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Original Article

Survival analysis of postoperative nausea and vomiting in patients receiving patient-controlled epidural analgesia

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Abstract

Background: Postoperative nausea and vomiting as well as postoperative pain are two major concerns when patients undergo surgery and receive anesthetics. Various models and predictive methods have been developed to investigate the risk factors of postoperative nausea and vomiting, and different types of preventive managements have subsequently been developed. However, there continues to be a wide variation in the previously reported incidence rates of postoperative nausea and vomiting. This may have occurred because patients were assessed at different time points, coupled with the overall limitation of the statistical methods used. However, using survival analysis with Cox regression, and thus factoring in these time effects, may solve this statistical limitation and reveal risk factors related to the occurrence of postoperative nausea and vomiting in the following period.

Methods: In this retrospective, observational, uni-institutional study, we analyzed the results of 229 patients who received patient-controlled epidural analgesia following surgery from June 2007 to December 2007. We investigated the risk factors for the occurrence of postoperative nausea and vomiting, and also assessed the effect of evaluating patients at different time points using the Cox proportional hazards model. Furthermore, the results of this inquiry were compared with those results using logistic regression.

Results: The overall incidence of postoperative nausea and vomiting in our study was 35.4%. Using logistic regression, we found that only sex, but not the total doses and the average dose of opioids, had significant effects on the occurrence of postoperative nausea and vomiting at some time points. Cox regression showed that, when patients consumed a higher average dose of opioids, this correlated with a higher incidence of postoperative nausea and vomiting with a hazard ratio of 1.286.

Conclusion: Survival analysis using Cox regression showed that the average consumption of opioids played an important role in postoperative nausea and vomiting, a result not found by logistic regression. Therefore, the incidence of postoperative nausea and vomiting in patients cannot be reliably determined on the basis of a single visit at one point in time.

Keywords: epidural analgesia; logistic models; patient-controlled analgesia; postoperative nausea and vomiting; survival analysis

1. Introduction

Postoperative nausea and vomiting and postoperative pain are two major concerns in patients receiving surgeries and anesthetics.[1] Frequently, postoperative nausea and vomiting occurs in patients receiving general, regional, or local anesthesia and causes significant suffering.[2–4] Sometimes, patients prefer to endure postoperative pain rather than receive opioids that may result in postoperative nausea and vomiting,[5] and

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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may even voluntarily pay more to obtain effective antiemetic therapies.[6]

Previous studies attempted to investigate the incidence and risk factors of postoperative nausea and vomiting using different predictive models.[7–10] However, the incidences of postoperative nausea and vomiting explored in previous studies ranged from 10% to 30% in general anesthesia[2,11–14] and from 3.2% to 34% in patients receiving patient-controlled epidural analgesia.[15–21] This disparity may be attributable to the different time points used when the patients were visited. Postoperative nausea and vomiting could occur several minutes, hours, or even days after anesthesia. If the investigation of postoperative nausea and vomiting is limited to a specified time point, the analysis will be confounded.

In this study, we analyzed the information obtained by repeatedly visiting the patients to explore the risk factors and incidence of postoperative nausea and vomiting, and assessed the effects of time points, which have rarely been discussed in the literature. When considering the effects of time, survival analysis was applied to analyze the occurrence of postoperative nausea and vomiting. We compared the results obtained by logistic regression to those determined by survival analysis to elucidate the differences between the two statistical methods. This research may contribute to a clearer understanding of the incidence of postoperative nausea and vomiting.

2. Methods

In this retrospective, observational, uni-institutional (a medical center in central Taiwan) study, we analyzed the results of 229 patients receiving postsurgical patient-controlled epidural analgesia from June 2007 to December 2007. Ethical approval was obtained from the Institutional Review Board of Taichung Veterans General Hospital. The data were reviewed for patients receiving general anesthesia for the following surgeries: (1) upper abdomen surgery; (2) lower abdomen surgery; and (3) chest surgery. The composition prescription in patient-controlled epidural analgesia consists of bupivacaine (0.1%) and fentanyl (1.5 μg/mL) in normal saline (500 mL). We collected data including age, sex, body mass index, types of surgery, the setting of patient-controlled analgesia pumps, total dosage (mL) and average dosage (mL/hour) of patient-controlled epidural analgesia, and the time point of postoperative nausea and vomiting occurrence.

In our institution, patients were visited five times over a 3-day period of patient-controlled epidural analgesia use, and the five time points were as follows: (1) the first visit on operation day (OPD-1); (2) the second visit on operation day (OPD-2); (3) the third visit on the 1st postoperative day (POD-1-1); (4) the fourth visit on the 1st postoperative day (POD-1-2); and (5) the fifth and final visit on the 2nd postoperative day (POD-2). If the patient had used patient-controlled epidural analgesia on the first visit, the zero time point was backtracked by calculating the average dosage on the first visit.

When patients were receiving patient-controlled epidural analgesia, we followed up the patients and adjusted the depth of the epidural catheter or the dosage of medications according to the patients' pain intensity at rest and in motion after surgeries. Our goal was to keep the patients' pain intensity below 3 at rest and below 5 in motion by using the numeric rating scale (where 0 = no pain and 10 = most intense pain imaginable). When analgesia in the required dermatome failed or was found to be inadequate, the type of pain management would be changed to other regimens such as intravenous patient-controlled analgesia. Consequently, these patients were not included in this study.

IBM SPSS Statistics 20 (IBM SPSS Inc. Chicago, IL, USA) was used to analyze these data. The Cox proportional hazards model (Cox model) was used to determine the correlations between variables and survival time to calculate the odds ratio of the risk factors. When patients suffered from postoperative nausea and vomiting in the following periods, it was defined as the occurrence of an event. Survival time was outlined as the time duration until the occurrence of postoperative nausea and vomiting. If an event did not occur in the following period, then the patient was assumed to be censored. We also applied logistic regression to analyze the correlations between variables and the incidences of postoperative nausea and vomiting at specific time points, and compared the results with those obtained using the Cox model. Both in the Cox model and logistic regression, the forward likelihood ratio was used to identify significant variables. A p value <0.05 was considered significant.

3. Results

A total of 229 patients received patient-controlled epidural analgesia for postoperative pain control between June 2007 and December 2007. The demographic data of the patients are shown in Table 1. The settings of patient-controlled analgesia pumps were as follows: bolus dosage, 4.38 ± 0.94 mL; continuous infusion dosage, 4.25 ± 1.18 mL; lockout time, 17.9 ± 4.6 minutes; and 4-hour upper limit dosage, 46.8 ± 11.25 mL. In patients with and without postoperative nausea and vomiting, the average total dosage of patient-controlled analgesia was 106.5 ± 91.73 mL versus 279.2 ± 98.85 mL and the duration of patient-controlled analgesia use was 16 ± 14.4 hours versus 46.7 ± 6 hours, respectively. The overall incidence of postoperative nausea and vomiting was 35.4% (Table 1), and ranged from 5.5% to 17.6% at five different time points (Table 2). The highest incidence of postoperative nausea and vomiting was noted at the third visit on postoperative Day 1 (POD-1-1); the lowest was found at OPD-1 (Table 2).

Before logistic regression was applied to explore the risk factors for incidence of postoperative nausea and vomiting in patients with patient-controlled epidural analgesia, univariate analysis of candidate variables was performed. These results, as provided in Table 3, revealed that age, sex, height, and surgical sites may play significant roles in predicting the occurrence of postoperative nausea and vomiting in POD-1-1, POD-1-2, or POD-2.

At three time points (POD-1-1, POD-1-2, and POD-2), sex was found to have a significant influence on the occurrence of