

## ORIGINAL RESEARCH

# Impact of Music on Postoperative Pain, Anxiety, and Narcotic Use After Robotic Prostatectomy: A Randomized Controlled Trial

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Authors' disclosures of conflicts of interest are found at the end of this article.

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<https://doi.org/10.6004/jadpro.2022.13.2.3>

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## Abstract

**Background:** Music is a safe and cost-effective intervention that can reduce postoperative pain and anxiety. We investigated the effects of music therapy on postoperative recovery in patients undergoing robotic-assisted laparoscopic prostatectomy (RALP). **Methods:** Subjects were males 18 years and older undergoing RALP at a single tertiary care institution. Patients were randomized to music or control groups. The music group received 30 minutes of music in the recovery area and on postoperative day (POD) 1, while the control group was not provided postoperative music. Inpatient narcotic use (morphine milligram equivalent, or MME) and outpatient narcotic use were measured, and the State-Trait Anxiety Inventory (STAI) survey was completed on POD 1 and POD 7 by an inpatient advanced practitioner (AP). T-test and Chi-square were used to compare the groups. Linear regression was used to adjust for age, blood loss, and inpatient MME. **Results:** A total of 40 patients were prospectively recruited. There was no statistically significant difference in the hourly MME (2.06 [0.71–3.17] vs. 1.55 [0.83– 3.37]) or total MME (49.52 [17–76] vs. 37.25 [20–69]) used in the music vs. non-music arms, respectively. Evaluation of STAI questionnaire revealed no overall differences in anxiety levels among the two groups on POD 1 or POD 7. After adjusting for age, blood loss, and inpatient MME use, patients assigned to the music intervention had a 26% reduction in post-hospitalization use. **Conclusion:** Our prospective randomized study suggests that music can be an AP-driven adjunct to facilitate postoperative patient comfort and reduce narcotic use upon discharge in prostate cancer patients.

**R**adical prostatectomy is a commonly performed cancer treatment for men with prostate cancer, and approximately 90,000 cases are performed annually in the United States (Lowrance et al., 2012). While a significant reduction in postoperative pain has been observed with widespread implementation of robotic-assisted laparoscopic prostatectomy (RALP) as opposed to an open approach (Batley et al., 2016), there continues to be room for improvement of postoperative pain management.

The safe and effective management of postoperative pain can be challenging, especially in the face of the current opioid epidemic within the United States, which emphasizes the need for minimizing opioid use. Undergoing surgery has been shown to be an independent risk factor for long-term opioid use, and a further increased risk is observed among male patients (Hah et al., 2017; Sun et al., 2016). A previous analysis suggests that increased risk for chronic opioid use can begin after just 3 to 5 days of opioid treatment for acute pain (Shah, 2017), a window that is reasonable for the treatment of postoperative pain following RALP. The minimization of postoperative narcotic requirements is therefore a crucial objective for the surgeon and the perioperative team.

In addition to pain, anxiety is common in the perioperative period. Up to 75% of surgical patients suffer from anxiety, and this anxiety can contribute to increased postoperative pain levels (Kühlmann et al., 2018). With regard to prostate cancer patients, worry regarding the diagnosis of prostate cancer and sexual performance outcomes are reported sources of significant anxiety in the perioperative period (Arslan et al., 2008).

Music is a safe and cost-effective intervention that has been shown to reduce pain, anxiety, and analgesia use within the perioperative setting in many surgical fields, including orthopedic surgery, cardiac surgery, gynecologic surgery, and several more (Hole et al., 2015; Kühlmann et al., 2018; Nilsson, 2008). Inpatient advanced practitioners (APs) can enhance the postoperative care of urologic patients (Mishra et al., 2020). We aim to evaluate the effect of AP-driven perioperative music administration on patients who underwent RALP and hypothesize that music will reduce both narcotic medication requirements and anxiety levels.

## MATERIALS AND METHODS

Institutional review board approval (study 20180498) was obtained for a randomized controlled trial design including all male patients undergoing RALP at a single tertiary care institution from February 2019 to November 2019. Patients with no previous history of chronic pain or opioid use were eligible for participation.

Patients were randomized 1:1 into music or non-music cohorts using a random number generator. All patients in the music cohort were provided a music playing device and received 30 minutes of music in the genre of their choice in the recovery area on postoperative day (POD) 0. On POD 1, they received an additional 30 minutes of music while on the nursing floor. Each patient was provided counseling and positive reinforcement of the intervention by an inpatient AP on POD 1. Patients in the non-music cohort were not provided a device for music intervention, and personal use of music was not restricted, nor encouraged.

On POD 1, patients in both cohorts were given the State-Trait Anxiety Inventory (STAI), a validated anxiety inventory, by an inpatient AP. The STAI questionnaire was repeated 1 week postoperatively. All STAI inventories were performed by a single urology-trained certified nurse practitioner (author Emily Sopko, APRN, CNP).

Both cohorts received standard post-operative pain management, including access to narcotic pain medication “as needed.” Narcotic medication intake was recorded and converted to morphine milligram equivalent (MME) for the length of inpatient stay, and narcotic use was tracked following discharge.

Baseline demographic information was collected. T-test and Chi-square were used to compare continuous and categorical data, respectively. Linear regression was used to adjust for prostate-specific antigen (PSA), operative time, blood loss, and inpatient MME. A *p* value of less than .05 was considered statistically significant. All statistical analysis was done utilizing Stata, version 16.

## RESULTS

A total of 40 patients were prospectively recruited for the study. There were no baseline demographic differences among music vs. non-music arms. Specifically, the average age, (64.8 vs. 62.1

years,  $p = .89$ ), PSA (11.56 vs. 8.17 ng/mL,  $p = .81$ ), Gleason score ( $p = .836$ ), operative time (283 vs. 299 minutes,  $p = .15$ ), and blood loss (187 vs. 173 mL,  $p = .59$ ) were not significantly different between the music and non-music groups, respectively (Table 1).

Analysis revealed no significant differences in average POD 1 STAI scores (34.85 [ $\pm 8.56$ ] vs. 36.8 [ $\pm 6.87$ ],  $p = 0.22$ ) or POD 7 STAI scores (28.11 [ $\pm$

9.27] vs. 28.22 [ $\pm 9.17$ ],  $p = .51$ ), between music and non-music groups, respectively (Table 1).

There was no statistically significant difference in the hourly MME (2.33 [ $\pm 1.85$ ] vs. 1.84 [ $\pm 1.22$ ] mg/hr,  $p = .97$ ) or total inpatient MME (54.91 [ $\pm 29.34$ ] vs. 44.32 [ $\pm 25.22$ ] mg,  $p = .83$ ) used in music vs. non-music arms, respectively. The number of narcotic tablets used in the week after discharge was 5.73 ( $\pm 3.61$ ) for the music group and

**Table 1. Post-Operative Recovery Parameters in Music vs. Non-Music Arm**

Variable	Music	Non-Music	<i>p</i> value
Age ( $\pm$ SD)	64.88 ( $\pm 6.23$ )	62.13 ( $\pm 7.50$ )	.89
Gleason score			.836
3+3	4	3	
3+4	7	8	
4+3	3	3	
4+4	3	2	
4+5	4	1	
Operative time (min), mean ( $\pm$ SD)	283 ( $\pm 49.35$ )	298.58 ( $\pm 32.67$ )	.15
Blood loss (mL), mean ( $\pm$ SD)	186.91 ( $\pm 229.34$ )	172.5 ( $\pm 125.11$ )	.59
PSA (ng/mL), mean ( $\pm$ SD)	11.56 ( $\pm 14.98$ )	8.17 ( $\pm 6.07$ )	.81
Lymph node yield (number nodes), mean ( $\pm$ SD)	13.21 ( $\pm 9.68$ )	7.94 ( $\pm 5.18$ )	.97
MME total (mg), mean ( $\pm$ SD)	54.91 ( $\pm 29.34$ )	44.32 ( $\pm 25.22$ )	.83
MME hourly (mg/hr), mean ( $\pm$ SD)	2.33 ( $\pm 1.85$ )	1.84 ( $\pm 1.22$ )	.97
STAI 1 score ( $\pm$ SD)	34.85 ( $\pm 8.56$ )	36.8 ( $\pm 6.87$ )	.22
STAI 1 scale			.67
Low anxiety (score 22–37)	12	11	
Moderate anxiety (38–44)	7	5	
High anxiety (45–80)	2	3	
STAI 2 score ( $\pm$ SD)	28.11 ( $\pm 9.27$ )	28.22 ( $\pm 9.17$ )	.51
STAI 2 scale			.39
Low anxiety (score 22–37)	18	18	
Moderate anxiety (38–44)	0	1	
High anxiety (45–80)	2	0	
Discharge rx prescribed			.95
Oxycodone 5 mg	18	13	
Percocet 5/325 mg	0	3	
Tramadol 50 mg	0	1	
No. of pills used ( $\pm$ SD)	5.73 ( $\pm 3.61$ )	4.25 ( $\pm 3.31$ )	.88

Note. SD = standard deviation. PSA = prostate-specific antigen; MME = morphine milligram equivalent; STAI = State-Trait Anxiety Inventory.

4.25 ( $\pm$  3.31) for the non-music group ( $p = .88$ ; Table 1).

Longer operative time was associated with increased total MME (odds ratio [OR] 1.42 [1.01–2.30],  $p = .043$ ). After adjusting for age, blood loss, and inpatient MME use, patients assigned to the music intervention were found to have a 26% reduction in posthospitalization narcotic use (OR 0.74 [0.54–0.98],  $p = .041$ ; Table 2).

## DISCUSSION

Our prospective randomized study reveals that use of postoperative music intervention following RALP is associated with a reduced risk of narcotic use after discharge, which is consistent with several similar studies (Fu et al., 2020; Wang et al., 2015). One review by Hole and colleagues (2015), which included 73 randomized controlled trials and 6,902 patients, found a significant reduction in postoperative pain, anxiety, and analgesia use with perioperative music interventions. Other reviews have published similar conclusions (Nilsson, 2008; Wang et al., 2015).

There exists neurobiologic evidence for the mechanisms by which music can ameliorate pain, as seen in our study. The gate control pain theory describes the experience of pain as multifactorial, with contributions from both neurotransmitters and psychosocial inputs playing roles in the perception of pain (Chai et al., 2017). In the setting of acute pain, music has been shown to stimulate

the dopaminergic neurotransmission pathway and increase circulating endogenous opioids, both of which can reduce pain via neurotransmission. Psychosocial or emotional inputs are also affected by music, which increases positive emotions, decreases cognitive distortion, acts as an anxiolytic by reducing stress and sympathetic nervous system activation (Chai et al., 2017).

The opioid crisis in the United States highlights the importance of working to reduce the use of narcotic pain medication as much as possible. In 2013, the estimated overall cost of opioid use, abuse, and overdose was \$78.5 billion, and over 30,000 deaths were reported to be caused by opioid overdose alone in 2015 (Kiechle & Gonzalez, 2018). Medical opioids, such as those prescribed to postoperative patients, are often noted to be available to individuals prior to being diagnosed with an opioid addiction. Shkoilyar and colleagues (2020) examined 10,768 males undergoing RALP in the United States who were prescribed 4 to 7 days' worth of opioids and found that 6.5% of these men had continued opioid use 90 to 180 days following their surgery. Our study highlights how music intervention can help to optimize the postoperative pain regimen by reducing the number of narcotic pills required following RALP. The use of such adjuvant pain management strategies may help reduce the overall contribution that postoperative medical opioids make to the opioid crisis.

**Table 2. Linear Regression Analysis**

Variable	OR	95% CI	<i>p</i> value
A: Inpatient MME use post RALP			
Music intervention	15.96	0.09–70.324	0.83
PSA	1.001	0.33–3.04	0.989
OR time	1.42	1.01–2.3	0.043
Age	0.22	0.28–1.74	0.55
B: Outpatient narcotic requirement at 1 week			
Age	1.01	0.98–1.02	0.57
Blood loss	1.004	0.99–1.004	0.72
MME	1.001	0.997–1.004	0.553
Music intervention	0.74	0.54–0.98	0.041

*Note.* Bold signifies  $p < .05$ . CI = confidence interval; PSA = prostate-specific antigen; OR = odds ratio; MME = morphine milligram equivalent; RALP = robotic-assisted laparoscopic prostatectomy.

Despite reducing postoperative pain and analgesia use, we did not see a significant reduction in postoperative anxiety levels with music intervention in our series, while multiple previous studies have shown this (Arslan et al., 2008; Binns-Turner et al., 2011; Cooke et al., 2005). The timing of music intervention may be important for anxiety reduction. Anxiety levels are highest preoperatively, which may account for the increased anxiolytic effect seen with preoperative music intervention in other studies (Arslan et al., 2008; Binns-Turner et al., 2011; Chai et al., 2017). In addition, there may be an elevated baseline level of anxiety in our patients due to a cancer diagnosis, which may influence the effect of music intervention. An additional contributing factor may be that all of our patients were treated with the music genre of their choice. This “locus of control,” or patient self-selection of music type, is theorized to improve adherence and efficacy of music intervention (Chai et al., 2017), although no clear benefit has been described for the perioperative population. One systematic review saw an increased but not significant reduction in pain and analgesia use when patients were able to choose their own music as opposed to no choice (Hole et al., 2015). However, this review also noted a nonsignificant trend toward increased anxiety seen in patients who were given a choice over music type (Hole et al., 2015). A second, recently published review found no difference in pain reduction or anxiety levels with patient choice of music (Kühlmann et al., 2018). We believe that giving patients their choice of music allows for a more patient-centered care approach and may facilitate patient willingness to participate in therapy; however, this added locus of control may have inadvertently contributed to an increased level of anxiety for our patients, which may also account for the difference in findings of our study as compared to other studies.

Our music protocol was driven entirely by our inpatient certified nurse practitioner, who provided counseling and positive reinforcement of therapy as well as postoperative STAI surveys to assess effect. Inclusion of an inpatient AP in the postoperative care team has been shown to reduce cost and length of inpatient stay for bladder cancer patients after cystectomy (Mishra et al., 2020). Our study highlights how an increased role of APs

in the multimodal management of postoperative pain can reduce narcotic use in prostate cancer patients. Once a protocol is put into action, music therapy carries the additional benefit of being an independent nursing intervention, adding to the perioperative nursing armamentarium of tools for reducing postoperative pain.

The strengths of our study include its prospective and randomized design. We were also able to achieve consistency in data collection by having each STAI survey given by a single author. Limitations include the relatively small sample size, a lack of preoperative baseline anxiety levels to utilize for comparison, and an inability to blind patients to our intervention. In addition, while our findings pointed to a lower rate of postoperative medication use after discharge, whether this was secondary to the music or the intervention bias is difficult to discern. In addition, we did not limit music in the home setting in the standard group; therefore, there could be crossover between the two groups. Furthermore, as this was a pilot study aimed to prove feasibility of music therapy in the immediate postoperative period, we did not calculate the sample size needed to detect the difference. The findings of nonsignificance could be reflective of the sample size.

## CONCLUSIONS

Investigation into the optimization of postoperative pain management remains an important area of study, as it affects patient experience and satisfaction, health-care costs, and even public health matters. We have shown that a music intervention is a useful adjunct to the inpatient AP's role in caring for patients undergoing RALP, and it is effective in reducing narcotic use after discharge. ●

## Disclosure

Funding was provided by grant from the Accreditation Council for Graduate Medical Education (ACGME). The authors have no conflicts of interest to disclose.

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