Original Research

Propofol Use in the Elderly Population: Prevalence of Overdose and Association With 30-Day Mortality

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ABSTRACT

Purpose: Geriatric patients are more sensitive to the anesthetic effects of propofol and its adverse effects, such as hypotension, than is the general population; thus, a reduced dose (1–1.5 mg/kg) is recommended for the induction of anesthesia. The extent to which clinicians follow established dosing guidelines has not been well described. Therefore, we investigated the prevalence of propofol overdose in the elderly population to determine whether propofol overdose occurs and is associated with increased hypotension and 30-day mortality.

Methods: In this retrospective study in patients who received propofol for the induction of general anesthesia, data on demographic characteristics, preoperative medications, intraoperative management, and 30-day mortality were collected. The dose of propofol used for the induction of anesthesia and the median blood pressure in the pre- and immediate postinduction periods were determined. *Hypotension* was defined as either: (1) a decrease in mean arterial pressure (MAP) of >40% concurrent with a MAP of <70 mm Hg; or (2) a MAP of <60 mm Hg.

Findings: A total of 17,540 patients were included in the analysis; 4033 (23.0%) were aged >65 years. The median (interquartile range) propofol dose in the group aged >65 years was 1.8 (1.4–2.2) mg/kg, above the recommended dose, in comparison to 2.2 (1.9–2.5) mg/kg in younger patients. On multivariate analysis, increased propofol dose was associated with increased postinduction hypotension, especially in patients over 70 years of age, but not 30-day mortality.

Implications: Older patients received greater-than-recommended doses of propofol for induction, which may have led to significant dose-dependent hypotension. Despite this finding, the dose of propofol for induction was not independently associated with a greater 30-day mortality rate. More education regarding geriatric concerns is needed for encouraging anesthesiologists to tailor the plan for anesthesia in geriatric patients. However, overall postsurgical mortality is a function of preoperative risk and type surgical procedure. (*Clin Ther.* 2015;37:2676–2685)

Key words: 30-day mortality, elderly, propofol overdose, hypotension.

INTRODUCTION

Elderly patients constitute a large proportion of the surgical population in the United States, and anesthesiologists are often faced with the need for tailoring the anesthesia technique to account for geriatric physiology.[1] The anesthesiologist may change the selection of medications or modify dosing in an attempt to optimize postoperative outcomes. However, geriatric-specific guidelines on anesthesia do not exist, and an anesthesiologist

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may modify the technique based on a nonscientific impression of what is best for the patient.

The use of propofol in the elderly population is one specific area of equipoise. Propofol is the medication most commonly used for inducing anesthesia in surgical patients in the United States. However, a common adverse effect of propofol-based induction is dose-dependent hypotension. Propofol-related hypotension increases with dose and results from a decrease in systemic vascular resistance and, to a lesser extent, myocardial depression.[2–7] Elderly patients in particular have an increased sensitivity to this effect, leading to the manufacturers' recommendation that the dose of propofol used for induction be decreased in elderly patients from a recommended dose of 2 to 2.5 mg/kg, to 1 to 1.5 mg/kg.[8–14] Reich et al[15] reported that postinduction hypotension was associated with increased mortality despite controlling for the effects of age, preexisting hypotension, and American Society of Anesthesiologists (ASA)–defined physical status. Those investigators recommended that propofol induction be avoided in the elderly population, especially in patients with baseline low blood pressure.

Nonetheless, many anesthesiologists continue to use propofol in the elderly population instead of induction drugs that cause less hypotension, such as etomidate. There is a distinct impression that propofol is well tolerated; however, it is unclear whether anesthesiologists employ reduced doses and whether reduced propofol doses can be used for avoiding hypotension. To address these areas of equipoise, we performed a retrospective review of data from a large clinical cohort of patients aged 19 to 89 years who received propofol for the induction of general anesthesia. Our hypothesis was that elderly patients often receive propofol in excess of 1.5 mg/kg (the recommended dose for age >65 years) and that this relative overdose is associated with increased postinduction hypotension and increased 30-day mortality.

PATIENTS AND METHODS

The study protocol was approved by the Program for the Protection of Human Subjects, Icahn School of Medicine at Mount Sinai (New York, New York), and the requirement for written informed consent was waived pursuant to 45 CFR 46.101(i). Data from all inpatients and day-of-admission surgical patients aged 19 to 89 years who had received a general anesthetic with induction using intravenous propofol between January 2006 and December 2009 were included, with the exception of those undergoing cardiac or obstetric surgery (eg, cesarean section). In patients who underwent multiple surgeries in the time period studied, only data from the most recent surgery were included in the analysis. Primary outcomes were hypotension in the 10 minutes after induction and 30-day mortality.

Perioperative demographic, medication, and physiologic data were extracted from the anesthesia information management system (AIMS) (CompuRecord; Phillips Medical Systems, Andover, Massachusetts). Classification of preoperative antihypertensive medication was based on the major classes of antihypertensive medications recommended by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure for the treatment of hypertension.[16] Additional data on demographic characteristics and mortality were obtained from the institutional data warehouse. We also utilized the Social Security Administration Death Master File (National Technical Information Service, Alexandria, Virginia) as an additional source of data on mortality.

As a measure of coexisting illness, we used the both the ASA physical status score and the All Patient Refined–Diagnosis Related Group risk for mortality (APR-DRG ROM) scale score (extreme, major, moderate, and minor). ASA scores range from 1 (healthy with no comorbidities) to 5 (not expected to survive without the operation).[17] APR-DRG is a classification scheme developed by 3M (Maplewood, Minnesota) based on nationwide samples and used by Medicare to estimate resource consumption by patients.[18] ROM score is calculated based on primary and secondary discharge diagnoses and thus captures all comorbidities present during an admission. Although ASA and ROM are correlated in many conditions, they sometimes differ because the ASA score is a qualitative score assigned by the anesthesiologist, whereas ROM is determined based on administrative coding data. APR-DRG ROM has been reported to correlate well with mortality among patients in the intensive care unit and to be a suitable tool for risk adjustment of 30-day mortality in patients with acute myocardial infarction.[19–21]

Determination of Dose of Propofol Used for Induction and Co-Induction Agents

At the Icahn School of Medicine, propofol is typically injected manually, usually as a single bolus,