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Effect of music therapy on postembolization syndrome in Thai patients with hepatocellular carcinoma: A quasi-experimental crossover study

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Abstract

Background: Postembolization syndrome (PES), including abdominal pain, nausea, and vomiting, are complications most severe on the first day after transarterial chemoembolization (TACE). Music therapy has been found to help manage pain. If pain, a cause of nausea and vomiting, can be relieved, then nausea and vomiting should also be reduced.

Objectives: This study aimed to examine the effect of music therapy on PES in patients with liver cancer after receiving TACE.

Methods: This study employed a quasi-experimental crossover design. The study was conducted at the inpatient units of a specialized hospital for cancer in Bangkok, Thailand, from March 2020 to October 2021. Thirty patients with liver cancer were purposively selected based on the pre-determined criteria. A change-over design was used to compare patients' changes in abdominal pain, nausea, and vomiting from the experimental period to the other control period. During the experimental period, music therapy was administered for 30 minutes on Day 0 after TACE, then twice a day in the morning and evening of Days 1 and 2 after TACE, and in the morning of Day 3 after TACE. During the control period, the patients used silent headphones. Data were analyzed using Wilcoxon signed ranks and Friedman tests.

Results: The participants perceived abdominal pain, nausea, and vomiting at a mild level during all periods. Pain scores in the music therapy period were significantly lower than those in the control period on Days 0, 1, and 2 after TACE (p <0.001, p <0.01, and p <0.001, respectively) and lower than at the baseline (p <0.001). There were no statistically significant differences in nausea and vomiting scores between the music therapy period and the control period on Days 0, 1, and 2 after TACE and no statistically significant differences at the baseline.

Conclusion: Music therapy effectively reduces mild pain among patients with liver cancer experiencing PES. This therapy can be used as a non-pharmacological treatment for nurses and other healthcare professionals in caring for patients with liver cancer.

Keywords

music therapy; transarterial chemoembolization; abdominal pain; nausea; vomiting; liver neoplasms; Thailand

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Background

Liver cancer ranks sixth among newly diagnosed diseases, and it is the third leading cause of death by cancer all over the world (World Health Organization, 2022). In Thailand, according to the cancer registry, in 2020, liver cancer ranked second in males and fifth in females among newly diagnosed cancer cases (National Cancer Institute, 2021). It was the first leading cause of death among all types of cancer (Faculty of Medicine Siriraj Hospital, 2019). Transarterial chemoembolization (TACE) is the first choice of palliative care for patients who cannot undergo surgery (Ahmed et al., 2016) to prolong the prognosis, control the symptoms, and improve patients' quality of life (Jamnongsilp et al., 2016).

Even though TACE is beneficial, it can lead to numerous complications, including abdominal pain, nausea, vomiting, and fever, all of which constitute postembolization syndrome (PES), which is generally found in 25.2% to 90% of patients receiving TACE. The onset begins as early as two to three hours after the treatment, up to seven to ten days afterward (Blackburn & West, 2016; Cao et al., 2013; Dhand & Gupta,

2011; Temtap et al., 2017). PES is cytotoxicity caused by the treatment as well as inflammation of the liver (Dhand & Gupta, 2011). Based on a literature review, abdominal pain, nausea, and vomiting are most severe on the first day after TACE (Xu et al., 2016). Also, pain can occur in 80% of the cases, and it is reported to be most severe 12 to 24 hours after TAEC (Patel et al., 2000). There is evidence that pain is caused by the tension of the diverticula of the liver, death of the tumor, or a lack of blood flow to the liver tissue, as well as side effects of embolization (Zeng et al., 2014). In addition, nausea can be found in 38.3% to 52.5% and vomiting in 20.9% to 40.3% of patients after TACE (Lu et al., 2021; Wang et al., 2013). Besides, there is evidence that the cause of nausea and vomiting after TACE is chemotherapy in the blood circulation system that stimulates chemotherapy receptors of the gastrointestinal tract. Furthermore, nausea and vomiting can result from psychological reasons, stress, and treatment-related pain. Pain signals are sent through the cerebral cortex and the limbic system to stimulate the vomiting center directly, so nausea and vomiting can occur after TACE (Lu et al., 2021). PES affects patients' functioning, well-being, and emotions (Cao et al., 2013).

At present, there is both pharmacological and non-pharmacological symptom management. In the past, most of the management strategies of PES were mainly pharmacological (Blackburn & West, 2016). However, as regards non-pharmacological symptom management, a review of the literature has shown that pain management can be done with ear acupressure (Jamnongsilp et al., 2016), acupressure at the wrist-ankle (Zeng et al., 2014), progressive muscle relaxation (Vuttanon et al., 2019), and traditional Chinese acupressure massage which can reduce fatigue in liver cancer patients after TACE (Lan et al., 2015). In addition, it has been documented that non-pharmacological management strategies to reduce pain in cancer patients include hypnosis (Syrjala et al., 1992) and music therapy (Krishnaswamy & Nair, 2016).

Previous studies carried out to investigate non-pharmacological symptom management in cancer patients mostly deal with one to two symptoms and require a specialist who conducts the therapy, or the patients have to undergo training with a specialist. However, it can be seen that music therapy allows patients to listen to their favorite songs can easily be done, enables patients to relax, and is inexpensive (Parisuthkul & Yeela, 2011). Moreover, music can help manage such symptoms as pain (Krishnaswamy & Nair, 2016), depression (Jasemi et al., 2016), and nausea and vomiting (Pakpoe, 2007).

However, no study has been undertaken to examine the effect of music on the PES symptom, which requires simultaneous care and can be relieved with appropriate management. It is believed that music therapy could manage pain, which, in turn, directly stimulates the vomiting center leading to nausea and vomiting (Lu et al., 2021). If pain, a cause of nausea and vomiting, can be relieved, nausea and vomiting should be reduced as well, hence less suffering and more likelihood that the patients will continue their treatment to ensure a more favorable prognosis and better quality of life. This study aimed to examine the effect of music therapy on PES in patients with liver cancer after TACE.

Methods

Study Design

This study employed a quasi-experimental crossover design. The study was conducted at the inpatient units of the National Cancer Institute, Bangkok, Thailand, from March 2020 to October 2021.

Samples/Participants

Thirty participants were selected using purposive sampling. The inclusion criteria were as follows: 1) patients with liver cancer treated with TACE; 2) 18 years old or older, and if older than 60, they had to pass the Thai version of a short portable mental status questionnaire (SPMSQ) with the scores of at least 8 points; 3) Eastern Cooperative Oncology Group (ECOG) functionality score was ≤ 2; 4) able to communicate in the Thai language; 5) liked to listen to music; 6) no hearing loss, and 7) willing to participate in this study. The exclusion criteria were the following: 1) those who did not receive two consecutive cycles of TACE and 2) had an acute and critical illness during their participation in this study.

Instruments

The instruments used in this study were divided into the screening instruments and data collection instruments:

1) The Thai version of the Short Portable Mental Status Questionnaire (SPMSQ) was used to screen the cognition of participants aged 60 and older. The researcher received permission to use the instrument developed by Pfeiffer (1975) and translated into Thai by Yamvong (1995) with three qualified experts on hand nursing instructors to examine its content validity. As for reliability, the Thai SPMSQ was tried out with ten elderly patients, and its coefficient was 0.76. When used with 56 elderly participants, the coefficient was 0.94. The questionnaire was composed of ten short items; the correct answer was equal to 1 point, while the incorrect answer was equal to 0 point. In this study, the test was used to screen prospective participants who were older than 60 years old. Those with scores ≥ 8 points were able to participate in the study (Yamvong, 1995).

2) The Eastern Cooperative Oncology Group (ECOG) performance status (Oken et al., 1982) was used to assess the function ability of cancer patients. The assessment was divided into six-point scores, with 0 = fully active, able to carry on all; 1 = restricted in physically strenuous activity but ambulatory and able to carry out light work; 2 = ambulatory and capable of all self-care but unable to carry out any work activities, up and about more than 50% of waking hours; 3 = capable of only limited self-care, confined to bed or chair more than 50% of waking hours; 4 = completely disabled, cannot carry out any self-care; totally confined to a bed or chair, and 5 = dead (Oken et al., 1982). In this study, the participants had to have ECOG performance status scores of 0-2.

Regarding the instruments, the demographic and clinical characteristics questionnaire was used to collect demographic and clinical characteristics data of patients with TACE. Also, the researchers developed the severity of the PES symptom scale to assess the participants' perception of the current severity of PES symptoms. The development process was as follows: in step 1, the content domains of PES symptoms within the contexts of transarterial chemoembolization were

determined as a result of a thorough review of the literature. In step 2, PES symptom generation was based on the information gained during the previous step, consisting of three symptoms of abdominal pain, nausea, and vomiting. During step 3, the scaling format for the PES symptoms was determined using a numerical rating scale (0 = no symptom at all, 1-3 = mild symptoms, 4-6 = moderate symptoms, and 7-10 = severe symptoms). In step 4, the PES symptoms scale was submitted to a panel of three experts, and CVI was 1.00. Finally, in step 5, a pilot test was done, with Cronbach's alpha coefficient (n = 20) equal to 0.78. In the main study, with 30 participants, Cronbach's alpha coefficient was 0.79.

Intervention

During the experimental period, the participants listened to Western music in addition to receiving routine care, which was modern classical music (relaxing music) created by Gordon Gibson, Michael Maxwell, and John Herberman. It consisted of stream sound, including streaming, morning light, and sheltered shore; sea sound, including the canon stirs, beyond the horizon, in a protected cove, and forever by the sea; wind sound, including walk softly, revitalize, winding path, and sparkling sky; and songbirds sound, including new England spring, northern mist, southern symphony, coastal horizons, and prairie glory. Each sound was played in a 30-minute session via an MP3 player using headphones. All four sounds were evaluated by the three music experts for similarity of characteristics such as relaxing sound (CVI = 0.88). In addition, the participants were allowed to select the sound they felt would be relaxing. The intervention was administered on the day after the participants received TACE, two hours after the transfer to the ward (post-TACE Day 0), then twice a day in the morning and evening on post-TACE Days 1 and 2, and in the morning on post-TACE Day 3.

During the control period, the participants received silent headphones in addition to routine care. Each participant was randomly assigned to the experimental or control period first, which would be changed to the alternate period in the following sessions (6-8 weeks). Thus, between-subject variability of symptoms was eliminated. However, this study design suffered frequently from the bias of treatment-by-period interaction (carryover effect). Therefore, a 6-8 weeks washout period was established between the crossover to reduce potential carryover effects. **Figure 1** presents the detail of the intervention and data collection.

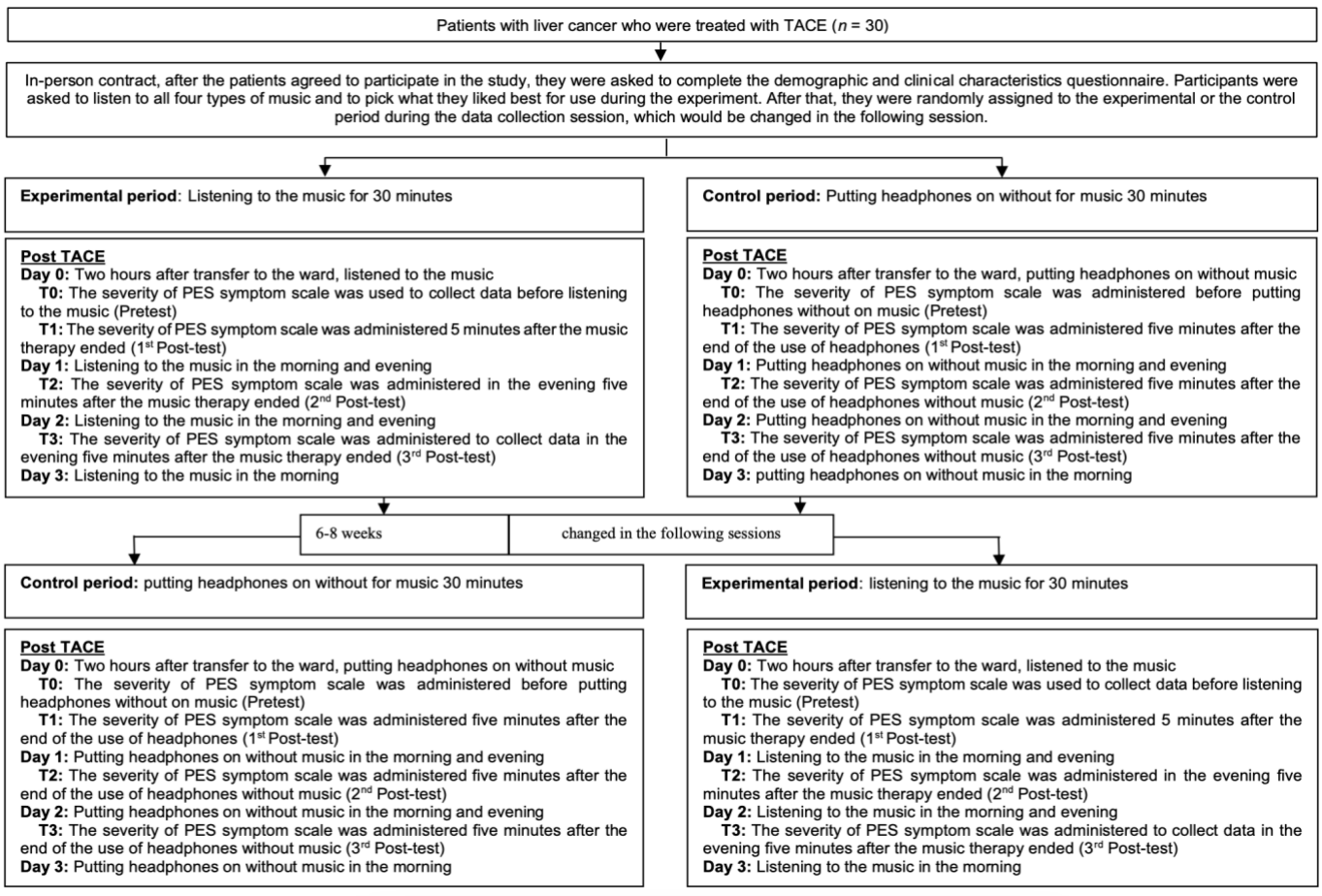

Figure 1 Intervention and data collection

Data Collection

The data collection processes in both periods were similar (**Figure 1**). On the day after the participants received TACE (post-TACE Day 0), the research assistant collected data regarding the severity of PES symptoms before the intervention (pretest) and after the intervention (1st post-test). Then the research assistant collected data using the severity of the PES symptom scale on the evening of Days 1 and 2 after the intervention (2nd and 3rd post-test).

Data Analysis

The IBM SPSS Statistics for Windows (Version 21.0) was used to analyze data as follows: 1) Data regarding general characteristics were analyzed using descriptive statistics of

frequency, percentage, mean, and standard deviation; 2) Clinical characteristics between the experimental period and control period were compared using the Chi-square and Fisher's exact tests; 3) The scores of perceived severity of PES obtained during the experimental and control period on the post-TACE Days 0, 1, and 2 were analyzed with Wilcoxon signed ranks test. Also, data collected during the experimental period before and after the intervention on the post-TACE Days 0, 1, and 2 were analyzed using Friedman test. If differences were observed, Wilcoxon signed rank test was used to analyze the difference between each pair.

Ethical Considerations

The study was approved by the Institutional Review Board of the Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Thailand (COA's approval number: MURA2018/ 818 on 19 November 2018). It was also approved by the Ethics Committee of the National Cancer Institute, Thailand (approval number: 249_2018T_OUT579 on 23 November 2018). The participants were asked to sign the informed consent form prior to data collection.

Results

The total number of participants was 30 in both periods. Most of them, or 83.3%, were male, and their mean age was 60.7 (SD ± 9.1). More than three-quarters, or 76.7%, were married, and 56.6% completed primary education. More than half, or 53.3%, liked to listen to songbird music. The mean duration of liver cancer diagnosis was 3.9 months (SD ± 4.2), 63.3% had hepatitis B, and 20% had hepatitis C as their liver disease. Nearly all participants, or 93.3%, were classified as Child A when it came to Child-Pugh Classification, and almost half, or 43.3%, were in the intermediate stage of liver cancer. Furthermore, 63.3% were treated with TACE for the first time, and 66.7% received Mitomycin C (**Table 1**).

Table 1 General characteristics of the participants (*N* = 30)

Characteristics		Frequency	Percentage
Gender	Male	25	83.30
	Female	5	16.70
Age (years)	Mean = 60.7 (SD ± 9.1) Range 36-86 years		
Marital status	Single	4	13.30
	Married	23	76.70
	Divorced/Widowed	3	10.00
Educational background	Primary education	17	56.60
	Secondary education	6	20.00
	Certificate	5	16.70
	Bachelor's degree	2	6.70
Music preference	Songbirds sound	16	53.30
	Sea sound	7	23.30
	Stream sound	6	20.00
	Wind sound	1	3.40
Duration of disease (months)	Mean = 3.9 (SD ± 4.2) Range 1-17 months		
Liver disease	Hepatitis B	19	63.30
	Hepatitis C	6	20.00
	None	5	16.70
Child-Pugh Classification	Child A	28	93.30
	Child B	2	6.70
Stage	Early stage	12	40.00
	Intermediate stage	13	43.30
	Advanced stage	5	16.70
Cycle of TACE	1st	19	63.30
	≥ 2nd	11	36.70
Chemotherapy drugs used in TACE	Mitomycin C	20	66.70
	Doxorubicin	4	13.30
	Mitomycin C+ Doxorubicin	6	20.00

Table 2 shows the comparison of the clinical characteristics between the experimental period and control period analyzed using the Chi-square test and Fisher's exact test. There were no statistical differences between clinical characteristics between both periods.

When considering PES before the intervention (T0) and during the experimental period, it could be seen that all participants, or 100%, suffered abdominal pain, with a mean pain score of 2.67 points (SD ± 1.09). Ten percent suffered from nausea, with a mean score of 0.33 points (SD ± 1.09), and 6.6% suffered from vomiting, with a mean score of 0.27 points (SD ± 1.05). On the other hand, during the control period, all of the participants, or 100%, suffered abdominal pain, with a mean score of 2.93 points (SD ± 1.36). Moreover, 10% suffered from nausea, with a mean score of 0.17 points (SD ± 0.53). However, none of the participants suffered from vomiting. After the intervention in the experimental period and control period, it was found that the mean scores of abdominal pain, nausea, and vomiting on the post-TACE Day 0 (T1), post-TACE Day 1 (T2) and post-TACE Day 2 (T3) (**Table 3**).

The results showed that the decrease in abdominal pain scores after TACE in the experimental period was significantly greater than in the control period at T1, T2, and T3. However, there was no statistical significance, only at time 0 (**Table 4**). In addition, there were no statistically significant differences in nausea scores and vomiting scores obtained after TACE in the experimental and control periods at T0, T1, T2, and T3.

Table 2 Comparison of the clinical characteristics between the experimental period and control period (*N* = 30)

Variables	Experimental period		Control period		Statistical test	*p*-value
	Frequency	Percentage	Frequency	Percentage		
Chemotherapy drug					0.00	1.000[a]
MMC/ Doxorubicin	24	80.00	24	80.00		
MMC + Doxorubicin	6	20.00	6	20.00		
MMC (mg)						1.000[b]
None	3	10.00	3	10.00		
10-20	27	90.00	27	90.00		
Doxorubicin (mg)					0.00	1.000[a]
None	21	70.00	21	70.00		
10-50	9	30.00	9	30.00		
Painkillers						
Day 0 (post-TACE)						0.706[b]
No	25	83.30	27	90.00		
Yes	5	16.70	3	10.00		
Day 1 (post-TACE)						0.706[b]
No	27	90.00	25	83.30		
Yes	3	10.00	5	16.70		
Day 2 (post-TACE)					0.09	0.760[a]
No	22	73.30	24	80.00		
Yes	8	26.70	6	20.00		
Antiemesis drug						
Day 0 (post-TACE)						1.000[b]
No	29	96.70	29	96.70		
Yes	1	3.30	1	3.30		
Day 1 (post-TACE)						1.000[b]
No	28	93.30	28	93.30		
Yes	2	6.70	2	6.70		
Day 2 (post-TACE)						1.000[b]
No	28	93.30	29	96.70		
Yes	2	6.70	1	3.30		

[a]= Chi-square
[b]= Fisher's exact test

Table 3 Distribution of PES (abdominal pain, nausea, and vomiting) post TACE change before and after intervention (*N* = 30)

PES		Experimental period		Control period	
		N (%)	Mean (SD)	*N* (%)	Mean (SD)
Abdominal pain	T0 (Pretest)				
	None	0 (0.00)		0 (0.00)	
	Mild	24 (80.00)	2.67 (1.09)	24 (80.00)	2.93 (1.36)
	Moderate	6 (20.00)		5 (16.70)	
	Severe	0 (0.00)		1 (3.30)	
	T1 (1st Post-test)				
	None	16 (53.30)		1 (3.30)	
	Mild	14 (46.70)	0.70 (0.88)	26 (86.70)	2.23 (1.10)
	Moderate	0 (0.00)		3 (10.00)	
	Severe	0 (0.00)		0 (0.00)	
	T2 (2nd Post-test)				
	None	9 (30.00)		5 (16.70)	
	Mild	21 (70.00)	0.97 (0.81)	22 (73.30)	1.73 (1.29)
	Moderate	0 (0.00)		3 (10.00)	
	Severe	0 (0.00)		0 (0.00)	
	T3 (3rd Post-test)				
	None	10 (33.30)		4 (13.30)	
	Mild	20 (66.70)	1.07 (0.94)	25 (83.40)	2.00 (1.08)
	Moderate	0 (0.00)		1 (3.30)	
	Severe	0 (0.00)		0 (0.00)	
Nausea	T0 (Pretest)				
	None	27 (90.00)		27 (90.00)	
	Mild	2 (6.70)	0.33 (1.09)	3 (10.00)	0.17 (0.53)
	Moderate	1 (3.30)		0 (0.00)	
	Severe	0 (0.00)		0 (0.00)	
	T1 (1st Post-test)				
	None	28 (93.30)		29 (96.70)	
	Mild	2 (6.70)	0.10 (0.40)	1 (3.30)	0.07 (0.37)
	Moderate	0 (0.00)		0 (0.00)	
	Severe	0 (0.00)		0 (0.00)	

Table 3 (Cont.)

PES		Experimental period		Control period	
		N (%)	Mean (SD)	*N* (%)	Mean (SD)
	T2 (2nd Post-test)				
	None	26 (86.70)		26 (86.70)	
	Mild	4 (13.30)	0.23 (0.68)	3 (10.00)	0.37 (1.07)
	Moderate	0 (0.00)		1 (3.30)	
	Severe	0 (0.00)		0 (0.00)	
	T3 (3rd Post-test)				
	None	25 (83.30)		27 (90.00)	
	Mild	5 (16.70)	0.30 (.75)	2 (6.70)	0.43 (1.85)
	Moderate	0 (0.00)		1 (3.30)	
	Severe	0 (0.00)		0 (0.00)	
Vomiting	T0 (Pretest)				
	None	28 (93.40)		30 (100.00)	
	Mild	1 (3.30)	0.27 (1.05)	0 (0.00)	0.00 (0.00)
	Moderate	1 (3.30)		0 (0.00)	
	Severe	0 (0.00)		0 (0.00)	
	T1 (1st Post-test)				
	None	28 (93.40)		30 (100.00)	
	Mild	2 (6.60)	0.10 (0.40)	0 (0.00)	0.00 (0.00)
	Moderate	0 (0.00)		0 (0.00)	
	Severe	0 (0.00)		0 (0.00)	
	T2 (2nd Post-test)				
	None	28 (93.40)		27 (90.00)	
	Mild	2 (6.60)	0.10 (0.40)	3 (10.00)	0.20 (0.66)
	Moderate	0 (0.00)		0 (0.00)	
	Severe	0 (0.00)		0 (0.00)	
	T3 (3rd Post-test)				
	None	28 (93.40)		29 (96.70)	
	Mild	2 (6.60)	0.07 (0.25)	1 (3.30)	0.17 (0.91)
	Moderate	0 (0.00)		0 (0.00)	
	Severe	0 (0.00)		0 (0.00)	

T0: Post TACE Day 0, before the intervention
T1: Post TACE Day 0, after the intervention
T2: Post TACE Day 1, after the intervention in the evening
T3: Post TACE Day 2, after the intervention in the evening
SD: Standard deviation

Table 4 Comparison of the differences in changes in abdominal pain scores between the experimental period and the control period (*N* = 30)

Time	Difference in changes in abdominal pain scores [a]	Mean rank	Sum of Rank	*Z*	*p*-value
T0	Negative Ranks	8.10	40.50	-1.50	0.134
	Positive Ranks	8.68	95.50		
T1	Negative Ranks	5.00	5.00	-4.53	<0.001
	Positive Ranks	14.35	373.00		
T2	Negative Ranks	11.00	33.00	-3.14	0.002
	Positive Ranks	11.58	220.00		
T3	Negative Ranks	0.00	0.00	-3.86	<0.001
	Positive Ranks	9.50	171.00		

T0: Post TACE Day 0, before the intervention
T1: Post TACE Day 0, after the intervention
T2: Post TACE Day 1, after the intervention in the evening
T3: Post TACE Day 2, after the intervention in the evening
[a] = changes of abdominal pain scores in the control period - change of abdominal pain scores in the experimental period

Table 5 Comparison of the difference in changes in abdominal pain scores over time within the experimental period (*N* = 30)

Time	Mean rank	χ^2	df	*p*-value
T0	3.80	51.18	3	<0.001
T1	1.82			
T2	2.15			
T3	2.23			

T0: Post TACE Day 0, before the intervention
T1: Post TACE Day 0, after the intervention
T2: Post TACE Day 1, after the intervention in the evening
T3: Post TACE Day 2, after the intervention in the evening

Friedman's test was carried out to analyze changes in the experimental period. There was a significant difference in abdominal pain scores (p <0.001) at four times points of data collection (**Table 5**). In addition, there was no effect of the music therapy in the experimental period on nausea and vomiting scores at four-time points of data collection (T0, T1, T2, and T3).

Friedman's test was used to examine the difference within the group, followed by the post hoc Wilcoxon signed ranks test. The post hoc Wilcoxon signed ranks test was carried out to analyze the data collected within the experimental period. It showed significant differences in abdominal pain scores after TACE in T1, T2, and T3 compared to T0 (all p <0.001) (**Table 6**).

Table 6 Post hoc Wilcoxon signed ranks test for over time within the experimental period (*N* = 30)

Time	Difference in changes in abdominal pain scores	Mean rank	Sum of Rank	*Z*	*p*-value
T0 – T1	Negative Ranks	0.00	0.00	-4.81	<0.001
	Positive Ranks	15.00	435.00		
T0 – T2	Negative Ranks	7.00	7.00	-4.53	<0.001
	Positive Ranks	14.78	399.00		
T0 – T3	Negative Ranks	4.50	9.00	-4.43	<0.001
	Positive Ranks	14.76	369.00		
T1 – T2	Negative Ranks	6.50	26.00	-1.80	0.073
	Positive Ranks	7.90	79.00		
T1 – T3	Negative Ranks	7.92	47.50	-1.72	0.086
	Positive Ranks	10.29	123.50		
T2 – T3	Negative Ranks	9.11	82.00	-0.55	0.585
	Positive Ranks	10.80	108.00		

T0: Post TACE Day 0, before the intervention
T1: Post TACE Day 0, after the intervention
T2: Post TACE Day 1, after the intervention in the evening
T3: Post TACE Day 2, after the intervention in the evening

Discussion

The findings of the present study showed that there was a difference in abdominal pain scores of PES between the experimental period and the control period on post-TACE Days 0, 1, and 2 (p <0.001, p <0.01, and p <0.001, respectively). Furthermore, there was a greater decrease in abdominal pain scores in the experimental period than in the control period.

During the experimental period, there was a difference in abdominal pain scores of PES before (T0) and after the intervention on post-TACE Day 0 (T1), post-TACE Day 1 (T2), and post-TACE Day 2 (T3) (p <0.001). The finding also showed a significant difference in abdominal pain scores obtained at time points 1, 2, and 3 compared to time point 0 (all p <0.001).

Other studies had shown that when music therapy was implemented, and patients focused on music, their limbic system was stimulated (Soonthornkul Na Cholburi, 2003), and neurotransmitters were sent to stimulate the anterior pituitary via the thalamus to secrete endorphins and enkephalins (Wells-Federman et al., 1995). It is believed that this can relieve pain and close the gate that controls pain at the spinal cord, going to the reticular formation to inhibit the pain signals at the SG cells from going to T cells, so the neurotransmitters do not reach the brain, hence reduction in pain sensation (Leaungsomnapa & Ngamkham, 2013). Therefore, music therapy enabled patients who had received TACE in this study to suffer less pain during the experimental period compared to the control period with statistical significance. Such a finding was similar to the results of a previous study that music therapy could relieve pain in cancer patients (Krishnaswamy & Nair, 2016).

With regard to nausea and vomiting, there were no significant differences in the nausea scores and vomiting scores of PES between the experimental period and the control period on post-TACE Days 0, 1, and 2.

This could be explained by the fact that the incidence of nausea and vomiting among the participants was very low in this study. This was probably because two-thirds of the participants, or 66.7%, received Mitomycin C, which has a low incidence rate of vomiting (10%-30%) (Jansing, 2019). In addition, they also received antiemesis drugs called Metoclopramide (10 mg) and Dexamethasone (8 mg) intravenously 30 minutes before TACE. Metoclopramide directly affects the chemoreceptor trigger zone (CTZ) by blocking dopamine 2 receptors (DRD2). Therefore, it increases the threshold of CTZ and reduces the sensitivity of visceral nerves that transmit afferent impulses from the gastrointestinal tract to the vomiting center (Perwitasari et al., 2011). It was also found that an intake of 8 mg of Dexamethasone one hour before TACE could reduce the incidence of nausea and vomiting after TACE from 50.9% and 19% to 30% and 14%, respectively (Sainamthip et al., 2021).

Before the intervention, during the experimental period, the mean score of nausea of the participants was 0.33 (SD ± 1.09), and the mean score of vomiting was 0.27 (SD ± 1.05). During the control period, the mean nausea score was 0.17 (SD ± 0.53), and no vomiting was found. It could be seen that the mean scores of nausea and vomiting before the intervention in both periods were relatively low and not different. After the intervention, the mean scores of nausea and vomiting were also very low. Statistical analysis revealed no statistically significant differences between mean scores of nausea and vomiting.

Another plausible explanation is that even though the participants did not receive music therapy during the control period, the environment was similar to that of the experimental period. It may also be possible that while the participants were lying down with the headphones on without music, they may have done something else, such as sleeping. Poompu (2002) found that 91.1% of pediatric cancer patients chose to sleep to manage their nausea and vomiting. For these reasons, in this study, the participants perceived that they had a mild level of nausea and vomiting, hence no statistically significant differences during the experimental and control periods.

Analysis of data obtained within the experimental period revealed no difference in nausea scores and vomiting scores before (T0) and after intervention on post-TACE Day 0 (T1), post-TACE Day 1 (T2), and post-TACE Day 2 (T3). This may have been because there was a low incidence and very low mean scores of nausea and vomiting before the intervention, so even though the mean scores further decreased after the intervention, the decrease was not significantly different. Therefore, a statistical analysis could not reflect significant differences between nausea and vomiting scores before and after the implementation of music therapy.

It was also possible that the music used to reduce nausea and vomiting in this study was Western music which aimed to enhance relaxation. However, the participants may not be

familiar with the such genre of music due to cultural differences. Five participants asked for Thai folk music before finally choosing songbird music. It has been documented that personal preference causes more relaxation during music therapy (Mitchell & MacDonald, 2006). Cultural components and music appreciation result in learning, familiarity, and memorization (Chiengchana & Trakarnrung, 2014). Previous research suggests that Thai folk music has relaxing effects and promotes well-being (Purinai, 2013). Therefore, it could be concluded that the Western music used in this study may not be what the participants preferred, so it could not attract their attention or make them turn away from discomfort caused by nausea and vomiting after TACE.

Implications to Nursing Care Practice

The findings provide evidence that music therapy in this study can be used as a non-pharmacological therapy to relieve the abdominal pain of patients with liver cancer undergoing transarterial chemoembolization. In addition, music therapy has a calming effect and provides a sense of relaxation that can help reduce pain. Therefore, nurses can use music therapy effectively to increase the quality of nursing care for patients nationally and internationally.

Limitations of the Study

This study was a crossover design (each patient was used as their own control). Thus, between-subject variability of symptoms was eliminated. However, this study design generally suffers from the bias of treatment-by-period interaction (carryover effect), although this study had a six-to-eight-week washout period established between the crossover to reduce potential carryover effects. In addition, the severity of PES before intervention on post-TACE Days 1 and 2 during both periods was not assessed. As a result, it could not be clearly concluded whether the results assessed after receiving music therapy on post-TACE Days 1 and 2 were actually caused by music therapy as the passing of time may have resulted in changes in levels of severity of PES.

Conclusion

There was a significant effect of music therapy on the abdominal pain of PES after TACE. However, music therapy did not have an impact on the nausea and vomiting of PES after TACE. Therefore, music therapy can be used as an alternative method to provide nursing care to patients with liver cancer experiencing PES with mild abdominal pain. Although nausea and vomiting scores in this study were not significantly different, the patients in the music therapy period felt sleepy, calm, and relaxed. In addition, music therapy is convenient and inexpensive and effectively reduces pain among patients with liver cancer experiencing PES. Thus, music therapy would be helpful for patients with liver cancer post-TACE.

Declaration of Conflicting Interest

None declared.

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Authors' Contributions

WK contributed to study conceptualization and design, manuscript writing, data collection, data analysis, and interpretation. KH and BS contributed to study conceptualization and design, critical revisions for important intellectual content, and language editing. All authors were accountable for each stage of the study and agreed to the final manuscript to be published.

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Data Availability

The datasets generated or analyzed during the current study are available from the corresponding author upon reasonable request.

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