the bladder below 28 °C. Ten of these patients were assigned to the group warmed by ECMO device, 18 were warmed without ECMO (non-ECMO group), using electrically heated blankets and hot air warming. The most common cause of these conditions is alcohol intoxication and drowning. ECMO warming may be accompanied by complications related to cannula insertion or bleeding. On the other hand, it is very effective, the median heating rate in the presented sample of patients was 0.41 °C/hr, although the heating rate is not completely linear, continuous checks for bleeding, etc. are needed. Patients included in the non-ECMO group warmed even faster (0.77 °C/hr) and for a shorter period of time; moreover, they had no secondary complications associated with treatment with the ECMO device. The length of hospital stay and mortality were comparable in both groups. The author also emphasized the need for very good coordination of the whole team and proper referral of hypothermic patients to ECMO centres

Avalanche medicine I

The avalanche session was opened by **Ing. Roman Juras, Ph.D**. with a lecture ***Snow and avalanche research in the Giant Mountains***. In the introduction he presented avalanche areas in the Krkonoše Mountains, which are less than 60 and have been regularly monitored since 1961. In the last season, 21 avalanches were recorded, which corresponds to the annual average in the Krkonoše Mountains of 20 avalanches/year, with fluctuations depending on the size of the snow cover (0-70 avalanches/year). The graphs then demonstrated the possible influence of climate change on avalanche occurrence. First of all, the already known increase in temperatures is an important factor, together with a 6% decrease in snow cover over 10 years at 800 m altitude. Last but not least, the share of snowfall in total precipitation is decreasing. Consequently, more rain is falling in winter and a higher proportion of wet avalanches is expected. According to climate models, the winter season will be shortened by 25 days by 2040. But the question arises whether less snow means fewer avalanches. There may be less snow, but it is often wet snow, and thus the risk of avalanches from wet snow is uncharacteristically shifted into the winter

months. Avalanche monitoring is one of the important bases for research on avalanches and changes in their nature. A number of parameters are recorded at the avalanche site, whether its size, the amount of material transported, etc. Drones are now being used for this purpose, which has both advantages and disadvantages. The undeniable advantage is that the avalanche can be monitored very soon after its fall, without endangering the health and life of people in the event of other avalanches falling, on the other hand, it is not always possible to use a drone, especially in terms of weather conditions (wind, frost, visibility, etc.). Roman then presented an avalanche from February 2021, which also claimed a victim. He showed direct drone video from the avalanche site, analyzed from a hydrological point of view the cause of its fall, including demonstrations of interesting animated models. If it is possible to summarise this issue on a few data points, there has been a slight decrease in the number of avalanches in the last decade, which is perhaps due to the decrease in the amount of snow. Finally, he presented the results of his own research, where he and his team investigated the effect of rain on snow cover and preferential pathways of water through snow. Because snow can hold relatively large amounts of water, the difference in the distribution of water in snow is evident between mature and immature snow

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Avalanche accidents in the Giant Mountains in winter 2020/2021 were also discussed by **Marin Honzík, DiS.** He mentioned some older avalanche accidents where the cause of death was often craniotrauma or asfyxia. He discussed in more detail from the medical and rescue point of view the avalanche accidents in the *Big Cauldron* in the *Jeseníky* Mountains in January 2021 and in the *Kotelní* Jama*,* in February in the *Giant Mine*, some of which were accompanied by interesting videos.

In March there was an avalanche accident in the same place as in the 1960s, in the *Biely Jar* area in Poland. He too invited the audience to vote on the next course of action. The questions were not only about whether to intervene by helicopter on the territory of a foreign country, but also about the further management of people and teams. Questions on planning escape routes from the avalanche site in case of secondary avalanches were very interesting. Last but not least, he also repeated the resuscitation procedures for such affected persons.

Travel tips, children on the ski slopes, journey do China

Due to the already advanced time, the avalanche block had to be interrupted and the rest of the lectures moved to the next day. After dinner, those interested gathered for the traditional evening ***travelogue screening***. The author of the first one was **Jan Pala, PhD**, who in many photos and videos gave a number of tips, When and how to start with children on the ski slopes. This was followed by **JUDr. Jiří Žák's *Journey to China and Back***, which took us to the *Sichuan region*.

Avalanche medicine II

On Sunday morning the interrupted **avalanche block** was introduced by **Mgr. Iva Sikulová, PhD** with a lecture about ***avalanche accidents in winter 2020/2021 in Slovakia***. The beginning of winter was poor in snow in Slovakia, but on the other hand winter conditions lasted until May. In total, 43 avalanche accidents were documented, 12 people were injured during them, 6 people were completely buried, and one accident unfortunately claimed two victims. Most of the avalanche accidents occurred at the lowest avalanche levels. The first accident occurred in mid-December **on *Chopok***. Its participants were mountaineers who planned to go climbing in mixes. They managed to pull down a slab avalanche, but fortunately they stayed on its surface. Iva pointed out that avalanches at the beginning of winter are tricky because they are not big, but they usually drag their victims through the rock debris. The second accident also happened on Chopok, this time to two ski mountaineers who were about to ski down a chute. Fortunately, they chose the right tactics and skied one after the other. In the critical chute the first skier pulled down the avalanche, but he too remained on the surface after the mass of snow stopped. Nevertheless, several errors can be traced in the analysis of this accident: the skiers ascended the slope without knowing the snow conditions in the open terrain where they subsequently went. In addition, the second skier did not have full avalanche equipment – he lacked a shovel, so that if the first skier who had pulled the avalanche had not stayed on the surface, his friend would not have been able to dig him out. An interesting avalanche accident happened in January in *Lomnické sedlo*, when the buried skiers were very lucky to reach the metal structures of the snow barriers. Thanks to this, they had a supply of air.

However, a tragic accident occurred in February **on the *Kondratova kopje***, where a trio of ski mountaineers from Poland went. They decided to return because of the weather deterioration, but firstly they lost their orientation and went in the opposite direction and secondly, they started to traverse a steep slope with hard snow. The problem with hard, wind-consolidated snow is that its cracks can spread over a long distance, and the resulting torn slab tends to be large. That's what happened to these skiers, all three ended up buried. Miraculously, one of them dug himself out of the snow after an incredible 3 hours, as it was not very deep. He tried for some time to look for his other two friends, but was unsuccessful and also had no phone signal to call for help, so he went looking for him. He was not able to find a signal until 9pm and the rescue team did not reach the scene until 1am.

They were found buried at a depth of only 50-80 cm. One of those buried even had an airbag backpack, he even had a pull cord ready but did not activate it. The great danger of slabs is that while moving on the slab one does not feel that one is on the slab, but when a critical layer occurs, the cracks are transmitted very far, so that in the end a big avalanche breaks off. In addition, such slabs are difficult to read in the field. In March, two hikers were crossing a summer hiking trail below *Pekelník* in ***Malá Fatra*,** but it is not crossable in winter because it passes through avalanche terrain. They were pushed by an avalanche into a trough covered with cranberries, which prevented them from reaching the end of the trough, but the trees

caused them many injuries. In March there was also an accident at ***Predne Solisko***, where three very experienced ski mountaineers were scheduled to ski in a very exposed terrain. They had followed the correct spacing and had done a *stress test and snow profile*, but this revealed slabby snow, so they tried to escape down the slope onto the ridge. Unfortunately, during this hiking ascent, a slab broke off with them as the hikers add a lot of additional loads to the slope. They traversed very exposed terrain with the avalanche, up to 350 vertical metres in total. Fortunately, the avalanche snow accumulation spilled over a large area, so all those affected remained on the surface but had severe injuries. The injured treated each other, insulated themselves with alu foils and waited for the rescuers. The same spot could have been fatal for the mountain service workers a day later: when they came to document the avalanche site the next day, they also tore off an avalanche. Fortunately, they were unharmed as they were secured on a rope.

In March there was also an avalanche accident in Jamnická dolina. Two skiers went skiing in the terrain at a level 3 avalanche danger. Both were equipped with airbags, but had placed their skis on their packs in such a way that they would not perform their function if they were activated. They were just ascending on crampons parallel to each other, not behind each other, when they pulled off the big avalanche. One of those hits remained on the surface, the other fortunately had his head above the surface of the snow. Witnesses to the accident who were nearby helped with the rescue. Based on many of these accidents, it is important to remember that the snow stability test itself can have a very different result on the slope where it is performed and elsewhere in the terrain we ski. In addition, one of the specific features of the Slovak mountains is that they are very windy, and therefore large slabs of hard wind-consolidated snow often form.

Jan Pala, PhD ended the avalanche session with a ***summary of the world's avalanche accidents*** in his COVID-19 lecture on the cause of the record number of avalanche deaths. The year 2020 was marked by the closure of most European ski resorts, with only resorts in Bulgaria, Macedonia, Spain and Switzerland actually operating. As a result, many skiers took to the slopes, even though they normally ski on the slopes. In addition, they often went directly to the ski resorts, which brought with it a number of unusual avalanche accidents. Avalanche danger levels are not declared in the area of ski resorts due to their regular snow grooming, but without the aforementioned snow grooming these slopes are potentially very dangerous. The trend in the number of avalanche accidents speaks for itself: 78 were recorded in the 2018/19 season, only 53 in the 2019/2020 season, before rising to 130 in the final 2020/2021 season. The author then discussed several interesting accidents, for example from *Ötztal* in Austria, where an avalanche accident occurred on a steep slope below the cable car. Already on 10.10.2020 an avalanche accident occurred on the *Grossvenediger* during a hiking ascent and even claimed one victim. Avalanche casualties have also occurred again in connection with work activities, such as in Spain, where a fatal one occurred while working with a snowplough and one of the victims was only extricated after 29 days.

Frostbite – treatment and sequelae

MUDr. Jaroslava Říhová also stayed in the winter mountains in her lecture ***Long-term treatment of polytrauma with frostbite.*** In the introduction of her lecture, she stated that when staying in the mountains, whether summer or winter, it is necessary to follow the basic rules, especially that the group goes and acclimatizes only as fast as its weakest member. She then presented a case which, in her own words, was the most complex in the time she has been involved in frostbite. It involved an expedition of three mountaineers on snowshoes to the Austrian Alps, where one of the members was a girl who wanted to return when the weather changed due to fatigue. The others wanted to continue on, but she, exhausted, slipped on the icy terrain and a fall of about 500 metres ensued. The rescue operation lasted almost 6 hours and the girl was found unconscious, with numerous injuries and hypothermia at 27.5 °C. She was transported to the University Clinic in Graz, where, in addition to hypothermia, a complicated pelvic fracture was diagnosed as the dominant injury. Due to the risk of serious bleeding complications, ECMO machine was not used for warming. Of course, frostbite was an accompanying injury. The patient had undergone a number of surgeries, and due to the significant swelling of the hands with grade 3 frostbite, it was necessary to make incisions in the palms to prevent the swelling from compressing important blood vessels and nerves (called *compartment syndrome*). After less than a month, she was ready to be repatriated to the Czech Republic, but it was very difficult to find a destination facility that had sufficient experience in treating both pelvic injuries and frostbite. Fortunately, cooperation was established with a facility in *Vysoké nad Jizerou* that specializes in hand surgery. Sessions in the hyperbaric chamber were also recommended, but mainly in Vysoké she underwent special rehabilitation. Gradually, soft tissue necrosis was delineated, and unfortunately osteomyelitis occurred on the last article of the 2nd and 3rd fingers of the right hand, but the extent of amputation was considerably less than could have been anticipated at the beginning of the case. The patient continues to have a problem with complicated healing of fractures in the pelvis and spine. The need for multidisciplinary collaboration was further emphasized in this case, and it is still striking how many climbers do not follow the basic rules. Last but not least, it is essential to have good insurance for travel abroad. The case presented was printed as an annotated case report in the journal *Causa subita*.

Photophthalmia solaris

And in the field of ice and snow, **JUDr. Jiří Žák** also stayed and introduced us to ***Snow Blindness: a case study*.** He repeated the basic information about *snow blindness*, including its prevention. He then presented the case of climbers who went hiking on the Austrian mountain *Wildspitze*. It was a long glacial hike which, in their case, was completed entirely in fog and cloudy skies. On the ascent to the ridge, there was the added bonus of snow and diffuse light, which causes disorientation. The climbers were aware of the importance of eye protection, but after putting on glacier goggles, the disorientation already caused by diffuse light was even worse. In the evening, two of the participants felt severe burning and cutting in their eyes. Only basic first aid was provided as first aid kits were limited due to the hike planned for only two days. It was confirmed that snow blindness usually heals spontaneously by the second day. The lesson from the case, however, is that it is necessary to protect one's eyesight in the mountains and especially on the glacier with suitable goggles even if it is not a classic clear sunny day

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Mountain rescue in the mountains of Tenerife

Robert Bednařík took us to a completely different mountain environment with his story about **Rescue in the mountains of Tenerife.** He first introduced us to the basic geography of *Tenerife* in the *Canary Islands*. It is a very variable terrain, with a 3715-meter-high volcano rising from the sea. Apart from hiking, which is often challenging here, those interested in climbing and gorge traversing will also find it challenging. Some areas are very difficult to rescue from in the event of an accident; there is no typical mountain rescue service. However, helicopters capable of rescue here have sufficient power

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Snakebite envenomation in the Balkan mountains

The last lecture of the seminar was interestingly titled **W*elcome to the Balkans, Your Pink Viper*** and its author was **RNDr. Jan Pala, PhD.** He first introduced the snake called the *pink viper*. This viper is normally shy, but if a person startles it, for example when it is moving, it can bite. The familiar viper has a venom that is mainly cardiotoxic, whereas the venom of the roseate viper also affects blood clotting and is *nephrotoxic*. Moreover, a bite is not like a bite: we may encounter a so-called *dry bite*, where the amount of venom injected is minimal, or, on the contrary, the snake may release large quantities of its venom into its victim. The author then presented his own case of a bite. It all took place in *Macedonia*, where in summer the temperature was already over 30 °C in the early morning and therefore the reptiles were already active. On the way he scared away a pink viper, which bit him in the area of his right leg. First aid in such a case consists of disinfecting the wound and, most importantly, transporting him quickly to hospital. Fortunately, the bitten man was only a short distance from the road, so instead of calling the ambulance and waiting for its arrival, he decided to walk down the road himself. He was hospitalized at the university clinic in *Skopje*. He was surprised by the speed with which the poison had taken effect: a few minutes after the bite he was still coming down the road on his own, but 90 minutes after the bite he was already in the hospital, almost immobilized, and even collapsed there. In the hospital he was given antisera, antibiotics, infusion therapy. He was repatriated to the Czech Republic, where he spent some time in hospital, after which he started his recovery, which was surprisingly quite lengthy and even now the swelling of the right lower limb persists, especially after exertion. In conclusion, Dr. Pala repeated the first aid for snakebite: the limb and the affected person should be immobilized, the wound should only be gently disinfected, do not cut it in any way, do not try to suck the venom out of the wound, this would rather lead to the spread of the venom and exposure of the mucous membranes of the mouth to the venom. We do not attempt to strangle or constrict the limb, and we do not give the affected person any alcohol or stimulants. If possible, it is a good idea to photograph the snake and remember its size, but do not try to catch it. The key is to get the bitten person to the hospital as soon as possible; if he or she does not get to the hospital within 6 to 8 hours, such a bite can be fatal

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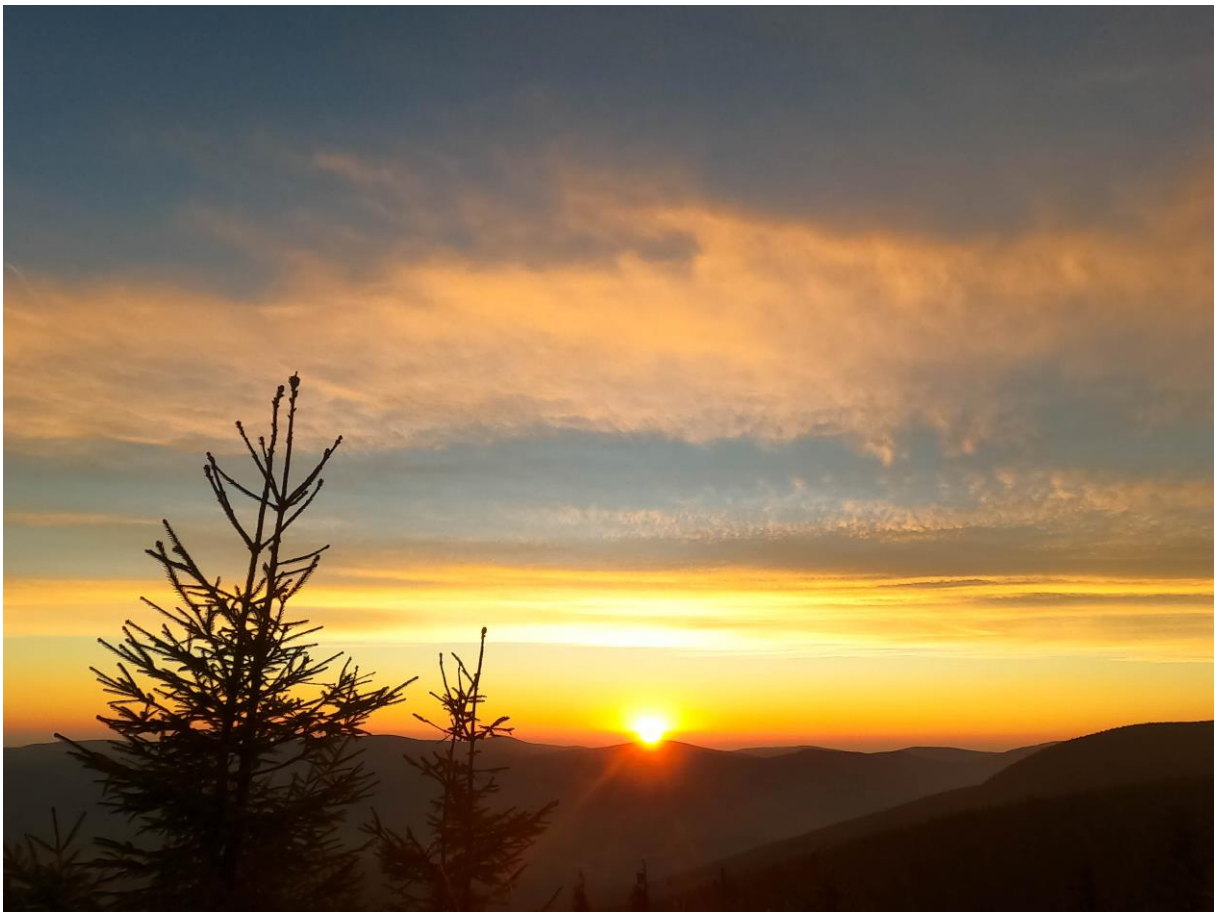

Closing

At the end of the seminar, the President of the Society of Mountain Medicine, Lenka Horáková, MD, thanked everyone for their participation and the speakers for their very interesting lectures. The date of the next one, 32. Pelikan Seminar, which will take place 28.-30.10.2O22 in the Highlands.

Written by: Lenka Horáková, MD; 31. 10. 2021
Photo:
Translation: Ivan Rotman, MD & www.DeepL.com/Translator (free version), 15. 1. 2022