GAS CROTHERAPY IN THE TREATMENT OF TRAUMATISMS IN THE SPORTSMAN OF HIGH LEVEL

H.CHICK, A-L. CARAYON, J-C. ROGNON, A. COHPAN

HISTORY

For more than 15 years in sports physiotherapy, we always used cryotherapy in the treatment of traumatology. The different techniques offered during those years were:

- Ice
- Cryogel
- Cryotherapy with gas nitrogen

Ice

It is easy to obtain in the form of ice cubes, but although it has advantages which are formally acknowledged and non-negligible, its use is not very practical and imposes constraints. Indeed, in order to be efficient, the vessel containing ice cubes has to be big enough to cover the area to be treated, and this requires more ice than an ordinary fridge can produce. It is therefore necessary for a clinic or treatment centre to purchase an ice cube machine, which is rather expensive.
Furthermore, the ice vessels are only waterproof if they don't leak and the problem of the humidification of the tissues to be treated is constant.
Some laboratories studied the problem and produced the second generation: Cryogel.

Cryogel

It is a gel contained in a watertight plastic bag that can be cooled in the fridge or the freezer. The use of Cryogel is much easier than that of ice and has the advantage of eliminating the problems of humidification. However:

- 2 hours in the fridge bring it down to -3 C
- 3 to 4 hours in the freezer bring it down to -14 C. It is then possible that it provokes burns because there is, as of yet, no method to measure the skin temperature.

After these solid cryotherapy treatments, gas cryotherapy appeared: the Japanese Professor Yamauchi at the end of the 70s, the German Professor Fricke in 1982, and then the French in 1986, developed this therapeutic concept. The interest that the medical establishment granted these techniques resulted in the first international Cryotherapy Symposium in Madrid in 1990.

Nitrogen cryotherapy

It is interesting because it insures a minimum temperature of -120 C which does not cause the humidification of the tissues. The studies on this «great cold» showed analgesic, anti-inflammatory, vasomotor and neurological effects which were higher than those obtained with ice, because of the «thermal shock» obtained. Despite being used by many countries such as Spain, Portugal, Italy or Poland, this system has nevertheless remained too expensive for common use, bearing in mind the cost of the equipment and the consumption of nitrogen, of which 48% is lost through evaporation.
It was therefore necessary to design an apparatus which would conform to all the security norms required by the use of very low temperatures.

REQUIREMENTS OF THE APPARATUS

The cold had to be in gas form and lower than -60 C in order to create the durable reflex physiological effects of the «thermal shock».
The gas had to be non-toxic, easily stockable, easy to purchase and of reasonable price for frequent and regular use in sport.
The apparatus had to be easy to handle and autonomous, in order to be transported into locker rooms or on the edge of a sports field.

OUR CHOICE

Indeed, from a bottle of medical carbon dioxide, the apparatus creates a depressurisation of the gas which at 50 bars gives a temperature of -78 C. The originality of the technique lies in the association of a very low temperature and the use of the pressure of the gas. Scientific studies show that it is the importance of the thermal shock and the speed of the decrease in temperature which influence the quality of the treatment. The comparison of the ice curve and the CO2 curve (Fig.1) shows that the decrease of the temperature caused with CO2 is far quicker than with ice. Furthermore, the same comparison between the temperatures achieved at different depths between ice and CO2 show that a temperature of around 30 C at a depth of 14mm is obtained after 20 minutes with ice, whereas the same result is obtained in less than 2 minutes with CO2 (Fig.2).

USE: SIMPLE AND SAFE

After having outlined the area to be treated, we can place a catheter which is sensitive to the tenth of degree on the skin, and this catheter will inform us in real time of the temperature of the tissues and will allow the prevention of a possible phlyctena caused by cold.

A second safety measure is the technique that consists in sweeping the area to be treated in a regular manner with a gun that is placed at approximately 15 cm from the skin.

DURATION OF THE TREATMENT

Approximately 1 minute and 30 seconds... which is equivalent to a 3 hours application of an ice vessel.

Two phase treatments

First phase: 30 seconds, holding the gun 10cm away from the skin in order to obtain the «thermal shock»

Second phase: one minute of sweeping with the gun, holding it further away from the skin. This second phase ensures the deeper penetration of the cold.

Effects obtained

An analgesic effect which lasts for approximately three hours. The conduction of nociceptive fibres is slowed down or even stopped by the application of cold at a very low temperature.

An anti-inflammatory effect which lasts for approximately three hours. It has been established that the fast and intensive application of the cold causes the production of chemical mediators responsible for the inflammation, i.e. enzymes and collagenases, to be divided by four.

A vasomotor effect which lasts for approximately three hours. The effect of the cold on vasomotor reflexes is well known. Furthermore, there is a drainage effect due to the pressure of 50 bars used for the pulverisation.

This vasomotor effect immediately prevents oedemas.

A neurological effect which lasts for approximately 15 minutes. The effect of the cold provokes a muscular relaxation due to the reduction of the activity of the gammamotoneurones.

Let us add here that all these effects potentialise each other.

OUR EXPERIENCE WITH RECENT SPRAINS IN HIGH LEVEL SPORTSPEOPLE

The population

Only high level sportspeople:

Professional basketball players (category A)

Players in the top handball team which participated in the European Cup.

UFR/STAPS Students.

Demands

These sportspeople need to take their sport up again very quickly, if not immediately. This necessitates a functional treatment of the lesion with three main aims:

To respect the articulatory integrity by protecting the lesions until the healing is complete. This will be achieved by strapping, which is systematically carried out.

To eliminate pain.

To limit or reduce the haematoma and/or the oedema.

Methodology applied

Within the briefest possible delay after the occurrence of the sprain, on the edge of the field or in the changing rooms: a 2-minute cryotherapy session.
This emergency treatment will precede the doctor's visit, who will determine what kind of sprain it is and, if necessary, will prescribe X-rays. It must be noted that during radiological examinations, a cryotherapy session allows the radiologist to take better pictures of a heavily oedemaed ankle in a forced position.

From D+1 until D+3, a cryotherapy session in the morning with the application of a strapping, plus another cryotherapy session in the evening.
At D+3, indolence is achieved and the reuptake of training is possible.
At D+4, a single daily cryotherapy session is carried out, followed by a strapping.
At D+5, strappings need to be systematic before training and competitions. The patient during his rehabilitation can request a cryotherapy session, which will almost exclusively be proprioceptive.

RESULTS

Out of a sample of 17 people presenting a sprained ankle, we had four girls and thirteen boys whose ages range from 17 to 24 years, with an average age of 22.

The pathologies of these patients:

16 recent sprains seen to within three hours, of which were seen to on the field.
4 benign ones with no laxity when examined.
12 fairly serious ones
8 only concerned the LLE
4 concerned the LLE and the *anterior capsule (equine varus)*

A serious sprain seen to after 15 days of immobilisation in plaster.

The protocol mentioned above was applied. The results were as follows:

First cryotherapy session: immediate disappearance of pain, which returns after three to five hours with diminished intensity.
The absence of pain after three days in 15 out of 17 cases; this state allows the reuptake of training. The absence of pain in the remaining two cases was achieved at D+5.
Within 48 hours, an important resorption of the oedema and/or the haematoma is translated into a difference in cm between the damaged side and the healthy side being inferior to 1.7cm.
On the third day, 15 out of 17 patients had resumed training. The remaining two resumed training after 7 days, and four patients had to play in matches before D+7: one handball and three basketball players.

In the long term, after two or three months, the results are stable and equivalent to those obtained with traditional treatments.

CONCLUSION

The conclusion has to compliment low-temperature cryotherapy, which allowed an early resumption of training, thus avoiding the loss of cardio-respiratory training that frequently occurs following these pathologies.