

Cryonic Medical

Advanced Cryotherapy Equine Treatment Protocol



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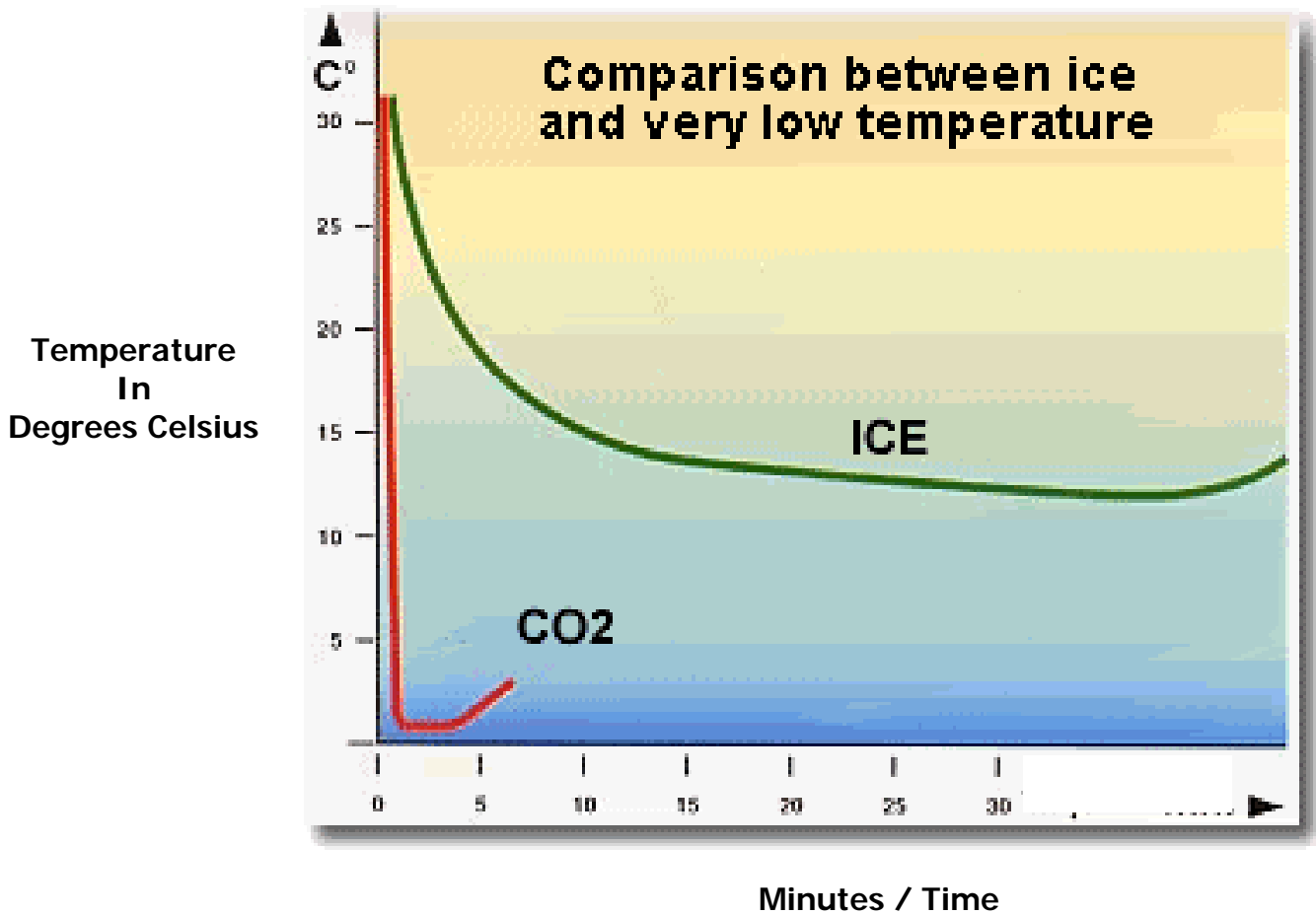
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***THIS DOCUMENT WAS WRITTEN BY
THE VETERINARY SCIENTIFIC COMMITTEE OF CRYONIC MEDICAL***

Time and Temperature Comparison of Ice and CO₂ Gas

Scientific studies have demonstrated that the magnitude of cold, and the speed of temperature descent, are the two primary factors that influence the quality and efficacy of cold therapy treatment.



History of Low Temperature Cryotherapy

Cold therapy has existed since antiquity, but only since the 1970's have researchers begun investigating the physiological effects of cold temperatures by application of ice packs, or cold sprays.

Japan, followed by Germany, were the first two countries to develop a scientific methodology with a codified assessment of the results of a rapid lowering of cutaneous temperature.

During the *First International Symposium on Cryotherapy* held in 1990, it was demonstrated that only the abrupt lowering of local temperature in a minimum of time, obtained by the heating and evaporation of liquid nitrogen (-120° C), could induce durable results in the treatment of pain and inflammation.

Further development of this cryogenic technique has been hindered by the cumbersome equipment required, the cost of liquid nitrogen and the heavy 48% evaporation loss. Even today researchers do not know how to produce intense cold under strong pressure, without the use of liquid gas expansion. It has quickly become obvious that there is a need for a new technology using equipment that is simple, reliable, and employs gas which is easy to procure and does not evaporate.

Existing techniques that function with ambient air ventilation provide good results down to a temperature of around -30°C, however, we have noticed that these temperatures are insufficient for obtaining immediate cryothermolysis. We do know, however, that only thermal shock induces lasting reactions in the organism, under the condition that the temperatures used are very low (around -60°C). The lower the temperature, the more quickly thermal shock will be obtained.

In order to respond to the technical requirements necessary for treatment, Cryonic Medical has perfected and patented a technique of sublimation of solid carbon dioxide. This consists of a spray projection of dry ice crystals at 50 bars of pressure. This produces two effects: a -78° C cold projection (satisfying the primary requisite of a temperature below -60°C); and the pressure of the gas creates the necessary speed for an abrupt drop in the skin temperature (this being the secondary requisite). The resulting cryothermolysis is almost immediate.

Cryonic Medical advanced cryotherapy is not only indicated in emergency procedures in the areas of trauma, sports medicine, surgery, and acute inflammation, but it is also recognized as efficient in the treatment of acute and chronic neuromuscular conditions.

Physiologic Effects of Advanced Cryotherapy

Cryonic Medical advanced cryotherapy using very low temperatures produces four significant effects through the induction of "cryothermolysis":

Analgesic Effect: This reaction is obtained through the inhibition of nociceptor nerve sensors and a sharp decrease of their neuro conduction velocity. There are now several published articles describing laboratory tests in which fiber conduction velocity has been reduced to practically zero. The analgesic effect on acute pain lasts approximately three hours.

Anti-inflammatory Effect: During acute inflammation there is a significant production of inflammatory enzymes categorized collagenase and hyaluronidase. Scientific tests have shown that the activity of these enzymes is dramatically reduced following the early application of gas cryotherapy, resulting in immediate interruption of the acute inflammatory reaction.

Vasoconstriction / Vasodilation Effects: The vasomotor effect on blood vessels with this novel Cryonic Medical technique illustrate its therapeutic potential. The intensity of "cryothermolysis" induces an almost immediate (7 seconds) reflex vasoconstriction. Coupled with high gas pressure (50 bars), which has a massaging and draining effect on tissue, the technique gives very rapid results in the treatment of edema and hematoma. The ensuing vasodilatation in deep tissues (117% in 20 seconds) produces an increase of circulatory flow and a decrease in histamine, lactic acid and fibrin, a substantial decrease in PCO₂ and an increase in PO₂. Finally, a vasomotor commotion is thus provoked by "cryothermolysis" by reactivating microcirculation at the level of metarterioles and venules.

	<u>Ice</u>	<u>Liquid CO₂</u>
Vasoconstriction peak	38%	38%
Time of onset	30 seconds	7 seconds
Vasodilatation peak	80%	117%
Time of onset	20 minutes	20 seconds

Neurological Effect: Advanced cryotherapy induces the relaxation of large muscular fibers, primarily due to the activation of gamma motor neurons . Numerous studies are currently being performed to clarify the mechanisms involved in the local decrease of muscle tone. It is possible that there is a reflex action situated at the level of the spinal cord.

Tendon and Ligament Disorders

Acute Case

- Speed of intervention determines the efficacy of treatment,
- The affected area can be localized with precision by using an infrared thermograph. It is important that this area be shaved in order to effectively apply the advanced cryotherapy treatment.

Treatment Protocol

Day 0:

Apply advanced cryotherapy to the affected area in slow longitudinal motion, controlling temperature descent. When skin temperature reaches between 2°C and 4°C this range must be maintained for a 45 to 60 second period. In the event that the SDF is affected, the medial and lateral parts should be treated for a duration of 30 seconds each. This application should be repeated three times at 3 to 4 hour intervals.

Day 1 to 3:

The same treatment should be applied twice a day.

Prophylaxis

According to some Equine Veterinarians "Cold temperatures can assist in reducing the incidence of tendonitis during the immediate post-exercise period, by avoiding micro-lesions and their subsequent aggravation, which could result in fatigue tendonitis. We therefore recommend tendon cooling after every strenuous exercise".

A 60-second advanced cryotherapy session should be administered right after exercising. This is accomplished by inducing temperature descent to 4°C, which is maintained for 60 seconds.

The region to be treated can be identified through the use of the infrared thermograph. Other inflammatory ailments will benefit from the same treatment protocol:

- Sesamoiditis / Inflammation of Sesamoid Bones
- Suspensor Desmitis / Ligament Inflammation
- Synovial Membrane Inflammation

Treatment should be adapted according to the evolution of the inflammatory condition. Assessment of temperature descent, and hence adaptation of the treatment, can be obtained by using the infrared thermograph.

Hematomas

The efficacy of treatment for hematoma re-absorption will depend on swiftness of intervention. The area to be treated must absolutely be shaved.

Treatment Protocol

Day 0 to 1:

Apply advanced cryotherapy to the area with a brushing motion, controlling temperature descent. Maintain skin temperature between 2°C and 4°C for 45 to 60 seconds. Apply treatment twice a day.

Day 2 to 3:

Same protocol once a day.

Muscle Recuperation of Competition-Horse Myalgia

Certain specific muscular tension foci (Tender Points) are located on the equine musculoskeletal structure. These are zones situated in a muscle or within its fascia, and are suggestive of spasms of one or several muscle groups, depending on the points identified.

Palpation of this hyperalgesic point will usually provoke an avoidance reaction in the horse. Advanced cryotherapy application to these precise points results in alleviation of the painful spasm when a temperature of 4°C is reached.

Subsequent spraying of the affected muscle bodies induces relaxation of the muscle fascia that was initiated by the advanced cryotherapy on the Tender Point.

Treatment Protocol

- I. Application by circular, or brushing spray motion on the identified point, until a temperature of 4°C has been reached.
- II. Without interrupting the cryothermolysis, the affected muscle groups should be slowly brushed, at a distance of about 5–8 cm, in both of the coat-hair directions, for 90 seconds.
On muscle groups with an abundant surface area (glutei), the use of reflex traces works well. The recommended muscle direction should then be sprayed three times. The spray pressure of the gas cryotherapy hand-piece effectively replaces the pressure of a finger or elbow.
- III. An indispensable complimentary use of the advanced cryotherapy treatment consists using the spray to stimulate the acupuncture points along the paravertebral lines. By applying advanced cryotherapy for only a few seconds on points that follow the paravertebral line, or along a muscle body, additional muscle relaxation can be achieved.
- IV. The treatment session ends with a “Spray and Stretch” technique that consists of stretching after advanced cryotherapy application. The affected muscle groups must be stretched passively.

Advanced Cryotherapy in Sport Horses

Clinical Cases

The following Cryonic Medical equine clinical observations were based on a large quantity of horses (approximately 200) of various breeds and equine disciplines.

This study was performed at several sites: in stables, on the racetrack, or in more serious situations... the Equine Veterinary Clinic.

Each equine discipline imposes its own physical requirements, and therefore generates pathological conditions that are characteristically frequent in that discipline. There are, however, a certain number of injuries that are very common to all disciplines, such as injuries in the dorsal lumbar area.

In order to simplify this treatment protocol, we have organized our observations by type of injury, citing a few cases that are representative of the different sport activities. The proof of the efficacy of advanced cryotherapy is based upon on the following type of evidence:

1. Clinical Examination

- Static: visual and by palpation.
- Dynamic: change in locomotion.

2. Additional Examinations

- Echography
- Local thermography

I. Tendon and Ligament Repair

A. Acute Tendon Injuries

Treatment efficacy will depend on the severity of the lesion and swiftness of intervention. In the case of a superficial lesion, use of advanced cryotherapy alone will typically provide satisfactory results.

1. "Tendonitis" (stage 1):

This injury is either due to direct superficial trauma, or to effort.

Clinical Signs: heat, moderate or no edema, slight tenderness on palpation.

Echographic Signs: image suggestive of edema in the tendon area.

Treatment:

If possible, treat the entire injury zone in question. Intervene immediately with 3 sessions per day (45 to 60 seconds per session), for three consecutive days, or less in case of obvious improvement.

Prophylaxis:

An additional application after exercise should be considered when the horse resumes competition.

Examples:

5-year-old Jumper

Traumatic peri-tendonitis of the left anterior SDF sustained during a competition on Sunday. Treatment on the following Monday, Tuesday and Wednesday. B1 level competition on Thursday without any problems, after which prophylactic treatment was applied.

5-year-old Jumper

In a sale demonstration, horse was forced to jump too many obstacles. A morning examination by the Equine Veterinarian revealed a positive flexion test, and exertion peritendonitis of the right anterior SDF.

Dynamic Observation:

Irregularities on a straight line, worsening on a circle.

Treatment:

Three 60-second advanced cryotherapy sessions given at 3-hour intervals. On the same evening an Equine Veterinarian exam concludes that the flexion test is negative, there are no straight-line irregularities, and dynamic examination on a circle shows a 95% improvement.

Racehorses (Trotters and Gallop)

Frequent injuries of the anterior SDF.

Immediate Clinical Signs:

Irregularity after the race, without echographic images of more serious injury.

Treatment:

Three advanced cryotherapy sessions per day, for three days. Apply prophylaxis for three days after workouts have resumed.

2. "Tendon Injury with Fibrillary Lesions"

In the case of more serious injuries demonstrated by echographic examination, advanced cryotherapy allows constant control of the inflammatory response during the acute phase:

- Collagenase and hyaluronidase activity is inhibited, and hematic infiltrates are rapidly reabsorbed,
- Advanced cryotherapy facilitates the efficacy of other physiotherapeutic treatments, and allows a rapid resumption of walking thanks to the analgesic effect.

These properties favor good quality healing, limiting the risk of relapse. A number of jumpers have been treated using this protocol and today their sports career is proceeding without any difficulty. In the case of chronic or recurrent tendonitis, we have observed clear improvement of clinical and echographic signs. The resumption of sports activities

after injury is now much more rigorously controlled. Hence, prophylactic cryotherapy assumes an important role in controlling and alleviating inflammatory reaction as soon as it appears.

The most representative case that we have treated was a female trotter who suffered from recurrent tendonitis of the left anterior SDF, for which an array of standard treatments had been tried without success. After eight weeks of physiotherapy in an Equine Veterinary Clinic, the mare was able to resume racing in 4 months. Prophylactic advanced cryotherapy was used during the entire period during which exercise was being reintroduced, allowing optimal management of the healed but still fragile tendon lesion. One month later the mare was able to start working out. Advanced cryotherapy was applied systematically at a rate of three sessions per day after each brisk exercise. The mare began racing again after one and a half months. Advanced cryotherapy was applied immediately after the race and again every 3 hours for 48 hours, followed by twice a day for 2 days. The tendon showed no signs of fatigue (absence of abnormal heat, deformation or tenderness).

To conclude, in this type of more serious injury, advanced cryotherapy allows a more rapid re-absorption of hematomas and edema, significantly decreases the damaging effects of swelling, and by its analgesic properties permits the resumption of hand-guided walking. Walking is fundamental for maintenance of physical fitness and especially for correct vascularization of the tendon, which occurs as the foot is placed on, and lifted from, the ground.

Note:

In all cases of serious tendon injuries, it is essential to shave the entire region to be treated in order to increase the efficacy of the cryotherapy (speed of skin temperature descent). Shaving is usually done at the time of the echographic examination.

B. Ligament and Related Injuries

1. Desmopathy / Ligament Disease

As for ligament injuries, here again the outcome of treatment will depend on the rapidity of intervention.

In cases of minor extensions associated with hematic infiltrates, advanced cryotherapy alone will suffice. Where more serious extensions are involved (muscle fiber lacerations with localized hematoma), as in previous injuries, cryotherapy will enhance the efficacy of other forms of treatment to control inflammation.

Most Frequent Locations:

- Collateral fetlock ligaments, and fetlock suspensor ligaments

Clinical Signs:

- Warmth
- Tender palpation
- Echography confirms the benign nature of the lesion

Dynamic Examination:

- Although there is no limping, difficulty can be observed during the decreasing phase of gait, particularly when there is injury to the hind limb fetlock suspensor.

Standard Treatment Is As Follows:

- Shave the area to be treated,
- Three 60-second applications per day for three days

Results Observed:

- A 3-degree difference in temperature compared to the contra-lateral limb,
- This difference, as well as functional and local signs, subsides after treatment.

Illustrative Cases:

In jumpers we have mostly treated injuries to the forelimb fetlock suspensor. In case of benign injury, the results were highly satisfactory when gas cryotherapy treatment was initiated early, that is on the same day. For more serious injuries the duration of the advanced cryotherapy treatment was necessarily longer and associated with other therapeutic methods. We have seen cases of trotters that have benefited from the same protocol, the site of injury being more frequently on the hind limbs. In benign injuries, resumption of training was quicker by adding prophylactic sessions.

2. Supra-Spinal Ligament Inflammation

We have on two occasions encountered and treated inflammation of the supra-spinal ligament in jumpers. These horses were exercised on flat terrain and jumped obstacles while on draw reins, creating abnormal tension in the lumbar region. Clinical signs included pain upon palpation, poor engagement of obstacles with a rider, especially on use of the whip. The suppression of draw reins with initiation of advanced cryotherapy enabled the horses to return to normal exercising in a few days, and the area affected quickly returned to normal during treatment.

Other cases of injury to the supra-spinal ligament are exemplified by several horses that presented a heightened sensitivity of the withers region due to poor adaptation to the saddle equipment (pain upon palpation, warmth due to heat provoked by the saddle). These clinical signs are often associated with an incorrect attitude at an obstacle: fall or flight after the bar due to painful contact of the saddle in the reception phase.

Treatment:

- Elimination of the cause of the injury (reduce the thickness of the saddle pads or change the saddle),
- Treatment three times a day for three days demonstrated rapid improvement.

3. Bursitis and Synovitis

During the course of our observations, we have encountered several cases of withers bursitis (non infectious). Cases of tenosynovitis / tendon sheath inflammation were much more frequent.

Clinical Signs:

- Warmth
- Pain upon palpation

Dynamic Examination:

Change in gait varies according to the intensity of the lesion, which is usually linked to the length of illness. Chronic lesions generate a peri-articular organization that seldom favors a return to normality.

Treatment:

- Early: treatment with advanced cryotherapy, three times a day for three days,
- Late : initially identical to that of early treatment, continued once or twice a day until disappearance of clinical signs.

Clinical Cases:

Eight-Year-Old Trotting Horse

Limping after a promenade on uneven terrain (bicipital bursitis).

Clinical Signs:

Warmth at the point of shoulder, pain upon pressure, retropulsion-provoked reaction of the forelimb, slight limping and limited stride.

Treatment:

Because advanced cryotherapy was begun late, it had to be continued for 10 days.

II. Traumatic Serous Arthritis (Carpus and Hock)

a. Swollen Knee

- A horse that kicked his door and fell down on its knees.

b. Inflammation of the Hock Joint

- A horse that continuously kicked the wall of his stall.

Non-response to treatment after three days of application was likely due to the presence of a previously unnoticed infection. In three treated cases presenting no improvement, additional investigative procedures (articular puncture) were found to be positive.

Clinical Case:

Four-Year-Old Horse

Young Horses' Week at Fontainebleau, France.

Chronology:

Monday afternoon - the course was covered in 8 points without problems.

Tuesday morning - the hock joint had become swollen overnight due to the horse's agitation. The animal was experiencing difficulty in the use of his hind limbs and caution in resting the limbs.

Tuesday from 10 am to 4pm - three 90-second treatment sessions at three-hour intervals.

Tuesday 5pm - course covered in 4 points without apparent difficulty.

Note:

When possible it is advisable to shave the area affected before treatment. Dorsal recess of the tarso-synovium of the hock joint + medial and lateral synovial recesses.

III. Hematoma Evacuation

Lesions Were Linked to Direct Trauma:

- Kicks
- Obstacle bars
- Violent contact with pedestals, with doors, during transportation

Cases treated included injuries to the buttock muscular masses, the femoral-caudal muscles, the lateral side of the shoulder, the cranial side of the canon, the cranial side of the 1.2 interphalangeal joint.

Clinical Signs:

- Pain upon palpation of the hematic mass, often noticeable to the naked eye.
- Warmth
- Difficulty in gait, variable according to localization

It is of the utmost importance to intervene as quickly as possible in the hours following the injury, as treatment will not be effective if the hematoma is organized. Shaving is essential.

Treatment:

- Three applications a day for a maximum of three days.
- Rapid regression of clinical signs.

Clinical Case:

Four-Year-Old Jumper of Prestigious Lineage

Had been kicked on the right femoral-caudal muscles.

Treatment began the same evening and was continued for three days, after which physiotherapy was begun due to the severity of injury.

5th day: painless palpation, normal gait during a right-hand circle, adduction, stretching with a rider without reaction.

Note:

As is well known, organization of the hematoma can lead to serious consequences for the sports career of the horse due to the risk of calcification. Hence the importance of rapid intervention to avoid later repercussions.

Ten-Year-Old Jumper

Wound with large hematoma on the medial side of the left hind limb caused by a collision as the horse passed over a pedestal. Resumed competition a week later.

Eight-Year-Old Jumper

Hematoma located above the hoof where it struck the bar. Difficulty in resting the foot, pain upon pressure. Training was resumed after two days of advanced cryotherapy treatment.

IV. Myalgia / Muscle Pain Relief

Each equine discipline has its specific physical constraints. Certain muscular groups are solicited more intensively than others according to the efforts required. An obstacle jumper will not show the same signs of fatigue as an endurance horse. Although our studies could not be inclusive of all the disciplines, we have been able to observe and treat a considerable number of lesions, which we subsequently organized into groups reflecting their frequency within each specialty.

Lumbar-sacral Joint:

Buttock muscles; obstacle jumpers, dressage, trotters, gallopers.

Thorax-lumbar Joint:

Long dorsal; obstacle jumpers, trotters.

Withers:

Thoracic and cervical trapezius, rhomboid; dressage, obstacle jumpers, trotters.

Neck:

Lateral right of the head, brachio-cephalic; dressage.

Forelimbs:

Shoulder muscles (deltoid and pectorals); obstacle jumpers.

Hind Limbs: femoral-caudal and buttocks; dressage, obstacle jumpers.

Hunting Horses:

We have had experience with a few and the results were spectacular. The muscle spasms disappeared, and the muscle pains located along the line of the vertebral column.

Muscle Pain Clinical Signs:

Palpable Tenderness combined with an avoiding reaction by the horse.

Treatment for Myalgia / Muscle Pain:

Use advanced cryotherapy for 45 seconds on the sensitive point of the muscle body. Then stimulate individual acupuncture points along the back with a brief, 2 to 4 second spray.

Other disciplines to be studied include polo, in which the muscle relaxant effects of cryotherapy will surely find a use.

V. Arthropathy / Joint Disease

Only the vertebral column was studied in horses presenting varying degrees of arthrosis. The presence of degenerative pathology can increase joint fatigue following exercise.

Clinical Signs:

- Sensitivity to pressure of the spinal processes and of the longissimus along the vertebral column; sometimes a collapsing attitude
- Gait difficulty when mounted

Treatment:

Using the advanced cryotherapy spray hand-piece, use a circular, brushing motion on the affected joint for 45 to 60 seconds, followed by 2 to 4 second stimulation of the acupuncture pressure points located on specific peripheral muscle masses.