A Randomized Controlled Trial Comparing Patient-Controlled and Physician-Controlled Sedation in the Emergency Department

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Study objective: We compare patient-controlled sedation (PCS) and emergency physician–controlled sedation (EPCS) with respect to propofol requirements, depth of sedation, adverse events, recovery time, physician satisfaction, and patient satisfaction in emergency department (ED) patients requiring brief but painful procedures.

Methods: One hundred sixty-six patients in this randomized controlled trial received propofol sedation according to one of 2 regimens: infusion of propofol at doses determined by the treating physician (EPCS group) or infusion of propofol with a patient-controlled infusion pump (PCS group). The PCS group received an initial physician-controlled bolus following by self-administered doses. Depth of sedation was assessed at 3-minute intervals. Adverse events were recorded as they occurred. Physician and patient satisfaction were recorded with 100-mm visual analog scales.

Results: There was a nonsignificant trend toward lower total propofol doses with PCS relative to EPCS (medians 1.36 versus 1.60 mg/kg, respectively; median difference –0.15 mg/kg; 95% confidence interval of the difference –0.33 to 0.05 mg/kg; \( P = .14 \)). Adverse events, requirement for treatment of adverse events, and recovery time did not differ in the 2 groups. Depth of sedation was lower in the PCS group. Procedural success, ease of procedure, and patient satisfaction were similar in both groups despite nearly twice as many patients recalling the procedure in the PCS group and 15% of patients requiring additional physician-administered doses in the PCS group.

Conclusion: Compared with EPCS, PCS demonstrated similar propofol dosing, safety, recovery, and satisfaction but resulted in lighter sedation. Propofol PCS appears safe and effective for ED procedures requiring moderate rather than deep sedation. [Ann Emerg Med. 2010;56:502-508.]

Please see page 503 for the Editor’s Capsule Summary of this article.

INTRODUCTION

Background

Procedural sedation is frequently used in emergency departments (EDs) for reduction of fractures and dislocations, electrical cardioversions, and other painful but brief procedures. One potent short-acting sedative agent that has gained popularity in this setting is propofol. Propofol is advantageous in that it has a rapid onset, short duration of action, antiemetic effect, and a high degree of patient satisfaction. However, sedatives such as propofol exhibit interindividual variability in both pharmacokinetic and pharmacodynamic responses. Thus, there is the potential for both under- and oversedation, with the latter being potentially more severe. The most common adverse events observed with oversedation are respiratory depression and apnea.

Importance

Patient-controlled sedation (PCS) is a technique that has been tested to optimize the dose of propofol and reduce oversedation during procedural sedation by allowing the patient to control the depth of his or her own sedation during a painful procedure. The technique is analogous to patient-controlled analgesia with a patient-controlled analgesia infusion pump. PCS can be used only for moderate, not deep, sedation because the fundamental assumption is that patients have access to their internal pain or comfort state that allows them to titrate and regulate the dose of analgesic and sedative agents to their...
Editor’s Capsule Summary

What is already known on this topic
Patient-controlled pumps safely and effectively permit hospital inpatients to self-titrate opioids.

What question this study addressed
Can these same patient-controlled pumps be used for emergency department patients to self-titrate propofol sedation?

What this study adds to our knowledge
In this 166-patient randomized controlled trial, patient-controlled propofol achieved lighter sedation depth than when physician-administered, but otherwise exhibited similar parameters of safety and efficacy.

How this is relevant to clinical practice
Patient-controlled propofol sedation appears safe and feasible for settings in which no more than moderate sedation is required.

Goals of This Investigation
The goal of this study was to provide an initial investigation of dose requirements, safety, and efficacy of PCS in the ED setting. Given that PCS is purported to optimize the propofol dose and reduce oversedation, our primary hypothesis was that the total propofol dose would be lower in the PCS group compared with that in the traditional emergency physician–controlled sedation (EPCS) group. Furthermore, we compared PCS and EPCS with respect to depth of sedation, adverse events, recovery time, and patient and physician satisfaction.

MATERIALS AND METHODS

Study Design
An unblinded randomized controlled trial was conducted. Given that patients or physicians were administering the sedation, it was not possible to blind the physician or patient to treatment allocation. Bias was minimized by ensuring concealment of the treatment allocation until consent was obtained and the patient was enrolled in the trial.

Setting
The study was conducted in the ED of an adult inner-city university hospital. The city has a population of 1.8 million. The ED treats more than 70,000 patients per year, with a diverse case mix. Attending emergency physicians have been using propofol as the sedative of choice for procedural sedation in this department for more than 5 years. Other sedative agents occasionally used for procedural sedation include ketamine and nitrous oxide. The study was approved by the hospital’s Human Research Ethics Committee.

Selection of Participants
Patients requiring mild to moderate procedural sedation as part of their treatment in the ED were eligible for inclusion. Patients were excluded if they had a history of propofol intolerance (including sensitivity to eggs and soybeans) or had a physical disability that prevented their use of a patient-controlled analgesia hand pump. Pregnant individuals, those younger than 16 years, and individuals who had cognitive or communication difficulties that impaired their understanding of the PCS procedure or the obtaining of informed consent were also excluded. The treating physician was responsible for the assessment of eligibility and obtaining informed written consent. Eligible patients not enrolled in the study were mostly sedated with propofol, according to our current practices.

The randomization sequence was generated with the aid of a random-number table by a research assistant not involved in patient enrollment. Participants were randomized into blocks of 4. Random allocation concealment was implemented through the use of serially numbered, tamper-evident envelopes. The envelopes contained group assignment, study instructions, and data sheets.

Interventions
The primary drug used for sedation in both arms of the trial was propofol. The treating physician was able, theoretically, to add any further drugs to aid in the sedation. Analgesic agents were not prescribed specifically by the study protocol but were permissible in both arms of the study before and during the procedure. The choice of analgesic agents and their dose was at the discretion of the treating physician. According to current practice, the EPCS group received propofol sedation at dosages determined by the treating physician according to his or her own judgment. The PCS group underwent sedation with a patient-controlled infusion pump containing propofol. The pump used in the trial was a Master PCA Pump (Fresenius Kabi, Homberg, Germany). An initial bolus of 0.75 mg/kg (or 0.5 mg/kg if the patient was older than 65 years) was delivered by the physician. This dose was chosen because it reflects the initial propofol dose that has historically been administered by Australian emergency physicians. The initial dose was followed by patient-administered increments of 20 mg, with a lockout period of 1 minute. Subsequent doses were not weight based because the patient-controlled analgesia pump can be programmed to provide only 1 dose to all patients. Any patient
determined to be undersedated to a level affecting his or her well-being within the PCS arm of the trial could be administered additional 20-mg bolus doses by the treating physician. One physician was responsible for the sedation and a separate physician was responsible for the procedure. The physicians were emergency medicine residents or attending physicians.

Methods of Measurement

After enrollment, the treating nurse recorded basic demographic information, patient weight, fasting status, and type of procedure. The nurse then continued to monitor vital signs continuously and record these every 3 minutes during the procedure. In the EPCS group, the dose of propofol was prospectively recorded by the patient’s nurse. In the PCS group, the dose of propofol was obtained from the patient-controlled analgesia machine at the end of the trial and recorded on the patient’s data sheet. Other data recorded by the treating nurse included depth of sedation, adverse events, length of sedation, physician’s rating of the ease of the procedure, patient satisfaction with the procedure, patient recall, and success of the procedure. Depth of sedation was scored every 3 minutes with a modification of the Observers Assessment of Alertness/Sedation Scale.9 A ready response when spoken to in normal tone was scored a 5; a lethargic response, a 4; a response after loudly or repeatedly calling the patient’s name, a 3; and a response to physical stimulus, a 2. No response for each of the preceding was scored a 1 and no response to a painful stimulus was scored a 0. The study ended when the sedation score returned to 5 for 2 consecutive readings at least 3 minutes apart.

Overall depth of sedation was defined as the deepest level of sedation achieved. Length of sedation was defined as the interval from the time propofol was administered to the time of return to consciousness (defined as a sedation score of 5 for at least 3 minutes). Physicians and patients rated their satisfaction by using paper-and-pencil 100-mm visual analog scales.10 Such ratings were obtained at the end of the procedure. Adverse events were recorded throughout the procedure and included pulse rate less than 60 or greater than 120 beats/min, systolic blood pressure less than 80 or greater than 180 mm Hg, respiratory rate less than 10 breaths/min, loss of end tidal carbon dioxide (ETCO2) trace on capnography, 10 mm Hg increase in ETCO2, obstructed airway requiring airway manipulation or use of airway adjuncts, SaO2 less than 90%, vomiting, or aspiration of stomach contents. ETCO2 and SaO2 measurements were continuously monitored and recorded every 3 minutes, along with vital signs. Loss of ETCO2 tracing was determined from a visual inspection in real time.

Outcome Measures

The primary outcome measure was total propofol dose per kilogram of body weight. Previous research has demonstrated that mean total EPCS propofol dose provided to ED patients is 1.8 mg/kg, with SD = 1.0.8 The investigators believed that adequate sedation could occur at 1.3 to 1.4 mg/kg. Therefore, a 25% reduction in total propofol dose was determined a priori to be clinically significant. With these criteria, with a significance level of .05 and power of 0.80, 80 patients were needed in each of the 2 trial arms. Secondary outcome variables included depth of sedation, adverse events, length of sedation, physician’s rating of the ease of the procedure, and patient satisfaction with the procedure. We chose dose per kilogram as the primary outcome measure rather than the more clinically relevant outcome of adverse events because of the low frequency of such events. It was anticipated that detecting changes in adverse events would require a sample size that would be excessively large for this initial trial.

Primary Data Analysis

Data were analyzed on an intention-to-treat basis. All statistical analyses involved 2-tailed tests with SPSS version 15 (SPSS, Inc., Chicago, IL) for Windows and confidence interval (CI) analysis, version 2, University of Southampton (Confidence Interval Analysis for Windows). P<.05 was considered statistically significant. The primary outcome variable did not conform to the gaussian distribution; therefore, total dose in the PCS and EPCS groups was compared with the Mann-Whitney U test. Secondary outcomes were reported with descriptive statistics.

RESULTS

During the 12-month study period, from December 2007 to December 2008, 80 patients were randomized to PCS and 86 to EPCS groups (Figure 1). Baseline characteristics were similar between the 2 groups (Table 1). Four patients, 2 in each group,
received midazolam in addition to propofol, without an obvious indication other than to augment the sedation.

Total propofol dose was slightly lower in the PCS (median = 1.36 mg/kg; interquartile range [IQR] = 1.05 to 1.89 mg/kg) than in the EPCS groups (median = 1.60 mg/kg; IQR = 1.16 to 2.14 mg/kg) (Figure 2). However, this difference was smaller than anticipated and was not statistically significant (median difference = –0.15; 95% CI of the difference = –0.33 to 0.05; P = .14). Examination of the data indicated that the difference between the groups may have been minimized by 2 factors. The first was the Hawthorne effect, whereby physicians reduced the dose after seeing the doses self-administered by patients. Specifically, in the first 6 months of the study, the total propofol dose (milligrams/kilogram) in the PCS group was 26% lower than that in the EPCS group. However, this difference was not evident in the second 6 months, in which the total propofol dose was similar between the PCS and EPCS groups (Figure 2). The second factor was that fentanyl use may have reduced the propofol dose in the EPCS group. The majority of patients in both the EPCS (71%) and PCS (63%) groups received fentanyl, and for those patients in the PCS group, fentanyl use did not affect the overall dose of propofol provided. However, in the EPCS group, patients who received fentanyl received a 28% lower total propofol dose than patients who did not receive fentanyl (Figure 2; Figure E1, available online at http://www.annemergmed.com).

Lighter sedation was observed in the PCS compared with the EPCS group (Figure 3A). As shown in Figure 3B, depth of sedation is important because individuals who were more deeply sedated tended to have a higher requirement for treatment of adverse events. We found no significant difference between

**Table 1. Baseline characteristics of patients in the EPCS and PCS groups.**

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>EPCS (n=86)</th>
<th>PCS (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, No. (%)</td>
<td>43 (50)</td>
<td>46 (57.5)</td>
</tr>
<tr>
<td>Age, y, median (IQR)</td>
<td>39 (22.8–57.3)</td>
<td>39 (25–59.8)</td>
</tr>
<tr>
<td>Weight, kg, median (IQR)</td>
<td>74.5 (64.8–85)</td>
<td>75 (65–90)</td>
</tr>
<tr>
<td>ASA status, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1*</td>
<td>70 (83.3)</td>
<td>66 (83.5)</td>
</tr>
<tr>
<td>2</td>
<td>14 (16.3)</td>
<td>11 (13.8)</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>2 (2.5)</td>
</tr>
<tr>
<td>Procedure, No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction of wrist, hand, or finger</td>
<td>45 (52.3)</td>
<td>43 (53.8)</td>
</tr>
<tr>
<td>Reduction of foot or ankle</td>
<td>14 (16.3)</td>
<td>9 (11.3)</td>
</tr>
<tr>
<td>Reduction of dislocated hip</td>
<td>2 (2.3)</td>
<td>5 (6.3)</td>
</tr>
<tr>
<td>Reduction of dislocated shoulder</td>
<td>18 (20.9)</td>
<td>13 (16.3)</td>
</tr>
<tr>
<td>Reduction of dislocated elbow</td>
<td>3 (3.5)</td>
<td>6 (7.5)</td>
</tr>
<tr>
<td>Other reduction</td>
<td>3 (3.5)</td>
<td>3 (3.8)</td>
</tr>
<tr>
<td>Incision and drainage of abscess</td>
<td>1 (1.2)</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Analgesia requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morphine, mg median (IQR)</td>
<td>0.0 (0–5)</td>
<td>2.5 (0–5)</td>
</tr>
<tr>
<td>Fentanyl, μg, median (IQR)</td>
<td>50 (0–50)</td>
<td>35 (0–50)</td>
</tr>
<tr>
<td>Patients receiving midazolam, no. (%)</td>
<td>2 (2.3)</td>
<td>2 (2.5)</td>
</tr>
</tbody>
</table>

ASA, American Society of Anesthesiologists.

*Total % may not equal 100 because of missing data.

Figure 2. Total propofol dose, total propofol dose in the first and final halves of the study, and total propofol dose with and without fentanyl in the PCS and EPCS groups.

Whiskers present the minimum and maximum value, X indicates the median value, and the box represents the 25th and 75th percentile.

Figure 3. Depth of sedation and treatment of adverse events. A, Deepest level of sedation recorded in the EPCS and PCS groups. B, Depth of sedation and need for treatment for adverse events.
adverse events and percentage of patients requiring treatment of adverse events in the PCS compared with the EPCS group, although there were trends favoring the PCS group (Table 2). The most common adverse event experienced in both the PCS and EPCS groups was respiratory depression (loss of ETCO₂ trace), which was treated with painful stimuli, chin lift, or jaw thrust. One patient in the EPCS group required bag-valve-mask ventilation.

Table 2. Adverse events.

<table>
<thead>
<tr>
<th>Adverse event</th>
<th>EPCS (n=86)</th>
<th>PCS (n=80)</th>
<th>Difference</th>
<th>95% CI of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse events, No. (%)</td>
<td>21 (24.4)</td>
<td>16 (20)</td>
<td>↓ 4.4</td>
<td>−8.3–16.8</td>
</tr>
<tr>
<td>Pulse rate &lt;60 beats/min, No. (%)</td>
<td>3 (3.5)</td>
<td>3 (3.8)</td>
<td>↑ 0.3</td>
<td>−7.3–6.5</td>
</tr>
<tr>
<td>Pulse rate &gt;120 beats/min, No. (%)</td>
<td>1 (1.2)</td>
<td>0</td>
<td>↑ 1.2</td>
<td>−3.5–6.3</td>
</tr>
<tr>
<td>Systolic blood pressure &lt;80 mm Hg, No. (%)</td>
<td>1 (1.2)</td>
<td>0</td>
<td>↑ 1.2</td>
<td>−3.5–6.3</td>
</tr>
<tr>
<td>Systolic blood pressure &gt;180 mm Hg, No. (%)</td>
<td>0</td>
<td>3 (3.8)</td>
<td>↑ 3.8</td>
<td>−10.5–1.2</td>
</tr>
<tr>
<td>Respiratory rate &lt;10 breaths/min, No. (%)</td>
<td>6 (7.0)</td>
<td>3 (3.8)</td>
<td>↑ 3.2</td>
<td>−4.5–11.0</td>
</tr>
<tr>
<td>Loss of ETCO₂ trace, No. (%)</td>
<td>10 (11.6)</td>
<td>9 (11.3)</td>
<td>↓ 0.4</td>
<td>−9.8–10.3</td>
</tr>
<tr>
<td>10 mm Hg increase in ETCO₂, No. (%)</td>
<td>1 (1.2)</td>
<td>1 (1.3)</td>
<td>↑ 0.1</td>
<td>−5.6–5.2</td>
</tr>
<tr>
<td>Obstructed airway, No. (%)</td>
<td>6 (7.0)</td>
<td>1 (1.3)</td>
<td>↑ 5.7</td>
<td>−0.9–13.2</td>
</tr>
<tr>
<td>SaO₂ &lt;90%, No. (%)</td>
<td>0</td>
<td>1 (1.3)</td>
<td>↑ 1.3</td>
<td>−6.7–3.1</td>
</tr>
<tr>
<td>Treatment required for adverse events, No. (%)</td>
<td>17 (19.8)</td>
<td>8 (10)</td>
<td>↑ 9.8</td>
<td>−1.3–20.5</td>
</tr>
<tr>
<td>Painful stimuli to stimulate breathing, No. (%)</td>
<td>10 (11.6)</td>
<td>4 (5.0)</td>
<td>↑ 6.6</td>
<td>−2.2–15.6</td>
</tr>
<tr>
<td>Chin lift or jaw thrust, No. (%)</td>
<td>13 (15.1)</td>
<td>7 (8.8)</td>
<td>↑ 6.4</td>
<td>−3.9–16.4</td>
</tr>
<tr>
<td>Bag-valve-mask ventilation, No. (%)</td>
<td>1 (1.2)</td>
<td>0</td>
<td>↑ 1.1</td>
<td>−3.5–6.2</td>
</tr>
<tr>
<td>Number of patients for whom the procedure was successful</td>
<td>78* (95.1)</td>
<td>75† (97.4)</td>
<td>↑ 2.3</td>
<td>−9.5–4.8</td>
</tr>
</tbody>
</table>

*Overall n=82 because data were not available for 4 patients.
†Overall n=77 because data were not available for 3 patients.

Median difference is 0, 95% CI of the difference = -1 to 1, p =0.85.

Return to consciousness is defined as a score of 5 on the Observers Assessment of Alertness/Sedation scale for at least 3 minutes.

**Figure 4.** Time to return to consciousness in the EPCS and PCS groups.

The most common adverse event that occurred in both the PCS and EPCS groups was respiratory depression (loss of ETCO₂ trace), which was treated with painful stimuli, chin lift, or jaw thrust. One patient in the EPCS group required bag-valve-mask ventilation.

Recovery time did not differ (Figure 4), and there was no difference in patient satisfaction between the EPCS and PCS groups (Figure E2, available online at http://www.annemergmed.com). Moreover, physician rating of the ease of the procedure did not differ between the 2 groups (Figure E3, available online at http://www.annemergmed.com). However, 13 patients in the PCS group required the physician to intervene and provide an additional dose before the 1-minute lockout had expired. Eight patients received 1 additional bolus from the physician, 4 patients received between 2 and 3 additional boluses from the physician, and 1 patient received 7 additional boluses from the physician. Figure 5 demonstrates that the number of patients who found the procedure painful and the number of patients who found the sedation adequate in the EPCS and PCS groups were similar. However, the number of patients who recalled the procedure was higher in the PCS compared with the EPCS group.

**LIMITATIONS**

The limitations of the trial are its unblinded nature, creating the likely presence of a Hawthorne effect, which was unexpected and rendered the initial assumptions about potential for dose reduction too optimistic. The change in dosing practices in the EPCS group could be explained by the patients’ positive feedback at the conclusion of the PCS procedures. Lower PCS doses in the early part of the trial, accompanied by lighter levels of sedation, could then be observed by physicians to have no
influence on procedural success or patient satisfaction. The EPCS group may have started to converge with PCS dosing inadvertently. A blinded randomized controlled trial would be necessary to further elucidate whether PCS is associated with dose reductions.

A second limitation of this study is that our sample size calculation was based on a 25% reduction in propofol dose. We focused on total propofol dose because there has been evidence in the literature that lower propofol dose is associated with fewer adverse events and shorter recovery time.\textsuperscript{8,11,12} However, it would have been optimal to examine a more clinically relevant outcome, such as adverse events, as the primary outcome. The large number of participants required to compare a low-frequency outcome such as adverse events meant that this study was not significantly powered to compare this outcome statistically.

**DISCUSSION**

To our knowledge, this is the first study examining PCS for ED procedures. The results indicate support for PCS as an alternative to EPCS for moderate sedation in the ED. Compared with EPCS, PCS demonstrated similar propofol dosing, safety, recovery, and satisfaction but resulted in lighter sedation. Patients were more likely to recall the procedure in the PCS compared with the EPCS group. PCS therefore appears to provide a safe and efficacious alternative to EPCS. These results are in line with those of previous studies that have examined PCS for procedures performed outside the ED setting, such as for dental treatment.\textsuperscript{13-16} colonoscopy,\textsuperscript{17} transvaginal oocyte retrieval,\textsuperscript{18} shock-wave lithotripsy,\textsuperscript{19,20} and burn-dressing changes.\textsuperscript{21} All have reported that PCS is safe and effective for patients. One small study of local anesthetic augmentation with PCS was reported for ED repair of hand injuries.\textsuperscript{22} Our study adds to the literature by demonstrating that PCS with propofol can provide a safe and effective alternative to the traditional EPCS for the spectrum of painful procedures performed in the ED.

Patient satisfaction was high in both groups despite greater numbers of patients in the PCS group recollecting the procedure. The recollection of pain was no different between the groups. It was beyond the scope of this trial to determine why PCS was associated with high levels of patient satisfaction despite increased awareness of the procedure itself. However, previous research has indicated that PCS may enhance satisfaction by conferring a sense of control over an unpleasant stimulus.\textsuperscript{23} Observational studies confirm that patients experience high levels of satisfaction when they have a degree of control over their own sedation and, if given the option, would preferentially use PCS again.\textsuperscript{15} Some patients, however, are anxious about the prospect and decline participation. Indeed, up to one quarter of patients assessed to be eligible for this study declined to take part, presumably because they did not wish to risk being in the PCS arm of the trial.\textsuperscript{24} Heuss et al\textsuperscript{17} similarly found that 35% of eligible patients in his cohort were unwilling to undergo PCS. PCS then remains an option for those patients willing to actively participate in their sedation and who are not overtly anxious.

There was no demonstrable decrease in the duration of sedation in the PCS group of this study, which is in contrast to previous research that has observed that PCS is associated with reduced recovery time for patients undergoing operating room procedures.\textsuperscript{16} The temporal dosing profile for patients in the EPCS group in our trial was not recorded with enough rigor (ie, more frequently than a 3-minute window) to make any meaningful comparisons with PCS. Anecdotally, onset of and time to maximal sedation was slightly delayed in the PCS group. The forced 1-minute lockout between doses and smaller boluses likely offset earlier higher doses in the EPCS group, resulting in similar overall durations of sedation.

This study did highlight several logistic difficulties with the use of PCS. Emergency physicians intervened and provided additional sedation to approximately 15% of patients in the PCS group, presumably because the patient was determined to be undersedated to a level affecting the patient’s well-being. There was also one instance in which the PCS machine did not work. Despite these difficulties, physician ratings of the ease of performing the procedure and adequacy of sedation were similar in the 2 groups.

PCS is safe and efficacious in the ED setting for a range of procedure types. It is well tolerated by patients despite an increased recall of the procedure itself. Modest dose reductions are possible, depending on the prevailing dosage protocols of the ED.

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**Author contributions:** AB, KC, and SR conceived the study and designed the trial. AB and JG obtained research funding. AB supervised the conduct of the trial and data collection. AD trained staff in the use of the device and assisted in data collection. TL managed the data, including quality control, and assisted in data collection. JG cleaned and analyzed the data and drafted the article with AB. AB takes responsibility for the paper as a whole.

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REFERENCES


Figure E1. Relationship between total propofol dose and total fentanyl dose in the PCS and EPCS groups.

Figure E2. Patient satisfaction in the EPCS and PCS groups.

Median difference is 0, 95% CI of the difference = 0 to 2, p =0.20.

Patient satisfaction is measured on a 100mm visual analog scale ranging from least to most satisfied.
Figure E3. Physician’s rating of the ease of procedure in the EPCS and PCS groups.