Iranian Heart Journal; 2021; 22 (4)

Original Article

The Effect of Patient-Controlled Analgesia on Patient Satisfaction After Coronary Artery Bypass Grafting: A Clinical Trial

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ABSTRACT

Background: Acute pain management has been a challenge for health professionals. We designed the present study to evaluate the effectiveness of pain control between intravenous patient-controlled analgesia (IV PCA) and conventional nurse-controlled analgesia (NCA) after coronary artery bypass graft (CABG) surgery concerning patient satisfaction during the postoperative period in the intensive care unit (ICU).

Methods: In this randomized clinical trial, 80 patients who underwent first-time elective CABG were enrolled by the convenience sampling method and were randomly allocated to 2 groups: PCA and NCA. PCA plus a continuous infusion of morphine was started immediately after the transfer of the patients to the ICU. NCA was based on the IV injections of morphine on demand. The level of pain was assessed using a numeric rating scale, and patient satisfaction was assessed using the pain treatment satisfaction scale. Further, sedation levels, morphine consumption, and side effects were evaluated from extubation until 48 hours after surgery. Additionally, nurses' opinions regarding the PCA method were obtained.

Results: Numeric rating scale scores were higher in the NCA group than in the PCA group. Morphine consumption in the PCA group was significantly higher than that in the NCA group. Patient satisfaction was higher in the PCA group than in the NCA group ($P<0.001$). PCA was safe, and there were no differences in the incidence of serious adverse effects such as nausea and vomiting or respiratory depression.

Conclusions: In our patients, PCA with a background infusion of morphine increased morphine consumption and improved pain relief, without increasing side effects. It appears that NCA can be recommended for patients after CABG. ***(Iranian Heart Journal 2021; 22(4): 101-111)***

KEYWORDS: Patient-controlled analgesia, Coronary artery bypass surgery, Verbal rating scale, Morphine

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Received: June 15, 2020 **Accepted:** August 12, 2020

Iranian Heart Journal; 2021; 22 (4)

Effective control of postoperative pain prevents pulmonary, inflammatory, and metabolic complications; moreover, it speeds up patient recovery and reduces the length of hospital stay. [1] Inadequate postoperative treatment might decrease patient satisfaction. Previous studies have shown that most patients do not receive adequate analgesic drugs after surgery. Coronary artery bypass grafting (CABG) is one of the intrathoracic surgeries and one of the most common cardiac surgeries over the past 2 decades. [2] Post-CABG pain is induced due to sternotomy, pericardiotomy, incisions to prepare grafts from the saphenous vein or the internal mammary arteries, and the placement of chest tubes, all of which will lead to moderate-to-severe postoperative pain. [3] The inability to take a deep breath or cough owing to postoperative chest pain can also lead to reduced vital capacity and functional residual capacity, which itself leads to atelectasis or pneumonia. [4]

The standard method of administering analgesics based on the needs of patients is that nurses must wait until patients complain of pain before analgesic administration. Therefore, since many patients do not know that they need to ask for analgesics for pain relief, or they wait until their pain reaches severe levels, their pain is sometimes not properly relieved. Nonetheless, analgesic administration often does not relieve pain because physicians tend to prescribe narcotic analgesics less than the permitted dosage or with long intervals to prevent complications, and nurses also inject such drugs less than the dose prescribed. [5]

Nowadays, one of the intravenous (IV) injection methods for controlling acute postoperative pain is the patient-controlled analgesia (PCA) method, which is performed by PCA injection pumps. PCA has been used as a postoperative pain control method for over 4 decades. This method allows the patient to receive certain amounts of analgesics continuously; and if the pain is exacerbated, the patient receives an additional predetermined dose prescribed by the physician through the intravenous catheter by pressing a button. [2] By comparison with the conventional nurse-controlled analgesia (NCA), PCA is a method for pain relief in patients who do not want to ask for analgesics and it eliminates the time interval between the patient's request for analgesics and the preparation and injection of the drugs by care providers. [6] Some studies have reported a relationship between improvements in the respiratory pattern and patient satisfaction and PCA as opposed to the conventional methods in controlling postoperative pain. [1] There are contradictory results regarding the efficacy and patient satisfaction concerning PCA and NCA methods. It seems that more research is required to investigate factors affecting pain severity and patient satisfaction. Although the use of the PCA method dates back to more than 4 decades, this method has been used inadequately in Iran in recent years. Indeed, there is a paucity of information regarding its application and the rates of acceptance and satisfaction among patients or healthcare personnel in Iranian sources. Since individuals show different reactions and responses to pain in different cultures even with similar pain intensity, [2] this study aimed to investigate effectiveness between PCA and NCA in ameliorating postoperative pain and enhancing patient satisfaction.

METHODS

The present clinical trial was conducted to evaluate the effect of PCA on patient satisfaction in patients undergoing CABG at Rajaie Cardiovascular Medical and Research Center between June and December 2011. The study protocol was approved by the Ethics Committee of the Vice-

Chancellorship for Research of Tabriz University of Medical Sciences, and all the participating patients provided written informed consent. The sample size was calculated to be 45 individuals for each of 2 groups according to the characteristics of the community and the drop-out probability. The inclusion criteria consisted of age between 30 and 60 years old, not having kidney and liver diseases, not suffering from psychotic diseases, and being able to answer the questions in the questionnaire. The exclusion criteria were composed of allergies to morphine, addiction, and an ejection fraction below 30%, undergoing emergency surgical operations, inability to work with the PCA pump, undergoing re-operation due to postoperative hemorrhage, hemodynamic instability, needing balloon pumps, and decreased consciousness levels. The participants were assigned to control (NCA) and intervention (PCA) groups via the random allocation method.

On the preoperative day, the researcher trained all the participants orally with the aid of a pamphlet on how to respond to pain based on a numerical scale for measuring pain intensity rated from 0 to 10. For patients in the intervention group, more training was provided concerning the PCA pump orally with the aid of educational pamphlets entitled “PCA”. All the patients received a prodrug and underwent anesthesia on the day of surgery. They were all admitted to the intensive care unit (ICU) after surgery. In the trial group, the patients received a disposable IV PCA pump immediately after ICU admission with a continuous infusion (3 mL/h, 1 mg of a bolus dose, and a 15-minute non-injection period with morphine [0.01 h/mg/kg]) until discharge. For the patients in the control group, the NCA was carried out by administering the analgesic drug according to the patients’ needs. The nurse was allowed to inject 3 to 5 mg of an IV morphine bolus to the patients, if needed, to relieve pain. Data collection was carried out using a demographic checklist consisting of social and individual sections and 2 questionnaires: one for measuring patient satisfaction with pain control and the other one for assessing nurses’ viewpoints on pain control by the PCA method, as well as the pain intensity scale and the sedation level scale. The patient satisfaction questionnaire consisted of 36 questions in 6 general areas: pain, information on pain and treatment, clinical care, route of analgesic administration, side effects of drugs, satisfaction with analgesic drugs, and care. The total score of each item and the total score (range =36–180) were considered to be the satisfaction level, with lower scores representing higher patient satisfaction. This questionnaire was provided to the patients after their transfer to the surgical ward from the ICU to be completed within 24 to 48 hours and delivered to the researcher. For the assessment of nurses’ viewpoints regarding the PCA method, a 6-item questionnaire designed by Tsang and Brush [7] (1999) was used. Pain intensity was measured using a numeric pain rating scale ranging from 0 to 10, every 4 hours, with 0 and 10 indicating no pain and the most severe pain, respectively. The sedation level was measured using a standard sedation level scale ranging from 0 to 4 every 4 hours, with scores 0 and 4 indicating full consciousness to 4 for coma and unconsciousness, respectively. The morphine dose and side effects were recorded in each of the study groups in order to finally compare the 2 groups.

Statistical Analysis

Data analysis was carried out using the SPSS software, version 17. For the assessment of patient satisfaction with pain control, descriptive statistics (frequencies, percentages, and the mean ± standard

deviation [SD]) and inferential statistics (mean difference tests for independent groups) were used in the 2 groups. Additionally, for the determination of pain intensity and the side effects and doses of morphine and their comparison between the 2 study groups, the independent *t* test was employed. The Mann–Whitney test was applied to assess the sedation level and compare it between the 2 groups. Moreover, for the assessment of nurses' viewpoints on pain control in the experimental group, descriptive statistical methods were used. Descriptive statistics tests were drawn upon to examine the relationship between some of the sociodemographic characteristics and patient satisfaction with pain control in the experimental and control groups. In this study, a *P*-value of greater than 0.05 was considered statistically significant.

RESULTS

The study population consisted of 80 patients. Forty patients comprised the experimental group at an average age of 50.50±6.50 years, mean weight of 80.35±14.26 kg, and ejection fraction of 50.50±7.40%. The mean duration of surgery and pump use was 277.0±73.66 minutes and 90.17±32.43 minutes, respectively. The mean age, mean weight, and ejection fraction in the control group were 53.25±5.29 years, 75.07±11.99 kg, and 44.25±9.51%, respectively. The mean duration of surgery and pump use was 260.50±55.29 minutes and 78.30±32.64 minutes, respectively. The groups were homogenous in terms of sex, level of education, number of grafts, weight, duration of surgery, and duration of pump use (Table 1).

The mean overall patient satisfaction in the experimental group was significantly higher than that in the control group (1.71±0.20 vs 2.30±0.39; $P<0.001$). The highest overall satisfaction in the experimental group was related to the "pain level of the patient before asking for analgesics from the physician" and "the patient's pain level before taking the drug". However, the highest overall satisfaction in the control group was related to "pain on the third postoperative day". Although there was no significant difference between the 2 groups in terms of satisfaction with information about pain and treatment, the highest level of satisfaction with information was related to "information about the causes of pain" in the experimental group and "receiving information about other ways to treat pain" in the control group. There was also no significant difference between the 2 groups regarding satisfaction with medical care, but the highest satisfaction with medical care was related to " the provision of analgesics by the medical personnel" in the experimental group and "efforts made by the treatment personnel to reduce the patient's concerns" in the control group. The highest level of satisfaction with the drug administration method in both groups was related to "fast-acting analgesic drugs", and the patients in the experimental group reported more satisfaction with their administration method. The highest level of satisfaction with side effects in the experimental group was the absence of skin rash and itching, diarrhea, vomiting, nausea, lack of concentration, and drowsiness; furthermore, none of the dangerous complications of morphine caused severe discomfort in this group. The highest level of satisfaction with side effects in the control group included no skin rash and itching, vomiting, diarrhea, constipation, dizziness, and lack of concentration. The results also showed no significant differences between the 2 groups in terms of satisfaction with side effects. The highest degree of satisfaction with pain control and care in the ICU in the experimental group included the pain relief method, the tendency to continue

this method, intervals between the consumption of drugs, the drug dosage received, and the relief rate. The higher satisfaction with pain treatment and care of the control group in the ICU, respectively, included the effectiveness of the drug, the care provided by the nursing staff for pain and its treatment, the intervals of the drug use, and pain information. The results also showed a significant difference between the 2 groups in terms of satisfaction with pain treatment and care, and the experimental group reported more satisfaction with the treatment of their pain and care in the ICU. Most of the nurses had almost positive attitudes toward PCA. The highest degree of satisfaction with pain control in the PCA method was related to "patients' lack of anxiety when using the PCA pump". There was a significant difference between the 2 groups concerning pain intensity, meaning that the experimental group reported less pain intensity than the control group during the ICU stay (Table 2).

No significant difference existed between the 2 groups regarding the sedation level, nor was there any significant difference between the 2 groups vis-à-vis side effects (Table 3).

The morphine dose consumed in the experimental group was significantly higher than that of the control group. No significant differences were observed between the level of satisfaction and other variables, except for ejection fraction in both experimental and control groups.

Table 1. Comparison of personal, social, and physiological characteristics between the 2 study groups

Variables	NCA Group (n=40)	PCA Group (n=40)	*P*-value
Sex	Male, 34 (85%) Female, 6 (15%)	Male, 33 (82.5%) Female, 8 (17.5%)	0.76
Education	Under diploma, 22 (55%) Diploma, 10 (25%) Higher, 8 (20%)	Under diploma, 18 (45%) Diploma, 11 (27.5%) Higher, 11 (27.5%)	0.36
Graft	One, 2 (5%) Two, 3 (7.5%) Three, 20 (50%) Four, 13 (32.5%) Five, 2 (5%)	One, 3 (7.5%) Two, 4 (10%) Three, 15 (37.5%) Four, 18 (45%) Five, 0 (0%)	0.8
Age	53.25 ± 5.29 (41-60)	50.50 ± 6.50 (35-60)	0.04
Weight	75.07 ± 11.92	80.35 ± 14.26	0.07
Operation time, min	260.50 ± 55.29	277.0 ± 73.66	0.26
Pump duration, min	78.30 ± 32.64	90.17 ± 32.43	0.12
Ejection fraction	44.25 ± 9.51	50.50 ± 7.40	0.002

Table 2. Comparison of pain intensity between the 2 study groups

Pain Intensity	Group	Mean ± SD	95% CI	*P*-value
Post Extubation	PCA NCA	1.42 ± 1.78 3.50 ± 2.40	0.77-2.19 2.53-4.40	<0.001
First 4 hours	PCA NCA	1.07 ± 1.42 3.77 ± 2.15	0.62-1.65 2.89-4.53	<0.001
Second 4 hours	PCA NCA	0.67 ± 0.97 3.70 ± 2.27	0.43-1.22 2.88–4.43	<0.001
Third 4 hours	PCA NCA	0.60 ± 0.87 3.77 ± 2.09	0.37-1.07 3.01-4.67	<0.001
Fourth 4 hours	PCA NCA	1.02 ± 1.49 3.52 ± 2.09	0.53-1.80 2.74-4.38	<0.001

Fifth 4 hours	PCA NCA	0.80 ± 1.20 3.07 ± 2.17	0.37-1.28 2.46-4.09	<0.001
Sixth 4 hours	PCA NCA	0.67 ± 1.11 2.70 ± 1.98	0.32-1.26 2.24-3.62	<0.001
Seventh 4 hours	PCA NCA	0.67 ± 1.20 3.07 ± 2.08	0.16-1.14 2.32-3.92	<0.001
Eighth 4 hours	PCA NCA	0.32 ± 0.79 2.57 ± 1.61	0.04-0.59 2.07-3.17	<0.001
Ninth 4 hours	PCA NCA	0.13 ± 0.44 2.93 ± 1.84	0.02-0.30 2.27-3.60	<0.001
Total	PCA NCA	0.75 ± 0.66 3.27 ± 1.17	0.54-0.96 2.89-3.64	<0.001

Table 3. Comparison of the sedation rate between the 2 study groups

Sedation Rates	Group	Mean ± SD	95% CI	*P*-value
Post extubation	PCA NCA	- 0.75 ± 0.47	- 0.07-0.22	0.31
First 4 hours	PCA NCA	0.40 ± 0.49 0.40 ± 0.67	0.24-0.55 0.18-0.61	0.61
Second 4 hours	PCA NCA	0.17 ± 0.38 0.15 ± 0.36	0.05-0.29 0.03–0.26	0.76
Third 4 hours	PCA NCA	0.12 ± 0.33 0.17 ± 0.38	0.01-0.23 0.05-0.29	0.53
Fourth 4 hours	PCA NCA	0.50 ± 0.22 0.17 ± 0.38	0.02-0.12 0.05-0.29	0.07
Fifth 4 hours	PCA NCA	0.25 ± 0.43 0.15 ± 0.36	0.10-0.39 0.03-0.26	0.26
Sixth 4 hours	PCA NCA	0.40 ± 0.49 0.25 ± 0.43	0.10-0.44 0.09-0.40	0.15
Seventh 4 hours	PCA NCA	0.50 ± 0.50 0.30 ± 0.46	0.35-0.74 0.16-0.51	0.07
Eighth 4 hours	PCA NCA	0.20 ± 0.40 0.17 ± 0.38	0.10-0.44 0.04-0.33	0.77
Ninth 4 hours	PCA NCA	0.06 ± 0.25 0.09 ± 0.29	0.02-0.16 0.01-0.20	0.72
Total	PCA NCA	0.22 ± 0.10 0.19 ± 0.12	0.18-0.25 0.15-0.23	0.27

DISCUSSION

The results of this study showed that patients in the experimental group had higher overall satisfaction with pain control than those in the control group. Contrary to the results of this study, Tsang and Brush [7] reported in their study that there was no difference between patients in both the experimental and control groups in terms of their satisfaction with pain control. In their study on patients undergoing CABG or heart valve replacement, Boldt et al [1] reported that the PCA method increased the satisfaction of patients after cardiac surgery. Macintyre [8] believed that measuring patient satisfaction with postoperative pain relief was a complex issue and that patient dissatisfaction was mainly due to the lack of proper pain relief. In another study, Evans et al [9] maintained that it was inappropriate to reduce patient satisfaction from a multidimensional category to a 1-dimensional category. Thus, it can be stated that it is impossible to properly measure patient satisfaction using the 5-item questionnaire in the study by Tsang and Brush, [7] thereby justifying the discrepancy between the results of the above study and the present study. In other words, the measurement of patient satisfaction with

pain control in our study was carried out using a questionnaire by Evans et al, [9] which was a much more accurate tool than the one used by Tsang and Brush. [7] In the present study, patients in the experimental group reported a higher satisfaction rate, which is consistent with a study carried out by Peterson et al, [10] who were forced to use a supplementary analgesic to control pain in a group who used the same NCA method as the present study. Nonetheless, patients in the experimental group did not receive an additional pain control drug after their surgery. Another study showed that nurses' fears of addiction and respiratory depression led to the lack of the proper use of opioid analgesics to control postoperative pain in patients. In addition, nurses tended to use non-opioid analgesics instead of prescribed analgesic drugs. The results of our study showed that patients in the experimental group were more satisfied with the administration of the drug. Gordon et al [5] reported in their study that the use of continuous infusions contributed to the maintenance of the serum levels of analgesics; moreover, patients could sleep easily without intermittent attacks of pain. [6] In their study on patient satisfaction with the administration of the drug in PCA and NCA groups, Tsang and Brush [7] showed no differences between the 2 groups concerning the above variable. Overall, 64% of the patients were satisfied with their pain and anxiety control method. Most of the patients who controlled their pain using PCA recommended the use of this administration method, which is consistent with the results of the present study. In this study, there was no significant difference between the 2 groups regarding the incidence of side effects. In a meta-analysis conducted by Bainbridge, Martin, and Cheng, [11] there was no difference between patients in the PCA and NCA groups in terms of the incidence of side effects such as nausea, vomiting, and severe sedation, which is consistent with the results of the present study. Guler et al, [12] Mota et al, [13] and Dal et al [19] also showed no differences between the 2 groups as regards the incidence of side effects such as nausea, vomiting, and severe sedation. It seems that most on-demand (PRN) medications are not prescribed by nurses and, accordingly, the blood serum levels of the analgesic drugs do not lead to the incidence of side effects. Moreover, in the patients in the PCA group, the serum level of the analgesic drug was maintained within the preset safe range to prevent side effects due to the use of continuous infusions. [2]

We found that patients in the experimental group reported more satisfaction with the treatment of pain and care. Tsang and Brush [7] reported no difference in patient satisfaction between the 2 groups of pain control, which is not consistent with the present study. Still, Boldt et al [1] showed that PCA had an effect on increasing the satisfaction of patients after cardiac surgery, which is consistent with the present study. This discrepancy in the results can be due to the difference in the type and duration of the PCA method because Boldt et al [1] used the PCA method without continuous infusions for 48 hours for their patients, whereas Tsang and Brush [7] utilized the PCA method along with continuous infusions for 24 hours and, if necessary, increased its duration. Generally, assessing patient satisfaction with postoperative pain relief is a complex subject, and it is important to consider several influential factors during patient examinations. The method of assessing patient satisfaction used by Tsang and Brush [7] was the use of a 5-item questionnaire. The assessment method used by Boldt et al [1] to determine satisfaction levels while carrying out pain control 3 times a day was based on 0 to 6 criteria (with 0 and 6 representing the worst and the best satisfaction level, respectively); it, therefore, cannot yield a

robust conclusion. The significant difference observed in our study can be due to the use of PCA with continuous infusions for 48 hours since the highest postoperative pain was seen on the first and second days after surgery, and better pain control during this period can have a significant effect on patient satisfaction. [14] Comprehensive questions have been used to measure patient satisfaction with pain relief, yielding more accurate results. In this study, most of the nurses expressed satisfaction with pain control via the PCA method. Moreover, in an investigation by Peterson et al, [10] all nurses were satisfied with the PCA method and preferred it to the NCA method, which is similar to the results of the present study. In the study by Tsang and Brush, [7] the majority of nurses disagreed to use PCA as a pain control method, and most nurses did not consider PCA to be a supplementary aid with positive effects. Further, the highest satisfaction levels with the PCA method as a pain control method were related to "good pain control with PCA pumps by patients", which is not consistent with the results of the present study. Many reasons have been cited concerning the almost negative attitude of nurses toward the use of PCA in heart surgery ICU in the study by Tsang and Brush [7] such as reluctance to change in a typical functional pattern, the need to learn new technology, the loss of patient control, and nurses' willingness to use morphine to control blood pressure without taking pain into account. Some nurses referred to their concerns about side effects, especially respiratory depression and drug addiction, as the reason for their reluctance to use higher analgesic doses for better pain control. [7, 15, 16] This concern is much more pronounced with the use of the PCA pump, especially if the PCA method is used along with continuous infusions. [8] Our results demonstrated that most nurses had an almost positive attitude toward the PCA method, and the most positive attitude toward the PCA method was related to "lack of patients' anxiety discomfort when using the PCA pump", which does not chime in with the results reported by Tsang and Brush. [7] This result may be because there was no difference in pain intensity 48 hours after surgery in the investigation by Tsang and Brush, [7] while we found a significant difference in pain intensity 48 hours after surgery, which may have affected the almost positive attitude toward the PCA pump in our study. In this study, patients in the PCA group reported less pain intensity than their counterparts in the NCA group. The results of the comparison of pain intensity between the NCA and PCA groups undergoing cardiac surgery in the study by Boldt et al [1] showed that PCA had an effect on the reduction of pain intensity, which is consistent with the results of the present study. However, in the study by Tsang and Brush, [7] the results of the comparison of pain intensity between NCA and PCA groups undergoing cardiac surgery showed that pain intensity was similar in both groups, and there was no statistically significant difference. Thus, they concluded that there was no clear advantage in the routine use of PCA immediately after cardiac surgery, which is not consistent with the present study. The existence of such discrepancies in the desired outcomes of PCA versus NCA may be due to the shortcomings of these investigations because they have used cardiac surgical procedures such as valve replacement and CABG. Many studies have stated that the type of cardiac surgery can affect pain intensity. [15] For instance, previous studies have suggested that patients for whom internal mammary artery grafts are used require the use of a special surgical position for the separation of the artery from the chest wall and, thus, experience more pain than patients for whom only saphenous vein grafts are used. [15, 17, 18] The age range of

study participants was one of our study's limitations. Researchers in similar studies have found that age has a significant impact on the incidence rate of postoperative pain, and patients younger than 60 years old feel higher levels of pain than older patients. [2, 22] Accordingly, our selection of patients not older than 75 years of age might have exerted a confounding impact on the results.

There was no significant difference between the 2 groups in this study in terms of the sedation level. Previous investigations have shown that the addition of continuous infusions to the PCA method does not increase the sedation level, which is similar to the findings in the present study. [12, 19] The results of studies carried out by Tsang and Brush [7] and Boldt et al [1] showed no difference in the sedation level between PCA and NCA groups, which is consistent with the results of the present study. Our results showed no significant difference between the 2 groups apropos of the incidence of side effects. Despite the increase in the morphine dose in the PCA group, no difference was found in the incidence of side effects, especially respiratory depression. In a review study, Macintyre [8] stated that there was no difference between both PCA and NCA groups in terms of the incidence of side effects such as nausea, vomiting, itching, and digestive system function, which is consistent with the present study; however, he believed that the addition of continuous infusions to the PCA method increased the risk of respiratory depression, which is not consistent with the present study. In a study on 1000 patients who received morphine as PCA plus continuous infusions after surgery, Flisberg et al [20] reported that respiratory depression was found in only 13 patients (1.2%). In another study on 178 postoperative patients, Overdyk et al [21] found that the incidence of a diminished respiration rate (32% vs 53%) and decreased blood oxygen (8% vs 17%) was observed less frequently in the PCA group with continuous infusions than in the PCA group with bolus doses alone, despite receiving twice as much morphine. In this study, the morphine dose in the experimental group was higher than that in the other group. The results of the study by Boldt et al [1] showed that the PCA method increased the analgesic dose, which is consistent with the results of the present study. Boldt et al [1] attributed the increased use of analgesics in the PCA group to the fact that nurses were afraid of side effects when using more opioids. They also attributed the tendency of nurses to focus on fixing hemodynamic status to a lack of proper pain evaluation and treatment. They also referred to the lack of proper patient-nurse ratio as an important factor in providing the possibility to request the analgesic for patients. The results of the investigation by Tsang and Brush [7] showed no difference between the 2 groups regarding the morphine dose, which is not consistent with the present study. The findings of this study showed no correlation between sociodemographic characteristics and patient satisfaction with pain control, except for ejection fraction, which was higher in the PCA group, thus leading to better pain control outcomes. The results of a study on more than 10 000 patients showed that postoperative pain increased with increased body mass index and the duration of surgery. [3] As was previously mentioned, pain intensity affects patient satisfaction, and since there was no significant difference between body mass index and the duration of surgery between the 2 groups in the present study, there was also no relationship between these cases and patient satisfaction. The investigation by Boldt et al [1] was conducted in Germany, and it predated our investigation. This interval indeed reflects the difference in the level of healthcare services in Iran compared with

other developed countries, but it should be noted that due to the long history of PCA, this method has been discussed and evaluated in developed countries for many years now.

CONCLUSIONS

The PCA method has been used in Iranian hospitals for several years now. However, due to the rapid advancements in science and technology and the increasing need for nurses in various health sectors, self-care methods should be a goal for authorities to improve healthcare services in the country.

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