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Editorial

Cryotherapy in rheumatic diseases

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Rheumatic diseases are related to a degenerative process (osteoarthritis) or to chronic inflammation (e.g., rheumatoid arthritis and spondylarthropathies) and can cause severe functional impairments. Some of the rheumatic diseases are extremely common in the general population. In addition to the drugs (analgesics and anti-inflammatory agents) and rehabilitative techniques often recommended for rheumatic diseases, cryotherapy is widely used both by healthcare professionals and by patients at home. Cryotherapy is an easy-to-use nonpharmacological method for obtaining pain relief.

Cold application has long been known to produce therapeutic effects. In the aphorisms of Hippocrates (460–370 BC), the use of ice or snow was already recommended to diminish edema and pain [1]. The use of cold applications remained empirical until the 1970s, when this method became known as cryotherapy (from the Greek cryo, which means cold).

The physiological effects of cryotherapy include a steep and substantial drop in skin temperature [2] and a modest and delayed decline in temperatures within the muscles and joints [3,4]. Cryotherapy also induces arteriolar and capillary vasoconstriction in the skin [5], causing a decrease in local blood flow. For instance, a cold pack applied for 20 minutes decreases synovial blood flow in patients with arthritis [6].

Cryotherapy has three main effects: analgesia, anti-inflammatory effects, and decreased edema and bleeding. Cold-induced analgesia is related to both direct effects (gate control, decreases in nociceptor excitability thresholds and in nerve conduction velocities [5,7]) and indirect effects consisting in decreased edema and muscle spasm [5]. In a study of patients with rheumatoid arthritis (RA), the pain threshold increased immediately after an ice massage [8]. Analgesia may occur when the skin temperature drops to 10 °C–15 °C and may persist for 15–30 minutes after the end of the cold application. The anti-inflammatory effect of cryotherapy is ascribable to decreases in enzyme activities (e.g., metalloproteinases) and in the production of chemical mediators of inflammation and cell metabolism [5]. Cold application decreases the oxygen and ATP needs, thereby improving cell survival and diminishing secondary hypoxic lesions. Finally, cryotherapy may prevent and/or diminish postoperative edema or bleeding by decreasing vascular permeability and inducing vasoconstriction [5].

The combined effects of cryotherapy (decrease in pain, inflammation, and/or edema) may promote recovery of joint motion. These therapeutic effects constitute a theoretical rationale for including cryotherapy within the therapeutic armamentarium for rheumatic diseases. Empirically, over 60% of physiatrists and rheumatologists believe that cryotherapy is beneficial in a variety of conditions (e.g., arthritis, low back pain, and neck pain) [9].

Although cryotherapy has been investigated as a treatment modality for rheumatic diseases, the conclusions are limited by the small number and imperfect design of the available studies [10,11]. Few studies evaluated the analgesic effects of cryotherapy in osteoarthritis. Ice massage (20 minutes 5 days a week for 3 weeks) significantly improved knee range-of-motion and strength in patients with knee osteoarthritis [10]. In addition, cold packs decreased swelling [10]. A few studies investigated cryotherapy in patient with inflammatory joint diseases such as RA [4,11,12]. Although a Cochrane review found no objective evidence of efficacy, its authors suggested that cryotherapy might serve as an adjunct to rehabilitation therapy given the absence of adverse effects [11]. Finally, a recent review identified only three studies (of poor methodological quality) of the efficacy of cryotherapy in patients with low back pain, indicating that no conclusions can be drawn based on the available evidence [13].

Cryotherapy is the most widely used physical treatment modality in musculoskeletal traumatology and surgery (joint or ligament reconstruction procedures or arthroscopy) to minimize pain and to prevent or minimize bleeding and swelling.

Contraindications to cryotherapy include Raynaud phenomenon, cryoglobulinemia, cold allergy or hypersensitivity, exaggerated skin sensitivity and/or fragility (e.g., due to hemophilia, alcohol abuse, anesthesia of an extremity, or glucocorticoid therapy), and peripheral vascular disorders. Reported side effects of cryotherapy consist of pain, skin lesions (chilblains or necrosis), and damage to peripheral nerves (common peroneal nerve or ulnar nerve) [14]. These side effects are rare and minor [10,11] provided appropriate precautions are taken (no direct contact between the cold pack and the skin, no application on peripheral nerves, and skin temperature kept above 2 °C).

The optimal parameters for cold application remain controversial. Intermittent application instead of continuous application has been advocated despite the absence of scientific proof of a difference in efficacy. Each session should last 25 to 30 minutes, which is

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the time thought to be needed to substantially decrease temperature, blood flow, and metabolism. It has been suggested, however, that the application time be adapted according to the amount of adipose tissue (a poor conductor). Other factors such as concomitant compression and the presence of an interface can increase or decrease the temperature drop.

Several methods are available for cold application [5]. The simplest is a pouch filled with ice cubes or, preferably, a mixture of water and crushed ice. Straps can be used to secure the pouch and to apply compression. Cold packs are the most widely used cryotherapy method. New cold packs with cells to maintain a more stable temperature and provide flexibility have been developed. With the CryoCuff® and Polar Care® packs, water at a constant temperature circulates within a cuff shaped to fit each type of joint. Unfortunately, comparative studies are too scarce to determine whether one of these techniques is superior over the others.

A number of more complex methods seek to achieve a thermal shock to amplify and prolong the beneficial effects of cold (very low temperature cryotherapy). CO_2 cryotherapy consists in spraying carbon dioxide microcrystals (at 50 bars), which undergo instantaneous sublimation, causing a large and rapid change in temperature [15,16]. Care should be taken to avoid burns by taking appropriate precautions (skin temperature above 2–4 °C, absence of pain). In elderly patients with acute or chronic pain, CO_2 cryotherapy produced significant decreases in pain scores [16]. In cold air cryotherapy, ambient air is filtered and sprayed onto the skin at −30°C [12,17]. Thus, no consumables are needed. Marked drops in temperature are achieved at the skin and within the joints [17]. Studies are needed to obtain scientific evidence on the potential benefits of these new cryotherapy modalities.

Cryotherapy can also be applied to the entire body. In Scandinavian countries, ice-water immersion has long been used, in particular to relieve musculoskeletal pain [18]. In addition to this natural method of whole-body cryotherapy (WBC), cryogenic chambers were developed in the 1980s. The chamber is filled with dehydrated air at −105 °C to −140 °C. One or a few patients spend up to 2–3 minutes in the chamber after passing through one or two acclimation chambers [19]. Recent studies suggest that WBC may be effective (by inducing a major temperature drop) in blunting nociceptive perceptions and inflammatory processes in patients with RA, ankylosing spondylarthritis, osteoarthritis, or fibromyalgia [12,20]. However, the available evidence is scant and has not been widely disseminated. In addition, no studies have established that WBC is superior over other cryotherapy methods. In a randomized single-blind study in 60 patients with RA, WBC at −110 °C or −60 °C was compared to cold air at −30 °C and to cold packs [12]. No major differences in pain or inflammation were found between WBC and the other two methods. Given the high cost and limited availability of WBC, together with the possible side effects (with discomfort leading some patients to discontinue the treatment), WBC does not seem superior over conventional cold application methods [12]. Furthermore, the ability of WBC to enhance recovery and rehabilitation in athletes remains to be proven [19].

In conclusion, although cryotherapy may constitute a safe adjunctive treatment method in patients with rheumatic diseases, further studies are needed to confirm its efficacy.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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