

Efficiency of propofol versus midazolam and fentanyl sedation at a pediatric teaching hospital: a prospective study

Jenifer R. Lightdale, MD, MPH, Clarissa Valim, MD, ScD, Adrienne R. Newburg, AB, Lisa B. Mahoney, BS, Steven Zgleszewski, MD, Victor L. Fox, MD

Boston, Massachusetts, USA

Background: Many pediatric endoscopists are adopting propofol in their practices, with the expectation that propofol will increase their overall efficiency.

Objective and Setting: To compare the efficiency of propofol versus midazolam and fentanyl by measuring elapsed times between initial intravenous administration and patient discharge at a pediatric teaching hospital.

Design: Endoscopy times were prospectively collected for consecutive patients who were undergoing either anesthesiologist-administered propofol or endoscopist-administered midazolam and fentanyl. The effect of the type of sedation on these times was assessed by using multiple linear regression by adjusting for other candidate predictors, including concomitant use of other sedatives, endotracheal intubation by anesthesiologists, and the presence of fellow trainees.

Main Outcome Measurements: Time to onset of sedation (time sedation started to scope in), procedure time (endoscope in to endoscope out), discharge time (endoscope out to hospital discharge), and total time (sedation started to hospital discharge).

Results: The times for 134 children (mean age 12 ± 5 years) to receive propofol sedation were compared with those of 195 children (13 ± 5 years) who received midazolam and fentanyl. Midazolam and fentanyl cases disproportionately included EGDs ($P < .001$) and patients who were classified as American Society of Anesthesiologists I ($P < .03$). Patients who received propofol had shorter times until sedated, similar procedure times, longer discharge times, and comparable total times. Multivariate analyses confirmed that fellow participation prolonged the procedure times ($P < .0001$), and endotracheal intubation prolonged propofol times ($P < .01$), but adjusting for these did not change the comparison results.

Conclusions: Anesthesiologist-administered propofol sedation in a pediatric teaching endoscopy unit may not lead to faster hospital times when compared with endoscopist-administered midazolam and fentanyl. These results are not explained by controlling for patient characteristics, the presence of a trainee, the sedative doses, or endotracheal intubation for airway management. (*Gastrointest Endosc* 2008;67:1067-75.)

Academic institutions are increasingly being charged with providing efficient patient care across all settings, including pediatric endoscopy units.¹⁻³ One means of increasing efficiency may be to use propofol (2,6-diisopropylphenol) to reduce the time needed for the onset of sedation and recovery from sedation. A prevailing expectation by gastroenterologists who care for patients of all ages is that propofol administered by both

anesthesiologists and nonanesthesiologists will increase the efficiency in the endoscopy unit by decreasing the total time required for GI procedures.³⁻⁷

Propofol is highly effective at inducing sedation in children who are undergoing an upper and lower endoscopy, and provides excellent amnesia for the procedure.⁸ A growing number of pediatric endoscopists are using or planning to use propofol in their own practices, mostly with the assistance or the supervision of an anesthesiologist.³ An additional attraction has been the pharmacokinetics of propofol, which allow for rapid patient awakening even after prolonged administration.⁹ Several studies in adults found that patients who received propofol recover neurocognitive faculties more quickly than

Abbreviations: ASA, American Society of Anesthesiologists; IQR, interquartile range; OR, operating room; PACU, postanesthesia care unit.

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those who received traditional sedatives.¹⁰⁻¹³ In pediatrics, propofol recovery times have been measured to full consciousness,⁸ which allows the presumption that rapid discharge will follow.

The aim of our study was to compare the efficiency of anesthesiologist-administered propofol with that of endoscopist-administered midazolam and fentanyl sedation in an academic pediatric endoscopy unit. Effectiveness, safety, and the quality of both types of sedation for pediatric endoscopy have been independently well established^{5,14,15}; therefore, we focused on measuring elapsed times between the initial administration of either type of intravenous (IV) sedation to our patients and their discharge from the hospital by using a prospective, observational design.

PATIENTS AND METHODS

We prospectively collected endoscopic procedure-related times for consecutive patients who had sedation with propofol and compared them with times for patients who received procedural sedation with midazolam and fentanyl during approximately the same time period. Hospital-approved sedation regimens were followed, with routine administration of propofol sedation by anesthesiologists and midazolam and fentanyl administration by endoscopists. Our primary outcomes measurement was the total time (time sedation started to the time of discharge from the hospital). Additional outcomes of interest included the following: the time to onset of sedation (time sedation started to when the endoscope was inserted), the procedure time (time endoscope in to endoscope out), and the discharge time (the time the endoscope was withdrawn to time of discharge from the hospital).

Patients

With institutional approval, participants were identified as outpatients as those who were undergoing elective procedures at a single, freestanding pediatric hospital in 1 of 2 procedure rooms in the endoscopy unit, with either propofol sedation (May 5, 2004 to September 9, 2004) or with midazolam and fentanyl sedation (December 9, 2003 to November 16, 2004). As is the standard of care for pediatrics, the primary staff gastroenterologists determined which type of sedation (propofol or midazolam and fentanyl) the patients would receive at the time of procedure booking, based on physician personal preference and assessment of the patients' needs.¹⁶ We did not collect data on additional patients referred by their primary gastroenterologists for procedures with general anesthesia in the operating room (OR).

Each patient referred for propofol sedation in the endoscopy unit was subsequently reviewed by a staff anesthesiologist, who concurred with the referral to perform the procedure with propofol outside the OR or who referred the patient for general anesthesia in the OR.

Capsule Summary

What is already known on this topic

- The safety and quality of propofol sedation for children undergoing endoscopy has been well established, so pediatric endoscopists may expect that the use of propofol will increase efficiency in all institutional settings.

What this study adds to our knowledge

- Of 134 consecutive children undergoing either anesthesiologist-administered propofol or endoscopist-administered midazolam and fentanyl, the propofol group had a shorter time to full sedation, a similar procedure time, a longer discharge time, and a comparable total time compared with the midazolam and fentanyl group.
- Fellow participation prolonged procedure times, and endotracheal intubation prolonged times in the propofol group, but adjusting for these did not change comparison results.

Demographic information was collected for each patient, including age, sex, and weight. We excluded from the study any patients who were undergoing procedures in the OR, as well as patients who were undergoing emergency procedures in the endoscopy unit with either type of sedation.

Clinical procedure

All procedures were performed by using the standard technique. Endoscopists at our institution routinely acquire biopsy specimens from multiple levels in the esophagus, the stomach, and the duodenum on an upper endoscopy, and in the terminal ileum, the cecum, and other locations on a colonoscopy, regardless of whether mucosa was grossly normal or abnormal.

Per anesthesiologist or endoscopist preference, some patients received oral midazolam (0.5 mg/kg, maximum dose 20 mg) in preparation for peripheral IV catheter placement. For both sedation regimens, GI procedures proceeded routinely and patient care followed standard practice, which included participation by endoscopy fellow trainees. Staff endoscopists were present during the entire duration of all procedures. All patients were continuously monitored for heart rate, respiratory rate, blood pressure, end-tidal carbon dioxide, and transcutaneous oxygen saturation, as well as an electrocardiogram. Vital signs, visual assessment of patient chest-wall excursion, and the depth of sedation by using the Ramsay scale¹⁷ were documented every 5 minutes by the anesthesiologists during propofol sedation and by the endoscopy nurses during sedation with midazolam and fentanyl.

All patients recovered from sedation in the post-anesthesia care unit (PACU) by using standard protocols.

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