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## Effects of Reflexotherapy on Acute Postoperative Pain and Anxiety Among Patients With Digestive Cancer

### KEY WORDS

Anxiety  
Digestive cancer  
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Even after receiving analgesia, patients with gastric and liver cancer still report moderate levels of postoperative pain. The purpose of the study was to investigate the efficacy of foot reflexotherapy as adjuvant therapy in relieving pain and anxiety in postoperative patients with gastric cancer and hepatocellular cancer. The study design was a randomized controlled trial. Data were collected from 4 surgical wards of a medical center in 2005 in Taipei, Taiwan. Sixty-one patients who had received surgery for gastric cancer or hepatocellular carcinoma were randomly allocated to an intervention ( $n = 30$ ) or control ( $n = 31$ ) group. Patients in the intervention group received the usual pain management plus 20 minutes of foot reflexotherapy during postoperative days 2, 3, and 4. Patients in the control group received usual pain management. Outcome measures included the short-form McGill Pain Questionnaire, visual analog scale for pain, summary of the pain medications consumed, and the Hospital Anxiety and Depression Scale. Results demonstrated that studied patients reported moderately high levels of pain and anxiety postoperatively while patients were managed with patient-controlled analgesia. Using generalized estimation equations and controlling for confounding variables, less pain ( $P < .05$ ) and anxiety ( $P < .05$ ) over time were reported by the intervention group compared with the control group. In addition, patients in the intervention group received significantly less opioid analgesics than the control group ( $P < .05$ ). Findings from this study provide nurses with an additional treatment to offer postoperative digestive cancer patients.

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Cancer has been the leading cause of death in Taiwan for the last 2 decades.<sup>1</sup> Among all types of cancers, cancer of the digestive system occurs most frequently. Patients with cancers such as hepatocellular carcinoma or gastric cancer often have to receive major abdominal surgery as a treatment modality. Thus, management of postoperative symptoms becomes an essential part of nursing care. Despite this, postoperative pain management remains one of the major challenges in the care of surgical patients. The understanding of acute pain physiology has advanced, and new methods of pain management have emerged. Although care has improved, studies still show that postoperative pain continues to be inadequately treated, and those patients still experience moderate to severe pain after surgery.<sup>2-4</sup> In addition, patients often experience anxiety that is commonly associated with pain. Acute postoperative pain and anxiety affect postsurgery recovery, resulting in more complications, longer hospital stays, greater disability, and potentially chronic pain.<sup>4</sup>

Although Western medicine is still a mainstream for patients with postoperative pain, complimentary and alternative therapies that could help in promoting comfort are recently beginning to gain acceptance by practitioners. Since 1997, the US National Institutes of Health<sup>5</sup> issued a report acknowledging that alternative and complimentary therapies could alleviate some side effects of treatment, such as pain. Reflexology is one of the most popular forms of alternative and complementary therapy which, when integrated with pharmacological treatment, may be valuable in the management of acute postoperative pain. However, there are concerns regarding the use of such therapy when their effectiveness has not been clearly demonstrated. Furthermore, little information is available on the effect of reflexotherapy in postoperative pain of cancer patients.<sup>6,7</sup> Therefore, the purpose of this study was to determine the effects of foot reflexotherapy as an adjuvant therapy on acute postoperative pain and anxiety among patients with digestive cancer.

Reflexology is a manual technique based on the zone theory that reflex points on the feet correspond to organs, glands, and parts of the body. These points are linked to internal organs and structures by energy channels, zones, and/or meridians.<sup>7</sup> When illnesses or imbalances occur in the body, consequent energy channels become blocked. Reflexology massage is used to open up these blockages, thus allowing energy to flow freely again, restoring the body's natural balance and health.<sup>7</sup> Based on the neuromatrix theory of pain,<sup>8</sup> reflexotherapy is also thought to relieve pain by transmitting afferent impulses and close the neural gates in the dorsal horn of the spinal cord, thus blocking pain transmission.<sup>6</sup> The technique of reflexology is simple, can be performed anywhere, requires no special equipment, is noninvasive, and does not interfere with other treatments a patient may be receiving.<sup>9</sup>

There is scant research on the effects of foot reflexology for postoperative patients. However, the effects of foot massage were examined in 3 studies. For these studies, massage was defined as a form of touch or manipulation performed on the soft tissue. First, a sample of 59 women who underwent

laparoscopic sterilization was randomly allocated to 2 groups. The intervention group received a foot massage and analgesia, whereas the control group received only analgesia. At baseline, there were no differences in the pain experienced by the 2 groups after surgery. The intervention group reported less pain than the control group.<sup>10</sup> Yet, the pain level reported in this population was relatively low. In another study, hand and feet massage was administered to 1 group of 18 patients who underwent gynecological, gastrointestinal, urological, head and neck, and plastic surgery. These patients reported a decrease in pain intensity and distress.<sup>7</sup> In the last study, foot massage was given to 25 patients after cardiac surgery. No significant differences in pain and psychological variables were found between intervention and control groups.<sup>11</sup> The research on foot massage is scant, and the study designs lack rigor.

The effect of foot reflexology in cancer patients was investigated. Patients with breast and lung cancer received 15 minutes of foot reflexotherapy. Reflexology was found to alleviate anxiety and pain immediately for 23 patients.<sup>9</sup> In another study, the effects of foot reflexology in 36 hospitalized patients with metastatic cancer were investigated.<sup>12</sup> Results of 2 sessions of reflexotherapy over 2 days resulted in a reduction of pain and nausea.<sup>13,14</sup> There was no effect on pain after 3 hours or 24 hours of intervention. Consequently, 10 minutes of foot massage administered to hospitalized cancer patients resulted in immediate effects on perceived pain and nausea.

In conclusion, foot reflexology is an easy, noninvasive, and nonpharmacological therapy. Although the effectiveness of foot reflexology has been studied in medical populations, only a study was aimed at postoperative cancer patients. Furthermore, these study results were limited in generalizability because of methodological issues. In addition, there are no studies that support the effects of foot reflexotherapy in acute postoperative pain of digestive cancer patients. The specific aims of this study were to develop a reflexotherapy protocol and to investigate the efficacy of foot reflexotherapy for alleviation of pain and anxiety in patients with cancer undergoing major abdominal surgery.

The research questions were as follows:

1. What are the effects of foot reflexology on pain and anxiety in patients who have undergone surgery for digestive cancer as compared with a control group?
2. What is the difference in pain medication consumption postoperatively between intervention (narcotic analgesia and foot reflexology) and control groups (narcotic analgesia) of patients with digestive cancer?

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## ■ Methods

### Study Design

This study is a double-blind, randomized, controlled trial. Study participants were randomly allocated to the foot reflexotherapy group or control group. A stratified block

randomization procedure was used, with stratification for the diagnosis of gastric cancer or liver cancer. The random numbers were computer generated, and slips bearing the allocated group were placed in envelopes that were serially numbered, sealed, and opaque. Subjects in the intervention group received 10 minutes of foot reflexotherapy on each foot for a total of 20 minutes once per day for 3 consecutive days on the same time in the evening by a certified nurse reflexologist. Subjects in the control group received routine care. The intervention was initiated during the second day in consideration of patients who were waking up from surgical anesthesia and more willing to accept the intervention. Patients were off the patient-controlled analgesia (PCA) on the morning of the fourth day postoperatively and received as needed intravenous injections of meperidine (Demerol) for pain. Pain medication was recorded during the study.

## Sample and Setting

A sample of 62 postoperative gastric and liver cancer patients in 4 wards of a major medical center in the northern Taiwan was enrolled over a 10-month study period in 2005. All patients who met the following inclusion criteria were invited to participate in this study period: 18 years or older, had major abdominal surgery for mainly hepatocellular cancer and gastric cancer in the 24 hours prior, alert, awake, in a stable medical condition, able to verbally communicate, received general anesthetics, and used PCAs for pain. Exclusion criteria were history of chronic pain, disseminated cancer, narcotic or ethanol addiction, peripheral neuropathy, foot amputation, diagnosed deep vein thrombosis, open wound on foot, dementia, or psychiatric diagnoses.

## Intervention

An intervention protocol was developed by following Fr Josef Eugster's foot reflexology manual which is based on the original Ingham method.<sup>15</sup> The protocol was reviewed by 3 reflexology experts and revised accordingly. The final protocol was used in a small pilot study and was further revised. A nurse therapist certified as a reflexologist provided foot reflexotherapy to all patients in the intervention group. Before the therapy, the feet were assessed to ensure that there were no contradictions to massage such as ulcer or edema. Each patient was assisted to a comfortable position. The foot reflexology was initiated during the evening on postoperative day 2 while patients are on PCA and between 1 and 3 hours after a dose of pain medication. The intervention of reflexotherapy is based on the previous finding which suggested that a 20-minute massage may produce beneficial results.<sup>10</sup>

During the intervention, the therapist used her thumb and forefingers to apply pressures and massage to each reflex zone twice initially. For the purpose of this study, digestive reflex zones of upper and lower abdomen, liver, spleen, gall bladder, duodenal, intestine, and colon are massaged 5 times or more as suggested by experts. The techniques of kneading, friction,

rubbing, and pétrissage were applied as recommended by Fr Josef Eugster.<sup>15</sup>

## Data Collection

Demographic data, surgical data, and history of analgesic consumption were collected from the patients' chart. Visual analog scale (VAS) for pain was collected daily from baseline, during the intervention, and at follow-up. Data of the McGill Pain Questionnaire (MPQ) and the Hospital Anxiety Scale were collected at baseline and posttest (postoperative day 5) only. Data were collected by a trained research assistant who was blinded to randomization. In addition, VAS for pain was collected before and after each session of reflexotherapy.

## Instruments

Pain was assessed with the short-form MPQ (SF-MPQ).<sup>16</sup> The SF-MPQ consists of a pain descriptor and a VAS for pain. The descriptor describes 15 different types of pain rated by the respondent as 0 (none), 1 (mild), 2 (moderate), and 3 (severe). The 11 descriptors represent the sensory dimensions, whereas others represent the affective dimensions. The SF-MPQ correlates highly with scores of original MPQ. The Chinese version of SF-MPQ was used. Cronbach  $\alpha$  for the SF-MPQ was .78.

Visual analog scale for pain consists of a 100-mm line with end points of 0, indicating no pain, and 100, signifying the worst thinkable pain. Scores are obtained by counting the number of millimeters from 0 to the pain mark made by each participant. Visual analog scale has been reported as the most sensitive, valid, and reliable method for measuring pain intensity.<sup>16,17</sup>

Anxiety was measured with the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS).<sup>18</sup> The HADS is a reliable instrument for screening clinically significant anxiety and depression. It has also been shown to be a valid measure of the severity of disorders of mood. Scores on the HADS subscales range from 0 to 21, with higher scores indicating more anxious or depressed mood. Scores of 8 to 10 indicate possible cases of anxiety, and scores of 11 or more are proposed by the authors of the scale to indicate definite cases.<sup>18</sup> Cronbach  $\alpha$  was .72.

## Power Analysis

The sample size was determined after data collection of a pilot study of 10 patients. A sample of 48 was proposed based on the sample sizes needed for a power of 80%, effect size of 0.35, and  $\alpha = .05$  as recommended by Stevens.<sup>19(p511)</sup> A sample of 24 would be needed per group; a total sample of 48 will be sufficient for this study. However, 25% attrition rates could be expected; therefore, 62 subjects were estimated for this study.

## Ethical Considerations

Approvals from the college and the hospital research and ethics committees were obtained before initiation of the

study. Potential patients were approached and fully informed of the purpose of the research, its methods, benefits, and risks. Patients gave written consent once they agreed to participate. Anonymity and confidentiality were ensured, and participants could withdraw from the study at any point without affecting their subsequent treatment.

## Data Analysis

All statistical analyses were carried out using the SAS statistical package (SAS Inc, Cary, North Carolina). A general linear model was used to model the outcome (pain and anxiety) as a function of main effect (group difference) and the covariates, including age, sex, and types of cancer. Both the stability analysis and the analysis of repeated relationships were performed by generalized estimation equations (GEE). An interaction term (group difference  $\times$  time) was added into each model to investigate the synergistic effect of reflexotherapy with time. Generalized estimation equation was chosen because clinical repeated data frequently have a nonnormal distribution, and the variances often cannot be assumed to be equal, as required of an analysis of variance model.<sup>20</sup>

## Results

### Sample

A total of 62 participants enrolled in the study; each group consisted of 31 patients. During the study period, 1 patient from the control group dropped out because of postoperative complications. The final sample included 31 hepatocellular cancer and 30 gastric cancer patients; 29 (47.54%) were males, and 32 (52.46%) were females, with an average age of 59.8 years (SD, 14.70 years). Forty-seven (77%) of them were married. More than half of the participants had more than a high school education ( $n = 32$ , 52.4%). Gastric cancer

patients had a surgical procedure of total ( $n = 3$ , 10%) or subtotal ( $n = 27$ , 90%) gastrectomy, whereas liver cancer patients had a lobectomy ( $n = 14$ , 45.16%) or segmentectomy ( $n = 17$ , 54.84%). No significant differences existed between the intervention and group at baseline with regard to demographics, disease, or treatment variables ( $P > .05$ ).

## Changes in Pain Perception Over Time

Effects of reflexotherapy on postoperative pain were measured by assessing the MPQ, daily VAS for pain, and narcotic analgesia consumption. The descriptive data of these variables are presented in Table 1. At baseline, the mean MPQ scores for the intervention group were 15.61 (SD, 5.93) and 15.27 (SD, 4.60) for the control group. There were no statistically significant differences between the groups ( $t = 0.25$ ,  $P = .80$ ). The changes in mean pain perception for both groups declined from baseline to posttest at postoperative day 5 (Figure 1).

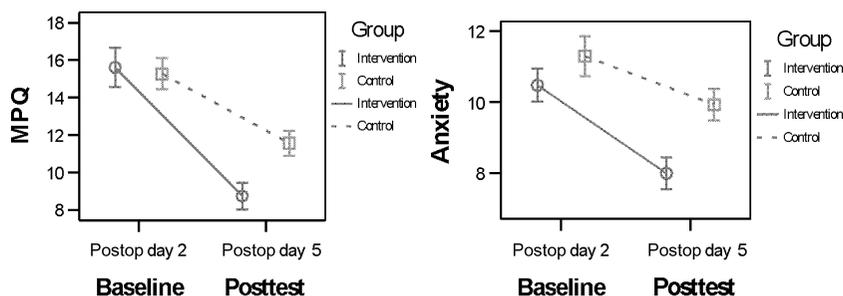
Using GEE, after controlling for potential confounding variables, for the MPQ, the GEE results demonstrated no group effects ( $P > .05$ ). Conversely, an interaction term (group difference  $\times$  time) was statistically significant ( $-3.17$ ,  $P = .02$ ), indicating that patients who received reflexotherapy had less pain compared with control group patients over time (Table 2). The time-dependent changes, which were also statistically significant indicated that perceived pain for the intervention group decreased by an additional 3.70 points ( $P < .0001$ ). In addition, older patients generally had higher perceived pain score when compared with younger patients pain score (0.07 points per year of age,  $P = .01$ ). No differences were found with regard to sex and types of diagnosis between the groups over time ( $P > .05$ ).

At baseline, the mean VAS pain score for the intervention group was 42.74 (SD, 19.95) as compared with 45.67 (SD, 17.15) for the control group ( $t = 0.61$ ,  $P = .54$ ). Participants had moderate levels of pain postoperatively even under PCA.

**Table 1 • Clinical Variables for Intervention and Control Groups (mean, SD) ( $n = 61$ )**

Variables	Intervention ( $n = 30$ )		Control ( $n = 31$ )		<i>t</i>	<i>P</i>
	Mean	SD	Mean	SD		
McGill Pain Scale						
Baseline	15.61	5.93	15.27	4.60	0.25	.80
Posttest	8.74	3.96	11.57	3.62		
VAS for pain						
Baseline (day 2)	42.74	19.95	45.67	17.15	0.61	.54
Postop day 3	33.23	14.58	46.67	16.88		
Postop day 4	45.16	20.14	60.17	12.21		
Postop day 5	37.74	13.34	55.83	16.54		
Postop day 6	38.06	13.46	54.17	18.75		
Anxiety						
Baseline	10.48	2.57	11.30	3.10	1.12	.27
Posttest	8.00	2.52	9.93	2.45		
Demerol used (mg)	67.74	59.48	107.33	63.13	2.52	.01

Abbreviation: VAS, visual analog scale.



**Figure 1** ■ Changes in perceived pain (MPQ) and anxiety over time at baseline (postoperative day 2), and follow-up (postoperative day 5). The data are shown as means  $\pm$  SEM (error bars). MPQ indicates McGill Pain Questionnaire.

For those in the intervention group, VAS pain declined on postoperative day 3 (first day of reflexotherapy), but the pain increased on day 4 and descended to a lower value at day 5 (the last day of reflexotherapy) and remained on the same level of pain on day 6 (follow-up). In contrast, for those in the control group, pain increased over time throughout the follow-up period. Both groups of patients reported more pain on the fourth day postoperatively.

Generalized estimation equation results demonstrate that changes for mean VAS pain were statistically significantly lower in the intervention group ( $-21.22$ ,  $P < .0001$ ) than those in the control group. The time-dependent changes were also a statistically significant indication that values for the intervention group decreased by an additional 2.42 points daily ( $P = .010$ ). Furthermore, an interaction term (group difference  $\times$  time) was also noted, revealing that patients receiving reflexotherapy had further decreased pain over time ( $-2.41$ ,  $P = .029$ ). Older patients had higher VAS pain (0.24 per year,  $P = .0003$ ). No differences in pain over time were evident with sex ( $P = .77$ ) and cancer type ( $P = .97$ ) (Figure 2).

Visual analog scale for pain was also collected before and immediately after each session of reflexotherapy for the intervention group. The preintervention mean pain score for reflexotherapy session 1 was 42.74 mm (SD, 19.95 mm), which decreased to 30.65 mm ( $t = 3.958$ ,  $P < .001$ ) immediately after therapy, resulting in a mean difference of 12.09 mm (SD, 17.01 mm). Similarly, the mean pain score for therapy session 2 decreased 9.97 mm, from 33.23 mm (SD, 14.58 mm) to 23.55 mm (SD, 13.97 mm) ( $t = 5.97$ ,  $P < .001$ ). Again, the mean pain score for therapy session 3

decreased 16.13 mm from 45.16 mm (SD, 20.15 mm) to 29.03 mm (SD, 21.73 mm) ( $t = 4.52$ ,  $P < .001$ ). Thus, pain levels reported by patients decreased significantly during reflexotherapy.

Participants were on a routine pain management program, where patients could request for narcotic analgesia if needed. The intervention group used, on average, 67.74 mg Demerol, whereas the control group used, on average, 107.33 mg. A  $t$  test revealed a significant difference between groups ( $t = 2.52$ ,  $P = .015$ ). Patients in the reflexotherapy group received significantly less opioid analgesics than the control group.

### Changes in Perceived Anxiety

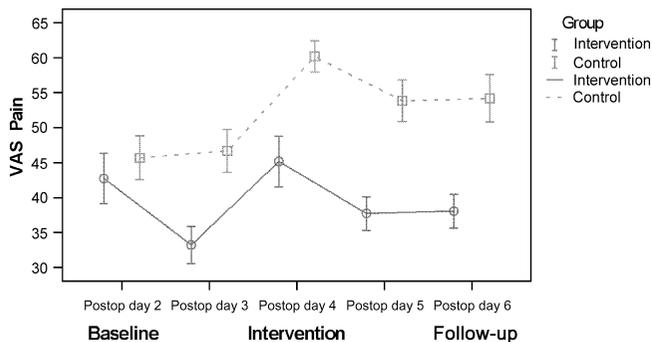
Level of anxiety at baseline was 10.48 (SD, 2.57) for the intervention group and 11.30 (SD, 3.10) for the control group; patients had moderately high levels of anxiety after surgery. There was no statistically significant difference between groups at baseline ( $t = 1.11$ ,  $P = .27$ ). Both groups' anxiety levels decreased from postoperative day 2 to day 5. The GEE results demonstrate no statistically significant variations within the intervention group compared with the control group ( $P > .05$ ). Time-dependent changes were statistically significant and indicated that anxiety in the intervention group decreased by 1.37 ( $P < .0001$ ) over time. Moreover, an interaction term (group difference  $\times$  time) was also noted, revealing that patients receiving reflexotherapy had further decreased perceived anxiety over time ( $-1.12$ ,  $P = .023$ ). Patients with gastric cancer generally were more anxious than patients with liver cancer ( $-1.37$ ,  $P = .023$ ). No

❁ **Table 2** • Generalized Linear Model<sup>a</sup> on the Effect of Pain for Reflexotherapy (n = 61)

Variable	MPQ Pain			VAS Pain		
	$\beta$	SE	P	$\beta$	SE	P
Group (intervention vs control)	-0.63	1.23	.61	-21.22	4.93	<.0001
Time	-3.70	0.29	<.0001	-2.42	0.95	.0107
Time $\times$ group (intervention vs control)	-3.17	1.41	.02	-2.41	1.38	.0290
Sex (male vs female)	1.37	0.84	.11	-0.55	1.94	.776
Age (y)	0.07	0.03	.01	0.24	0.09	.0003
Cancer type (gastric vs liver)	0.65	0.80	.42	-0.11	3.14	.9715

Abbreviations:  $\beta$ , coefficient of modeling; MPQ, McGill Pain Questionnaire; VAS, visual analog scale.

<sup>a</sup>Using GEEs (generalized estimation equations) for repeated measurements and the correlation structure exchangeable.



**Figure 2** ■ Changes in VAS pain over time at baseline (postoperative day 2) and during reflexotherapy (postoperative days 3-5) and follow-up (postoperative day 6). The data are shown as means ± SEM (error bars). VAS indicates visual analog scale.

differences in sex and age were found over time ( $P > .05$ ) (Table 3).

## ■ Discussion

We were surprised to find that levels of perceived pain were moderately high postoperatively even with PCA used by our study participants. These results, along with those of similar studies, indicate that acute postoperative pain continues to be inadequately treated.<sup>2-4</sup> We also discovered that perceived pain is highly correlated with anxiety ( $r = 0.43, P = .001$ ) in this population; consequently, interventions coupled with pharmacological management to decrease perceptions of pain and anxiety postoperatively become essential in this population.

Our data revealed that patients with gastric and liver cancers in the reflexotherapy group experienced a statistically significant improvement in perceived pain and anxiety postoperatively as compared with those in the control group. Although the mechanism of foot reflexology on acute postoperative pain has not yet been well established, reflexology therapy might adjust any imbalance that is apparent in the feet as reflected in the body organs or structure. This then produces a reflex response within the corresponding area of body which allows healing processes to take place and promoting comfort.<sup>21</sup> From the view of neuromatrix theory, reflexotherapy may modulate the pain experience by altering the pattern-generating matrix where the brain, neurotransmitters, and hormones contribute to pain suppression and release of endogenous opiates.<sup>22</sup> In addition, foot reflexology may also stimulate the nonpainful nerve fibers, resulting in pain inhibition.<sup>7,23</sup>

The study results demonstrated that noninvasive foot reflexology reduced the perceived pain and anxiety postoperatively among digestive cancer patients; no previous study has tested foot reflexology in hospitalized surgical patients. Reflexology studies conducted with nonsurgical cancer patients have shown that this treatment might improve pain and anxiety.<sup>9,12,14</sup> Our study adds empirical support for the effectiveness of reflexotherapy in gastric and liver cancer

populations. Although the finding of this study may be considered generalizable in relation to the design, the sample size remains relatively small so as to generalize to all cancer patients.

Our study found that the patients in the reflexotherapy group consumed a significantly less amount of as-needed narcotic analgesia as compared with patients in the control group. Previous studies that investigated the effects of foot reflexology in pain conditions rarely documented narcotic analgesia consumption; thus, our study contributes to the initial evidence of reflexology in alleviating pain. However, all of our patients were on the PCA from the day of surgery to day 4 postoperatively. We were unable to analyze the data on the amount of narcotic analgesia consumed during the period of PCA; therefore, interpretations of our findings are limited.

This study provides a foundation for future studies of reflexology therapy in managing acute postoperative pain and anxiety in patients with gastric and liver cancers. Future research studies could include replication and expansion of the current study and include a larger sample using a longitudinal design. Another study will be conducted to better understand the short- and long-term outcomes of reflexology. The study took place in 4 surgical wards of a medical center; caution should be taken when generalizing to other settings. Future studies could be replicated in different populations to improve the generalizability of the findings.

## ■ Conclusions/Implications

Nurses are in a position to consider the offering of foot reflexology as one option in the management of acute postoperative pain. The technique of foot reflexology is simple and noninvasive. The techniques can be easily learned and applied in clinical settings. Following this study, we trained surgical care nurses, and they now implement reflexotherapy in caring for surgical patients with digestive cancer. Furthermore, we offered foot reflexology workshops and trained patients, families, and healthcare professionals. They have reported positive and promising results.

☀ **Table 3** • Generalized Linear Model<sup>a</sup> on the Effect of Anxiety for Reflexotherapy

Variable	Anxiety		
	$\beta$	SE	P
Group (intervention vs control)	0.31	0.98	.7525
Time	-1.37	0.25	<.0001
Time × group (intervention vs control)	-1.12	0.49	.0231
Sex (male vs female)	-1.06	0.54	.0518
Age (y)	-0.00	0.02	.9930
Cancer type (gastric vs liver)	-1.37	0.61	.0234

Abbreviation:  $\beta$ , coefficient of modeling.

<sup>a</sup>Using GEEs (generalized estimation equations) for repeated measurements and the correlation structure exchangeable.

In conclusion, our results suggest that reflexotherapy might effectively decrease perceived pain and anxiety postoperatively when complemented with pharmacological pain therapy in patients with gastric and liver cancers. The study provides a research-based intervention for clinicians caring for patients with digestive cancer. The application of these findings might have important implications for patients with high levels of perceived pain and anxiety postoperatively. Assessment of pain and anxiety levels of these patients should be an essential part of nursing practice, and clinicians might want to consider providing foot reflexology as a method for improving symptoms of pain and anxiety.

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