Hyperbaric CO2 cryotherapy effective tool to control edematous disease processes

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Early communication

Abstract

Cryotherapy is a wellknown method to reduce pain, but it is also commonly used to reduce tissue edema. Edema presents a problem in diagnostic assessment, treatment and complications. Different methods of cryotherapy, such as cold packs and cold water, have been studied in different conditions and species for pain and edema, with little evidence of edema reduction. We present here a case series of treating edema with hyperbaric CO2 cryotherapy in order to prevent problems created by tissue edema. 30 seconds of hyperbaric CO2 treatment was found to be effective in treating edema prior to ultrasonographic imaging in tendon area, wound closure, joint effusion and unspecified tissue edema. No negative reactions or tissue damage was recorded. Further studies into the effect of hyperbaric CO2 cryotherapy treatment and comparison to other cold therapies in edematous disease processes are recommended.

Background

Edema is a problem that causes tissue damage as well as complications in diagnostics, treatment and outcome management. Edematous tissue is difficult to interpret in ultrasonographic imaging, edema is a cause of tissue damage and edematous tissue may be more prone to infections and other complication. Also, edema may create a challenge for repair, for example in wound management.

Cold therapy is commonly used in the sports medicine and has been found to be effective in reducing pain in many species, including horses and humans; however, there are limited studies to show the efficacy of cryotherapy in reducing swelling. Studies examining regular cold pack therapies to reduce swelling have come to no conclusions about its efficacy. We found no studies to examine the effect of hyperbaric cryotherapy therapy on edema. Hence, this study is a case series of edematous processes and their treatment with hyperbaric CO2 cryotherapy to aid in edema control.

Methods and materials

We present four different cases of edematous processes where we tested hyperbaric CO2 cryotherapy to reduce edema. Cases where edema was present and creating a challenge for effective therapy were recruited between August and October 2018.

Cases

1. Warmblood mare 15 years, in foal: Udder blood supply related edema
2. Warmblood gelding, 15 years: Wound management prior to closure and during treatment in tendon area
3. Warmblood stallion, 16 years: Tendon damage treatment prior to ultrasound imaging
4. Warmblood gelding, 11 years: Joint effusion treatment in competition dressage horse

These cases were identified from regular daily equine practice (Equidea Ltd, Sipoo, Finland) and recruited at diagnosis. Cases where edema was present and creating a challenge for effective therapy were recruited between August and October 2018. Cases were followed up during treatment until normal function was restored.

Treatment consisted of hyperbaric CO2 cryotherapy for 30 seconds per treatment, and the treatment effect was measured and presented here after the first time of treatment. A series of treatments was used for cases 2, 3 and 4, and we also present the results of further treatments

Results

Case 1: Warmblood mare 15 years, in foal: Udder blood supply related edema. Follow-up 24 h

In this case there was no abnormal functionality except slight discomfort from the large swelling that developed rapidly to the skin above the udder. The swelling and surrounding tissue around the blood supply to the area was treated. The swelling stopped growing and then started to decline. After 20 hours from the initial treatment there was approximately ¼ of the edema left. The surrounding tissues did not have any edema present.

Case 1: The picture on the right at the time of diagnosis and treatment, the second picture taken 15 hours after the treatment

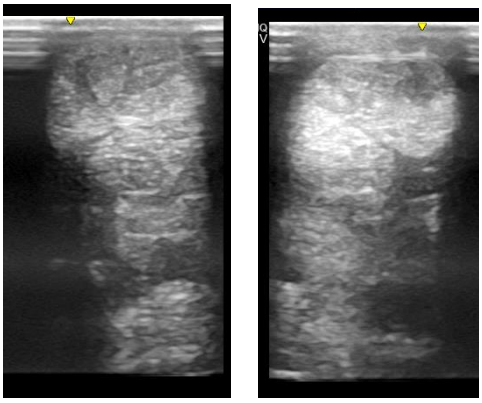
Case 2: Warmblood gelding, 15 years: Wound management prior to closure and during treatment in tendon area

The vet was called out to treat a large wound in the left front leg tendon area. The injury had happened in the pasture and was noticed a couple of hours after. At veterinary inspection the wound area was swollen, some skin was torn beyond repair and there was marked swelling above the wound area in the tendon sheets. Tissue damage and cavity was identified to continue high into the upper tendon sheet. The wound was treated in standing anesthesia, flushed with saline solution and cleaned from non-viable skin. The edema was preventing closure with remaining skin. The area around the wound was treated with hyperbaric CO2 cryotherapy. The edema was reduced in 20 minutes to a level where partial wound closure was possible. The lower part of wound area was left open with drainage for the first 3 days. A course of trimethoprim sulfonamide for 5 days was given orally with 10 mg/kg every 12 h. Cryotherapy was given once daily and bandage support was kept 24/7 for the first two weeks of treatment. Swelling was evident each day before the cryotherapy was given and kept in control with daily management. The stitches were removed at day 14 and final check was done on day 21. The horse returned to normal use, although tendency to develop edema to the leg remained for 2 consecutive months. The owner used bandage support and regular cryotherapy treatments to control it.

Case 2: Wound at diagnosis, 24 hours after closure and 20 days after closure

Case 3: Warmblood stallion, 16 years: Tendon damage treatment prior to ultrasound imaging

The vet was called out to assess an old tendon injury that had developed new edema to the old injury site. The injury site had marked swelling around a defined area in the upper part of tendon sheet. The injury site was scanned first and then 20 minutes after cryotherapy. The edema in the area was reduced and the actual core lesion within the tendon was easier to assess.



Case 3

Tendon damage assessment. First picture with acute swelling and edema, the second image is taken 20 min after hyperbaric CO2 cryotherapy treatment, and the lesion area is easier to assess.

1 First scan and 2: second scan after 20 min of cryotherapy

Case 4: Warmblood gelding, 11 years: Joint effusion treatment in competition dressage horse

The horse was presented to the vet because of slightly reduced performance in dressage competitions. No sign of proper lameness was noted upon inspection in any gaits on firm or soft surface. In palpation, both front leg coffin joints were distended. The horse was treated with hyperbaric cryotherapy and a palpable difference in the amount of joint effusion was noted 24 h later. The horse performed much better according to rider's subjective evaluation as well as the scores and placings achieved during the following weeks. The horse was treated regularly every 3 to 5 weeks since the and did not receive any other medication to keep joint effusion on moderate level.

Conclusions

From the body of evidence we know that cryotherapy can be used as an analgesic therapy. On top of analgesic effect, the presented case studies suggest hyperbaric CO2 cryotherapy to have good effect to reduce edema. Edema can hinder the diagnostic process, treatment and good clinical outcome in many cases. Therefore we suggest that hyperbaric CO2 cryotherapy can be an efficient tool in clinical use and should be investigated further. A clinical study to compare against other cold therapies and placebo is recommended.