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Contents

Irregular Volume 7 Number 9 November 28, 2019

REVIEW

MINIREVIEWS

META-ANALYSIS

Contents

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META-ANALYSIS

Use of music during colonoscopy: An updated meta-analysis of randomized controlled trials

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Abstract

BACKGROUND

Music seems to be beneficial in multiple clinical areas. Colonoscopy is a stressful event for patients, especially with conscious sedation. Music during colonoscopy has been evaluated in multiple randomized controlled trials (RCTs) with varied results. Even meta-analyses on the subject over the years have yielded inconsistent conclusions. Therefore, we conducted an up-to-date meta-analysis regarding music during colonoscopy.

AIM

To assess the effects of music played during colonoscopy on patients' perspectives and sedation requirements.

METHODS

Multiple large databases were aggressively searched (November 2018). RCTs comparing music to without music during colonoscopy on adult patients were included. Pooled estimates were calculated for sedative medication doses, total procedure time, and patients' experience, willingness to repeat procedure, and pain scores using odds ratio (OR) and mean difference (MD) with random effects model.

RESULTS

Eleven studies (n = 988) were included. Music during colonoscopy showed a

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statistically significant reduction in procedure times (MD: -2.3 min; 95%CI: -4.13 to -0.47; P = 0.01) and patients' pain (MD: -1.26; 95%CI: -2.28 to -0.24; P = 0.02) while improving patients' experience (MD: -1.11; 95%CI: -1.7 to -0.53; P < 0.01) as compared to no music. No statistically significant differences were observed between music and no music during colonoscopy for midazolam (MD: -0.4 mg; 95%CI: -0.9 to 0.09; P = 0.11), meperidine (MD: -3.06 mg; 95%CI: -10.79 to 4.67; P = 0.44), or patients' willingness to repeat the colonoscopy (OR: 3.89; 95%CI: 0.76 to 19.97; P = 0.1).

CONCLUSION
Music appears to improve overall patient experience while reducing procedure times and patient pain. Therefore, music, being a non-invasive intervention, should be strongly considered during colonoscopy.

Key words: Colonoscopy; Music; Relaxation; Meta-analysis

Core tip: Music during stressful events has been shown to improve patient experience. Colonoscopy is a stressful event for many patients. Music during colonoscopy has been studied by many randomized controlled trials and meta-analyses with varying results. Therefore, given new studies available for analysis, we performed an updated meta-analysis. This meta-analysis demonstrated that music during colonoscopy reduces patients' pain while improving patients' experience and procedure times. With these results and extremely limited adverse effects of music, music should be strongly considered during colonoscopy.

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INTRODUCTION

Colonoscopy is an important procedure with screening, diagnostic, and therapeutic indications, but it is associated with significant patient anxiety. Stress and discomfort encountered both pre- and intra-operatively are associated with delays in proceeding with screening colonoscopy, increased medication use during the procedure, decreased patient satisfaction, and increased patient refusal to repeat colonoscopy[1-3].

Utilization of music during gastrointestinal procedures is a common approach to reduce patient anxiety, as it has been in many fields of medicine, including radiology, gynecology, urology, and pulmonology[4-11]. Multiple randomized control trials (RCTs) have attempted to quantify the effects of music on various aspects of undergoing colonoscopy. A previous meta-analysis of RCTs demonstrated increased patient willingness to repeat the procedure when music was utilized in the endoscopy suite; however, no significant differences in levels of dosage of administered sedative, patient reported pain level, nor procedure time[12]. Other meta-analyses have also come to differing conclusions regarding the utility of music during colonoscopy[13-15]. Over time, many other RCTs have been undertaken, demonstrating variable findings in regards to significant differences in these aforementioned parameters. Some studies demonstrate reduced anxiety scores and improved satisfaction[16-25]. Some studies showed reduced pain scores[19,26-27] and reduced sedative requirements[18-19,28-30]. Furthermore, some studies demonstrated little significant difference amongst anxiety levels nor sedation requirements, though variable improvements in patient experience and willingness to repeat the procedure[31-35]. Given this variation in results and sedative medication utilized, this meta-analysis sought to include novel data points by selecting only studies using moderate sedation to ascertain any significant differences in patient reported pain, satisfaction, procedure time, sedating medication requirements, and patient willingness to repeat exam when music is utilized in the endoscopy suite.

MATERIALS AND METHODS

Data acquisition

Medline, PubMed, Scopus, Cumulative Index for Nursing and Allied Health Literature, Cochrane Central Register of Controlled trials, and Embase were searched for articles (search date November 2018) using "music" and "colonoscopy". Studies included were RCTs with adult subjects (age ≥ 18 years) comparing music *vs* no music during colonoscopy and only moderate sedation. Two independent reviewers extracted data using standard forms. Pooled estimates were calculated for the effects of music for dose of sedative medications (midazolam and meperidine), total procedure time, and patient's self-reported pain scores, experience, and willingness to repeat the same procedure using odds ratio (OR) and mean difference (MD) with random effects model.

Statistics

The impact of music on patients having colonoscopy was analyzed by calculating pooled estimates of sedative medication doses (meperidine and midazolam), total procedure time, and patients' pain scores, experience, and willingness to repeat the colonoscopy using OR and MD. A random effects model was utilized to calculate the summary estimate with significance was indicated by P-value < 0.05. I^2 measure of inconsistency was used to assess heterogeneity.

Quality assessment of studies

The Cochrane's Collaboration Risk of Bias Tool was used to assess the quality of included studies[36]. In this tool, each outcome was given a GRADE (very low, low, moderate, or high) based on the quality of evidence. The parameters evaluated in each study were as follows: Precision, consistency of results, effect magnitude, and potential bias (publication and other forms)[37].

RESULTS

The initial search identified 177 articles. Figure 1 of these articles, 11 RCTs (n = 988) met the inclusion criteria[18,19,25,26,28,29,32,33,35,38,39]. Table 1 all RCTs were published from 2002-2016. Studies were global, including many countries (United States, Germany, Spain, Japan, Italy, China, Turkey, India, Australia, and Sri Lanka). Most of the studies were deemed high quality studies based on the Cochrane's Collaboration Risk of Bias Tool (Table 2).

Procedure times were evaluated in nine studies[19,25,26,28,29,32,35,38,39]. Music during colonoscopy demonstrated a statistically significant reduction in procedure times (MD: -2.3 min; 95%CI: -4.13 to -0.47; P = 0.01). Figure 2 Patient pain scores were evaluated in six studies[18,19,28,29,33,35]. The use of music during colonoscopy showed statistically significant decrease in patient pain levels as compared to no music (MD: -1.26; 95%CI: -2.28 to -0.24; P = 0.02). Figure 3 Furthermore, patient experience was improved using music as compared to no music (MD: -1.11; 95%CI: -1.7 to -0.53; P < 0.01) in four studies[18,28,29,35]. Figure 4 No statistically significant differences were observed between music and no music during colonoscopy for midazolam (MD: -0.4 mg; 95%CI: -0.9 to 0.09; P = 0.11), meperidine (MD: -3.06 mg; 95%CI: -10.79 to 4.67; P = 0.44), or patients' willingness to repeat the procedure (OR: 3.89; 95%CI: 0.76 to 19.97; P = 0.1).

DISCUSSION

Undergoing colonoscopy is a stressful experience for many patients. The ease of introducing music into the endoscopy suite makes its use an attractive modality to enhance the patient experience. Multiple studies demonstrate that use of music not only subjectively improves patient experience during medical procedures, but improves objective measures of patient stress including heart rate, blood pressure, and measured levels of salivary cortisol[16,27,39,40]. As noted above, multiple RCTs have attempted to demonstrate possible benefits of music during colonoscopy with variable results. Ten years ago, many authors of this study conducted a meta-analysis yielding the observation that while music does increase patient willingness to repeat the procedure, it did not necessarily reduce need for sedating medication, reduce patient reported pain score, nor reduce procedure time[12]. However, many RCTs conducted over the ensuing decade supplied new data points which suggest the benefits of music during colonoscopy may be greater than previously observed, with

Table 1 Description of studies included in the meta-analysis

Ref.	Publication year	Number of patients	Type of study	Type of music
De silva *et al*[26]	2016	118	RCT	Variety per patient
Martindale *et al*[33]	2013	119	RCT	Classical
Costa *et al*[19]	2010	110	RCT	Variety per patient
Bechtold *et al*[35]	2006	29	RCT	Watermark by Enya
Ovayolu *et al*[18]	2006	32	RCT	Turkish classical
Harikumar *et al*[28]	2006	166	RCT	Choice of 6 styles (headphones)
Uedo *et al*[39]	2004	60	RCT	Easy-listening
López-Cepero Andrada *et al*[25]	2004	78	RCT	Classical
Smolen *et al*[32]	2002	34	RCT	Variety per patient
Schiemann *et al*[38]	2002	133	RCT	Variety radio station
Lee *et al*[29]	2002	109	RCT	Variety per patient

RCT: Randomized controlled trial.

possible statistically significant reduced procedure times, patient reported pain scores, and enhanced overall patient experience.

This meta-analysis concludes that music played during colonoscopy improved patient experience and procedure times while reducing patient pain. This meta-analysis is unique from the others given the use of the newest RCTs and minimizing confounding variables by only using moderate sedation rather than moderate and deep sedation.

This updated meta-analysis has many strengths. This meta-analysis includes only RCTs to limit selection and observation bias, more patients than prior meta-analyses, and global studies. This meta-analysis also focused on only one type of sedation. However, all meta-analyses have limitations as well. First, music was initiated at different times during the procedure process, in some studies initiated pre-procedurally while initiated later in others. Second, the delivery method also differed amongst studies, with some patients receiving music *via* headphones and others *via* a radio in the room. Third, the genre of music varied widely amongst these studies with some studies utilized classical or easy listening selections, while other studies allowed patients to select their own music. The inevitable variation of any given individual patient's response to different music selections, particularly when considering cultural and generational preferences as well as response to stressful stimuli, must be considered when translating these results into one's own clinical practice. Naturally, music selection likely also alters the behavior of the performing endoscopist with new evidence that selection of music can affect adenoma detection rate[41].

In conclusion, given the low cost and relative ease of introducing music during colonoscopy, these results suggest it is reasonable to include music to both improve patient pain and experience as well as possibly productivity given reduced procedure times.

Table 2 Quality assessment summary of all included studies

Ref.	Study design	Random sequence generation	Allocation con-cealment	Blinding	Blinding outcome assessment	Incomplete outcome data	Selective reporting	Other bias	Quality assessment
De silva *et al*[26], 2016	RCT	Adequate	Adequate	Double-blinded	Adequate	None	None	None	High
Martindale *et al*[33], 2013	RCT	Adequate	Adequate	Double-blinded	Adequate	None	None	None	High
Costa *et al*[19], 2010	RCT	Adequate	Inadequate	Single-blinded	Adequate	None	None	None	Moderate
Bechtold *et al*[35], 2006	RCT	Adequate	Not described	None	Inadequate	None	None	None	Low
Ovayolu *et al*[18], 2006	RCT	Adequate	Adequate	Double-blinded	Adequate	None	None	None	High
Harikumar *et al*[28], 2006	RCT	Adequate	Adequate	Single-blinded	Adequate	None	None	None	Moderate
Uedo *et al*[39], 2004	RCT	Not described	Not described	Double-blinded	Adequate	None	None	None	Low
López-Cepero Andrada *et al*[25], 2004	RCT	Not described	Adequate	Double-blinded	Adequate	None	None	None	Moderate
Smolen *et al*[32], 2002	RCT	Not described	Adequate	Double-blinded	Adequate	None	None	None	Moderate
Schiemann *et al*[38], 2002	RCT	Not described	Adequate	Double-blinded	Adequate	None	None	None	Moderate
Lee *et al*[29], 2002	RCT	Not described	Adequate	Double-blinded	Adequate	None	None	None	Moderate

RCT: Randomized controlled trial.

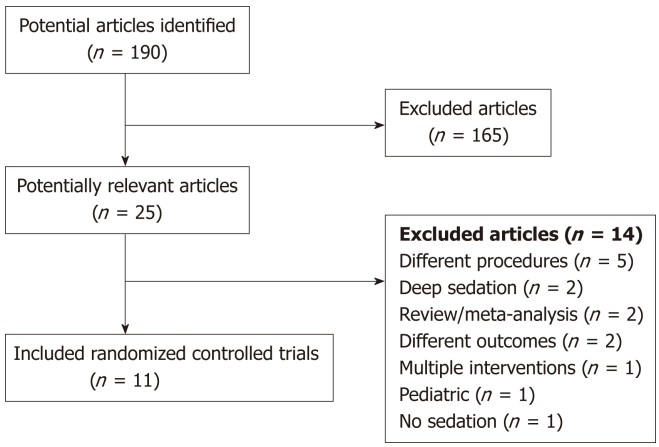

Figure 1 Details of search algorithm.

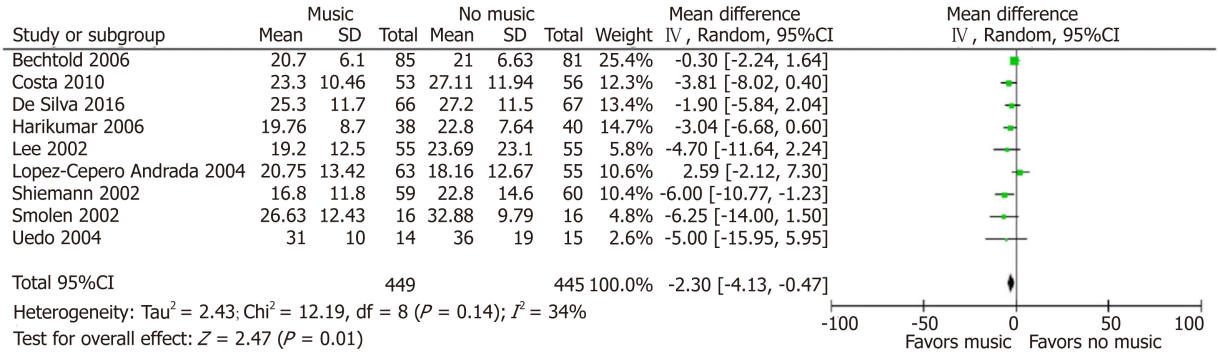

Figure 2 Forest plot showing comparison between music and no music during colonoscopy for procedure time.

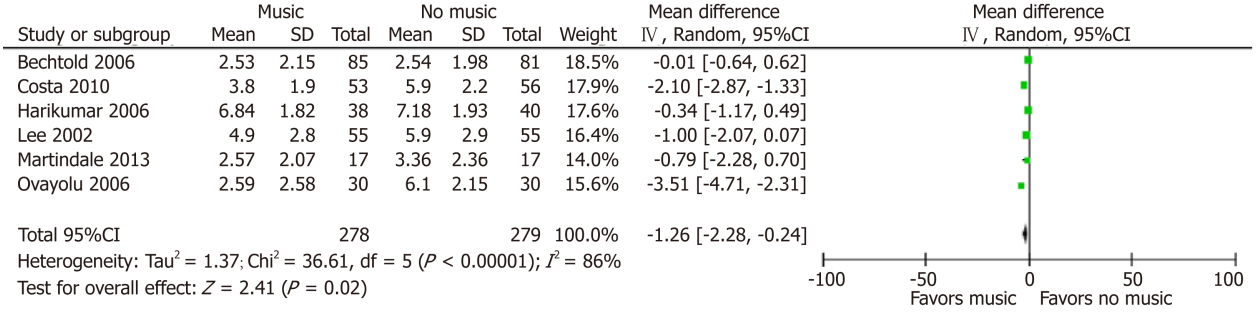

Figure 3 Forest plot showing comparison between music and no music during colonoscopy for patients' pain.

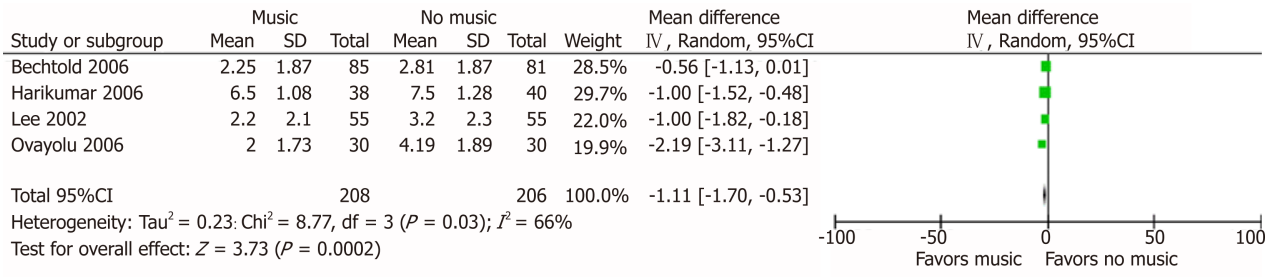

Figure 4 Forest plot showing comparison between music and no music during colonoscopy for patients' experience.

ARTICLE HIGHLIGHTS

Research background

Music during colonoscopy has been a controversy subject despite multiple randomized controlled trials and meta-analyses. Studies vary from music during colonoscopy helping reduce need for sedative medications and enhancing patient experience to offering little to no benefit. Given this variability, we conducted this meta-analysis to include all studies to-date and limiting them to only conscious sedation.

Research motivation

To determine if music is beneficial to patients undergoing colonoscopy. If beneficial, music would be a very low-cost intervention to improve patients' experience and pain during a very stressful procedure.

Research objectives

The objectives of this research were to fully assess the effects of music during colonoscopy sedative medication doses (meperidine and midazolam), total procedure time, and patients' pain scores, experience, and willingness to repeat the colonoscopy.

Research methods

A meta-analysis was performed by calculating pooled estimates of sedative medication doses (meperidine and midazolam), total procedure time, and patients' pain scores, experience, and willingness to repeat the colonoscopy using odds ratio and mean difference using a random effects model.

Research results

This research showed that music during colonoscopy improved patient experience and procedure times while reducing patient pain.

Research conclusions

Music is a benefit to patients undergoing the stressful procedure of colonoscopy. Music during colonoscopy improves the patient experience while reducing pain. In addition, procedure times are improved with music playing during colonoscopy. Music is a low-cost intervention that shows significant benefit and should strongly be considered in endoscopy suites. In the future, more endoscopy suites should be equipped with music.

Research perspectives

This meta-analysis shows that music has a role in the endoscopy suite. Also, this meta-analysis demonstrates that with more studies, the results of any meta-analysis may be significantly altered as these results differ from some prior meta-analyses.

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