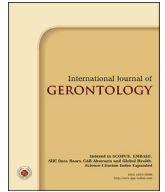


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## Original Article

## Comparative Analysis of Different Methods of Pain Management for Elderly Patients in the Surgical Intensive Care Unit

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## SUMMARY

**Background:** With technological advancements, more elderly patients are undergoing surgery and require care from surgical intensive care units. We aimed to determine the pain management method that provides better acute pain control in all-cause elderly surgical intensive care unit patients.

**Methods:** This retrospective cohort study included a chart review of patients treated in a 26-bed surgical intensive care unit from April 2011 through September 2012. The patient exclusion criteria were as follows: unconscious, uncooperative, <65 years, post-brain surgery, or had an American Society of Anesthesiologists classification <III. The primary aim was to compare visual analogue scale (0–100) scores between three different methods of pain management. The secondary endpoints were patient satisfaction and determinants of patient satisfaction.

**Results:** We evaluated 580 patients. The average age was 76 years, and 57% were male. At rest, the patient-controlled epidural analgesia group exhibited significantly lower pain scores ( $12.06 \pm 9.53$ ) compared with the other two groups. During movement, the patient-controlled epidural analgesia and pethidine/nonsteroidal anti-inflammatory drugs groups showed no difference; both exhibited lower pain scores than the patient-controlled analgesia group ( $41.38 \pm 12.5$ ). While coughing, the pethidine/nonsteroidal anti-inflammatory drugs group exhibited lower scores ( $39.67 \pm 24.50$ ) than the patient-controlled epidural analgesia and patient-controlled analgesia groups. The patient-controlled epidural analgesia group showed highest patient satisfaction ( $4.27 \pm 0.51$ ). Stepwise multiple linear regression analysis revealed that patient satisfaction was associated with patient-controlled epidural analgesia (positively) and T-piece trial (negatively).

**Conclusion:** Patient-controlled epidural analgesia appears to be a better choice for acute pain management for all-cause elderly surgical intensive care unit patients.

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## 1. Introduction

Life expectancy has increased over the years due to improvements in living conditions and advancements in medical technology. According to the Council for Economic Planning and

Development, the elderly (over 65 years old) will represent 32.89% of Taiwan's total population by 2041.<sup>1</sup>

Advancements in medical technology have led to significant developments in the fields of anesthesia and surgery. A greater number of elderly patients now benefit from an increasing variety of surgical procedures.<sup>2</sup> Therefore, it is essential to ascertain better postoperative care for the critically ill elderly. Intensive care units (ICUs) may provide the necessary support in this regard.

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Previous studies have shown that stable hemodynamic status and optimal pain management<sup>3</sup> serve to decrease perioperative morbidity and mortality.<sup>4</sup> Although pain sensation in humans decreases with age, postoperative acute pain still activates the sympathetic nervous system, leading to stress reactions that increase the burden on the heart and lungs; induce insomnia; and reduce gastrointestinal motility, wound healing, and immune reactions. Inadequate acute pain relief may cause reduced postoperative physical activity, increasing the possibility of atelectasis, thromboembolism, urinary retention, and fecal impaction.<sup>5</sup>

Acute pain management of the elderly requires special care. This population is often treated with lower doses of pain medication due to decreased cardiopulmonary reserve and slower drug metabolism. Insufficient pain relief may cause further complications, such as myocardial infarction.<sup>6</sup> The benefits of effective postoperative analgesia include early rehabilitation and smooth recovery,<sup>1</sup> decreased perioperative morbidity and mortality,<sup>7</sup> and decreased length of stay in both the ICU and the hospital, which can also result in reduced medical costs.<sup>8</sup>

Elderly patients admitted to the surgical ICU (SICU) postoperatively may experience severe acute pain and may need special postoperative analgesia. There have been a number of studies comparing the effects and benefits of different techniques of analgesia<sup>9</sup> or pain management,<sup>10–13</sup> but few studies focus on ICU patients, either due to fewer cases available or because of focus on some other specific factors,<sup>3,14,15</sup> including sedation.<sup>16–18</sup> There have been even fewer studies on elderly SICU patients.

The present study was designed to determine which method of pain management provided better acute pain control for all-cause elderly patients in a SICU.

## 2. Materials and methods

This was a retrospective cohort study approved by the Institutional Review Board of our hospital. The requirement for informed consent from the study subjects was waived by the Review Board.

In our hospital, intravenous pethidine/nonsteroidal anti-inflammatory drugs (NSAIDs), intravenous patient-controlled analgesia (PCA), and patient-controlled epidural analgesia (PCEA) are the three most commonly used methods for management of postoperative acute pain. Before surgery, each patient receives information on the PCA or PCEA device. Although intravenous pethidine/NSAIDs are prescribed for moderate pain and are covered by the Taiwan National Health Insurance, if patients choose to pay for self-controlled analgesia, they are first evaluated by an anesthesiologist or a specialized medical professional before being instructed on how to correctly use the PCA or PCEA device (i.e., to push a button in response to pain or prior to a known pain-inducing event). The PCA or PCEA pump functions are set by the anesthesiologist.

All anesthesiology department nurses are trained to evaluate postoperative acute pain and potential adverse events associated with anesthesia. They visit all patients once on postoperative day 1, i.e., within 24 h after surgery. Additionally, each nurse that visits patients has passed an examination on the questionnaire administered to the patients (Table 1) to ensure sufficient training. Furthermore, anesthesiology nurses have attended monthly case discussion meetings at least twice.

We conducted a chart review of 1872 selective and emergency surgery patients of a 26-bed SICU (located at a 1029-bed medical center in northern Taiwan) from April 2011 through September 2012. Patients who were admitted to the SICU but did not have anesthesia and surgery records available were not included in the chart review. Patients aged <65 years and with an American Society of Anesthesiologists (ASA) classification < III were excluded from the

study. Post-brain surgery patients and those who were unconscious or uncooperative on postoperative day 1 were also excluded.

We analyzed the charts of 580 elderly SICU patients. The primary endpoint was a comparison, by means of a visual analogue scale (VAS; rating 0–100), of three different methods of pain management (intravenous pethidine/NSAIDs, intravenous PCA, and PCEA) under three different conditions: at rest (general condition), during movement (e.g., while taking a bath in bed or during wound care), and during significant movement (e.g., coughing). The VAS is a tool used to “measure” the severity of pain, which is not directly measurable, by asking the patient to point out a position along a continuous line between two end-points (the line is marked 0–100).<sup>19</sup>

The secondary endpoints were patient satisfaction and determinants of patient satisfaction (e.g., pain management method used, respiratory support used, and consciousness on the Glasgow Coma Scale). Patient satisfaction was evaluated using patient satisfaction scores, where patients scored their satisfaction from 1 to 5, with 1 indicating complete dissatisfaction and 5 indicating complete satisfaction, under three different conditions: at rest, during movement, and while coughing.

The 580 elderly SICU patients whose charts were reviewed had received postoperative analgesia using one of the following techniques:

- (1) Intravenous pethidine or NSAIDs when necessary (pethidine/NSAIDs group; N = 449). Apart from when patients complained of acute pain, the SICU staff evaluated the patients every 4 h after their admission. Medication was provided if needed.
- (2) Intravenous patient-controlled analgesia (PCA group; N = 62). The PCA pump is an electronically controlled, peristaltic infusion pump. The PCA morphine concentration was 1 mg/mL. The PCA infusion pump was connected to the intravenous infusion set, and a 2-mL (2 mg) loading dose of morphine was administered before the patient was sent to the post-anesthesia care unit. For postoperative pain control, patients received additional bolus doses of 1 mL (1 mg), with a 6–10 min lock-out interval, and a 4-h limit of 20–30 mL (20–30 mg). PCA was maintained throughout the first 72 postoperative hours.
- (3) Patient-controlled epidural analgesia (PCEA group; N = 69). An epidural catheter was inserted at the thoracic (for thoracic surgery) or lumbar (for abdominal surgery) level before induction of anesthesia. PCEA commenced with a loading dose of 10 mL (0.2 µg/mL levobupivacaine with 2 µg/mL fentanyl), followed by a continuous infusion from the PCEA pump at 4–8 mL/h with a patient-controlled bolus dose of 2–5 mL, a 10–15 min lock-out interval, and a 4-h limit of 30–45 mL. PCEA was also maintained throughout the first 72 postoperative hours. PCEA is similar to PCA, but provides a continuous, rather than intermittent, infusion of analgesia.

### 2.1. Statistical analysis

Unless otherwise stated, continuous variables were examined by one-way analysis of variance with Scheffe's post hoc test and are expressed as the mean ± standard deviation (SD). The distribution of the data was assessed with the Kolmogorov–Smirnov test. Each comparison of numerical variables was performed using an unpaired *t*-test (parametric data) or a Mann–Whitney *U* test (nonparametric data). The level of significance was set at *p* < 0.05. Categorical variables were expressed as a number and percentage for each item and analyzed using a chi-square test or Fisher's exact

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