Computer-Assisted and Patient-Controlled Sedation Platforms

Daniel Pambianco, MD[a,*], Paul Niklewski, PhD[b,c,d]

KEYWORDS

• Sedation platforms • Computer-assisted sedation • Patient-controlled sedation
• Endoscopic sedation

KEY POINTS

- Ideal sedation requirements for endoscopy need to be matched to patient comfort, comorbidity risks, procedural discomfort, and the length of the procedure in order to minimize the unnecessary risk of deeper sedation or general anesthesia.
- Most patients require moderate sedation for relatively short procedures for which the ideal agent or administration model is still being sought.
- Patient- and computer-controlled sedation have the ability to impact the quality and safety of sedation for endoscopic procedures.

INTRODUCTION

Endoscopic procedures are vitally important in maintaining the health of a patient population; however, these procedures are invasive and cause patient discomfort and anxiety. Sedation has become a necessary part of the endoscopic procedure to ensure patient compliance through patient comfort. Optimally, sedation requirements for endoscopy need to be matched to patient comfort, comorbidity risks, the anticipated procedural discomfort, and the length of the procedure in order to minimize the unnecessary risk of deeper sedation or general anesthesia.[1] Most patients require moderate sedation for relatively short procedures for which the ideal agent or administration model is still being sought.

Patient- and computer-controlled sedation have been long studied, more than 50 years; but these platforms are not yet accepted broadly as a means of sedation

[a] Charlottesville Medical Research, 325 Winding River Lane, Suite 102, Charlottesville, VA 22911, USA; [b] Department of Pharmacology and Cell Biophysics, University of Cincinnati College of Medicine, 231 Albert Sabin Way, University of Cincinnati, Cincinnati, OH 45267-0575, USA; [c] Xavier University, 3800 Victory Pkwy, Cincinnati, OH 45207, USA; [d] Sedasys, a Division of Ethicon Endo-Surgery, Inc, Ethicon Endo-Surgery Inc, 4545 Creek Road, Cincinnati, OH 45242, USA
* Corresponding author.
E-mail address: dpambianco@aol.com

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in the United States.[2,3] As these technologies have advanced, so has the ability to impact the quality and safety of sedation for endoscopic procedures. A review of the current state of these technologic advances is discussed.

SEDATION MEDICATIONS APPROPRIATE FOR COMPUTER AND PATIENT CONTROL

When selecting sedation agents for computer or patient control, the pharmacokinetic/pharmacodynamic (PK/PD) properties of the agent are paramount. Agents, such as midazolam, are less than ideal for infusions and computer or patient control, primarily because of their long onset and offset time. Fig. 1 shows theoretic plasma and effect site concentrations for a single bolus dose of midazolam. As can be seen, the effect site concentration is not at steady state until almost 10 minutes. This time frame prohibits the ability to titrate for endoscopy procedures, especially those that last less than 10 minutes, such as esophagogastroduodenoscopy (EGD).

In recent years propofol has become the preferred sedative because of its PK/PD properties, allowing for rapid onset/offset and rapid clear-headed recovery. Propofol, when titrated, allows for a rapid and steady state titration. Propofol has historically been considered a general anesthetic, as it has been used to induce a state of general anesthesia. However, when titrated, it can be used for sedation. Fig. 2 shows 3 plots of propofol infusion, all having a total of 187.5 mg delivered after 20 minutes. The top subplot shows a single bolus of propofol, with a maximum effect site concentration of approximately 6 μg/mL, a general anesthetic concentration. When that same amount of propofol is delivered in 4 boluses, the effect site concentration is significantly reduced to just more than 2 μg/mL, as shown in the middle subplot. The bottom subplot shows a steady state infusion, a preferred delivery method for sedation. In this case, a loading dose is delivered followed by a steady state delivery. Therefore, the peaks and valleys are managed, and the effect site concentration does not exceed approximately 1.5 μg/mL. The dose, and the method of delivery, defines the effect site concentration. Computer-controlled sedation allows for an increased degree of control of drug optimization, providing a potentially more stable sedation experience compared with traditional bolus dosing.

Using a drug such as propofol allows for procedural titration not possible with a drug such as midazolam, with a more significant onset/offset time. Fig. 3 (scale

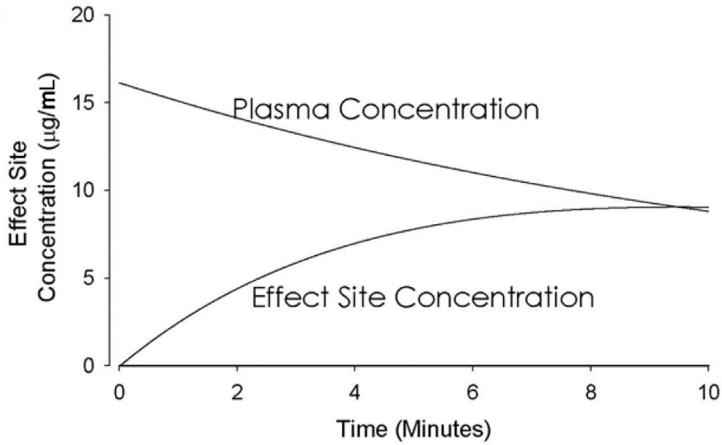

Fig. 1. Midazolam onset time for both the effect site and plasma concentration.