Analgesic Effect of Hydrotherapy: A Narrative Review of Current Evidence

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ABSTRACT

Pain is a primitive human instinct that alerts the body's defense mechanism to prevent damage. Hydrotherapy is the most common modality of treatment used for pain management in naturopathy. This review aims to scientifically evaluate the analgesic effects of hydrotherapy used for pain management. A thorough literature search from inception (1 January 1946) until 16 March 2022 was performed with electronic databases such as Scopus, Embase, PubMed/MEDLINE using the keywords "Hydrotherapy" OR "Balneotherapy" AND "Pain" OR "Analgesic effect." Seven articles were identified in total. The available evidence suggests hydrotherapy to have significant analgesic effects, attributed to the physical and thermal properties of water.

Key Words Balneotherapy, naturopathy, pain management.

INTRODUCTION

Pain is a primitive human instinct, a distressing sensation linked to actual or potential tissue damage. Pain alerts the body's defense mechanism to react to a stimulus that is causing tissue damage.[1] The sensation of pain is associated with the activation of primary afferent fibres, which include un-myelinated C-fibre and myelinated Aσ-fibre. Both nociceptors remain inactive in the absence of pain and are activated in response to a noxious stimulus. Pain perception occurs in three stages, (1) pain sensitivity, (2) transmission of signals from the periphery to the dorsal horn of the spinal cord – the centre, (3) transmission of signals to higher centres of the brain for integration.[2] Although pharmacological interventions reduce pain, adverse effects of medications have been reported.[3] Hydrotherapy is the external or internal use of water in any of its forms (packs,[4] immersion baths,[5] steam baths,[6] douches,[7] compresses,[8] fomentation,[9] and temperature [as water, ice, steam]) at varying pressures, durations, and sites for health promotion or treatment of various diseases.[10] The thermal, chemical, and physical properties of water are used for the management of various conditions such as arthritis,[11] multiple sclerosis,[12] diabetes mellitus,[4] hypertension,[13] fibromyalgia,[14] migraine,[15] bronchial asthma,[9] and neuralgia.[16] Hot and cold applications activate three sensory receptors located immediately beneath the skin, namely cold receptors, warmth receptors, and pain receptors (stimulated only by applying extreme degrees of hot or cold).[2]

Analgesic Effect of Cold

Cold application, in general, decreases skin and muscle temperature and reduces blood flow through sympathetic vasoconstriction. Cold-induced decrease in blood flow reduces swelling and slows down the migration of inflammatory mediators, thereby reducing inflammation. The application of cold produces a local anesthetic effect through three main mechanisms: decreasing the activation of nociceptors, decreasing nerve conduction velocity which transmits pain, and activating the transient receptor potential cation channel subfamily M member 8 (TRPM8). TRPM8 is a cold-sensitive ion channel that could contribute to the analgesic effect through activation of group II/III metabotropic glutamate receptors (inhibitors of nociceptive responses).[17]

Analgesic Effect of Heat

Similar to cold application, the analgesic effects of the application of heat are mediated through the transient receptor potential (TRP) membrane channels. Specifically, the TRP vanilloid 1 (TRPV1) receptor conducts the sensation of heat and also regulates antinociceptive pathways in the brain. Heat application also enhances the supply of nutrients and oxygen and the removal of pain-inducing mediators produced as a by-product of tissue damage.[17]

Analgesic Effect Mediated Through Proprioceptors

Apart from the nociceptive action, topical application of hot and cold water activates specialized nerve endings called proprioceptors. Proprioceptors detect changes in movement and pressure

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inside the tissue. Proprioceptor activity inhibits the transmission of nociceptive signals to the brain.[18] This current review aimed to report the scientific and evidence-based analgesic effect of hydrotherapy for pain management.

MATERIALS AND METHODS

A literature search was performed in electronic databases such as Scopus, Embase, PubMed/MEDLINE using the key words "Hydrotherapy" OR "Balneotherapy" AND "Pain" OR "Analgesic effect." A total of seven articles were found from inception (1 January 1946) until 16 March 2022. Quasi-experimental studies, randomized controlled trials, case reports, and case series that focus on hydrotherapy and pain management were included. Research protocols, commentaries, and articles that used hydrotherapy along with physical exercise and studies published in languages other than English were excluded. The reference sections of systematic reviews and meta-analyses was also assessed for any possible studies that would meet the inclusion criteria.

RESULTS

The literature search identified seven potential articles for this review. The characteristics of the included studies are detailed in Table 1.

Literature Characteristics

A total of seven studies, conducted in Newcastle, Lithuania, Finland, India, and Iran, were included in this review.[7,15,19-23] A total of 592 participants were enrolled in the study who were suffering from different sorts of pain: blue bottle sting, chronic inflammatory arthritis, migraine, postpartum pain, musculoskeletal pain, diabetic peripheral neuropathy, and primary dysmenorrhea. Among the included studies there were five randomized controlled trials (RCTs)[7,15,19,22,23] and one cross-over study.[20] No details about the study design were given for the seventh study. All the studies used hydrotherapy as their intervention, with a minimum duration of two minutes and up to one hour. For assessment, four studies used a visual analog scale (VAS),[15,19,20,22] one study used a McGill questionnaire,[23] one study used a McGill questionnaire and VAS,[7] and one study used a numerical rating scale (NRS). [21]

Risk of Bias

Cochrane risk of bias was used to assess the risk of bias of the included RCT. Out of five studies[7,15,19,22,23] regarding random sequence concealment, all five studies were rated low risk, four studies rated low risk in allocation concealment,[15,19,22,23] blinding of participants, and personnel reporting, three studies[15,19,22] rated low risk, all studies rated low risk in incomplete outcome data and selective outcome. There was no information in any of the studies about other sources of bias.

Intervention Results

Loten et al.[19] reported that hot water immersion showed better results when compared with ice pack application for pain management in blue bottle sting. They included 96 participants, of whom 88 completed the trial. Study group patients (n=49) received hot water immersion at 45°C and the control group patients (n=47) had ice pack application. A VAS was used to assess pain severity.

TABLE 1 Effects of hydrotherapy on various painful conditions

Author, year	Sample size	Study design	Participants	Intervention duration	Measurement scale	Conclusion
Loten et al., 2006[19]	T=96	RCT	Individuals with blue bottle sting	Hot water immersion (45°C) of affected body parts for 20 min.	Pain by using VAS	Hot water immersion bath reduces pain in patients affected with blue bottle sting.
Hinkka et al., 2017[20]	T=121	Cross-over study	Individuals with chronic inflammatory arthritis	Cold mist shower twice a day (morning and evening) for 2 mins.	Pain by using VAS	After cold mist shower, reduction of pain score in patients with chronic inflammatory arthritis.
Sujan et al., 2016[15]	T=40	RCT	Individuals with migraine	Hot arm and foot bath (103°F–110°F) for 20 min, simultaneous ice massage to head, scalp with ice bag for 5 mins, given 5 days a week for 6 weeks.	Pain by using VAS	Hot arm and foot bath and ice application simultaneously reduces pain in patients with migraine.
Batten et al., 2017[21]	T=45	Not reported	Women with postpartum pain	30-min warm water (37°C–38°C) immersion bath at 1 hour postpartum	Pain by using NRS	After warm water immersion bath, a significant reduction in pain was reported.
Rapolienė et al., 2019[22]	T=145	RCT	Individuals with musculoskeletal pain	Mineralized water bath for 20 min/day, 5 days a week for 2 weeks	Pain by using VAS	After a mineralized water bath, a reduction of pain in patients with musculoskeletal pain was reported.
Vakilinia et al., 2020[23]	T=60	RCT	Individuals with diabetic peripheral neuropathy	Warm water with 250 g of mineral salt foot bath (40°C–45°C) for 15 min, given for 1 month, before bedtime	McGill questionnaire	A warm saltwater foot bath reduces pain in patients with painful diabetic peripheral neuropathy.
Rahmania et al., 2021[7]	T=68	RCT	Women aged 18–22 years with primary dysmenorrhea	Full-body douche for 8 mins/day for 20 days, neutral at 92°F–97°F at a pressure of 0.5–7 bar.	McGill questionnaire, VAS	After full-body neutral douche, a significant reduction of pain was noted.

RCT = randomized controlled trial; T = total; VAS = visual analog scale; NRS = numeric rating scale.

After 20 minutes of intervention, 87% of the hot water immersion group reported having less pain, while only 33% reported having less pain in the ice pack group.

Hinkka et al.[20] reported that cold mist showers showed a reduction in pain in patients with inflammatory arthritis. They included 121 participants in the study. Participants received a cold mist shower for 2 minutes once in the morning and evening for 5 days. A VAS was used to assess pain severity. Results showed a significant reduction in pain and, also, an improvement in the quality of sleep. The study concluded that a cold mist shower was found to be effective in the management of pain in inflammatory arthritis.

Sujan et al.[15] reported that 40 migraine patients were enrolled. Patients in the intervention arm received a hot arm and foot bath (103°F–110°F) and an ice massage to the head daily for 20 minutes for 45 days. The control arm received usual pharmacological care. Using a VAS to assess pain severity, they found that there was a more significant decrease in frequency and intensity of headache with hydrotherapy and pharmacotherapy than with pharmacotherapy alone. They concluded that hydrotherapy increases vagal tone along with a reduction in frequency and intensity of headaches in migraines.

Batten et al.[21] reported on 45 postpartum women who received hydrotherapy in the form of an immersion bath with warm water of (37°F–38°F). Pain before the bath was assessed using a numeric rating scale (NRS). During an intervention of 30 minutes, an assessment was made at 3 time points: baseline assessment, 15 minutes into the bath, and at 30 minutes. They found that hydrotherapy could be an effective intervention for postpartum pain management and also enhanced the birth experience.

Rapolienė et al.[22] reported on 145 participants with musculoskeletal disorder who received 20 minutes of bath, 5 days a week for 2 weeks. This study consisted of 5 groups: 3 groups received baths with different levels of mineralized water (20, 40, and 60 g/L total dissolved solids), one group received tap water, and one was a control without intervention. A VAS scale was used to assess pain severity after the mineral bath. They concluded that mineral water is more efficient than tap water in pain reduction.

Vakilinia et al.[23] reported on 60 patients with diabetic peripheral neuropathy who participated in the study. In the 3-arm trial, the first arm received a warm foot bath at 40°C–45°C for 15 min/day for one month before bedtime, the second arm received 250 grams of mineralized warm foot bath at the same temperature as the first arm. The third arm was the control group, without intervention. Assessment was made through the douleur neuropathique questionnaire, the McGill pain questionnaire, and the World Health Organization brief quality of life questionnaire at baseline and one month after the intervention. They concluded that a saltwater foot bath was efficient in reducing pain in patients with diabetic peripheral neuropathy.

Rahmania et al.[7] reported that a neutral temperature douche (92°F–97°F) with a pressure of 0.5–7 bar reduced pain associated with primary dysmenorrhea. They included 68 participants, of whom 60 completed the trial. Study group patients (n=34) received the douche 20 minutes a day for 20 days, and control group patients (n=34) received the usual care. The McGill pain score and VAS were used to assess pain severity. Results showed that the neutral douche group had a reduction in pain compared with the control group.

DISCUSSION

The purpose of this review is to show the analgesic effect of hydrotherapy on pain. The intensity, duration, and frequency of the pain experienced by a patient affects the psychological state as well as social rapport and day-to-day activities. In short, pain directly influences the quality of life of a patient.[24] Patients leaned towards the use of complementary and integrative medicine, as outcomes were insufficient despite advances made in medical care to manage chronic pain. Patients feared the use of the analgesic drugs and their adverse effects.[25] A previous review stated that moderate to high-quality evidence is available to show the efficacy of hydrotherapy on pain and joint mobility in patients with rheumatic diseases, hip osteoarthritis, and lower back pain.[26] The previous review included studies with aquatic exercises, or water physiotherapy, whereas in this review, we focused exclusively on hydrotherapy treatment based on the temperature of water and duration of the treatment. This review includes recent studies done with hydrotherapy or balneotherapy alone and explored the possible physiological mechanism. However, the available literature showed only subjective improvements, and further studies with objective measurement for pain management would add more strength to our findings. To confirm our results, RCTs are required with revised methodologies and intervention procedures specifically designed for various disease conditions.

CONCLUSION

Based on available scientific evidence, this review suggests that hydrotherapy can be used effectively in various conditions for pain management. Further studies are required to determine the optimal frequency and duration of treatment and assess the sustained benefit following cessation of the intervention.

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CONFLICTS OF INTEREST DISCLOSURE

We have read and understood the *CAND Journal*'s policy on conflicts of interest and declare that we have none.

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