Satisfaction With Epidural and Intravenous Patient-Controlled Analgesia

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A B S T R A C T

Objective. Postoperative intravenous (IV) versus epidural morphine patient-controlled analgesia (PCA) were compared regarding maintenance of initial PCA route, pain levels, side effects, and levels of satisfaction. Additionally, the role of preoperative attitudinal expectations in predicting postoperative levels of satisfaction with pain management as well as maintenance of initial PCA route was evaluated.

Design. After either abdominal or thoracic surgery, 70 eligible patients were randomized to receive morphine either through an epidural route (n = 37) or an intravenous PCA pump (n = 33).

Setting. A large tertiary university teaching hospital in a major northeastern city.

Outcome measures. Patients completed visual analogue rating scales 1 week before surgery regarding attitudes such as expectations of satisfaction with pain management after surgery and expectations of medication efficacy postsurgically. Postoperatively, beginning the day after surgery, patients were asked to complete visual analogue rating scales every 12 hours until they were discharged, for a maximum of 3 postoperative days. The scales evaluated included pain, ability to think, and satisfaction with pain control.

Results. There were no significant between-group differences on the postoperative visual analogue scales. Although the overall rate of changing the initial PCA route to which the patients were randomized was identical for both groups (30%), those patients who had thoracic surgery changed their route of PCA administration significantly less when their initial PCA route was epidural (20%) than when their initial PCA route was IV (46%) (P < .05). Patients who were satisfied with pain control postoperatively were more likely to have been started on IV PCA (P = .001), have lower preoperative expectations of postoperative satisfaction with pain (P < .001), and have higher preoperative expectations of medication effects on postoperative pain (P < .001). Additionally, older patients (P = .007) and patients with lower preoperative expectations of postoperative satisfaction with pain (P = .003) were more likely to adhere to their initial treatment protocol.

Conclusions. Both techniques, IV and epidural PCA, result in high levels of satisfaction. Satisfaction with PCA can be accurately predicted in nearly three of four patients based on initial PCA route and preoperative attitudes. Additionally, maintaining the initial treatment plan can be accurately predicted based on age and preoperative attitudes. Patient expectations about pain relief should be addressed preoperatively, particularly with younger patients, for optimal results.

Key Words. PCA; Preoperative Expectations; Postoperative Satisfaction

The patient-activated analgesic system first appeared in 1968 [1] and has become an increasingly popular method of postoperative pain management. Trials starting in the 1970s and 1980s
Satisfaction With Epidural and Intravenous PCA

supported the safety and effectiveness of patient-controlled analgesia (PCA) in different types of pain, in particular postoperative pain [2–4]. In the past decade, studies have reported several advantages of postoperative PCA over conventional analgesia, such as improved pain relief [5], shorter hospital stay [6], lower level of analgesic consumption [7], less anxiety [8] and improved pulmonary function [9–10]. An additional noted advantage of PCA is its facilitation of active coping with pain on the part of the patient which can enhance feelings of control and self-efficacy [11–13]. However, despite the increasing popularity of PCA, postoperative pain often remains poorly controlled.

The literature suggests that patients who may be in severe pain still report high levels of satisfaction with pain management [14]. Efforts to account for this phenomenon suggest that factors other than pain play a role in determining patient satisfaction with pain management. Among those factors commonly identified to explain patient satisfaction with PCA are better analgesia, patient–physician relationship, patient’s prior experience with postoperative pain, patient’s expectations and personality traits, and desire for personal control [12,15–22]. To date, however, no one has questioned whether there might be a correlation between the type of surgery a patient undergoes and his or her satisfaction with PCA. Nor has the question of whether there is a correlation between the route of administration (epidural vs. intravenous [IV]) and patient satisfaction been adequately investigated.

Previous comparisons report greater satisfaction with IV PCA than epidural morphine [23,24]; faster onset of action is noted as an advantage of the IV PCA method [18]. However, the beneficial cognitive effect of epidural PCA over IV PCA has also been noted in the literature [18,25,26]. Additionally, there may be a significant interaction of type of surgery with PCA route [27–29]. Many of the previous epidural PCA versus IV PCA comparison studies, however, do not compare the same medications or contain additional medications for one of the routes. This study specifically limited morphine as the sole medication of both initial routes so as to control for effect of medication.

This study was undertaken to compare intravenous (IV) versus epidural morphine PCA subsequent to thoracic or abdominal surgery with regard to rates of maintaining the initial PCA route, postoperative pain levels, side effects, and levels of satisfaction. Additionally, the role of preoperative attitudinal expectations in predicting postoperative levels of satisfaction with pain management as well maintaining the initial PCA route was evaluated.

Method

The participants for this study were recruited from a large tertiary university teaching hospital in a major northeastern city. All consecutive patients scheduled for elective thoracic or abdominal surgery and older than 18 years who were not pregnant or morbidly obese and who did not have any major psychiatric disorder and were able to understand the instructions were considered for study inclusion. Informed consent was obtained presurgically from eligible patients, as per the study protocol approved by the Institutional Review Board.

On the day of surgery, all study participants had epidural (thoracic catheter) and IV (angiocatheter) accesses using standard techniques of insertion. All other anesthetic interventions followed routine protocol for thoracic and abdominal surgery, excluding the use of intraoperative narcotics via the epidural catheter. Patients were excluded if they did not have a functioning epidural catheter postoperatively. After surgery, 70 eligible patients were randomized to receive morphine either through an epidural (n = 37) or IV PCA pump (n = 33 patients). The anesthesiology-based pain management team was notified when the patient arrived in the postanesthesia care unit (PACU), where the patient was connected to both an epidural catheter and an IV catheter. The patient was given morphine PCA either through the epidural catheter or the IV catheter and saline through the other line. Each patient had a PCA button to allow self-administration of the medication. The PCA pump was covered and designed to have one button with connecting cable specially bifurcated to the epidural and IV pumps. This facilitated nursing staff and patients, to be unaware of whether the morphine was given by epidural or IV route. After the initial setup of the pumps and PCA button, the system was tested to verify the functionality of the catheter through administration of lidocaine 2% with epinephrine. When IV PCA was used, a standard solution of 1 mg/mL morphine in normal saline was used, whereas with epidural PCA, preservative-free morphine, 0.1 mg/mL, in normal saline was the infused solution. The loading dose was given by the anesthesiologist initiating the PCA in the recovery room. If patients’ pain levels remained above a rating of 3 on a visual analogue pain rating scale ranging from 0 to 10 after maximal loading doses (intravenously or epidurally), patients were changed at that point to a combination of preservative-free morphine, 0.1 mg/mL, and bupivacaine 0.125% delivered through epidural PCA. In all instances, the adjustment of morphine bolus dosages and basal in-
fusions were made by the pain management team anesthesiologists and nurses aiming to control postoperative pain efficiently (visual analogue scores less than or equal to 3) and minimize side effects.

Patients completed specially devised questionnaires, composed of 10-point visual analogue rating scales, at two times. Time 1 (T1): At their presurgical testing appointment, approximately 1 week before surgery, patients completed a questionnaire that evaluated demographic characteristics, preoperative level of pain, expected length of stay, and satisfaction analogue ratings, including satisfaction with the hospital experience, expectation of satisfaction with pain management after surgery, expectations of medication efficacy postsurgically, and the perceived role of staff in the management of pain. Time 2 (T2): Postoperatively, beginning with the day after surgery, patients were asked to complete 13 visual analogue rating scales every 12 hours until they were discharged, for a maximum of 3 postoperative days. Scales evaluated pain at rest, pain with cough or motion, nausea and vomiting, itching, anxiety, ability to think, ability to sleep, satisfaction with pain control, satisfaction with their overall hospital experience, dependency on staff for pain relief, perceived adequacy of amount of time spent by their doctors evaluating their pain, perceived adequacy of the amount of information their doctors provided about their health condition, and perception of their doctors’ concern of them as a person. Additionally, length of stay, postoperative number of days to first bowel movement, and externality (defined as the average 0–10 ratings of responsibility for pain control assigned to the surgeon, anesthesiologist, and nurse divided by the 0–10 rating of responsibility for pain control assigned to the self) were also evaluated.

The analysis of the data consisted of comparing the IV to epidural PCA groups on all postoperative variables such as pain control, patient expectations, satisfaction, and side effects. This was accomplished through two-factor repeated measures analyses of variance (ANOVAs). Post hoc Newman-Keuls analyses identified the relevant group differences. A Bonferroni correction was used to take into account the multiple comparisons. Analyses were performed according to the intention-to-treat principle. Patients assigned to one method were analyzed for outcome comparisons as though they had remained on that method even if they, in fact, were changed. Stepwise discriminant function analyses were conducted to establish a parsimonious set of preoperative variables that could classify patients and predict 1) postoperative satisfaction with pain control and 2) whether the patient changed or maintained their original epidural or IV PCA protocol. Discriminant analysis classifies patients into discrete groups and predicts group membership based on patient characteristics. All analyses were performed using SPSS 9.0 procedures.

Results

There were no significant demographic or preoperative differences between patients who were randomly assigned to the epidural group or the IV group (Table 1). Similarly, there were no significant attitudinal differences between the groups with regard to preoperative satisfaction with the hospital experience or preoperative expectations regarding pain, pain control, and staff responsibility.

Two-factor (PCA group started with and time) repeated measures ANOVAs were performed on the 13 postoperative rating scales. The 12-hour ratings were averaged for each day such that the analyses evaluated for differences between Postoperative Days 1, 2, and 3. A comparison of the number of days each group was observed showed that the epidural group was evaluated 87% of the maximum possible amount compared with 89% for the IV group. Patients with missing data on any of the 3 days, however, could not be included in the ANOVAs, reducing the sample size for the analyses of variance to 51. There were significant main effects of time, with decreases over time in pain with cough or motion ($P < .02$) and satisfaction with overall hospital experience ($P < .02$). There were no significant main effects of group or Group × Time.

There was a very high rate of patient satisfaction with postoperative pain control for the study patients as a whole. Only four patients (6%) rated their satisfaction at less than 5, the neutral point, on the rating scale of satisfaction, which ranged from 0 (lowest satisfaction) to 10 (highest satisfaction). The median rating was 7.5. It should also be noted that there were very low rates of pain at rest postoperatively for the study patients as a whole, with a median 3-day average rating of 2.1 (0–10 rating scale) and 75% of patients rating their pain at rest as less than 3.

Although the overall rate of changing the initial PCA route that patients were randomized to was identical for both groups (30%), there was a statistically significant difference in the rate of changing with the type of surgery (Table 2). Those patients who had thoracic surgery changed significantly less when their initial PCA route was epidural (20%) than IV (46%). Although not statistically significant, the trend appears to be reversed for the abdominal
group such that those patients who had their initial PCA route through IV changed less (20%) than those who had their initial PCA route epidurally (41%).

A stepwise discriminant function analysis was conducted to determine the degree of predictive ability of six variables on postoperative satisfaction with pain control: initial PCA group, preoperative expectation of satisfaction with postoperative pain management, preoperative expectation of medication effect on postoperative pain, preoperative satisfaction with the hospital experience, type of surgery, and total drug amount received. Variables chosen were based on statistical and clinical significance as well as the necessity of maintaining a sufficient ratio of patients per variable (necessary to meet the requirements of the discriminant analysis procedure). Table 3 shows that, in combination with each other, initial PCA group, preoperative expectation of postoperative satisfaction with pain management, and preoperative expectation of medication effect on postoperative pain form a parsimonious set of variables that best predicted postoperative pain control. Patients who were satisfied with pain control postoperatively were more likely to have been started on IV PCA, have lower preoperative expectations of postoperative satisfaction with pain, and have higher preoperative expectations of medication effect on postoperative pain.

Table 4 contains the classification and hit rate, demonstrating that, with these three predictor variables, 74% of the patients were correctly classified.

A second stepwise discriminant function analysis was conducted to determine the degree of predictive ability of 11 variables on whether they changed from their initial PCA group: initial PCA group, preoperative expectation of satisfaction with postoperative pain management, preoperative expectation of medication effect on postoperative pain, type of surgery, age, gender, externality, postoperative days to first bowel movement, postoperative length of stay, Postoperative Day 1 pain with cough, and Postoperative Day 1 satisfaction with pain control. Variables chosen were based on statistical and clinical significance as well as the necessity of maintaining a sufficient ratio of patients per variable (necessary to meet the requirements of the discriminant analysis procedure). Table 5 shows that, in combination with each other, age and preoperative expectation of postoperative satisfaction with pain control form a parsimonious set of variables that best predicted whether a patient starting out on their PCA route of administration would change or stay with that route for the entire postoperative period. Older patients and

Table 1  Patient Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total sample (n = 70)</th>
<th>Started epidural (n = 37)</th>
<th>Started IV (N = 33)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age ± SD (range)</td>
<td>64 ± 13.0 (27–87)</td>
<td>67 ± 12.1 (41–87)</td>
<td>62 ± 13.6 (27–83)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>35 (50%)</td>
<td>20 (54%)</td>
<td>15 (46%)</td>
</tr>
<tr>
<td>Female</td>
<td>35 (50%)</td>
<td>17 (46%)</td>
<td>18 (54%)</td>
</tr>
<tr>
<td>Type of surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal</td>
<td>37 (53%)</td>
<td>17 (46%)</td>
<td>20 (61%)</td>
</tr>
<tr>
<td>Thoracic</td>
<td>33 (47%)</td>
<td>20 (54%)</td>
<td>13 (39%)</td>
</tr>
<tr>
<td>Education*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade school</td>
<td>5 (8%)</td>
<td>3 (9%)</td>
<td>2 (6%)</td>
</tr>
<tr>
<td>High school</td>
<td>39 (61%)</td>
<td>17 (53%)</td>
<td>22 (69%)</td>
</tr>
<tr>
<td>College</td>
<td>16 (25%)</td>
<td>9 (28%)</td>
<td>7 (22%)</td>
</tr>
<tr>
<td>Graduate school</td>
<td>4 (6%)</td>
<td>3 (9%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Marital status†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>5 (8%)</td>
<td>3 (8%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>Married</td>
<td>47 (71%)</td>
<td>25 (69%)</td>
<td>22 (72%)</td>
</tr>
<tr>
<td>Divorced/separated</td>
<td>6 (9%)</td>
<td>4 (11%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>Widowed</td>
<td>8 (12%)</td>
<td>4 (11%)</td>
<td>4 (13%)</td>
</tr>
<tr>
<td>Mean preoperative pain score ± SD (range)‡</td>
<td>0.51 ± 1.3 (0–9)</td>
<td>0.74 ± 1.7 (0–9)</td>
<td>0.25 ± 0.6 (0–2)</td>
</tr>
</tbody>
</table>

*There were six missing responses for education.
†There were four missing responses for marital status.
‡Rated on a scale ranging from 0 (no pain) to 10 (worst pain imaginable).
patients with lower preoperative expectations of postoperative satisfaction with pain were more likely to remain with their original treatment protocol by maintaining their initial PCA route. Table 6 contains the classification and hit rate, demonstrating that with these two predictor variables, 66% of the patients were correctly classified.

Discussion

In concordance with previous reports [5,17,19,30–32], patients in the current study reported a high rate of satisfaction with the PCA modality of postoperative pain control (as reflected by a median score of 7.5 on the 0–10 scale), regardless of whether the PCA was given epidurally or intravenously. Additionally, when PCA is managed by anesthesiologists, especially those with a focused attention of an acute pain service (as in the current study), patient satisfaction is further enhanced [33].

Although there were no between-group differences in postoperative levels of pain, which were generally very low, and postoperative levels of satisfaction, the starting of patients on IV PCA versus epidural PCA (regardless of surgery group) was the most powerful predictor of postoperative satisfaction with pain control. Previous reports note that even though epidural morphine may provide superior pain relief, patients report greater satisfaction with IV PCA than with epidural morrhine [23,24]. The faster onset of action of IV may account for this finding. Patients have identified the quick onset of action of IV PCA as an advantage of that method [18].

Although the rate of changing for the total group from their initial PCA route of either IV PCA or epidural PCA was identical, there were significant differences between the surgery groups in the rate of changing. Those patients who had thoracic surgery changed significantly less when their PCA was through the epidural mode than through the IV mode. This is in concordance with previous observations that the use of epidural PCA with local anesthetics and opioid in the thoracic area is preferred to IV PCA in that it provides superior analgesia [27,28], improved pulmonary function, and reduced pulmonary complications [29].

Additionally, we found that older patients were more likely to remain with their initial treatment protocol. This is consistent with previous studies that report the elderly can achieve high levels of compliance with treatment [34, 35].

We found a significant effect of preoperative expectations on maintaining initial PCA route as well as on postoperative patient satisfaction, the latter finding also previously reported [20,36]. Expectations of postoperative pain and its relationship to postoperative satisfaction is a multifactorial complex concept that includes more than previous pain experiences [37]. Patients may well use PCA according to their expectations [21].

Our finding that patients with lower preoperative expectations of pain control but higher expectations of medication efficacy report higher levels of satisfaction postoperatively suggests the need for preoperative education by medical and nursing staff of patients in what to expect postoperatively [38]. It has been similarly noted that patients who preoperatively expect pain to occur postoperatively will report greater pain intensity than those who do not hold these expectancies [39]. Lack of information and ineffective pain control may be significant contributors to a greater intensity of pain.

Table 3  Summary of Stepwise Discriminant Analysis

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>Wilks's λ</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td>.859</td>
<td>.007</td>
</tr>
<tr>
<td>2</td>
<td>Preoperative expectation of postoperative satisfaction with pain management</td>
<td>.785</td>
<td>.003</td>
</tr>
</tbody>
</table>

Table 4  Classification Matrix: Postoperative Satisfaction with Pain Control

<table>
<thead>
<tr>
<th>Group</th>
<th>No. patients</th>
<th>Satisfied</th>
<th>Unsatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied</td>
<td>37</td>
<td>29 (78.4%)</td>
<td>8 (21.6%)</td>
</tr>
<tr>
<td>Unsatisfied</td>
<td>33</td>
<td>10 (30.3%)</td>
<td>23 (69.7%)</td>
</tr>
</tbody>
</table>

*Of original grouped cases, 74.3% were correctly classified.

Table 5  Summary of Stepwise Discriminant Analysis

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable entered</th>
<th>Wilks's λ</th>
<th>P</th>
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<td>.785</td>
<td>.003</td>
</tr>
</tbody>
</table>
In conclusion, the data from this study suggest that, although satisfaction with PCA via the IV or epidural route is multifactorially determined, it can be accurately predicted in nearly three of four patients based on initial PCA route and preoperative attitudes. Additionally, maintaining the initial treatment plan can be accurately predicted based on age and preoperative attitudes. Patient expectations about pain relief should be addressed preoperatively, particularly with younger patients, for optimal results. Both techniques, IV and epidural PCA, result in high levels of satisfaction and good pain relief regardless of the type of surgery.

### References

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