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Original Article

An analysis of surgical outcomes in patients aged 80 years and older

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ABSTRACT

Objectives: Elderly patients (aged ≥ 80 years) undergo an increasing number of operations. Elderly patients undergoing operations usually develop more postoperative complications and have poorer outcomes. The aim of this study is to identify the relative importance between preoperative and intraoperative variables to predict adverse postoperative outcomes in these patients.

Methods: We retrospectively analyzed the records of 404 patients (aged ≥ 80 years and underwent a noncardiac surgery) collected from the quality assurance database in our department. We reviewed the patients' preoperative and intraoperative variables as well as postoperative complications and outcomes. Odds ratios of risk factors were then calculated by univariate and multivariate analyses. In addition, hazard ratios of incidence of discharge and mortality rates were analyzed.

Results: Overall, 26.4% of patients developed one or more postoperative complications, and the in-hospital mortality rate was 6.7%. The majority of these patients had pre-existing cardiovascular disorders such as hypertension (47.5%). Respiratory complication was the most common postoperative complication (12.9%). Multivariate analysis showed male sex, anesthesia method, and colloid infusion were risk factors for increased respiratory complication. Our results showed that patients who developed different kinds of postoperative complications had a different level of risks associated with prolonged hospital stay and mortality.

Conclusion: Patients over the age of 80 years, of male sex, under general anesthesia, and receiving colloid infusion were at a higher risk of developing respiratory complications. Postoperative respiratory complications occurred in most of the geriatric surgical patients. Efforts to improve the surgical outcomes must include measures to minimize in-hospital complications. Detailed evaluation and better communicating the aforementioned risk factors to these patients are suggested for improving anesthesia quality and surgical outcomes.

1. Introduction

With better medical quality and living conditions, the elderly population around the world is growing each year. More and more elderly patients are encouraged to receive operations that have previously been considered too risky.[1,2] However, geriatric patients often pose a significant challenge not only in emergency surgery but also in elective surgery.[3] Because of the reduction in physiological reserve, these patients may not tolerate the surgery and may also develop more complications than younger patients.[3–7]

To survey the operative mortality in elder adults, Finlayson and Birkmeyer[6] conducted a retrospective study that included 1.2 million patients aged 65–99 years who received major elective surgery. They found that mortality risk increased generally with age. Operative mortality for patients over the age of 80 years was more than two times than that for patients aged between 65 years and 69 years. A study in Japan reported that risk factors for decreased survival rate in patients aged 80 years and older who underwent surgery with general anesthesia were the male sex, dependency in daily living, and abdominal surgery.[8]

Thus, it can be seen that some elderly patients benefit from the surgery, whereas others might suffer from postoperative

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complications that may lead to a worsening situation. Therefore, studies on operative risk evaluation for geriatric patients may help physicians to decide whether to perform surgery. However, to date, such studies were not conducted in Taiwan. Therefore, the aim of our study was to assess the postoperative outcomes of Taiwanese elderly patients aged $\geq$ 80 years who underwent elective or emergent, noncardiac surgeries requiring anesthesia as well as to analyze the associated risk factors and types of complications these patients develop following surgery.

2. Materials and methods

After obtaining approval from the Review Board of Chang Gung Memorial Hospital, Taoyuan, Taiwan, we retrospectively analyzed the records of all patients aged $\geq$ 80 years and underwent elective or emergent, noncardiac surgeries requiring anesthesia from January 1, 2008 to June 31, 2008 in our anesthesia quality assurance (QA) database. The QA database was composed of a number of standardized forms (database cards). Once a patient has received anesthesia for surgery, an anesthesiologist fills out a database card and data are registered in the database using a computer in the operating room. An anesthetic nurse updates the card at the time of care. The database card contained the following data: patients' demographics, comorbidities, anesthetic technique used, perioperative anesthetic management details, and minor or major perioperative complications. Perioperative complications such as changes in blood pressure or body temperature will have representing codes that are listed in a booklet that is kept near the anesthesia machine. Anesthetic nurses will inform the anesthesiologists about these complications and will also add the representing codes in the database card. Besides, every change following anesthetic administration such as change in blood pressure, body temperature, saturation, end-tidal carbon dioxide level is automatically fed into the computer, forming an "electronic anesthesia record" during every anesthetic delivery. On the next day, a trained continuous-quality-improvement coordinator checks the written anesthesia records, database cards, and electronic anesthesia record to ensure that every intraoperative event was recorded in coordination in our database. The data are verified by the anesthesiologists, anesthetic nurses, and a trained continuous-quality-improvement coordinator either in the computer anesthesia records or in the written anesthesia records. Thus, these data in the database system are reliable. In addition, any incident that occurred in the postanesthetic recovery unit was also recorded on these database cards.

Patients who were scheduled for surgery under local anesthesia or cardiac surgery were excluded from this study. Preoperative variables including age, sex, body weight, and emergency were assessed. Medical records were reviewed if additional data were required. Preoperative physical conditions that were assumed to have possible effects on the mortality or morbidity were chosen. These included diabetes, cardiovascular disorders, pulmonary system disorders, renal system disorders, hepatic system disorders, morbid obesity, and malignancy. All of these physical conditions have specific criteria for diagnoses. Cardiovascular disorders included coronary artery disease (CAD), hypertension, and congestive heart failure. Pulmonary system disorders included a wide range of pulmonary diseases such as chronic obstructive pulmonary disease (COPD), bronchial asthma, pneumonia, or restrictive lung disease. Morbid obesity is defined as patient's body mass index (BMI) value > 40 kg/m^2. Any abnormalities in renal function and hepatic function were also assessed.

Operative data included types of anesthesia, types of surgery, intraoperative fluid administration, surgical duration, and intraoperative abnormalities such as blood pressure > 180/110 mmHg, blood pressure < 80/40 mmHg, hypothermia (body temperature < 35°C), or no extubation at the end of surgery. Types of anesthesia were divided into regional anesthesia (spinal/epidural anesthesia or nerve block), general anesthesia (patients were intubated and volatile anesthetics were used), and intravenous general (IVG) anesthesia (patients were not intubated and intravenous anesthetics were used). Types of surgeries were divided into the following eight subgroups based on their specialties: urological surgeries; general surgeries; orthopedic surgeries; neurological surgeries; proctologic surgeries; ear, nose, and throat surgeries; vascular and chest surgeries; and other surgeries (e.g., plastic, gynecological, ophthalmic, dermatological, and dental surgeries).

The surgeons reported postoperative conditions that occurred in the intensive care units (ICUs) or wards in an electronic chart every day. We obtained the data on postoperative conditions, including postoperative complications of 404 patients, by reviewing the patient's complete electronic chart, including the admission note. If patients had any of the aforementioned diagnoses preoperatively, they will be noted in the admission note by surgeons and these will not be counted as postoperative complications in the data analysis. We classified these complications into the following six types: neurological complications, cardiovascular complications, respiratory complications, renal function disorders, shock, and infection. Death of the patient was also recorded in the chart. Neurological complications were defined as the new occurrence of transient ischemic attack or stroke, intracranial hemorrhage, and seizure. Cardiovascular complications were clinically diagnosed myocardial infarction, documented ventricular tachycardia or fibrillation, and heart failure. Respiratory complications included respiratory failure requiring intubation > 48 hours, clinically diagnosed pulmonary edema, lobar, or aspiration pneumonia confirmed by chest radiography. Renal function disorders were acute renal failure and acute-on-chronic renal failure requiring dialysis. Postoperative infection required documentation of a positive culture. Postoperative death was defined as death during hospitalization or discharge due to critical condition in the ICU, ordinary wards, or even on the operating table. Other variables such as length of hospitalization and hospital mortality were also recorded and analyzed.

2.1. Statistical analysis

All data were entered into a Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) spreadsheet and statistically analyzed using SPSS version 17.0 (SPSS Inc., Troy, NY, USA). Preoperative, intraoperative, and postoperative variables were assessed using descriptive statistics for mean and standard deviation of continuous variables and frequency tables for categorical variables. Variables that had significant association with postoperative adverse outcomes on univariate analysis were entered into a stepwise multivariate logistic regression model. Using this statistical model, each variable was examined for association with postoperative adverse outcomes while controlling for all other confounding variables. Logistic regression modeling was conducted for variables with $p < 0.05$, which was considered statistically significant. The odds ratios (ORs) and 95% confidence intervals of the variables were then summarized. In addition, because outcome is either discharge from the hospital or patient's death in the end, competing risks analysis was used to analyze how these perioperative conditions affected the cumulative incidence of discharge rate or mortality rate by hazard ratio. The R software (Foundation for Statistical Computing, Vienna, Austria) was used to analyze these cumulative incidence rates. The OR indicates only the overall odds