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Original Contribution

Does intravenous induction dosing among patients undergoing gastrointestinal surgical procedures follow current recommendations: a study of contemporary practice☆,☆☆

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Abstract

Study objective: It is recommended to correct intravenous induction doses by up to 50% for patients older than 65 years. The objectives were to determine (*a*) the degree to which anesthesia providers correct induction doses for age and (*b*) additionally adjust for American Society of Anesthesiologists physical status (ASA-PS) class (severity of illness) and (*c*) whether postinduction hypotension is more common among patients aged >65.

Design: Retrospective chart review.

Setting: Academic medical center.

Patients: A total of 1869 adult patients receiving general anesthesia for GI surgical procedures from February 2013 to January 2014.

Measurements: Patients were divided into 3 age groups (age <65, 65-79, ≥80 years) and then further stratified into ASA-PS class (I/II vs III/IV). Multiple pairwise comparisons were conducted using Welch *t* tests for continuous variables to determine whether dosing was different for the older groups vs the younger group; separate analyses were performed within and across ASA-PS class. This approach was also used to determine differences in mean arterial pressure change in the older groups vs the younger group, whereas the rates of hypotension among different age groups were compared by Cochran-Armitage trend test.

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Main results: No significant decrease in dosing between age groups was observed for fentanyl and midazolam. For propofol, there was a significantly lower dosing for older patients: 17% for patients aged 65-79 and 29% for those aged >80, which was still in less than the recommendations. An inverse relationship was observed between propofol dosing and ASA-PS class, but no consistent relationship was noted for fentanyl and midazolam. There were a significantly larger drop in mean arterial pressure and a greater likelihood of hypotension following induction in patients aged 65-79 years and >80 years as compared with those aged <65 years.

Conclusions: This study shows that the administered dose of anesthetic induction agents is significantly higher than that recommended for patients older than 65 years. This failure to age-adjust dose may contribute to hypotensive episodes.

1. Introduction

The segment of the population 65 years and older, typically defined as *elderly*, is currently the fastest growing portion of the population in the United States and the world. According to the 2010 US Census, 40 million people (13%) of the total US population of 309 million people are 65 years and over [1], and this is projected to increase to 72 million by 2030 and 86.7 million by 2050 [2]. Among the >65-year-old population, those 80 years and older are the fastest growing segment, and this presents a unique challenge to health providers. This segment of the population is the most vulnerable and is likely to have the highest number of comorbidities [3], to suffer from frailty, and to have diminishing physiological reserve [4]. As these demographics are changing, an increasing proportion of elderly patients are presenting for elevated-risk surgical procedures. Forty percent of all surgical procedures are currently performed in patients 65 years or older [5], and it is estimated that patients older than 65 years will require at least 1 surgical procedure during the remainder of their lives.

Several physiological changes that occur with aging [6] affect the pharmacokinetics (eg, slowed metabolism and redistribution) of anesthetic drugs [7]. Physiological changes occur in the central nervous system, leading to increased sensitivity to and thus potency of anesthetic drugs [8,9]. It is well known that patients who are older than 65 years require up to 50% less intravenous (IV) induction doses than younger patients [7–10]. Indeed, it is recommended that propofol dose be reduced to 1 mg/kg [11] for induction in this older group, and a major textbook of anesthesiology recommends that the initial doses of opioids should also be reduced by approximately 50% [12,13]. It is also recommended that IV induction be reduced further for patients who are frail and have *elevated severity of illness* or *burden of disease*, although these terms are not well defined. It is implicitly recognized that elderly patients are more likely to be classified as American Society of Anesthesiologists physical status (ASA-PS) class III or IV and may require even lesser amount of anesthetics [14]. Although recommendations currently exist for IV induction dosing for the elderly, it is not clear that they are being properly followed. Thus, we sought to determine the degree to which anesthesia providers (*a*) correct induction doses for age and (*b*) additionally adjust for ASA-PS class (severity of illness) and (c) whether postinduction hypotension is more common among patients aged >65 years.

2. Materials and methods

2.1. Study design

With appropriate institutional review board approval, a retrospective review was conducted of the intraoperative electronic anesthetic records of adult patients 18 years and older who received IV general anesthesia for gastrointestinal (GI) surgical procedures at Yale-New Haven Hospital, a tertiary care academic medical center, between February 2013 and January 2014. *GI surgery* was defined as any procedure involving the GI tract or gallbladder. Both laparoscopic and open abdominal procedures were included; endoscopic procedures were excluded.

2.2. Patient selection

Adult patients (n = 2471) who underwent GI procedures were identified from the electronic medical record (EMR). *Induction* was defined as the administration of IV propofol as the primary agent, with supplemental agents midazolam and/or fentanyl. Patients who underwent rapid sequence induction, monitored anesthesia care, inhalational anesthetic induction, or combined epidural-general or regional-general anesthesia, or were already intubated on arrival to the operating room were excluded. Patients who had multiple procedures or required temporary abdominal wall closure were also excluded, as were any patients with missing data points (eg, height, weight, preinduction blood pressure, postinduction blood pressure), leaving a final sample of 1869 patients (see CONSORT diagram, Fig. 1).

2.3. Data collection

The following data were extracted from preoperative and intraoperative anesthesia EMRs: patient information (age, sex, height, weight), date of surgery, attending surgeon,