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Review Article

Pain Intervention Techniques for Older Adults: A Biopsychosocial Perspective

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Abstract

Older adults face unique challenges in managing pain conditions, including physical decline, cognitive complications, multi-morbidities, increased rate of medication consumption, and awareness of alternative methods. From a biopsychosocial perspective, we know that an interdisciplinary approach leads to more effective strategies for pain management, particularly with older adults. Traditional therapies including exercise, stretching, and strength training may not be appropriate for all older adults, so alternatives must be considered such as acupuncture, chiropractic work, Eastern medicinal approaches, pharmacological intervention, and muscle stimulation. This review aims to highlight multiple pain management strategies in consideration for older adults and their respective challenges to managing pain conditions.

Keywords: *Pain; Older Adults; Biopsychosocial; Pain Intervention Techniques*

Introduction

Pain among older adults is a growing concern in the United States (US) [1,2]. The National Institutes of Health (NIH) has reported more than one-half (53%) of older adults experienced pain within the past 30 days; with an estimated population growth to 20% by 2020, this is a prominent issue in the demographic [1]. Chronic multi-morbidities and frequent under-treatment of older adults further complicate pain management strategies [3,4]. Pain is frequently undertreated in this population, due to patient limitations, inaccurate description of symptoms, and possibly provider aversion to prescribing more medications. Older adults consume five or more medications daily, increasing the risk for adverse drug reactions (ADRs), toxicity, falls, and decreased organ function [5-7]. Furthermore, this group often faces physical limitations that exacerbate pain conditions and limit physical ability. It is important to note that tailoring a treatment plan to address biopsychosocial concerns has shown more effective than a single traditional methodology alone [3,6]. This review will focus on pain management techniques geared toward older adults, within a biopsychosocial perspective, including pharmacological, physical, and alternative methodologies.

Pain management

Pharmacotherapy

Pharmacotherapy is a common component of pain management programs. A wide variety of medications have been shown to be effective in managing pain conditions, such as opioids, non-steroidal anti-inflammatory compounds (NSAIDs), antidepressants, transdermal patches, and topical agents. Determining the most appropriate and effective method must consider a multitude of factors, including physical function, cognitive function, lifestyle, and comorbid conditions. Older adults tend to have special circumstances that must be considered when designing a treatment plan. For example, many older adults face physical limitations that hinder the ability to participate in traditional exercise programs, including strength training or stretching [4]. Specialized exercise programs for older adults may not be

available or cost-effective, and often adherence is an issue. Furthermore, this population faces increased rates of cognitive decline and disease, which may affect adherence. Diseases like Alzheimer's and dementia can cause delirium and memory loss, leading the patient to forget or avoid taking medications properly [8,9]. This can be particularly problematic when the patient is on an anti-depressant regimen, as sudden cessation or inaccurate dosing can lead to suicidal ideations, increased pain experience, depression, and mood imbalance [10]. Moreover, improper adherence can also lead to problems of equilibrium, toxicity, and ADRs. Decreased liver function is common in older adults, and affects the ability to properly metabolize pharmacologic compounds and increase drug half-life, leading the patient to get too much or too little of the drug to be effective in managing the pain, or lead to issues of toxicity, ulcers, decreased gastrointestinal absorption, and decreased organ function [11]. Additionally, older adults tend to have decreased muscle mass and an increased level of body fat, both affecting pharmacokinetics and efficacy [12,13]. Many pain medications have sedative effects, leading to poor equilibrium and decreased appetite, resulting in a greater risk for fall injuries [5-7,14]. Falls are a common concern in this population and can lead to debilitating injury, necessitating more pain management or rehabilitation measures. Balance, strength training, and exercise may alleviate some of the fall-risk but, if a patient is taking pain medications improperly, the drug effects on the system may nullify these aspects.

Opioids

Opioids are a common pain relief route, and oral medications are the most commonly used vehicle for medication delivery. However, in recent years, the rate of abuse has risen to excessive proportions, calling for more regulation in their prescription and usage [14-17]. This has caused difficulty for patients and medical professionals alike, requiring more frequent visits and smaller prescriptions. While effective, opioids do come with a great deal of potential side-effects, such as their addictive nature, sedative and euphoric effects, gastrointestinal upset and constipation, drug interactions, respiratory depression, and sleep disturbance [9,18]. In efforts to combat some of these side effects, more medications are prescribed, increasing the risk for ADRs and unwanted side-effects, as well as the number of medications the patient must take each day. The restrictions on opioid distribution, coupled with the high addiction potential, have led clinicians to look elsewhere for pain relief strategies, which is of great importance in populations that are consuming multiple medications daily.

NSAIDs

NSAIDs are another widely used medication group, particularly in instances of pain resulting from musculoskeletal issues like arthritis [19]. As such, NSAIDs are frequently used with older adults, although they are often the offender of ADRs as they react with other common medications like aspirin and selective serotonin reuptake inhibitors (SSRIs) [20]. Furthermore, older adults are prone to gastrointestinal complications like ulcers and toxicity, commonly associated with NSAID use [11]. Yet, less than one-half of patients prescribed NSAIDs are also given gastroprotective medications [21]. While the anti-inflammatory component of NSAIDs may provide relief for musculoskeletal pain, they still require careful consideration when being added to a pain management program.

Antidepressants

Adjuvant analgesics like antidepressants are not always marketed as pain relief medications, but many have been found to be effective pain relievers. Comorbidities are of particular importance when starting an antidepressant regimen, and conditions like dementia, Parkinson's Disease (PD), Multiple Sclerosis (MS), metabolic deficiencies, hypothyroidism, substance abuse, cardiac disease, and delirium should be ruled out prior to beginning the therapy [22]. Disorders such as PD can exacerbate pain and lead to delirium or dementia onset [23-26]. Determination of the proper category of antidepressant is dependent on a multitude of factors, including comorbidities, other medications being taken, cognitive factors, and lifestyle. Each group carries side effects that range from mild to severe, including issues like appetite suppression, dry mouth, gastrointestinal upset, headache, cardiac symptoms, nausea, tremors, muscle weakness, vertigo, sleep disturbance, blurred vision, seizure, heartburn, rash, edema, and alopecia [27]. Dosage should be carefully monitored, and titrated upward only as necessary, with careful consideration to ADRs [27].

Topical and Injectable Agents

Varieties of topical compounds are available, many over the counter (OTC). These typically take the form of a cream or balm the patient can easily apply directly to the affected area. However, topicals may be irritating to the skin, or offend the sense of smell. They also generally need reapplication throughout the day to maintain a level of relief, and this could be inconvenient for the patient [28]. Furthermore, topical agents may not be powerful enough to penetrate the body to alleviate the pain, and thus be ineffective in certain cases. Topical creams are most applicable to superficial surface pain such as a strained muscle or for general soreness. Transdermal patches may also be an option, where they can avoid some of the pitfalls of topical compounds and deliver more concentrated and penetrating doses of medication to the body [28]. The patches may also be an option for patients experiencing incapacitation or pre/post-surgical pain management, because this eliminates the need for an additional intravenous setup and access or other medication administration [29]. Injectable medications are generally reserved for emergency administration or surgical-related pain relief. In cases where patients experience trauma and need immediate relief, intravenous administration is the most effective way to alleviate pain in the shortest amount of time. Patients may also be incapacitated, and injections are the best option to alleviate suffering [30]. In conjunction with prescribed medication regimens (and as stand-alone techniques), physical activities have shown to be rather effective in managing pain conditions. The next section will focus on traditional pain management techniques, including physical activity and cognitive-based approaches.

Traditional modalities

Physical treatments

Traditional pain management typically incorporates a variety of physical measures, such as exercise including cardiovascular activity and strength training. One misconception that many patients hold is that physical activity will not help their chronic ailment, but rather cause more damage and increase pain. However, exercise has shown physical benefits because it increases the production of a growth factor, leading the body to increase its natural response to healing [31]. Psychologically, exercise increases levels of serotonin, thus decreasing depressive symptoms and anxiety that often accompany a majority of those suffering from chronic illness [32]. Socially, exercise encourages people to get out of their house and interact with others, such as other patients or therapists at a rehabilitation facility, which can lead to increased perceived social support [33]. This is important because perceived social support has been shown to biologically act as a natural buffer against stress [34]. Exercise can also promote better sleep and sleep patterns, which is a common problem in pain patients, as many with chronic pain suffer from sleep disturbance [35]. Additionally, exercise provides cardiovascular benefits, such as decreasing blood pressure, cholesterol, and can lead to weight loss, which is a moderating factor in many suffering from chronic illnesses, such as congestive heart failure, which leads to the experience of chronic pain. For older adults, traditional exercise can be difficult, as many experience joint problems, decreased flexibility, and decreased endurance [36]. However, this does not mean they are without options or modifications. Specific activities good for older adults include water therapy, walking, or engaging in a group exercise class [37,38]. Water therapy is effective for individuals who cannot withstand high-impact surfaces, such as those with osteoarthritis, hip replacements, or lower chronic back pain [39]. McKenzie Water Therapy or Mechanical Diagnosis and Therapy use repeated assessments with a physical therapist who examines the body mechanics of each patient, and then creates exercises based on the individualized assessment [40]. For individuals participating in a McKenzie Water Therapy class, the specific limitations of the group would be taken into account when designing a class, allowing for customization with maximum benefit to all patients involved. These exercises are milder in relation to physical demand, making them appropriate for older adults who have to be careful to not "push the pace" and understand specific limitations they may have resulting from their chronic aliment(s) [41].

Not only is exercise important in treating chronic pain, but strength training is also essential. This type of training works to increase muscle mass defending against muscle atrophy and sarcopenia in older adults. For older adults, strength training should be modified to include eccentric exercises. These exercises focus on more repetitions at a lesser weight [42]. Additionally, it is recommended that older adults conduct strength-training exercises with resistance bands [43]. Not only is exercise and resistance training important for managing

chronic pain, balance training is also crucial. According to the *National Council on Aging*, every 15 seconds an older adult is treated in the emergency room for a fall, and every 29 minutes an older adult dies from complications of a fall. This is important because many older adults have a fear of falling, impeding their ability to engage in physical activities such as exercise. If patients are not routinely exercising, they will not reap any of the benefits previously discussed. One way to help older adults get over this fear is by helping them realize their self-efficacy, in relation to physical activity, as well as implement balance training.

Specific exercises to help older adults improve their balance are chair stands, balancing on one leg, and implementing exercises on a balance disk [44]. Other exercise regiments used to improve balance and flexibility also include Pilates, Ti chai, Qi gong, and yoga [45]. In a review by Bevers., *et al*. (2017), commentary was provided regarding older adults with chronic lower back pain (CLBP) and the potential for physical interventions [46]. Specifically, it was discussed that individuals suffering from CLBP are at an elevated risk for falling, a possible precursor for CLBP. Hulla, Moomey, Garner, Ray, and Gatchel (2016), who utilized a Neurocomm Smart Balance Master System to examine older adults with and without CLBP [47], explored the relationship between CLBP and fall risk. Their results confirmed that older adults with CLBP were associated with decreased performance on measures of balance. Falling has not been the only factor linked to CLBP, but several other physical measures have been found to play a significant role in estimating balance. For instance, Hulla, Gatchel, and Liegey-Dougall (2017) examined 129 adults with and without CLBP in relation to predicting postural control (i.e. composite, visual, and vestibular scores), and significant predictors included chair-stand test scores, sit- and- reach scores, sleep disturbance, and balance efficacy measures [44]. These results provide evidence that older adults should engage in balancing activities recommended by the *National Institute on Aging*, such as standing on one foot, walking heel to toe, and participating in Tai Chi, in an effort to prevent causes of CLBP such as falling.

Additionally, heat and cold therapies can provide pain relief and aid in exercise recovery. Superficial cold therapy may be used to reduce the sensation of pain by decreasing nerve activity by reducing blood flow, swelling, muscle spasms, and simultaneously increase pain tolerance, when applied to a specific localized area [48-51]. It has also been reported that cold application increases the threshold of pain by reducing the conduction velocity of nerve fibers transmitting pain stimuli from the peripheral to the central nervous system [52]. Cold application decreases joint and skin temperature while increasing joint stiffness; also, cryotherapy has a direct analgesic effect. This makes cold application effective in the treatment of acute pain, arthritic pain, and pain caused by inflammation [48,49,53,54]. The great advantages of superficial cold therapy are the lack of serious side effects, ease of application, and low cost [48]. Using cold therapy as a treatment, though, is difficult because it is such a localized control for pain. Cold therapy has shown to work well with superficial burns [55], localized pain around injection sites [56], and post exercise soreness [57]. For more significant pain relief, such as pain management after total knee arthroplasty in older adults, cryotherapy has shown insignificant results as an effective treatment [58,59].

A hot pack can also be used for around 30-minutes at a temperature of 109 - 113 Fahrenheit [60,61]. The increase of blood flow and supply of oxygen can help reduce pain, specifically with muscle spasms, myalgia, and fibromyalgia, along with decreasing joint and muscle stiffness [51,53]. Superficial heat is commonly used to relieve persistent muscular, joint, and chest pain [49,53,60,62,63]. Older adults who use such non-drug pain treatments regularly rate superficial heat as one of the most effective treatments for pain relief [53,64]. Effective pain management using local heat therapy provides positive care to patients with superficial muscular pain, and helps minimize adverse effects associated with pain medications [60].

Massage therapies with or without heat can also be soothing and effective in relieving certain pain conditions. Several types of specialists, including chiropractors, acupuncturists, and physical therapists, can administer a massage method called myofascial release therapy (MFRT), where tension is released through pressure points of hardened muscle [65,66]. This technique results in looser and more relaxed feeling muscles in the affected area. One chronic condition treated with chiropractic spinal manipulation is myofascial pain syndrome (MPS). This condition is caused by a tight spot in a muscle that cuts off blood flow to the affected area, causing chronic pain. Application of pressure to the ischemic areas is called Myofascial Massage Therapy, causing blood to flow back into the damaged spot. This method is

most effective when coupled with other treatments, such as heat massage, stretching, strength training, and other physical therapies previously discussed in this article [67]. For older adults, not only is ischemic compression therapy effective for elements like chronic lower back pain, but low variable amplitude thrust spinal manipulation is also effective [68]. Many patients report improvements in stiffness and pain from these techniques [65,66]. The patient can use tools like foam rollers, tennis balls, and massage sticks to perform variations of MFRT outside of a clinical setting as well, which could be more convenient and cost-effective for the patient [69]. However, a professional must always do spinal manipulations.

Whether or not a chiropractic approach effectively treats chronic pain as a "stand-alone" treatment method, it is apparent that older adults are nevertheless often interested in receiving chiropractic treatment when experiencing lower back pain [70]. The first study to compare treatments using a randomized controlled trial was in 2010. The study compared: full clinical practice guidelines-based treatment; spinal manipulative therapy administered by chiropractors; and family-physician directed usual care. Compared to family physician usual care, the chiropractor spinal manipulative therapy was associated with significantly reduced decline in activities-of-daily-living, and lower body function scores, thus partially supporting that chiropractic therapy is beneficial in terms of protecting older persons from functional and self-rated health declines [71]. Another study integrated chiropractic treatment to the typical medical treatment of uncomplicated back treatments, and found similar outcomes. Patients who use chiropractors have protective effects against declines in activities of daily living (ADLs), instrumental ADLs, and self-rated health over a 2-year period [72]. From these findings, we can conclude that chiropractic approaches are effective when used in integrated treatment approaches, when it is not being relied on for pain reduction outcomes alone. From a systematic review, we found that the chiropractic approach is only cost-effective. Due to inconsistent results, it is difficult to conclude whether pain outcomes are favorable in a chiropractic approach [73]. Furthermore, it is important to consider psychosocial concerns when choosing an appropriate physical pain treatment. In the following section, we will discuss more cognitive-based approaches to complement the already discussed physical activities.

Cognitive-Based Exercises

Mindfulness training utilizes relaxation techniques (e.g., breathing exercises, meditation, and guided imagery), which have shown to be effective for assisting with acute and chronic pain as well as quality-of-life [51,53,74-76]; however, these techniques are not applicable with patients who have significant cognitive impairment or severe depression [77]. Although mindfulness training does not always reduce pain intensity in itself, it can be used as a supplementary treatment to reduce pain-related distress, which improves perceived control [53,78-80]. For older adults, mindfulness meditation has been shown to decrease pain, and improve sleep and quality-of-life for those suffering from chronic lower back pain [81]. Through reflection and inner insight, mindfulness training has also been shown to increase physical exercise for older adults which, as we have discussed earlier, greatly improves health outcomes [82]. Another study, conducted by Meize-Grochowski., et al. (2015), showed that older adults with post-herpetic neuralgia reported improvement in neuropathic, affective, and total pain scores with mindfulness meditation, while a control group (which was invited to continue in the study as a delayed treatment group) showed worsened affective pain [83]. One last study, by Morone and Greco (2007), revealed that eight different mind-body interventions showed positive outcomes in older adults; however, the interventions were tailored and modified for the older adults, which incorporated a stronger biopsychosocial approach of treatment [76]. A solid support system, involving relatives and caregivers, should also be established to assist with pain reduction, by countering the presence of depression and/or anxiety, which affects quality of life [51,84]. In addition, guided imagery is an approach where the attention of the patient is focused on sights, sounds, music, and words to concentrate on relaxation and personal empowerment [81,85]. Guided imagery in older adults has shown to be an effective therapy for pain management [86,87]. For example, elderly patients with fibromyalgia benefited from guided imagery relaxation treatment, paired with usual care, on clinical measures of pain (i.e. Visual Analogue Scale, McGill Pain Questionnaire long form, and the Beck Depression Inventory), relative to a control group, which only received the usual care [88].

Additionally, biofeedback encourages relaxation that may alleviate some conditions associated with stress, such as migraine headaches, high blood pressure, and chronic pain [89]. Biofeedback can be used to monitor various sources of stress, and concentrate on

relaxation as an intervention [90], similar to the aforementioned relaxation therapies. Biofeedback allows patients to shift their focus on specific regions or problems that may be adding to their ailment using biological feedback (e.g. blood pressure, brain electrical activity, heart rate, and skin temperature). Through these indicators, the patient learns what may be a potential problem, and can then adjust their behavior from the data based on physiological function [51]. The biofeedback process is a non-invasive and non-pharmacological intervention, which has been shown to be efficacious in treating certain conditions [91]. For example, biofeedback was used as an intervention for adults after total knee arthroplasty; the results showed support that biofeedback is an effective complementary treatment option for pain rehabilitation after surgery [91]. Biofeedback therapy can also be used in part of interdisciplinary pain intervention programs, which generally include some form of relaxation training [92]. Older adults readily acquire the physiological self-regulation skills that are taught in biofeedback relaxation, which show an improvement in pain for older adults [93]. Biofeedback can be described as assisting in regaining balance, and a monitoring tool to regulate bodily processes, that usually occur involuntarily, by increasing awareness of one's own bodily functions and understanding the power of the mind to influence them [91,94].

Another commonly used intervention is cognitive behavioral therapy (CBT). CBT works by having patients reframe the way they see their chronic state of pain. Specific forms under the "umbrella" of CBT for older adults include: distractions such as music therapy; visiting with friends; art therapy; imagination and visualization techniques; relaxation; biofeedback; spirituality; aromatherapy; and creating goals to work towards increasing self-motivation in managing chronic pain [41,95,96,97]. CBT is a widely used methodology in conjunction with other physical and pharmacological pain interventions, and has shown great effectiveness as a management tool. CBT can be particularly effective in addressing social components of the biopsychosocial approach, because many older adults lack important social interaction and support in everyday life. It is important to note that addressing psychological and social components of pain management can lead to better outcomes and quality-of-life for pain patients.

Complementary Methods

Considering the unique challenges older adults face with more traditional physical measures of pain management and injury prevention, many look to methods complementary to aid in pain-relief. Some approaches have become more popular in recent years, such as chiropractic visits, transcutaneous electrical nerve stimulation (TENS), and Eastern medicinal techniques. Certain complementary methods have shown more efficacy in pain management, where others are still producing mixed-results. It is clear that the most effective pain management plan is one that is individually-tailored to the patient, so that, in cases where the more common methods are not producing the desired results or those methodologies are inappropriate, turning to newer approaches may yield better quality-of-life for the patient, but should be further explored, under supervision.

TENS

The most common form of electrical delivery is transcutaneous electrical nerve stimulation (TENS), which involves small pads with conducting gel attached to the painful area, which are electrified by a lower voltage [51,98,99]. TENS has been used successfully to treat chronic pain [100,101]. After a few treatments, TENS can lead to changes in restoration of proper nerve signaling, improved healing, and perfusion [51,102-104]. There have been some suggestions of age-related limits associated with the use of TENS with older adults [105]. In terms of age, there are mixed results on the relationship between pain and TENS treatment. Age has not been shown to have a significant impact on pain, comfort of TENS, or the ability to reduce pain as a treatment method for older adults [106]. However, there is also more recent support that TENS is an effective therapy in young, but not older, individuals. Therefore, future studies should distinguish the effects TENS has for older adults [107].

Acupuncture

In addition to TENS therapy, acupuncture is another widely known methodology that has produced both effective and indistinguishable results. Traditional Chinese Medicine has used acupuncture in order to treat pain for quite some time. Specific points on the body,

which often have no anatomic correlation to the nervous system, are stimulated via insertion of thin needles through the skin. This is done in order to regulate the flow of vital energy (chi) along the pathways called meridians. Acupuncture has been used to help treat several different common ailments (e.g., back pain, joint pain, neck pain, and headaches). Acupuncture stimulation has a result in tissue vasodilation for several hours, which can influence the effect of hormones (e.g., norepinephrine, dopamine, and endorphins) [51]. With regard to the older adult population, acupuncture results have been mixed [108]. More recently, acupuncture has support for being able to assist with biopsychosocial factors, such as anxiety, when treating post-surgery patients [109]. For older adults with osteoarthritis, acupuncture provides improved outcomes for the experience of pain and increased functioning, when compared to educational control groups [110,111]. When acupuncture is compared against TENS, there was also a small improvement in favor of acupuncture that lasted beyond the treatment period for older adults [112]. There is also a greater effectiveness when combining acupuncture with TENS in managing chronic lower back pain in older adults [81]. For older adults with chronic lower back pain, acupuncture has shown to effectively reduce pain ratings for the lower back [113].

Other Passive Modalities

Another passive intervention for older adults includes a host of injection therapies, such as platelet-rich plasma therapy (PRP), prolotherapy, Botox, chelation, and hyperbaric oxygen therapy.

PRP involves using an individual's own platelets, separating them from their blood and re-injecting these platelets into the damaged area. The platelets contain increased amounts of growth factor and, therefore, help to bring healing to the damaged area injected. Specifically, this therapy has been shown to be most effective when injected into a general area compared to a specific place [114].

Prolotherapy works by proliferating and dehydrating cells using a solution of dextrose- glycerin- phenol- lidocaine. This causes an increase in cytokines, leading the body's immune response to begin the process of phagocytosis. This therapy, while controversial, has been used the last 40+ years, and is most effective when used as a co-therapy [115].

Botox, when given in micro-doses can also be beneficial. This therapy works by impeding the communication of nerves to an area that is overstimulated, causing the muscle to spasm. Once the nerves are blocked, the areas under pressure muscles relax, bringing relief. Specifically, for older adults, this intervention has been used to treat neck pain, as well as migraine headaches [116].

Chelation is another injectable treatment which uses the amino acid ethylene diamine tetra-acetic acid, and is slowly injected into the body intravenously. This treatment works by attracting unwarranted minerals, such as metal, lead, copper, by binding to the amino acids and removing the harmful substances.

Hyperbaric Oxygen Therapy for chronic pain is proving to be beneficial [117]. This treatment works by allowing patients to take in a higher concentration of pure oxygen, which promotes the release of growth factor, again increasing the body's natural healing process.

While all of these aforementioned therapies are thought to be beneficial, it is worth noting that more clinical research is needed to examine the extent of their efficacy, especially with older adults managing chronic pain.

Conclusions

Older adults face a variety of challenges in effectively managing pain conditions. These challenges often cause difficulty participating in traditional physical treatment methodologies such as regular exercise, stretching, or strength training. Additionally, older adults take multiple medications daily, therefore lending more hurdles to traditional pharmacotherapies for risk of ADRs and unwanted side effects. This population and their unique circumstances have shed light on the dire need to customize interdisciplinary treatment programs, and the addressing of the "whole person" via biopsychosocial methods. It is of the utmost importance to consider each individual's needs when designing an appropriate pain management program, especially in the older adult populations. As reviewed in this article, a variety

of techniques are now available, some with growing evidence-based support. The most appropriate and effective methods must consider current medication use, physical ability, cognitive status, and comorbid conditions.

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