GERONTOLOGIA POLSKA 2024; 32; 166-173 ARTYKUŁ POGLĄDOWY / REVIEW PAPER
zgłoszono 28.05.2024 – zaakceptowano 14.06.2024

Non-pharmacological methods for chronic pain treatment in the elderly – literature review

Niefarmakologiczne metody leczenia przewlekłego bólu u osób starszych – przegląd literatury

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Streszczenie

Ból przewlekły ma istotny wpływ na jakość życia pacjentów. Zwiększa niepełnosprawność i zależność społeczną osób starszych. Leczenie bólu u osób starszych jest wyzwaniem i wymaga podejścia multimodalnego. Zaburzenia funkcji poznawczych, słabość, polipragmazja, choroby współistniejące, związane z wiekiem zmiany zarówno w farmakokinetyce, jak i dynamice leków przeciwbólowych wpływają na skuteczność i bezpieczeństwo farmakologicznego leczenia bólu. Dlatego interwencje niefarmakologiczne są obiecującą metodą wspomagającą/uzupełniającą u pacjentów w podeszłym wieku. W tej pracy dokonano przeglądu roli różnych metod niefarmakologicznych w leczeniu bólu przewlekłego u osób starszych. Wyniki badań klinicznych oceniających skuteczność i przydatność interwencji niefarmakologicznych u osób starszych są obiecujące. Oprócz działania przeciwbólowego, interwencje te zapewniają wielowymiarowy wpływ na pacjentów w podeszłym wieku, obejmujący aspekty zdrowia psychicznego, społecznego, psychicznego i behawioralnego. Szczególnie w tej grupie chorych należy szeroko propagować niefarmakologiczne metody przeciwbólowe. Podkreślamy również rolę przyszłych badań w tej dziedzinie w celu oceny bezpieczeństwa, protokołów leczenia, opłacalności i długoterminowych skutków tych interwencji. (Gerontol Pol 2024; 32; 166-173) doi: 10.53139/GP.20243219

Słowa kluczowe: *leczenie bólu, farmakoterapia, starzenie się społeczeństwa, terapia przeciwbólowa*

Abstract

Chronic pain has a significant impact on a patient's quality of life. It increases disability and social dependency of older adults. Pain management in the elderly is challenging and requires a multimodal approach. Cognitive impairment, frailty, polypharmacy, comorbidities, and age-related changes in both pharmacokinetic and dynamics of analgesic drugs affect the effectiveness and safety of pharmacological pain management. Therefore, non-pharmacological interventions are promising adjuvant/supplementary approaches in elderly patients. In this paper, we review the role of various non-pharmacological methods in the treatment of chronic pain in the elderly. Apart from analgesic effects, these interventions provide multidimensional effects on elderly patients including psychological, social, mental, and behavioral aspects of health. Non-pharmacological analgesic methods should be widely promoted especially in this group of patients. We also emphasize the role of future investigations in this area to evaluate the safety, treatment protocols, cost-effectiveness, and long-term effects of these interventions. (Gerontol Pol 2024; 32; 166-173) doi: 10.53139/GP.20243219

Keywords: *chronic pain, non-pharmacological intervention, elderly, aging population, analgesic therapy, complementary therapy*

Introduction

Society aging is a global phenomenon. It is estimated that by 2030 the number of people over 60 years old will increase to 1.4 billion. This poses a significant challenge for the healthcare system and is an emerging social problem. Aging is associated with an increased prevalence of chronic diseases. Multimorbidities in the elderly lead

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to disability, social dependence, and reduction of the quality of life (QoL) [1].

Chronic pain refers to the pain which lasts or recurs for more than 3 months. Chronic pain is one of the major issues in older adults. In people over 65 years of age, the occurrence of chronic pain reaches up to 60%. The most common causes of chronic pain include pain associated with degenerative diseases (affecting the low back and neck), musculoskeletal conditions, and neuropathic pain as a result of diabetes or postherpetic neuralgia [2].

Analgesic therapy in the elderly group is challenging. Frequently, it is difficult to assess the pain level reported by the patient because of cognitive impairment. Pharmacological methods including nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, and opioids remain the first line of treatment. However, their use is associated with an increased risk of side effects due to age-related changes in drug pharmacokinetics and pharmacodynamics i.e. impairment in kidney and liver function. Elderly patients are also at increased risk of drug--drug interactions because of frequent polypharmacy [3]. Currently, there is a growing interest in using non-pharmacological methods alongside traditional approaches for managing chronic pain in older patients.

Non-pharmacological analgesic methods in the elderly

Non-pharmacological therapy includes e.g. physical therapy, acupuncture therapy, massage therapy, osteopathic medicine, pain education, virtual reality therapy, and psychological therapy. One of the most beneficial advantages of non-pharmacological methods is the decreased consumption of analgesic agents lowering the risk of adverse events [4]. A non-pharmacological approach is associated with the increased threshold of pain tolerance, improving pain control, and strengthening the self-reliance of patients. So far, the efficacy and safety of non-pharmacological methods have been reported for several chronic conditions such as low back pain, neck pain, knee osteoarthritis (KOA), migraine and tension headaches, diabetic neuropathy, cancer pain, or rheumatoid arthritis [5]. The non-pharmacological approach in chronic pain seems to be especially indicated in elderly patients who often suffer from frequent comorbidities [6]. Non-pharmacological methods are safe, relatively cheap, and widely available therefore they should be an indispensable part of pain management in older patients.

In this paper, we review selected non-pharmacological analgesic approaches and their clinical significance in elderly patients based on novel scientific reports. We summarized our findings in table I.

Transcutaneous electrical nerve stimulation (TENS)

TENS is a noninvasive neuromodulation technique that delivers low-intensity electrical stimulation through the skin. Electrophysiological studies indicate that the analgetic effects of TENS are associated with the inhibition of central nociceptive neurons, activation of descending inhibitory systems, and inhibition of the primary somatosensory cortex [23].

A recent meta-analysis of fourteen studies (age range 54-84) shows that TENS is associated with significant pain relief, decreased disability, and improved walking ability in patients with KOA. Moreover, combining TENS with other analgesic methods was associated with better outcomes in the long-term function ability compared to other methods alone [7]. In a recent double-blinded, randomized trial it has been demonstrated that a combination of TENS and standard postoperative treatment after gamma-nail surgical fixation of hip fracture is associated with significantly decreased pain during walking and increased walking distance in elderly patients (mean age of participants 79,3 years) [8].

TENS is a promising, non-invasive alternative method in pain management. However, the significance of this method among elderly patients is inconclusive mostly due to a lack of high-quality studies. TENS safety and long-term effectiveness in chronic pain management in older patients require further investigations.

Virtual reality

Virtual reality (VR) is a modern, rapidly growing technology with multiple possible implementations in healthcare. In recent years VR technology has been intensively studied as a potential non-invasive adjuvant therapy in chronic pain. The analgesic effect of VR is associated with pain distraction, modification of pain perception, and visuomotor stimulation [24]. VR therapy also improves cognitive function and neural efficiency making this method particularly beneficial in pain management in older adults [25].

Recently, Stamm et al. showed that VR therapy improves the capacity of activities of daily living like mobility and personal hygiene in older people with chronic back pain. Moreover, VR therapy reduces the fear of movement/kinesiophobia. VR therapy is also associated with a reduction in pain intensity however with no statistical significance [9].

Sarkar et al. showed that VR meditation therapy decreases the pain intensity in the elderly with chronic KOA. VR meditation intervention is associated with a

Table I. Use of selected non-pharmacological methods for treating chronic pain in the elderly. TENS- Transcutaneous electrical nerve stimulation, VR- Virtual reality, NIBS- Non-invasive brain stimulation, KOA- Knee osteoarthritis

Method	Condition	Effect	Source	Ref.
TENS	KOA	Pain relief, decrease of disability, improvement of gait ability	Meta-analysis	[7]
	Femoral fracture treated with gamma-nail fixation	Decrease in pain level during walking, an increase in walking distance	Double-blinded, randomized clinical trial	[8]
VR	Chronic back pain	Improvement in the capacity of daily living activities, reduction of kinesiophobia and pain intensity	Randomized controlled clinical trial	[9]
	KOA	Decrease in pain intensity, reduction in pain interference related to mood, work, sleep, and daily activities, improvement of psychological functioning, reduction of negative feelings	Interventional clinical trial	[10]
NIBS	Musculoskeletal pain	Pain relief, the reduced area affected by pain, improvement of physical and emotional wellness, reduction of depression and anxiety symptoms	Multicenter, single-blinded, randomized controlled clinical trial	[11]
	KOA	Increase of both pressure and punctate mechanical pain threshold, reduction in pain sensation	Open-label, single-arm clinical trial	[12]
Electroacupuncture	Low back pain	Reduction in pain intensity, improvement in emotional functioning (no statistical significance), decrease in functional disability, no superiority to manual acupuncture and placebo	Triple-blind, placebo-controlled, randomized clinical trial	[13]
Acupuncture	Low back pain, knee pain	Significant reduction in both back and knee pain levels after 10 sessions of acupuncture, relief in symptoms of insomnia, palpitation, anxiety, and fatigue, reduction in the number of used painkillers	Single-arm clinical trial	[14]
Pilates	N/A	Improvement of emotional health, dynamic balance, flexibility, quality of sleep, and memory, reduction in the risk of falls, increases in muscle strength and lung capacity in the elderly	Meta-analysis	[15]
Pet-assisted therapy	Chronic pain (any cause)	Facilitation the implementation of evidence-based pain self-management strategies including mood, relaxation and distraction, physical activity, behavioral activation, social activation	Open-label, clinical trial	[16]
	Elderly patients with depression and anxiety	Moderate decrease in pain level (no statistical significance)	Single-center, randomized controlled clinical trial	[17]
	Arthritis	Significant decrease in pain in shoulders, back, and hips after 6 weeks of equine-assisted therapy	Randomized controlled clinical trial	[18]
Music therapy	Low back pain	Listening to patient-preferred music regulates the activity of brain regions responsible for pain sensation; the potential pain-relieving effect of short-term music therapy	Single-center, open-label, single-arm, longitudinal clinical trial	[19]
	Chronic pain	Music therapy may be the potential complementary non-pharmacological analgesic method in the elderly; most of the reviewed studies demonstrate only the short-term effect of music therapy; music-induced analgesic effect requires further investigations	Systematic review	[20]
Tai Chi	KOA, low back pain	Reduction of pain level, improvement of patient self-efficacy, reduction in fall risk, decrease in blood pressure; neuromodulation of cerebral cortex activity	Meta-analysis	[21]
	Chronic pain	No advantages of Tai Chi over conventional physical activity forms; improvement of balance, reduction in risk of falls	Meta-analysis	[22]

significant decrease in pain interference related to mood, work, sleep, and daily activities. VR meditation also improves the psychological functioning of patients through a reduction of negative feelings [10].

Non-invasive brain stimulation

Chronic pain can be perceived as a disorder of neuroplasticity caused by disruption of pain processing pathways. A dysregulation between excessive stimulation and inhibition of these pathways characterizes chronic pain. Non-invasive brain stimulation (NIBS) appears to be a helpful supplementary method due to regulating this imbalance [26].

NIBS involves neurostimulation of a selected brain area by applying a current directly or by creating an electric field on the scalp surface. With repeated neuromodulations of the cerebral cortex to reduce or increase its excitability, NIBS can be used for therapeutic purposes. NIBS methods include e.g transcranial magnetic stimulation (TMS), transcranial direct current stimulation (TDCS), and transcranial alternative current stimulation (TACS) [27].

Recent studies using TDCS in the treatment of chronic musculoskeletal pain show that this method has a positive effect on pain relief and physical wellness in the elderly. Additionally, TDCS improves emotional functioning, reduces catastrophic thinking, and symptoms of depression and anxiety, along with a reduction of the area affected by pain [11]. TDCS has also been used in studies of chronic pain in KOA. KOA is common among older patients and is associated with an increased disability rate and impaired QoL. The use of neurostimulation increased the excitability threshold and reduced the perception of pain in patients suffering from KOA [12].

Acupuncture

Acupuncture is a non-pharmacological analgesic method used since ancient times. It involves inserting a thin needle and manipulating it to stimulate specific anatomical points. It provides clinically relevant and persistent effects. Results suggest that acupuncture is promising adjunctive therapy in the case of chronic musculoskeletal, headaches and osteoarthritis pain [28]**.** Acupuncture and its intensified form electroacupuncture (EA) seem to be helpful in the treatment of back pain. EA has many advantages because it allows stimulation of a larger area for a shorter time and is characterized by easy modulation of parameters such as stimulus frequency, duration, and intensity of the treatment. It has been demonstrated that a 5-week course of EA is associated with a significant reduction in pain intensity among elderly patients. However, results suggest that EA is not superior to manual acupuncture and placebo [13].

Notable, acupuncture may relieve symptoms of insomnia, anxiety, and fatigue. Additionally, the effective analgesic effect of acupuncture may reduce the number of analgesic drugs used by the elderly and decrease the risk of drug-related adverse events [14]. Currently, there is an ongoing clinical trial determining the effectiveness of 3-6 months of acupuncture courses in improving the score of pain in elderly with chronic low back pain. 807 patients aged +65 years old are enrolled in this clinical trial [29].

Pilates

Another important non-invasive non-pharmacological method for treating chronic pain in the elderly is exercise activity. Results of a recent meta-analysis demonstrate that pilates is the most effective activity in the treatment of low back pain. Pilates has the most significant impact on both the reduction of pain-related disability and the number of used analgesic drugs [30].

Pilates is based on concentration, posture, and breathing control while activating the abdominal muscles that are involved in stabilizing the lumbopelvic section. In this type of exercise, emphasis is placed on the correct positioning of the shoulder and pelvic girdle, maintaining natural curves, and relieving the feet in a standing position [31]. Pilates has been proven to bring many benefits to the elderly, improving their emotional health, balance, and flexibility while reducing the risk of falls. Additionally, it has been noticed that pilates increases the muscle strength of the limbs and lung capacity, and improves the quality of sleep and memory in people with short-term memory deficits in this age group [15].

Pet-assisted therapy

When looking for methods of non-invasive non-pharmacological treatment of persistent pain in older people, a multi-pronged and creative approach should be taken into account. Interaction with pets in older people in several domains of health including behavioral, psychosocial, physiological, and mental aspects. Animal-assisted therapy reduces feelings of loneliness, increases self-esteem, has a beneficial effect on physical health, and improves cognitive abilities and QoL of the elderly [32].

Recently, it has been demonstrated that the presence of a pet in the life of an elderly person may play a key

role in pain self-management strategies. Pet ownership is associated with enhanced mood, companionship, and emotional support. Pets are also a source of joy and laughter. These positive activities may favor resilience of persistent pain. Pet ownership is also a kind of distraction from the pain and may provide relaxation to the elderly. Notable, dog or cat ownership is associated with increased physical activity which is one of the essential non-pharmacological methods in the management of chronic pain. What is important, pets may promote interpersonal interactions and enhance relationships in the community. Since chronic, limiting pain may lead to social isolation, pet-associated promotion of social activation may be of particular importance in the elderly. Moreover, patients report that animals themselves react to pain and take actions to increase the owner's comfort [16].

Depression is a common mood disorder in the elderly and significantly decreases the QoL. Depression often coexists with chronic pain and these two factors may have a synergetic impact on pre-frailty and frailty in the elderly [33]. It has been demonstrated that dog-assisted therapy (DAT) significantly reduces the symptoms of depression in the elderly. Notable, DAT exhibited a slight/not sizeable relief in pain reported by the elderly (no significance). In addition, DAT may facilitate interpersonal and social interactions resulting in an improvement of the QoL [17].

Hippotherapy (HT), also known as equine-assisted therapy is a form of animal-assisted intervention based on the interaction between humans and horses. HT has a beneficial impact on the social, mental, and physical aspects of health. The potential analgesic mechanism of HT is associated with the improvement of patient balance, coordination, and range of motion. In addition, HT may affect the activity of several brain regions including the prefrontal cortex. HT is associated with an increase in serotonin and a decrease in cortisol levels [34]. Recently, White-Lewis et al. showed that HT may decrease pain levels in the elderly with arthritis. In addition, HT improves the range of motion and patient QoL. Authors suggest that the analgesic effect of HT may be associated with an improvement in muscle strength, however, to fully elucidate the analgesic effect of HT more research is needed [18].

Music therapy

Music therapy is a potential non-invasive non-pharmacological analgesic intervention consisting of songwriting, music performance, and music listening. The mechanisms underlying the possible analgesic effect of music therapy are not yet elucidated. Music therapy influences the activity of the brain regions associated with nociception. It has been demonstrated that listening to 20 minutes of preferred music twice daily for four days reduces the activity of primary motor and somatosensory cortices in patients aged 65 years or older suffering from chronic low back pain. In addition, music stimuli may promote the release of β-endorphins, inhibiting nociceptive stimuli procession [19].

A recently published systematic review of 8 studies indicates that music therapy may be a potential adjuvant analgesic approach in older adults. In addition, music reduces levels of anxiety and depression which often coexist with chronic pain. Music therapy may improve QoL due to the reduction of helplessness and suicidal thoughts. The authors also emphasize the role of nurses in the promotion of music interventions in long-term care for elderly patients. However, due to a lack of high-quality studies investigating the analgesic effectiveness of music therapy in elderly patients, there are no evidence-based protocols for music interventions in this group of patients. Therefore we expect further studies investigating the role of music therapy in chronic pain management among the geriatric population [20].

Tai Chi

Tai Chi is a Chinese martial art practiced as a form of exercise and meditation. Tai Chi is practiced worldwide due to its beneficial impact on human health. Tai Chi relieves stress and enhances physical function including gait and dynamic balance. The potential pain-relieving effects of Tai Chi result from improving proprioception and muscular strength, alleviating inflammatory processes, and reducing joint mechanical stress. In addition, Tai Chi improves the cognitive abilities of the elderly which may also contribute to its analgesic effect [35].

In a recent meta-analysis of 7 randomized control trials, it has been demonstrated that long-term practice of Tai Chi (>8 weeks) can be an effective non-invasive complementary therapy in elderly with KOA and chronic low back pain. In addition, Tai Chi improves self-efficacy, reduces the risk of falls, and has a hypotensive effect. Notable, long-term Tai Chi affects the activity of several brain regions including the precentral gyrus, amygdala-medial prefrontal cortex, insular sulcus, and middle frontal sulcus. Therefore the analgesic effect of Tai Chi may be associated with its neuromodulatory impact on the cerebral cortex, however, to fully understand the underlying mechanism more research is needed in this area [21]. Interestingly, 12 weeks of Tai Chi increases the serum concentration of programmed death 1

Table II. Clinical trials of Tai Chi in chronic pain in middle-aged and elderly. KOA- knee osteoarthritis

Objectives	Disease	Study type	Age group	Phase	Sample size	Duration	Status	chictr.org.cn
Tai Chi vs physical therapy	Low back pain	Interventional	50-80	0	120	52 weeks	Prospective registration, not yet recruiting	ChiCTR2000029723
Comparison of different weekly frequency of Tai Chi	Low back pain	Interventional	60-80	1	34	24 weeks	Prospective registration, not yet recruiting	ChiCTR2200058190
Tai Chi vs health education effect on pain and physical function	KOA	Interventional	>40	0	50	18 weeks	Prospective registration, not yet recruiting	ChiCTR2300069339
Tai Chi effect on pain level, lumbar range of motion, and insomnia	Low back pain	Interventional	60-75	0	36	40 weeks	Prospective registration, not yet recruiting	ChiCTR2200064977

(PD-1) protein and decreases interferon-gamma (IFN-γ) in patients with KOA. In addition, Tai Chi affects both the opioidergic pain modulation pathway and the dopaminergic reward/motivation system. Results suggest that the pain-relieving effect of Tai Chi may be associated with the modulation of ongoing inflammation and regulation of activity of brain areas linked with opioidergic and dopaminergic systems [36].

The meta-analysis published by Zhu et al. this year seems to confirm the significance of Tai Chi as an adjuvant analgesic therapy in the elderly, however, the authors indicate that Tai Chi has no advantage over the traditional form of physical exercise including aerobic and strengthening exercises. Tai Chi practice, compared to conventional exercises, is associated with improved balance and reduced risk of falls in the elderly [22].

Currently, the efficacy of Tai Chi exercises in the elderly with KOA and chronic low back pain is undergoing investigation in four randomized controlled trials (according to data from the Chinese Clinical Trial Registry) (table II) [37-40].

Conclusions

Chronic pain is one of the major issues affecting a significant part of elderly patients. Chronic pain is associated with disability, social dependency, and decreased QoL. In addition, chronic pain frequently coexists with depression and somatic comorbidities such as neurodegenerative, cardiovascular, and pulmonary diseases.

Management of chronic pain in the elderly is challenging and associated with several clinical issues. Cognitive impairment, frailty, polypharmacy, age-related changes in metabolism, pharmacodynamics, and safety profile of common analgesic drugs are some of the major factors affecting the effectiveness and safety of pain-relieving therapy in elderly patients.

Currently, experts emphasize the role of a multimodal approach in analgesic therapy including both pharmacological and non-pharmacological methods. In this paper, we reviewed novel scientific reports regarding the role of non-pharmacological analgesic approaches in elderly patients. This review underscores the necessity of implementing an interdisciplinary approach to pain management that includes non-pharmacological interventions to address the physiological, psychological, and social dimensions of pain in older adults.

Non-pharmacological methods are promising adjuvant approaches in the elderly due to their multidirectional effects including analgesic activity and beneficial impact on psychological, social, and behavioral domains. Notably, these methods also decrease the risk of age-related conditions such as falls, depression, kinesiophobia, or hypertension. Non-pharmacological methods may also reduce the amount of painkillers used by elderly patients. Results also emphasize the role of a personalized and integrative approach while planning non-pharmacological interventions in older patients. However, more research is needed to evaluate the safety, cost-effectiveness, and long-term effects of these methods. In addition, there is an urgent need for evidence-based disease-specific protocols of non-pharmacological analgesic methods in the elderly. Future research may refine non-pharmacological methods, confirming they are suitable and beneficial to the elderly and supported by evidence-based medicine.

Conflict of interest
None

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