ACORN AUSTRALIAN COLLEGE OF PERIOPERATIVE NURSES | JOURNAL OF PERIOPERATIVE NURSING

Volume 36
Issue 1 *Journal of Perioperative Nursing*

Article 4

2-23-2023

Nonpharmacological interventions for the reduction of post-operative pain after ambulatory surgery: A systematic review of randomised controlled trials

Recommended Citation

Tololiu, Kevin E.; Duff, Jed; and Csokasi, Krisztina (2023) "Nonpharmacological interventions for the reduction of post-operative pain after ambulatory surgery: A systematic review of randomised controlled trials," *Journal of Perioperative Nursing*: Vol. 36 : Iss. 1 , Article 4.
Available at: https://doi.org/10.26550/2209-1092.1210

https://www.journal.acorn.org.au/jpn/vol36/iss1/4

Nonpharmacological interventions for the reduction of post-operative pain after ambulatory surgery: A systematic review of randomised controlled trials

Cover Page Footnote

Acknowledgment This paper would not be possible without the exceptional support of LPDP (Indonesian Endowment for Education) who funded the author's study in the Master of Advanced Practice Program at the Queensland University of Technology. The highest appreciation is given to the first supervisor and second author, Prof. Jed Duff, Professor of Nursing at the Queensland University of Technology and Chair of Nursing at Royal Brisbane and Woman's Hospital. His dedication, guidance, expertise and patience have greatly assisted with preparing this work for publication. The author would also like to thank Anna Doubrovsky, researcher at the Queensland University of Technology School of Nursing, and Centre of Clinical Nursing at Royal Brisbane and Woman's Hospital, for her assistance and statistics tutorial for the meta-analysis; and Dr Csókási Krisztina, Assistant Professor at the Institute of Psychology, University of Pecs, Hungary. Her clinical psychology insight contributed to solving problems in this study from a different perspective.

Peer-reviewed article

Authors

Kevin E Tololiu
University of Pecs, Doctoral School of Psychology (Cognitive Science); Universitas Negeri Gorontalo, Faculty of Sport and Health, Nursing Study Program

Jed Duff
PhD, RN, FACORN
Queensland University of Technology, Faculty of Health; Royal Brisbane and Women's Hospital, Nursing and Midwifery Research Centre

Krisztina Csokasi
University of Pecs, Institute of Psychology

Corresponding author

Kevin E Tololiu
University of Pecs

Nonpharmacological interventions for the reduction of post-operative pain after ambulatory surgery: A systematic review of randomised controlled trials

Abstract

Aims: To examine the effectiveness of nonpharmacological interventions for the reduction of post-operative pain in patients undergoing ambulatory surgery (also known as day surgery).

Background: Post-surgical pain remains prevalent, especially in day surgery cases. When poorly managed, this acute pain can lead to chronic pain and delayed recovery. Nowadays, several nonpharmacological regimens are available for reducing pain after ambulatory surgery. Further investigation is required to assess the quality of these alternatives.

Design: Systematic review

Methods: An electronic search of PubMed, CINAHL (via EBSCOhost), Embase, and Cochrane library was undertaken to screen and assess the studies of nonpharmacological intervention in reducing post-operative pain in ambulatory surgery. Inclusion criteria covered randomised controlled trials (RCTs) on patients undergoing day surgery in which the patients received nonpharmacological intervention for post-operative pain management. This review excluded studies published more than 25 years ago, studies using languages other than English and Bahasa Indonesia, and case reports, conference abstracts and review articles.

Results: Four eligible studies provided drug-free interventions for reducing pain after day surgery; the interventions included foot massage, acupuncture, audio–visual relaxation tools delivered by mobile technology and digital video discs (DVDs). There were varying respondents and tool assessment characteristics, especially in pain level instruments and pain outcome indicators across the studies. The risk of bias found in the studies was mainly associated with incomplete data and selective reporting. Although some studies showed less significant statistical results, the mean difference in the intervention arms showed meaningful effectiveness.

Conclusion: The appropriate application of nonpharmacological interventions might reduce patient pain levels after day surgery. High-quality RCTs and specific follow-up studies are needed to investigate the effectiveness of each intervention for post-operative pain reduction.

Keywords: day surgery, nonpharmacological therapy, post-operative pain

Introduction

Pain is defined as a subjective experience associated with physical trauma and psychological discomfort. This pain process involves neurosensory physiology and endocrine pathways and, if trauma has occurred, an immune response to damaged peripheral tissue. Inflammation is produced by chemical mediators such as histamine, bradykinin and prostaglandins.[1] Pain can be acute or chronic. Post-operative acute pain is due to tissue injury and/or removal in the operational procedure, and occurs within seven days after surgery.[2]

Post-operative pain may be more prevalent in patients undergoing day surgery because day surgery patients receive less health status monitoring than patients undergoing in-patient surgery, as day surgery patients are allowed to leave the hospital on the same day as the surgical procedure.[3]

Post-operative pain is common in surgical wards. Gan et al.[4] found acute pain was experienced by nearly 80 per cent of patients undergoing surgery, with patients mostly reporting either moderate or severe pain levels. Additionally, Singh et al.[5] claimed that from the critical five hours after surgery to the third day almost 90 per cent of patients reported experiencing pain. Post-surgical pain is experienced by most patients undergoing day surgery.

Minimal supervision during the day of surgery illustrates health care providers' attitude toward pain management after ambulatory surgery.[6] Since the pain is expected to eventually resolve, pain management is not considered a priority. However, untreated pain can remain for three months or longer.[7] Uncontrolled acute pain after surgery may lead to chronic pain, and severe acute pain can predict chronic pain after surgery.[8]

This pain can result in other complications, such as delayed recovery after surgery. A prospective study conducted by McGuire et al.[9] suggested that severe acute post-operative pain is associated with delayed punch biopsy wound healing. This delayed recovery with remaining pain can also reflect a sign of infection. Millett et al.[10] cite an example of an infection with *Propionibacterium acnes* that is associated with pain after shoulder surgery.

When the supply of medication is limited or absent, non-pharmacological therapies can be worth implementing. Therapies such as soft tissue massage can also be applied at home after discharge as medical devices are not required.[11] With clinical team support through a team-based approach to follow-up monitoring, implementation of a wide range of nonpharmacological therapies can be facilitated.[12]

In the current century, several methods and novel nonpharmacological techniques have been used to relieve pain post-operatively. These alternatives to medication have been shown to have positive effects on healing and pain reduction without a high risk of side effects. Techniques include deep breathing relaxation,[13,14] audio-visual distraction,[15] exercise[16,17] and electroanalgesia and laser therapy.[18] Other techniques also need to be considered, such as acupuncture,[19,20] massage,[21,22] music therapy[23] and reflexology.[23,24]

Aim

This study aims to examine the effectiveness of nonpharmacological interventions in reducing post-operative pain in patients undergoing day surgery.

Method

This systematic review followed Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. The review applied the PICOS (participant, interventions, comparators, outcomes, and study design) approach to formulate the search strategy in four electronic databases: PubMed, CINAHL (via EBSCOhost), Embase and Cochrane library through the Queensland University of Technology access. Cochrane risk of bias tool is used to assess the quality of the included articles.

Search strategy

The pieces of literature were searched by an independent viewer (KT) under the supervision of a second viewer (JD). The search was conducted from 24th February to 28th April 2021. The following terms were employed for the literature search: 'day surgery', 'ambulatory surgery', 'outpatient surgery', 'day-case surgery', 'nonpharmacological intervention', 'complementary therapy', 'alternative remedy', 'drug-free technique', 'post-operative pain', 'post-surgical pain', 'pain management' and 'pain remedy'. The search was filtered based on the Boolean operator (And, Or, and Not) as presented in Table 1.

Eligibility criteria

The review included peer-reviewed and randomised controlled trials (RCTs) published in the last 25 years. The authors sought to find recent research into nonpharmacological interventions for post-ambulatory surgery pain; however, the previous ten years did not provide a significant number of publications with RCTs for analysis.

Table 1: Search strategy

Population	Intervention	Comparator	Outcome
Day surgery; or	Nonpharmacological intervention; or	–	Post-operative pain; or
Ambulatory surgery; or	Complementary therapy; or	–	Post-surgical pain; or
Outpatient surgery; or	Alternative remedy; or	–	Pain management; or
Day case surgery	Drug-free technique	–	Pain remedy

The review contains studies of patients undergoing day surgery who received any nonpharmacological intervention for post-operative pain management regardless of sex or age. This review excluded studies using a language other than English and Bahasa Indonesia. Studies such as case reports, conference abstracts and review articles were also excluded due to incomplete essential information available. Additionally, psychological interventions were excluded to focus the scope of the clinical approach in the day surgery setting.

Study selection

From the four databases searched, 2050 published articles were identified, leaving 925 articles after the duplicate screening. Next, the title and abstract were screened to check the study relevance regarding the topic/research area and variable assessed (nonpharmacological method application) and 871 were excluded. This process reduced the number of studies to 54. After the full-text screening, 47 studies were excluded due to ineligible study design, language used, surgery type and lack of pain level indicator or pain outcome. After further screening, three studies were excluded due to incomplete supporting data of the research method, including the statistical result. As a result, 4 studies were selected for quality assessment. The selection process is illustrated in Figure 1.

Data extraction

Details extracted are presented as follows: First author, publication year, country of origin, topic, study sample, intervention, pain assessment schedule and pain assessment tools (see supplemental material). The primary data extraction was pain level measured in either standardised or developed pain level tools. The measures were summarised and synthesised in the narrative analysis provided by the mean pain score, statistical test and p-value. The meta-analysis was applied after filtering the studies with available mean and standard deviation as the requirement for the meta-analysis test.

Bias assessment

The quality of RCTs and clinical trials was assessed using the Cochrane risk of bias tool to identify bias risks. The risks of bias set included random sequence generation, allocation concealment, blinding, incomplete outcome data and other plausible bias. Each item was categorised as either low, unclear or high, depending on the risk of bias in the study. This overall risk of bias was based on individual studies from the Cochrane risk of bias tool.

Results

Study characteristics

The studies were conducted in England, Iceland and Canada. The sample of the studies ranged from 40 to 112, with 328 samples in total. All studies applied a randomised controlled trial design within the last twenty-five years. While one study sampled pediatric patients, two studies focused on adults as the population of interest. One study exclusively focused on females. The surgical procedures in the studies cover oral, ear nose and throat (ENT), digestive tract, reproduction system and general surgery.

The nonpharmacological interventions used included foot massage,[25] acupuncture,[26] educational DVD[27] and audio–visual relaxation tools delivered by mobile technology.[28] The interventions were delivered in different settings, including pre-operative holding area, recovery room, damage control surgery unit and patient's residence. The pain was assessed at varying times, comparing the pain level before and after the intervention. Three studies measured the pain intensity with a standardised tool – numeric rating score (NRS) or visual analog score (VAS) – while one study developed a pain measurement tool adjusted for pediatric patients. (A table of the study characteristics is included as supplemental material.)

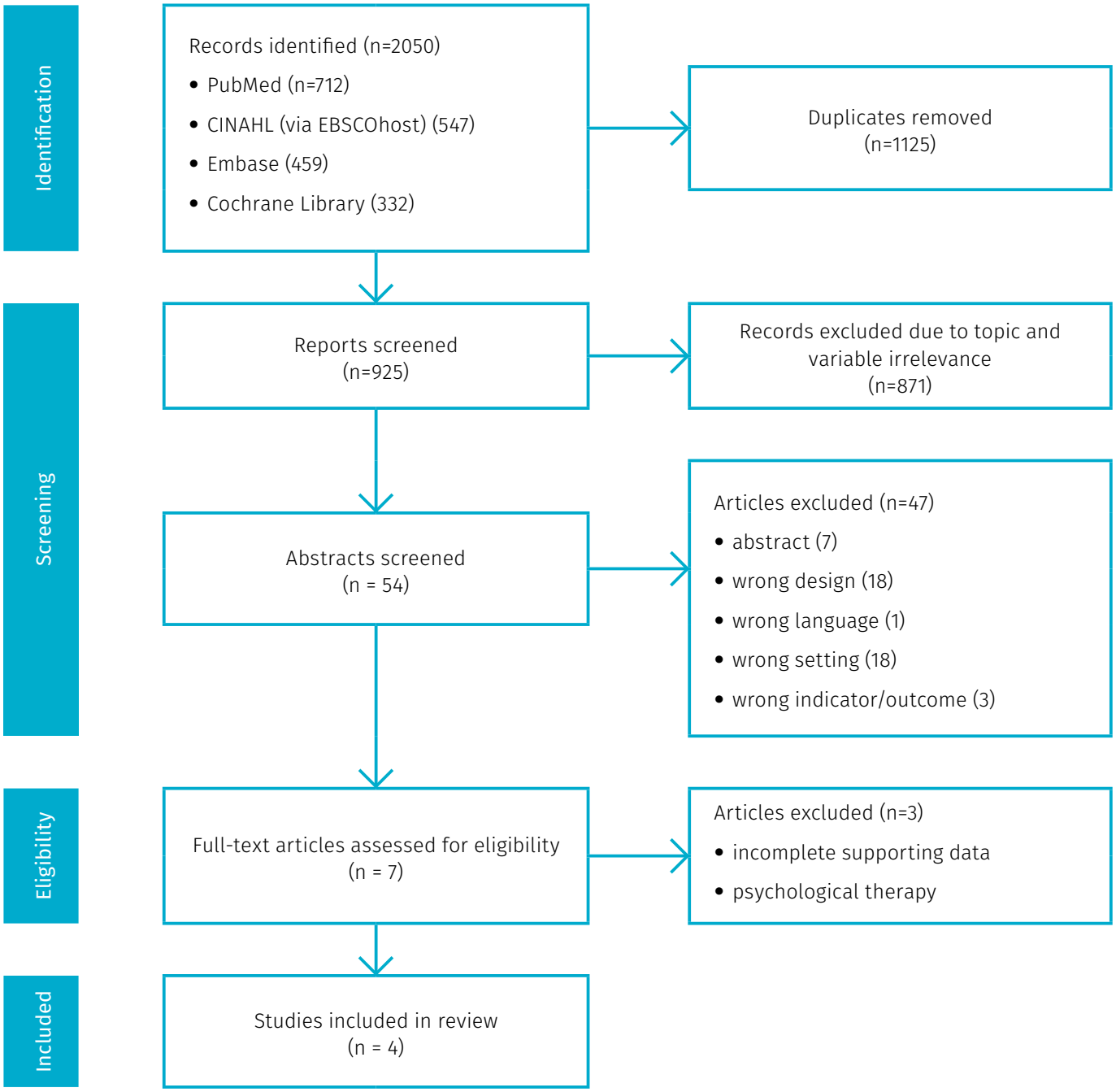

Figure 1: Flow chart of study retrieval and selection

The risk of bias

The overall risk of bias across studies is presented in Figure 2. Of the four studies reviewed, the study by Chartrand is the only one that demonstrated a random sequence generation technique by using a computer-generated list with the assistance of a third party to generate the allocation and using block randomisation to reach equal group numbers. The lack of randomisation in Hansen's study[28] is an obvious drawback of a clinically controlled trial. The allocation concealment and blinding of participants is highly vulnerable to the risk of bias in most studies. This was inevitable due to the nature of the intervention in the studies using foot massage,[25] acupuncture,[26] and DVD[27] as interventions as participants knew that they were in the experimental group once they began receiving the intervention. Additionally, those studies also provided an initial explanation of the study's aims to the participants when gaining consent which might affect the blinding of outcome assessment. However, some strategies were implemented to reduce the risk of bias – blinding the recovery nurse,[26] avoiding the discussion of effectiveness[25] and blinding the outcome assessors who were not involved in the video preparation.[27]

Incomplete outcome data and selective reporting bias were also visible in the studies. The unavailability of analgesic type, dosage and duration given as the primary prescription and the pain level data in the control group on day five after surgery demonstrated loss of follow-up by Hansen.[28] This bias might affect the pain level in each measurement point and consequently influence the results. The lack of standard deviation

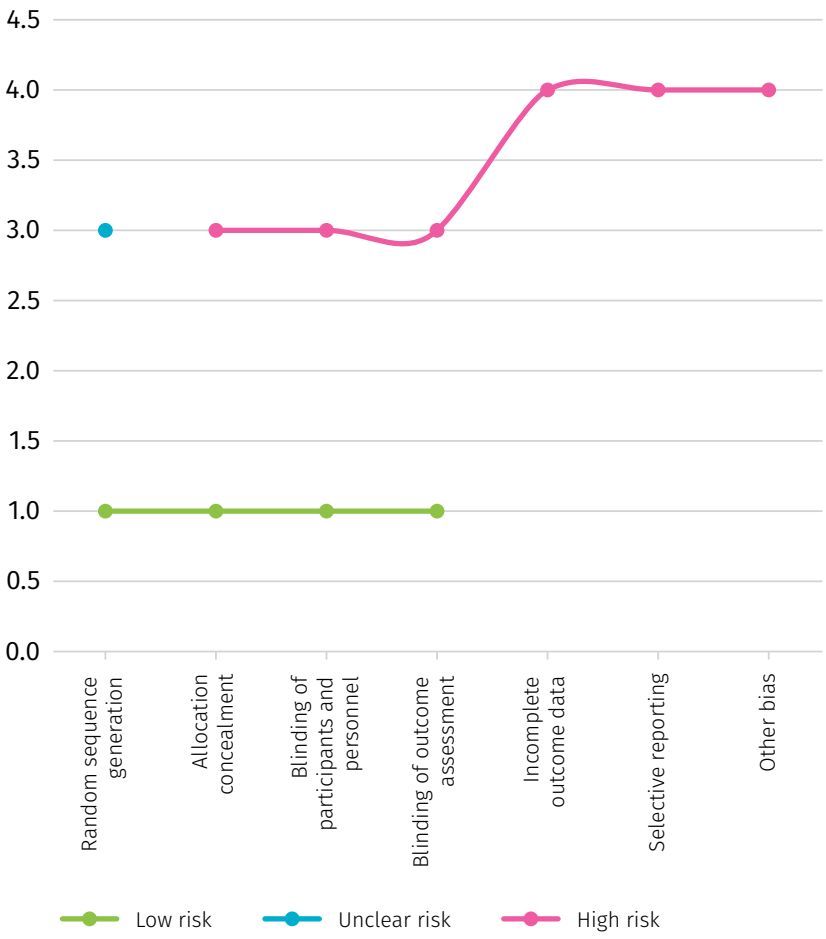

Figure 2: Risk of bias across studies

to support the data of mean pain level by Hulme,[25] Coe[26] and Chartrand[27] could also lead to bias when interpreting the effect of the interventions on pain.

Other plausible biases stemmed from the limited study sample size since some participants were unwilling to undergo specific treatments such as acupuncture.[26] Furthermore, sampling bias might occur with the educational DVD intervention[27] and affect generalisability as the samples in the study represented elective dental or ENT surgery in a single tertiary care hospital. Performance bias may have occurred with foot massage[25] as consistency of the intervention was not monitored and a more extended massage might affect endorphin release and psychological effects may have confounded the results.

The risk of bias across studies was examined using the Cochrane risk of bias tool. Regarding random sequence generation, only Chartrand et al.[27] were assessed as having low risk because a computer-generated list with the assistance of a third party was used to perform block randomisation. At the mean point, the other three studies[25,26,28] were assessed as having unclear risk due to the precise randomisation method. Regarding the allocation concealment, blinding of participants and personnel, and blinding of the outcome assessment, Hansen[28] was assessed as having a low risk

Table 2: Statistical outcomes

Author (year) Intervention	Difference in mean pain level		Statistical test	P-value	Indication (P>0.05)
	Intervention group/s	Control group			
Chartrand (2017)[27] educational DVD	• RR: 1.51 • DCS: 0.49	• RR: 2.06 • DCS: 1.16	Independent T-test	In RR, P = 0·27. In DCS, P = 0·02.	Not statistically significant in RR. Statistically significant in DCS unit.
Coe (1999)[26] acupuncture	• Recovery: 22 • 2 hours: 19 • 18 hours: 12.5 • 72 hours: 5	• Recovery: 27.5 • 2 hours: 23.5 • 18 hours: 24.5 • 72 hours: 14	T-tests and Mann–Whitney U-tests	P<0.05	Statistically significant.
Hansen (2015)[28] audio–visual relaxation tools	ART • 4 days before surgery: 2.58 • DOS, before surgery: 1.08 • DOS, after surgery: 2.58 • Day 5 after surgery: 1.58 MI • 4 days before surgery:1.78 • DOS, before surgery: 0.96 • DOS, after surgery: 2.90 • Day 5 after surgery: 1.89 NVAM • 4 days before surgery: 1.81 • DOS, before surgery: 1.31 • DOS, after surgery: 3.38 • Day 5 after surgery: 2.31 NVA • 4 days before surgery: 2.93 • DOS, before surgery: 2.29 • DOS, after surgery: 2.71 • Day 5 after surgery: 1.80	• 4 days before surgery: NA • DOS, before surgery: 2.25 • DOS, after surgery: 2.74 • Day 5 after surgery: NA	Matched-pairs T-tests and ANOVA	p=0.25 Difference significance of pain from 4 days before surgery to 5 days after. ART : p=0.01 NVAM p=0.03 NVA p=0.336 MI p=0.049	No statically significant difference between groups; however, ART and NVAM groups showed a significant difference in pain level means from four days before surgery to DOS before surgery.
Hulme (1999)[25] foot massage	• On arrival: 4.7 • Prior to massage: 4.8 • After massage: 4.1 • When ready to discharge: 3.5 • When leaving day-case unit: 3.0	• On arrival: 3.9 • 10 minutes after surgery: 5.5 • The next 10 minutes: 5.1 • When ready to discharge: 3.8 • When leaving day-case unit: 3.2	Chi-squared test, Fisher's exact test and a Mann–Whitney U-test	Difference significance between groups: >0.05 Difference significance of pain pattern over time P=0.038	Foot massage is not statistically significant compared to control but statistically significant compared to previous time

RR = recovery room; DCS = damage control surgery unit; DOS = day of surgery; ART = audio relaxation technique; MI = music intervention; NVAM = nature video application with music; NVA = nature video application without music; ANOVA = analysis of variance

of bias because the treatment allocation was not revealed until the intervention. In contrast, the other studies[25–27] had a high potential for error. The incomplete outcome data and selective report were assessed at high risk for all the studies.

Effect of nonpharmacological intervention on pain

Table 2 shows the statistical results for the outcome of interest. The results are displayed in p-value (in which 0.05 is perceived significant) and mean difference in pain levels between intervention and control groups. Hulme[25] found a lack of overall statistical difference in the pain level experienced between the foot massage and the control group by repeated-measures analysis of variance (ANOVA). Nonetheless, the score pattern difference over time between groups was significant in that the patients receiving massage reported consistent pain reduction compared to the control group before massage (10 minutes after surgery) until leaving the unit. Similarly, Hansen[28] found no significant differences in pain levels between the five groups at the measurement time by ANOVA although pain level means from the four days before surgery to pre-operation assessment time showed a significant decrease in the groups receiving audio relaxation technique (ART) and nature video application with music (NVAM).

In contrast to this, some studies found that nonpharmacological interventions could affect pain intensity. Coe[26] found that at 18 hours after surgery mean visual analog scores for patients who received acupuncture were 12.5 compared to 24.5 in the control group. And Chartrand et al.[27]found that pain levels were lower in the intervention group than the control group in the damage control surgery (DCS) unit, and pain intensity was lower in the intervention group than the control group in both the recovery room and the DCS unit.

Discussion

This review assessed the evidence for nonpharmacological treatment reducing post-operative pain levels after ambulatory surgery. Despite the risk of bias and the lack of highly significant statistical results across the studies, the findings suggest nonpharmacological interventions might serve as alternatives for pain management after day surgery. These alternatives include both contemporary therapies, such as audio–visual relaxation tools delivered by mobile technology and educational DVDs, and traditional methods, such as foot massage and acupuncture.

Digital technology nowadays makes a positive contribution to health care practice, for example, the audio–visual interventions used by Hansen which assisted in pain management through a number of mechanisms. The music intervention used by Hansen[28] had a positive effect on pain levels in adult patients undergoing ambulatory general surgery. This reduction of pain can be attributed to a psychological mechanism called the 'Mozart effect'. Electroencephalograms (EEGs) record brain activity as voltage traces often called 'brainwaves'. These waves are categorised according to frequency and can indicate states of the brain. 'Alpha' waves (8–13 Hz) are associated with a relaxed and comfortable state.[29] Auditory stimuli produced by music are transmitted through neurons to the auditory cortex in the temporal lobe of the brain and have been associated with an increase in alpha brainwaves.[29,30] The nature video interventions (with and without music)[28] provided a passive distraction from pain. According to 'gate control theory', sensory input that is not painful can prevent the sensation of pain from travelling to the central nervous system. Audio–visual distractors may activate the periaqueductal grey (PAG) region of the brain playing a critical role in responses to stimuli. This PAG activation produces enkephalin, an endogenous opioid that 'closes the gate' of pain.[31,32]

A non-randomised control group intervention study conducted by Gündüz and Çalişkan[33] revealed that using video after total knee arthroplasty reduced pain levels and drug dependency (P<0.05). Although Faramarzi et al.[34] reported insignificant findings, the role of educational and motivational information in a video might indirectly contribute to pain level reduction. As the video is prepared to meet the patient's needs, the informative presentation could cultivate familiarity and lessen the distress of the operation. This effect of familiarity and distress reduction aligns with psychological and physiological processes in which predicted cues lessen the impact of 'perception of endangerment' and reduce catecholamine (epinephrine and norepinephrine) release. As these hormones increase heart rate, blood vessel resistance and sensitivity of pain nociceptors, this technique could reduce pain.[32,35] However, this effect requires more investigation, especially when applied to paediatric subjects as they have different cognitive perceptions and neurovascular processes to adults. Vasey[36] suggested that parental support is essential when educating children using DVDs before surgery.

Pain reduction can also be achieved by conventional strategies passed

down through generations and adopted by health care institutions. One of these traditional methods is acupuncture, investigated by Coe[26] and found to alleviate the pain in the 18 hours after molar teeth extraction. A systematic review and meta-analysis by Wu et al.[19] supported this, finding that acupuncture could reduce pain intensity and opioid use of adult patients on the first post-surgical day ($P < 0.001$). This pain relief effect occurs because acupuncture procedures activate the nervous system, through needle pressure on meridian points, which triggers blood vessel vasodilatation and accelerates blood flow to inflammatory tissue resulting in improved recovery.[37] Consistent with this, RCTs by Chen[38] and Mikashima et al.[39] found that acupuncture positively contributed to pain relief after ambulatory total knee angioplasty (TKA).

Another traditional alternative is foot massage,[25] which follows a similar physiological process to acupuncture and can stimulate the blood vessels through therapeutic touch on reflexology points. An exploratory study by Ferrell-Torry and Glick[40] reported that 60 per cent of patients reported pain reduction with therapeutic massage and concluded that therapeutic massage can promote relaxation and diminish pain perception through therapeutic skin-to-skin contact. Another RCT, by Cutshall et al.[41] involving cardiovascular surgical patients, suggested that massage can minimise sympathetic nervous system activity leading to a relaxed state, decreased muscle tension, overall body relaxation and significant pain reduction ($p<0.01$). Supporting this, a study of cancer patients done by Grealish et al.[42] claimed that a ten-minute foot massage could facilitate an immediate reduction in pain.

Limitations

This research needs to include more studies for review. The small number of studies reviewed might not reflect the nonpharmacological interventions available for post-operative pain after day surgery. Additionally, one study had a randomised clinical trial in the final analysis. The high risk of bias in the studies is also another drawback. As selective reporting, incomplete data and other prejudices might be visible in all the studies, resulting bias is plausible. Lastly, this review includes a broad spectrum regardless of participant age and type of surgery. While the age difference between adults and pediatric patients reflects different psychophysiological mechanisms, pain perception and response to nonpharmacological approaches, the surgery type will influence pain perception and intervention processes. As a result, selective reporting may occur when generalising the study outcomes under discussion.

Conclusion

This review investigated evidence of nonpharmacological interventions for reducing post-operative pain levels after ambulatory surgery. Despite the lack of significant statistical results and meta-analysis in all studies, the mean pain level showed a meaningful decrease. Overall, groups who received the interventions – foot massage, acupuncture, educational DVD and audio–visual relaxation tools – saw a greater effect than the control groups. With appropriate application, these interventions can positively contribute to reducing pain after day surgery.

Recommendations for future research

Further high-quality RCTs are needed to investigate the effect of nonpharmacological interventions on post-operative pain levels after ambulatory surgery. The missing data and resulting bias can be minimised by keeping track of the data and targeting a larger sample size. Systematic reviews focussing on either adults or children, in specific day surgeries and for each type of intervention are also needed.

Acknowledgements

This paper would not be possible without the exceptional support of LPDP (Indonesian Endowment for Education) who funded the author's study in the Master of Advanced Practice Program at the Queensland University of Technology. The highest appreciation is given to the first supervisor and second author, Prof. Jed Duff, Professor of Nursing at the Queensland University of Technology and Chair of Nursing at Royal Brisbane and Woman's Hospital. His dedication, guidance, expertise and patience have greatly assisted with preparing this work for publication. The author would also like to thank Anna Doubrovsky, researcher at the Queensland University of Technology School of Nursing, and Centre of Clinical Nursing at Royal Brisbane and Woman's Hospital, for her assistance and statistics tutorial for the meta-analysis; and Dr Csókási Krisztina, Assistant Professor at the Institute of Psychology, University of Pecs, Hungary. Her clinical psychology insight contributed to solving problems in this study from a different perspective.

References

1. Hanci V, Yurtlu S, Domi R, Shibata Y, Eyigör C. Acute postoperative pain control [Internet]. Pain Res Manag. 2017[cited 2021 Jun];2017:7831014. DOI: 10.1155/2017/7831014
2. Gupta A, Kaur K, Sharma S, Goyal S, Arora S. Clinical aspects of acute postoperative pain management and its assessment. Journal Adv Pharm Technol Res. 2010;1(2): 97–108.
3. Campagna S, D'Oulx M, Rosetta P, Perretta P, Viglietti S, Berchialla P et al. Postoperative pain, an unmet problem in day or overnight Italian surgery patients: A prospective study [Internet]. Pain Res Manag. 2016[cited 2021 May];2016:6104383. DOI: 10.1155/2016/6104383
4. Gan T, Habib A, Miller T, White W, Apfelbaum J. Incidence, patient satisfaction and perceptions of post-surgical pain: Results from a US national survey [Internet]. Curr Med Res Opin. 2014 [cited 2021 May];30(1):149–60. DOI: 10.1185/03007995.2013.860019
5. Singh P, Saikia P, Lahakar M. Prevalence of acute postoperative pain in patients in adult age-group undergoing inpatient abdominal surgery and correlation of intensity of pain and satisfaction with analgesic management: A cross-sectional single institute-based study. Indian J Anesth. 2016[cited 2021 May];60(10):737–43. DOI: 10.4103/0019-5049.191686
6. Bell, F. (2000). A review of the literature on the attitudes of nurses to acute pain management [Internet]. J Orthop Nurs. 2000[cited 2022 Oct];4(2):64–70. DOI: 10.1054/joon.2000.0073
7. Glare P, Aubrey K, Myles P. Transition from acute to chronic pain after surgery [Internet]. The Lancet. 2019[cited 2021 Jun];393(10180):1537–46. DOI: 10.1016/S0140-6736(19)30352-6
8. Eisenach, JC. Preventing chronic pain after surgery: Who, how and when? Reg Anesth Pain Med. 2006[cited 2021 Jun];31(1):1–3. DOI: 10.1016/j.rapm.2005.11.008
9. McGuire L, Heffner K, Glaser R, Needleman B, Malarkey W, Dickinson S et al. Pain and wound healing in surgical patients [Internet]. Ann Behav Med. 2006[cited 2021 Jun];31(2):165–72. DOI: 10.1207/s15324796abm3102_8
10. Millett PJ, Yen YM, Price CS, Horan MP, van der Meijden OA, Elser F. Propionobacter acnes infection as an occult cause of postoperative shoulder pain: A case series. Clin Orthop Relat Res. 2011[cited 2021 Oct];469(10):2824–30. DOI: 10.1007/s11999-011-1767-4
11. Cronfalk BS, Strang P, Ternestedt BM, Friedrichsen M. The existential experiences of receiving soft tissue massage in palliative home care: An intervention. Support Care Cancer. 2009[cited 2021 Jun];17(9):1203–11. DOI: 10.1007/s00520-008-0575-1
12. Becker WC, Dorflinger L, Edmond SN, Islam L, Heapy AA, Fraenkel L. Barriers and facilitators to use of nonpharmacological treatments in chronic pain [Internet]. BMC Fam Pract. 2017[cited 2021 Oct];18(1);41. DOI: 10.1186/s12875-017-0608-2
13. Aulia A, Yesi M. Effect of deep breathing relaxation techniques for reducing pain after hernia surgery in inpatient of Regional Hospital Pariaman West Sumatera Indonesia [Internet]. IJRR. 2019[cited 2021 Jun]; 6(8):444–7. Available from: www.ijrrjournal.com/IJRR_Vol.6_Issue.8_Aug2019/IJRR0058.pdf
14. Sunadi A, Ifadah E, Syarif M. The effect of deep breathing relaxation to reduce postoperative pain in lower limb fracture [Internet]. Enferm Clin. 2020[cited 2021 Jun];30 (3):143–5. DOI: 10.1016/j.enfcli.2019.12.045
15. Finlay K, Wilson J, Gaston P, Al-Dujaili E, Power, I. Postoperative pain management through audio-analgesia: Investigating musical constructs [Internet]. Psychology of Music 2016[cited 2021Jun];44(3):493–513. DOI: 10.1177/0305735615577247
16. Florez-García M, García-Pérez F, Curbelo R, Curbelo R, Pérez-Porta I, Nishishinya B et al. Efficacy and safety of home-based exercises versus individualised supervised outpatient physical therapy programs after total knee arthroplasty: A systematic review and meta-analysis [Internet]. Knee Surg Sports Traumatol Arthrosc. 2017[cited];25(11):3340–53. DOI: 10.1007/s00167-016-4231-x
17. Gilmore S, Hahne A, Davidson M, & McClelland J. Predictors of substantial improvement in physical function six months after lumbar surgery: Is early postoperative walking important? A prospective cohort study [Internet]. BMC Musculoskelet Disord. 2019[cited 2021 Jun];20(1): 418. DOI: 10.1186/s12891-019-2806-7
18. White P, Lazo O, Galeas L, Cao X. Use of electroanalgesia and laser therapies as alternatives to opioids for acute and chronic pain management [Internet]. F1000 Res. 2017[cited 2021 Jul];6:2161. DOI: 10.12688/f1000research.12324.1
19. Wu M, Chen K, Chen I, Huang S, Tzeng P, Yeh M et al. The efficacy of acupuncture in postoperative pain management: A systematic review and meta-analysis. PloS One. 2016[cited 2021 Jul];11(3):e0150367. DOI: 10.1371/journal.pone.015036
20. Zhao Y, Zhang L, Wang Y, Liao C, Chen Y, Zhen Q et al. Acupuncture therapy for postoperative pain of anorectal diseases: A systematic review protocol [Internet]. Medicine. 2020; 99(7):e19112. DOI: 10.1097/MD.0000000000019112
21. Kukimoto Y, Ooe N, Ideguchi N. The effects of massage therapy on pain and anxiety after surgery: A systematic review and meta-analysis [Internet]. Pain Manag Nurs. 2017[cited 2021 Jul];18(6): 378–90. DOI: 10.1016/j.pmn.2017.09.001
22. Ramesh C, Pai V, Patil N, Nayak B, George A, George L et al. Effectiveness of massage therapy on postoperative outcomes among patients undergoing cardiac surgery: A systematic review. Int J Nurs Sci. 2015[cited 2021 Jul];2(3):304–12. DOI: 10.1016/j.ijnss.2015.07.006
23. Bab R, Babu D. Effectiveness of music therapy vs foot reflexology on pain among postoperative patients in selected hopitals at Mangalore. Int J Nurs Educ. 2014[cited 2021 Jul];6(1):226–8. DOI: 10.5958/j.0974-9357.6.1.046
24. Pa ESS, D'souza L. Effectiveness of foot reflexology on incisional pain among post LSCS mothers in selected hospitals, Mangaluru. AJNER. 2019[cited 2021 Jul];(1):155–9. DOI: 10.5958/2349-2996.2019.00032.6
25. Hulme J, Waterman H, Hillier F. The effect of foot massage on patients' perception of care following laparoscopic sterilisation as day case patients [Internet]. J Adv Nurs. 1999[cited 2021 May];30(2):460–8. DOI: 10.1046/j.1365-2648.1999.01101.x
26. Coe T. The effect of acupuncture on pain and swelling after day case molar teeth extraction under general anaesthesia [Internet]. Ambul Surg. 1999[cited 2021 May];7(1):45–9. DOI: 10.1016/S0966-6532(98)00049-3
27. Chartrand J, Tourigny J, MacCormick J. The effect of an educational preoperative DVD on parents' and children's outcomes after a same-day surgery: A randomised controlled trial [Internet]. J Adv Nur. 2017[cited 2021 May];73(3):599–611. DOI: 10.1111/jan.13161

28. Hansen M. A feasibility pilot study on the use of complementary therapies delivered via mobile technologies on Icelandic surgical patients' reports of anxiety, pain, and self-efficacy in healing [Internet]. BMC Complementary and Alternative Medicine. 2015[cited 2021 May];15:92. DOI: 10.1186/s12906-015-0613-8
29. Kučikienė D, Praninskienė R. The impact of music on the bioelectrical oscillations of the brain [Internet]. Acta Med Litu. 2018[cited 2021 Dec];25(2):101–6. DOI: 10.6001/actamedica.v25i2.3763
30. Sendelbach E, Halm A, Doran A, Miller H, Gaillard P. Effects of music therapy on physiological and psychological outcomes for patients undergoing cardiac surgery [Internet]. J Cardiovasc Nurs. 2006[cited 2021 Jul];21(3): 194–200. DOI: 10.1097/00005082-200605000-00007
31. Johnson MH. How does distraction work in the management of pain? [Internet] Curr Pain Headache Rep. 2005[cited 2021 Dec];9(2):90–5. DOI: 10.1007/s11916-005-0044-1
32. Pereira PJ, Lerner EA. Gate control theory springs a leak [Internet]. Neuron. 2017[cited 2021 Dec];93(4):723–4. DOI: 10.1016/j.neuron.2017.02.016
33. Gündüz CS, Çalişkan N. The effect of preoperative video-based pain training on postoperative pain and analgesic use in patients undergoing total knee arthroplasty: a non-randomized control group intervention study [Internet]. Clin Nurs Res. 2021[cited 2021 Dec];30(6):741–52. DOI: 10.1177/1054773820983361
34. Faramarzi M, Roosta S, Faramarzi A, Salehi A, Matani N. The effectiveness of a preoperative multi-component non-pharmacologic preparation on post-tonsillectomy pain: A randomized controlled clinical trial [Internet]. Int J Pediatr Otorhinolaryngol. 2020[cited 2021 Dec];138:110359. DOI: 10.1016/j.ijporl.2020.110359
35. Holsboer F, Ising M. Stress hormone regulation: Biological role and translation into therapy [Internet]. Annu Rev Psychol. 2010[cited 2021 Dec];61:81–109. DOI: 10.1146/annurev.psych.093008.100321
36. Vasey J. Using DVDs to educate children before surgery [Internet]. Nurs Child Young People. 2017[cited 2021 Dec];29(9):22. DOI: 10.7748/ncyp.29.9.22.s21
37. Chen T, Zhang W, Chu X, Wang Q. Acupuncture for pain management: Molecular mechanisms of action [Internet]. Am J Chin Med. 2020[cited 2021 Jul];48(4):793–811. DOI: 10.1142/S0192415X20500408
38. Chen C, Yang C, Hu C, Shih H, Chang H, Hsieh H. Acupuncture for pain relief after total knee arthroplasty: A randomised controlled trial [Internet]. Reg Anaesth Pain Med. 2015[cited 2021 Jul];40(1): 31–6. DOI: 10.1097/AAP.0000000000000138
39. Mikashima Y, Takagi T, Tomatsu T, Horikoshi M, Ikari K, Momohara S. Efficacy of acupuncture during post-acute phase of rehabilitation after total knee arthroplasty [Internet]. J Tradit Chin Med. 2012[cited 2021 Jul];32(4):545–8. DOI: 10.1016/s0254-6272(13)60068-0
40. Ferrell-Torry T, Glick J. The use of therapeutic massage as a nursing intervention to modify anxiety and the perception of cancer pain [Internet]. Cancer Nurs. 1993[cited 2021 Jul];16(2):93–101. Available from: https://journals.lww.com/cancernursingonline/Abstract/1993/04000/The_use_of_therapeutic_massage_as_a_nursing.2.aspx
41. Cutshall M, Wentworth J, Engen D, Sundt, M, Kelly F, Bauer A. Effect of massage therapy on pain, anxiety and tension in cardiac surgical patients: A pilot study. Complementary Ther Clin Pract. 2010;16(2):92–5. 10.1016/j.ctcp.2009.10.006
42. Grealish L, Lomasney A, Whiteman B. Foot massage: A nursing intervention to modify the distressing symptoms of pain and nausea in patients hospitalised with cancer [Internet]. Cancer Nurs. 2000[cited 2021 Jul];23(3):237–43. DOI: 10.1097/00002820-200006000-0001