

Sports Medicine, physiotherapy, rehabilitation

“Considerable experience in the treatment of trauma sports medicine contributes to the increasingly important development of general cryotherapy, and to the recognition of this method’s effectiveness”

Krzysztof Zimmer

General Cryotherapy in Sports medicine

This article describes the influence of low temperatures on the system and the use of general cryotherapy in the medicine of sports. Very positive effects are also presented, particularly in the treatment of acute trauma and overload, but also in the process of biological regeneration and the improvement of the athletes’ psychophysical requirements practising the various sporting disciplines.

Modern professional sport pushes the athletes to the limits of resistance of the human body. With the improvement of the methods of training, these limits are regularly exceeded and it is difficult to define the true term of human possibilities, in the ceaseless race to records. The marketing of sports and the popularity of the great sporting competitions in television and, consequently, the increasingly significant sums paid to the sportsmen, worsen this situation. All that creates new medical problems. New diseases related to intensive sports training appear. There is thus a pressure from the sporting class, which pushes to find solutions to quicker and more effective healing of the consequences due to many traditional sporting traumas. Sports medicine has to thus satisfy these new requirements.

This is why new methods are on demand, and the most modern medical techniques are applied, so that wounded sportsmen may take up again their activity as quickly as possible.

Certain sporting traumas are due to the action of great intensity forces, then named "acute" - they are almost unforeseeable and the possibilities of prevention are thus restricted. On the other hand, the majority of the sporting traumas occur following the repetitive action of forces of low intensity, over long periods. These chronic traumas, also said «of overload», require a special diagnostic and curative approach. In this case, preventive measures are essential.

The majority of the chronic traumas resulting from the intensive practice of sport appear with pain and tumefaction, therefore with inflammation symptoms. It has been long known that to cure inflammation, it is wise to locally lower the temperature at the level of the trauma. Progress made in cryogenics, science examining the reaction of the matter at extremely low temperatures, made it possible to find means to fight effectively against tissue inflammation - that is cryotherapy.

The cooling of tissues not only decreases the output of cellular breathing but also releases some enzymes from the damaged cells. This stops the dislocation of the very energetic connections (ATP, simple sugars, glycogen), as well as the production of the bradykinines, of prostaglandins and histamine. Thanks to the reduction of the permeability

of the endothelium of the blood vessels, the risks of swelling decrease because the contraction of the vessels reduces the bleeding.

Extremely low temperatures have also a significant influence on the nervous system. The stimuli speed transmission decreases and consequently, the feeling of pain also. A stimulation study on the endorphins production is on the way, but its results are not confirmed yet. On the other hand, the study of the influence of cold on collagen (element of the tendons, the ligaments and the muscles) showed that cold makes fibres more elastic, and thus more resistant to extension. Moreover, the influence of cold on the muscles limits spasticity and decreases the inter-tissue tension. Lastly, the results of examinations concerning the stimulative influence of extremely low temperatures on the immune system are very interesting, especially with regards to cellular immunity.

All these possibilities created by the application of cold, make cryotherapy very attractive in sports medicine. Cold can be applied in "acute" or "overload" traumas treatment, as well as in biological regeneration.

Cold application in sporting traumas treatment, is rather current and even traditional, especially in countries where ice is used daily. Small cubes of ice placed in a plastic bag or a special bag called "Ice bag" (English in the text), belong to the basic medical equipment at the time of sporting competitions and trainings.

It is significant that trainers know mnemotechnical abbreviation "ICE" (Immobilization Cooling Elevation...: of a limb above the thorax) to know what to do in the event of trauma of the limbs during the practice of a sport. There are also other methods allowing a local cooling, such as for example, a very simple and useful apparatus, the "CRYO-CUFF" commercialised by the Aircast Company or the very well known "HOT-COLD PACKS" proposed by 3M.

The application of cold treatment on chronic trauma is identical: an ice-filled bag, wet towels containing ice, sportsman lying on ice. Certain forms of localised cryotherapy, like cold air circulation, or the more effective liquid nitrogen, have become current to use. These methods are means to contend with pain caused by the enthesopathy syndromes, which are contusions or sprained articulations.

The idea to use a cryogenic room in the treatment of the degenerative and rheumatic diseases Introduced by R. Fricke in Europe, and developed by Z Zagrobelny, opened new treatment possibilities in sporting trauma matter. A great number of chronic trauma cause injury to conjunctive tissue protecting the articulations, and articular surface destruction.

More than five years' application of general cryotherapy in sports medicine allows putting forward the following applications:

- treatment of acute sporting traumas such as muscle contusions, intramuscular haematomas, sprained articulations, injury of extra-articular ligaments of 1st degree;
- treatment of the chronic overload trauma – such as patellar-cruraux enthesopathy disorders, tendinopathy, osteochondrose, affection of the rotator-cap, the syndrome of chronic tibial periostosis (shin splints);
- complementary treatment after intra-articular reconstitution operations, and tendon, ligament, muscles and bone operations;
- biological regeneration and chronic traumas disease prevention, during intensive training and the preparation for championships.

Treatment of acute sporting trauma.

In the treatment of acute sporting traumas, it is significant to immediately apply cold after the trauma. The cooling of para-articular tissue, the immobilization and the rising of the end of a limb above the chest are the principal processes on the place of accident. They are of considerable importance, unfortunately often underestimated, for the progress of the treatment.

A good example is knee sprain. In this case, the application of this technique prevents the appearance of a significant tumefaction of the para-articular tissue and intra-articular exudates, and consequently, the distension of the stump torn side ligaments is less. Thus, a well adapted treatment heals the ligaments without their lengthening, and thus guarantees a better treatment result: there will be no articulation chronic instability symptoms.

In the treatment of the acute sporting traumas, general cryotherapy allows the fast introduction of a functional treatment. It facilitates exercises realization during the rehabilitation programme, thanks to its analgesic and anti-tumefaction effectiveness.

The application of general cryotherapy gives good results in the treatment of supple tissue traumas such as muscular contusions and intramuscular haematomas. It was proven that thanks to this therapy, many high level sportsmen have avoided punctures and aspiration of intramuscular haematomas. After a 7 applications cycle of general cryotherapy, we observed total resorption of hematoma which, because of its dimensions and location and according to results of echography, should have led to a puncture.

In the same way, in the case of knee articulation sprain, the application of general cryotherapy makes diminish tumefaction and exudate, reduces pain and makes it possible to pass to kinesitherapy more quickly. Thus, in the program of treatment of paracentral lateral ligament, one can reduce by two weeks the interruption of training, compared to the traditional methods of treatment.

Treatment of the chronic sporting traumas

General cryotherapy plays a significant role in the treatment of the sports traumas caused by repetitive micro-traumas. The application of extremely low temperatures on conjunctive tissue and collagen makes it possible to improve quality of the cure of the damaged elements, stabilizing the articulations, muscular insertions, as well as tendons and ligaments.

Cryotherapy is advised in the therapeutic program of the initial stage of the rotators-cap affection. This affection is frequently met, in professional sport as well as amateur, especially in the disciplines related to the throw, those with the use of a racket (tennis, the squash, badminton and hockey), and others like in swimming and rowing. The narrowness of the muscular system stabilizing the articulation of the arm causes intense pain and limits articulation mobility. In this case, a precise diagnosis is essential to establish the treatment program.

In the initial stage of rotators-cap affection, the functional treatment is the most adapted method. But at more advanced stage, an operation followed by intense rehabilitation is necessary. General cryotherapy plays a significant role in these two methods. Extreme cold makes tumefaction decrease below the shoulder and the anaesthetic effect makes it possible to make strengthening exercises for the deltoid

muscle, which improves shoulder stability, and makes it possible to take up technical training again more quickly.

With the increasing popularity of fitness and bodybuilding clubs, the training aiming at the muscular mass development, cause more and more chronic syndromes, like pressure neuropathy. Let us take for example the following syndromes: narrowness of the higher opening of the thorax, caused by the hypertrophy or the limpness of the oblique muscles, and the Arcade of Frosh and Kiloh-Nevin, a syndrome of the fore-interosseous nerve.

The syndrome called **the narrowness of the higher opening of the thorax** consists of a compression of the vascular system and elements of the brachial plexus located above the clavicle. The causes of this compression are numerous. Generally it is an additional cervical rib or the hypertrophy and often tone-lacking edges of the oblique muscles. If a cervical rib is diagnosed, an operation is necessary. If not, compression can be caused by the hypertrophied paunch of the oblique muscles. This pathology found especially in sports of force where an intense training is accompanied by a somewhat illegal pharmacological doping, can lead to muscular overload which causes vascular system compression.

The Arcade of Frosh syndrome, i.e. the syndrome of the supinator muscle section, occurs when the hypertrophied edge of this muscle, or the blister being done, between the biceps tendon and the radius, press on the radial nerve causing the symptoms of its paresis.

The Kiloh-Nevin syndrome is the syndrome touching the fore-interosseous nerve. This nerve can be compressed in the forearm. The principal symptom is folding impossibility of the phalangeal articulations of the thumb and the index. This symptom is often wrongly interpreted, indeed, the generally established diagnosis being that of a tendon injury.

In critical cases, these syndromes require an operation; but noticed and diagnosed at the initial stage, they can be treated by the application of general cryotherapy. The extremely low temperatures make intertissular tension reduce in the muscles, which can release the compression of the nerves along with the symptoms which are associated there. Thereafter, the change of the training methods and the sporting material as well as the compensatory exercises will help to cure these syndromes.

General cryotherapy is often applied in enthesopathy treatments, i.e. syndromes of the tendinous insertions damage. We think particularly of the inflammation of humerus epicondyle or "tennis elbow" ("elbow of the tennis player"); of the inflammation of the humerus epitrochle ("the elbow of the golfer"), of the calcifying inflammation of the infraspinator muscle tendon of the foot.

In these syndromes, the most important is to remove the pain and then to make exercises reinforcing the muscles whose insertions were damaged.

The analgesic and anti-inflammatory effectiveness of general cryotherapy gives better results than traditional treatments.

Intensive training in certain sporting disciplines causes pains. These take place following the rise of the tissue tension caused by the biochemical reactions in the muscles which are tired. Traditionally, in the event of syndrome of tibial periostitis ("shin splints"), the athletes made a massage with ice to relieve their pains effectively. In this context, the application of general cryotherapy is obvious. The enthusiastic reactions of the runners who attend the cryogenic room systematically, made it possible to spread this method among the athletes.

General cryotherapy is also applied in the program of the sportsmen's treatment of the **fatigue** fractures. The fracture of fatigue occurs following the microtraumas which in the overloaded part of the bone cause a slit of fracture, often invisible during the traditional radiological examinations. It is diagnosed by using scintigraphic examination or Imagery by Magnetic Resonance (IRM). Cryogenic handling reduces the pain and improves the conditions of recovery of these fractures.

General cryotherapy in the process of biological regeneration

Experience in the treatment of the sporting traumas contributed to spread this method among the sportsmen. The champions' opinion is the best proof of its effectiveness, because in the world of professional sport, positive as well as negative opinions spread quickly, and champions know what is good, and what isn't.

At the end of the Nineties, many sportsmen were treated in the Cryotherapy Laboratory of the Physical Education Academy of Wroclaw. It was noticed that, in addition to the improvement of the local state in precise indications, their general condition had improved, and their force of will towards physical effort had increased. They supported well the intensification of the training program and obtained better results on important competitions. This is what justified the examination of the influence of general cryotherapy on physical and biological output of the sportsmen. The results obtained make it possible to advise this method as a perfect form of biological regeneration and preparation to intense training, or for important competitions.

Biological examinations of the sportsmen taking part in general cryotherapy program in relation to biological regeneration, proved an increase in the rate of capacity-stimulating hormones to make an effort (for example testosterone). After intense effort followed by a visit in the cryogenic room, an increase in skeletal muscles contractions was observed during the isokinetic examinations (Biodex 3Pro apparatus) and a diminution of the intratissulary tension.

The results of the examinations were confronted with the ones of other centres (University of Bouchum in Germany or the Olympic Preparations Centre of Lahti, in Finland). All prove considerable influence of general cryotherapy, on the improvement of parameters in resistance, ability and endurance, of various disciplines sportsmen.

These experiments in the sporting application of general cryotherapy have arisen interest in the whole world - many Olympic Committees plan to introduce this method among their means of preparation; intense scientific research is made in Germany, in Finland, in Switzerland and Latvia. There are mobile prototypes of cryogenic rooms, making it possible to use them in connection with special forms of training (for example in high mountain training).

The future of general cryotherapy application of the in the medicine of sports, seems radiant. This method will make it possible to intensify the training, to reduce the risk of the trauma and to obtain better results without disturbing homeostasis.

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Final remarks

- Krzysztof Zimmer, quoted at the beginning of article, works in the Traumatic Private Clinic of Surgery and Surgery of the Hand of the Medical Academy at Wroclaw.
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