J Med Sci 2007;27(5):207-214
http://jms.ndmctsgh.edu.tw/2705207.pdf

Study on Patient Satisfaction with Patient-Controlled Analgesia and Related Factors after Abdominal Surgery

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Background: Postoperative pain arises after acute surgical trauma, mostly within 72 hours after surgery. Such pain can be consistently controlled using patient-controlled analgesia (PCA) devices. The purpose of this study was to explore patient satisfaction with patient-controlled analgesia and related factors after abdominal surgery. **Methods:** A cross-sectional descriptive correlation design was developed, based on a convenience sample of 101 patients from a northern medical center in Taiwan using a visual analogue scale (VAS) to assess pain. PCA side effect symptom distress, PCA cognition, and patient satisfaction were also examined. **Results:** The results showed that patients generally had negative cognition about PCA use, as indicated by the mean pain level scores for the first through the third day after surgery, which were 3.8±2.7, 3.1±2.4, and 2.6±2.0, respectively; and that 29% of patients reported pain levels that were moderate or greater (VAS > 5) on the first day. While mean patient satisfaction level was 7.7±1.9, there were no significant differences between cognition, pain intensity, and satisfaction. Moreover, there was a negative correlation between PCA side effect symptom distress and satisfaction. **Conclusion:** We found that PCA side effect symptom distress was an important factor that influences satisfaction with PCA. This study also found that patients' cognition of PCA is still insufficient. Therefore, increasing patients' understanding of PCA, realization of instructions for the use of PCA, and elimination of analgesic side effect symptom distress can help patients avoid pain while increasing the effectiveness and patients' satisfaction with PCA.

Key words: PCA, cognition, pain, satisfaction

INTRODUCTION

Postoperative pain is a phenomenon that arises after acute surgical trauma, mostly within 72 h after surgery[1,2]. As acute postoperative pain causes a neural and endocrine stress response, which suppresses cellular and humoral immune function, postoperative infection can easily occur[3]. A study has indicated that postoperative pulmonary complications occurred in 8.6% of surgery patients, and that the level of pain on the first day after surgery was higher and the number of days of hospitalization greater in patients with pulmonary complications than in patients without pulmonary complications[4], indicating that postoperative pain not only delays recovery of physiological function, but also affects patients' emotional state and recovery from surgery, and prolongs hospital stay with consequent increases in medical costs[5]. Postoperative pain must therefore be effectively addressed. The effects of intravenous patient-control analgesia (IV-PCA) and conventional pain relief on intestinal function recovery and length of hospitalization are about the same, but patients that use IV-PCA are more satisfied with their surgery than patients who received conventional pain relief[6]. After an initial PCA loading dose is given, the main objective of PCA, apart from continuous drug administration, is to allow patients control their analgesia after each lockout interval (a fixed interval between two bolus doses) has elapsed. When the device is activated by pressing a button, a fixed PCA bolus dose is injected, so that the circulating analgesic can be maintained at a stable and effective concentration. PCA benefits patients by increasing their autonomy in delivering analgesic, thus reducing the time between pain occurrence and drug administration[2,3,7]. PCA administration is usually either by intravenous (IV-PCA) or epidural injection (Epi-PCA). There is no statistical difference between

Received: September 28, 2006; Revised: February 14, 2007; Accepted: April 10, 2007
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the pain-relieving effects of IV-PCA or Epi-PCA. However, Epi-doses are considerably smaller than IV-doses; the equianalgesic dose ratio of IV-PCA and Epi-PCA is 8.5:1[8]. Patients respond differently to PCA education, with 15% of patients who perceive a pain intensity of more than 5 on the visual analogue scale (VAS) within 4 hours after surgery not wanting to activate the PCA button. After instructions were given by nursing staff regarding the correct use of PCA, however, the mean pain level within 4 hours after surgery dropped to under 3 (VAS)[9], indicating that the correct use of PCA could effectively relieve postoperative pain in patients.

According to the literature, factors that influence satisfaction with postoperative pain relief include: (1) Personal factors: study indicates that the older the age, the higher the pain control satisfaction level, and the higher the educational level, the lower the pain control satisfaction level; pain control satisfaction levels are higher in widows and widowers than in married patients, and it is higher in married than in single patients[10]. Shiloh et al.[11] found significant correlation between internal health locus of control and pain relief satisfaction levels. However, there are controversial reports showing no correlation between patients' health locus of control and pain levels[12,13] and patients' satisfaction[13]. (2) Cognitive factors: Bader believes that patient satisfaction is related to preceding expectation; young and highly educated patients usually have greater expectations of PCA, often resulting in relatively low satisfaction[14]. Ward and Gordon reported that postoperative pain is usually at a medium level and greater, and that in most patients the anticipated pain is usually greater than the actual pain, which is why relatively high satisfaction levels are reached[15]. Other factors that influence the correct use of analgesics and pain treatment include knowing that postoperative pain is inevitable, the concern that narcotic analgesics are addictive, concern that analgesics affect wound healing, and the lack of confidence in device function[7,16-18]. (3) PCA administration method and side effects: Peng et al. show that patients with Epi-PCA report considerably higher satisfaction levels than patients receiving IV-PCA. The reason may be that with Epi-PCA, a smaller dose, is used with long-term stability and effective pain relief[8]. Due to the differences in the PCA prescription and administration methods, adverse reactions also occur in patients. Signs that are often used to monitor the side effects of PCA include over-sedation, nausea or vomiting, skin pruritus, urine retention, respiratory depression, dizziness, headache, insomnia, and lumbar back pain[2,19]. Chumbley et al.[19] demonstrated that 91% of patients have at least one side effect during PCA use. Nausea or vomiting was the most commonly observed side effect that may possibly influence patients' willingness to use PCA[8]. (4) Cancer patients believe that cancer pain is inevitable and difficult to control, and they are therefore more inclined to use analgesics to relieve pain[16].

Effective use of PCA for postoperative pain relief remains difficult to achieve due to the inaccurate perceptions of narcotic analgesics, even though more and more patients choose PCA for postoperative pain-relief. This study aimed to examine the factors influencing PCA satisfaction to improve postoperative pain relief.

MATERIALS AND METHODS

Study Design and Subjects

This study adapted a cross-sectional descriptive correlation design. A total of 105 patients who underwent routine laparotomy under general anesthesia and used postoperative PCA were recruited, of whom 4 declined to fill out the questionnaires. Inclusion criteria were: (1) at least 18 years of age, (2) pain relief by means of morphine PCA (including IV-PCA and Epi-PCA), (3) capable of verbal or written communication within 24 to 72 h after surgery, and (4) willingness to participate in the study and sign an informed consent form. The exclusion criteria were transfer to an intensive care unit for postoperative care and receiving NSAIDs (non-steroidal anti-inflammatory drugs) during the first three days post operation.

Study Tools

The questionnaire used in this study was divided into five sections, personal background data, pain assessment, PCA side effect symptom distress, PCA cognition, and patient satisfaction. These five sections are described as follows:

Personal Background Data

Data included gender, age, marital status, educational level, surgical type, diagnostic type, previous surgical experience, previous PCA-use experience, and record of analgesic use (including the use of non-PCA analgesics, daily PCA dose, effect of pain on sleep by self-report, and first time of ambulation).

Pain Assessment

Postoperative pain was assessed using a 0-10 cm VAS. A score of 0 indicated no pain at all, while extreme pain was equivalent to a score of 10. With VAS as the acute pain assessment tool, this study obtained an intraclass correlation coefficient (ICCs) of 0.97[21]. Previous studies found

that the highest pain intensity was observed in the first 24 h after surgery. Therefore, pain assessment was arranged at 10:00 the following day, if surgery was completed by 12:00 before noon; and at 14:00 the following day, if surgery was completed between 12:00 and 24:00. The assessments were carried out at the same time for three consecutive days after surgery on days 1, 2, and 3.

PCA Side Effect Symptom Distress

We developed a 9-item scale to assess PCA side effect symptom distress, including sedation, dizziness, pruritus, nausea or vomiting, headache, numbness of lower extremities, lumbar back pain, respiratory depression, insomnia, and urine retention[2,19]. A 5-point Likert scale was used (where 0 = no symptom distress to 4 = very severe symptom distress), and the higher the score, the more severe the symptom distress caused by PCA side effects.

PCA Cognition Scale

We developed an 8-item scale to assess participants' cognition of PCA. This scale consists of 8 items including anticipation of postoperative pain, analgesic pharmacology, occasions of analgesic use, and medical staff attitudes[7,17-18]. A 5-point Likert scale was used (where 1=strongly agree and 5=strongly disagree), and the higher the score, the better the patients' understanding of PCA use.

Patient Satisfaction

We used an 11-point rating scale developed by Shiloh et al. It consists of three items; (1) "How satisfied are you with the pain relief you received?" (where 0 = very unsatisfied to 10 = very satisfied); (2) "Would you choose the same pain relief method, if you had to undergo surgery again?" (0 = definitely no to 10 = definitely yes); (3) "Would you recommend the type of pain relief you got to another person who needs to undergo an operation?" (0 = definitely no to 10 = definitely yes). An average of the scale score ranged from 0 to 10, with higher scores indicating greater degrees of satisfaction. The scale's internal consistency by Cronbach's α was 0.85[11].

Scale Validity and Reliability

This study determined content validity by expert opinion. A panel of 6 expert practitioners, including anesthesiologists, attending surgeons, head nurses, and surgical ward supervisors examined the content validity of the questionnaire. A 4-point scale was used to rate items from very inappropriate (1) to appropriate (4). The questionnaires demonstrated good validity and a content validity index (CVI), with 0.88 for the PCA cognition scale, 1 for PCA side effect symptom distress, and 1 for patient satisfaction. After revising the questionnaires, 5 patients with different educational backgrounds, who met the inclusion criteria, were selected and asked to read the questionnaires and indicate whether the content was clear and easy to understand. This was the basis for wording the content of the questionnaire. To assess the reliability of the questionnaires, 20 patients who met the inclusion criteria were selected for pretesting. During pretesting, most laparotomy patients had an indwelling Foley bladder catheter, which made urine retention assessment impossible, and they were removed from the assessment. Internal consistency using Cronbach's α was 0.77 for the PCA side effect symptom distress, 0.68 for the PCA cognition scale, and 0.76 for patient satisfaction. After formal testing, the internal consistencies by Cronbach's α values were 0.72, 0.75, and 0.68, respectively.

Data Collection and Analysis

The investigator obtained permission from the Institutional Review Board of the Medical Center in Taiwan. During the study period, the investigator asked all the preoperative patients who met the criteria to participate in this study, and gained their written informed consent. Data were collected with regard to the intensity of pain from the first day to third day of the post surgery, and combined with the other questionnaires on the third day. Data were analyzed by using the SPSS version 10.0 software suite (Chinese version), and the main statistical methods included frequency distribution, percentage, *t* test, one-way ANOVA, Pearson product-moment correlation, and multiple stepwise regression.

RESULTS

A total of 101 patients, aged between 18 and 85 (mean age: 59.1±14.1) were included in this study. Demographic data is presented in Table 1.

Of all patients, 11 (10.9%) had no pain (VAS = 0) from the first to third day after surgery. On the first day after surgery, the mean pain score was 3.8±2.7, with 20 patients (19.8%) having no pain at all, and 29 (28.8%) reporting a pain score higher than 5. The mean pain score on the second day after surgery was 3.1±2.4, with 22 patients (21.8%) having no pain at all, and 16 (15.9%) reporting a pain score higher than 5. On the third day, the mean pain score was 2.6±2.0, with 23 patients (22.8%) having no pain at all, and 7 (7%) reporting a pain score higher than 5. It was found that pain scores in patients with poor sleep ("Patient complaining of surgical wound pain;

Table 1 Analysis of the relationship among demography data, pain level, PCA side effects distress, PCA recognition, and satisfaction (N=101)

Variables	n	%	PCA Satisfaction	
			M±SD	t or F value
Gender	51	50.5	7.3±2.2	t = -2.093
Male	50	49.5	8.1±1.6	p = .039 *
Female				
Age				
Below 40 year	8	7.9	7.8±0.9	F = 0.091
40-64 years	57	56.4	7.6±2.0	p = .913
Above 65 years	36	35.6	7.8±1.9	
Education level				
Less than elementary	14	13.9	7.5±1.4	F = 0.110
Elementary and junior high school	39	38.6	7.8±2.0	p = .979
Senior high school or vocational high school	21	20.8	7.7±1.7	
Junior college	11	10.9	7.8±2.3	
College	16	15.8	7.5±2.3	
Marital status				
Single	93	92.1	7.7±2.0	t = -0.262
Married	8	7.9	7.9±1.2	p = .794
Previous surgical experiences				
No	38	37.6	7.8±1.6	t = 0.333
Yes	63	62.4	7.7±2.1	p = .740
Previous experience of using PCA				
No	88	87.1	7.8±1.8	t = 1.051
Yes	13	12.9	7.2±2.6	p = .296
Surgical types				
Kidney	10	9.9	8.2±2.3	F = 1.516
Stomach	12	11.9	6.7±2.2	p = .215
Liver, gall bladder, pancreas, spleen	24	23.8	8.0±1.6	
Intestine	55	54.5	7.7±1.9	
Diagnostic types				
Non-cancer	35	34.7	8.0±1.9	t = 0.766
Cancer	66	65.3	7.6±2.0	p = .446
PCA types				
IV-PCA	51	50.5	7.7±2.1	t = -0.019
Epi-PCA	50	49.5	7.7±1.8	p = .985
Previous Use of analgesic other than PCA in postoperative room				
No	60	59.4	7.6±2.0	t = -0.508
Yes	41	40.6	7.8±1.9	p = .613
Previous use of analgesic other than PCA at ward				
No	28	27.7	7.5±2.0	t = -0.539
Yes	73	72.3	7.8±1.9	p = .591
Pain on postoperative day 1				r = 0.002
				p = .985
Pain on postoperative day 2				r = 0.066
				p = .511
Pain on postoperative day 3				r = 0.102
				p = .308
PCA side-effects distress				r = -0.278
				p = .005 **
PCA cognition				r = -0.143
				p = .154

* p < .05, ** p < .01

Table 2 PCA side-effects distress of subjects (N=101)

Variables	IV-PCA		EPi -PCA	
	Side-effects Distress		Side-effects Distress	
	n	M±SD	n	M ± SD
1.respiratory depression	22	0.3 ± 0.7	7	0.8 ± 0.5
2.numbness of lower extremities	6	0.2 ± 0.6	12	0.4 ± 0.8
3.headache	13	0.4 ± 0.9	12	0.3 ± 0.6
4.sedation	22	0.5 ± 0.7	14	0.4 ± 0.8
5.lumbar back pain	19	0.6 ± 0.9	19	0.6 ± 0.9
6.pruritus	10	0.4 ± 0.8	25	0.9 ± 1.1
7.insomnia	20	0.6 ± 0.9	11	0.5 ± 1.1
8.dizziness	24	0.8 ± 1.2	19	0.7 ± 1.0
9.nausea/ vomiting	20	0.7 ± 1.1	24	0.9 ± 1.1

cannot fall asleep") were significantly higher than in patients with normal sleep ("The wound pain didn't affect sleep") (day 1: $t = 3.460$, $P < 0.001$; day 2: $t = 5.335$, $P < 0.001$; day 3: $t = 4.633$, $P < 0.001$). A total of 81 patients (80.2%) engaged in out-of-bed activity within 3 days after surgery, the first time at 12-84 h after surgery (mean time: 50.4±19.6).

The mean score for PCA side effect symptom distress was 0.5±0.5, with most patients having moderate symptom distress from nausea or vomiting (n=44, mean=1.8, SD=1.0), and 23 patients (22.8%) showed no symptom distress at all. Of patients who used IV-PCA, the mean score for symptom distress was highest for dizziness (mean =0.8, SD=1.2), followed by nausea/vomiting (mean=0.7, SD=1.1). Of patients who used Epi-PCA, the mean score for symptom distress was highest for pruritus (mean=0.9, SD=1.1), and nausea or vomiting (mean=0.9, SD=1.1) (Table 2).

The total score for subjects' cognition of PCA ranged from 1.5 to 4.5, with a mean score of 2.8±0.7. This indicated a negative cognition of PCA. The lowest score (2.3 ±1.6) was for "a surgical wound usually hurts". The highest score (3.0±1.3) was for "frequent complaining about pain will result in doctors and nurses having a dislike for patients" (Table 3).

The mean score for patient satisfaction was 7.7±1.9. The main source of PCA-related information was acquired from the anesthesiologist (55 patients; 54.5%), relatives (24 patients; 23.8%), nurses (10 patients; 9.9%), surgeons (7 patients; 6.9%), surgeons and nurses (3 patients; 3.0%), or friends (2 patients; 2.0%). When asked the amount of information that was provided, 91 patients (90.1%) said the amount of information was sufficient, 6 patients (5.9%) said it was not sufficient, and 4 patients (4.0%) said it was poor. A comparison of the sources of information (nonanesthesiologists and anesthesiologists) showed that there was no statistically significant difference between patient satisfaction levels ($t = 0.933$, $P = 0.353$). With regard to personal factors, a significant difference in patient satisfaction was found between men and women. Female patients showed higher level of satisfaction than did male patients. A negative correlation was found between symptom distress of PCA side effects and patient

Table 3 Cognition of subjects to PCA (N=101)

Variables	n (%)					M±SD
	strongly disagree	disagree	uncertain	agree	strongly agree	
1. Surgical wound should be very painful	50 (49.5)	16 (15.8)	5 (5.0)	13 (12.9)	17 (16.8)	2.3±1.6
2. The analgesics cannot completely eliminate the pain	20 (19.8)	36 (35.6)	13 (12.9)	24 (23.8)	8 (7.9)	2.6±1.3
3. You can easily get addicted to the analgesic	12 (11.9)	32 (31.7)	34 (33.7)	18 (17.8)	5 (5.0)	2.7±1.1
4. The analgesic can affect the wound recovering	9 (8.9)	21 (20.8)	57 (56.4)	12 (11.9)	2 (2.0)	2.8±0.9
5. The analgesic had very many side effects	10 (9.9)	25 (24.8)	47 (46.5)	13 (12.9)	6 (5.9)	2.8±1.0
6. A good patient should endure the pain patiently, and not complain about it.	17 (16.8)	36 (35.6)	4 (4.0)	33 (32.7)	11 (10.9)	2.9±1.3
7. Frequent complaining about the pain may affect the condition judgment by the doctors or nurses	15 (14.9)	32 (31.7)	15 (14.9)	27 (26.7)	12 (11.9)	2.9±1.3
8. Frequent complaining about the pain may result in doctors or nurses having a dislike for the patient	13 (12.9)	30 (29.7)	19 (18.8)	21 (20.8)	18 (7.8)	3.0±1.3
M ± SD						2.8±0.7

Table 4 Stepwise regression analysis to predict satisfaction (N=101)

Variable entered	β	Standard β	Adjusted R^2	F	p
(Constant)	8.749				
Symptom distress of PCA side-effects	-1.115	-.305	.068	8.295	.005 **
Sex	-.916	-.239	.116	7.564	.001 ***

** p < .01, *** p < .001

satisfaction. No significant correlation was found between cognition of PCA and patient satisfaction, and between pain levels during the first three days after surgery (Table 1).

The best predictor of patient satisfaction was PCA side effect symptom distress and gender. The multiple stepwise regression analysis as shown could explain the 11.6% total variance of patient satisfaction (Table 4).

DISCUSSION

Analgesic Effectiveness of Postoperative PCA

This present study found a mean score of 3.5 for the highest pain level on the first day, of 2.9 on the second day, and of 2.5 on the third day after surgery. When comparing these results with those of Lee et al., who found the highest mean pain score of 7.4 at 72 h after surgery in patients who did not use PCA[16], it is obvious that PCA in patients of our study much improved their pain management. Yu et al. found that the pain intensity dropped to under 3 within 4 h after surgery in orthopedic surgery patients who had received instruction on the use of PCA by nursing staff[9]. In our study, patients received instruction on the use of PCA by various medical staff, and only 10.9% of patients were not free from pain by the end of the third day after surgery in contrast with 28.8% of patients suffering from a moderate amount of pain (VAS > 5) on the first day after surgery. It is clear that there is still room for improvement with regard to understanding the use of PCA by our patients.

Moreover, we found that pain affects sleep. On the third day post surgery, 20 patients (19.8%) did not yet engage in out-of-bed activity. For those patients who did engage in out-of-bed activity within 3 days of surgery, the mean time of this out-of-bed activity was 50.4±19.6 hours post surgery, which is much later than the mean time of 21.3 hours reported by Snell et al.[13]. This delay in ambulation may be explained by the older mean age of our patients (59.1 ± 14.1) compared with Snell et al.'s (42±9.5), and that 35.6% of patients were over 65 years of age in our study. Moreover, most patients in our study had an indwelling Foley bladder catheter, which complicated getting out of bed and caused pain when moving about, and which lowered patients' willingness to leave their bed. We suggest that, as a daily routine, nursing staff should not only assess the effects of pain on patients, but also encourage and assist patients with early ambulation. In case of elderly patients and patients with delayed ambulation, complications caused by inactivity, such as deep vein thrombosis, should be actively prevented.

Postoperative PCA Morphine Dose and Side Effects

Besides postoperative PCA, 40.6% of patients in the anesthesia recovery room and 72.3% of patients on the wards demanded additional use of analgesics. This indicates that PCA cannot completely alleviate patients' postoperative pain. Shiloh et al. indicated that pain levels are lower in patients who use high PCA morphine doses than in patients with low PCA morphine doses[11]. Further analysis shows that there is a correlation between pain intensity and the morphine dose in the first three days after surgery. There is a statistically positive correlation between morphine dose on the first and second day after surgery and pain levels (day 1: $r = 0.352$, $P < 0.001$; day 2: $r = 0.279$, $P = 0.006$; day 3: $r = 0.074$, $P = 0.523$). The higher the postoperative pain, the more morphine is required, and morphine dose is therefore an important factor that influences analgesic effects in patients. We suggest that, in future, an assessment on the initial dose is needed to

facilitate postoperative pain management.

There were 23 patients (22.8%) in this study who did not have any PCA-related side effects, and when side effects did occur, nausea or vomiting were the most commonly observed (44 patients). This is similar to the finding by Peng et al.[8], but different to that of Wang et al. that sleepiness was the side effect that occurred most commonly[2]. The main reason for this difference may be due to the droperidol being administered with PCA to prevent nausea or vomiting, which greatly reduced the result. For patients in our study, dizziness was the most severe symptom distress and nausea or vomiting second most severe in IV-PCA patients. For patients using Epi-PCA, pruritus and nausea or vomiting were the most severe distress symptoms. Wang et al. only recorded the number of side effects occuring[2], while in our study, we emphasized patients' subjective perception of side effects. The prevention and improvement of PCA associated side effects will be the subject of future study.

Patients' Cognition of PCA

The present study shows that patients' cognition of PCA is still relatively negative, which is similar to findings by Lee et al.[16] who found an overall negative belief in PCA. The worst cognition was "surgical wounds should be very painful", followed by "the analgesic cannot completely eliminate the pain", and "you can easily get addicted to the analgesic". Although scores for PCA cognition in our study were still negative, 90.1% of patients still thought that the amount of PCA information provided by medical staff was sufficient. Lee et al. suggested enhancing patients' preoperative understanding of narcotic analgesics and education on PCA use, because this helps patients adopt a positive view with regard to postoperative use of PCA to manage pain. This study shows that there are different sources of information on the use of PCA. The main source of PCA-related information was the anesthesiologists (54.5%), followed by family as the second source (24 patients; 23.8%). Further analysis of those 24 patients shows a mean age of 62.8 (SD = 11.6), indicating cases when medical staff gave instructions to relatives instead of the patient, or when family members passed the instructions onto the patient with their previous PCA use experience, as a result the patients may not have been correctly informed about the correct use of PCA. In Taiwan, PCA services are the authority of anesthesiologists, not the first-line nurses who have the most contact with patients, and therefore, anesthesiologists are the ones that should be involved in pain management. We therefore suggest constructing a standard PCA procedure and instructions, and providing nursing staff with on-the-job training, so that nurses can educate patients in the correct use of PCA. Moreover, elderly patients and their main caregivers should be included as targets of education for improving the cognition of PCA use.

Postoperative PCA Use Satisfaction Level and Influencing Factors

With regard to patient satisfaction, patients in the present study reported a mean score of 7.7, which indicated a high level of overall satisfaction. This is similar to the finding of Lebovits et al., where a mean satisfaction score of 7.5 (on the 0-10 scale) was obtained[23]. Yu et al. showed that with the provision of a comprehensive PCA handbook and nursing staff acting as instructors, the satisfaction score reached 9.2[9]. A high level of satisfaction of PCA use saves nursing time. However, in contrast, higher educated and young patients require less time of nursing staff, but show a lower level of satisfaction[24]. Knoerl et al. found that preoperative PCA instruction provides better postoperative pain control with more satisfaction[25]. This suggests that comprehensive instruction by nursing staff before an operation can enhance patient satisfaction and provide better pain management.

Results of our study show that patient satisfaction was higher in women than in men. A negative correlation was found between the level of symptom distress caused by PCA side effects and patient satisfaction. Further analysis of pain levels 3 days after surgery and PCA side effect symptom distress showed no significant difference between genders ($P > 0.05$). Analysis using female gender as a factor found that the higher the level PCA side effect symptom distress, the lower the satisfaction with the PCA ($r = -0.478$, $P < 0.001$). We can therefore conclude that PCA side effect symptom distress is a factor related to patient satisfaction. Moreover, Wang et al. reported that PCA-associated side effects may reduce a patients' willingness to use PCA[2]. We therefore suggest that reduction of side effects is crucial to the satisfaction with PCA.

Our study shows no significant correlation between patients' cognition of PCA, pain levels, and patient satisfaction. Shiloh et al. also indicates that there is no significant difference for pain levels, morphine dose, and patient satisfaction with PCA[11]. Further analysis shows that there were 29 patients with a pain level higher than 5 (0-10) (moderate pain) on the first day after surgery, of which 25 (86.2%) indicated an extent of satisfaction higher than 5. Similar to previous studies[10,15], our analysis shows that although patients endure above moderate pain levels, patients' satisfaction levels are still high. Chen et al.

reported significantly higher levels of satisfaction in patients who were instructed on the importance of pain control by doctors or nursing staff than patients who were not. Discussing pain control with patients can increase patient satisfaction; Ward and Gordon found that patients attach quite some importance to being informed about pain control, but are less concerned about its actual execution. Although cognition of pain-relief in patients of our study is still negative, 90.1% find the source of information to be sufficient, which suggests that patients attach importance to being informed.

Our study also found that there are no differences in satisfaction when different PCA administration methods are used, which is similar to the findings of Lebovits[25], but not those of Peng et al.[8], although, they used a small sample size, with two groups of 10 patients each. The present study analyzed the correlation between different PCA administration methods and pain intensity on the first to the third day after surgery, and no statistical difference was observed between IV-PCA and Epi-CPA (day 1: $t = 1.214$, $P = 0.228$; day 2: $t = 1.606$, $P = 0.111$; day 3: $t = -0.659$, $P = 0.511$). Total morphine consumption when using Epi-CPA, was however significantly lower than when using IV-PCA (day 1: $t = 5.662$, $P < 0.001$; day 2: $t = 5.319$, $P < 0.001$; day 3: t = 7.164, P < 0.001), which is similar to findings reported by Xu et al.6 and Peng et al.[8] Furthermore, no significant difference in PCA side effect symptom distress was observed between IV-PCA and Epi-CPA ($t = -0.266$, $P = 0.791$). A diagnosis of cancer did not make any difference to the satisfaction of PCA use ($t = 0.766$, $P = 0.446$), and no significant difference in total morphine consumption existed between patients who were and were not diagnosed with cancer for the same PCA administration method (IV-PCA: $t = 0.570$, $P = 0.572$; Epi-PCA: $t = 1.275$, $P = 0.237$). No statistically significant difference of PCA side effect symptom distress was observed, either between patients who were and were not diagnosed with cancer (IV-PCA: $t = -1.737$, $P = 0.08$; Epi-PCA: $t = 1.747$, $P = 0.09$). The reason for this may be that in 66 (65.3%) cancer surgery patients there was no metastasis before operation, and therefore a high homogeneity with noncancer patients exists before surgery.

Summarizing the analyses discussed above, results of the present study indicate that moderate pain levels (VAS > 5) are within the endurance range of patients, and that lower levels of PCA side effect symptom distress, and medical instruction are important factors influencing patients' satisfaction with PCA. On the other hand, this study also found that there is room for improvement in education for the cognition of PCA. Therefore, realization of instructions for PCA, increasing patients' understanding of PCA, and elimination of symptom distress caused by analgesic side effects, can improve patients pain alleviation and management and increase the effectiveness and patients' satisfaction with PCA.

LIMITATIONS

This study used nonrandom sampling, recruiting 101 laparotomy patients from the surgical wards of just one medical center. It is therefore difficult to extrapolate the results of this study to other hospitals or other surgical patients. The questionnaire used to evaluate PCA side effect symptom distress consisted of subjective assessment questions, and 79.2% of laparotomy patients in this study had urethral catheters during the three days post surgery, so it was therefore not easy to evaluate the side effect of urinary retention in this study. Moreover, similar studies in the past have also not evaluated urine retention[2]. Even though urine retention probably has a small effect on laparotomy patients, we suggest that non-laparotomy patients who do not have urine catheters should be included in future studies to assess the PCA side effect of urine retention, so as to confirm the overall effect of PCA side effects on patients.

ACKNOWLEDGMENTS

We thank the staff of surgical wards at Tri-Service General Hospital for their assistance and all of subjects who participated in the survey for this study. This study was supported by a grant from the Tri-Service General Hospital, Taipei, Taiwan (TSGH-C95-98).

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