Propofol Sedation in Gastrointestinal Endoscopy: A Gastroenterologist’s Perspective

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\textbf{Key Words}
Propofol \cdot Sedation \cdot Non-anesthesiologist \cdot Endoscopy

\textbf{Abstract}
The present article describes the recommendations regarding the use of propofol by non-anesthesiologists from published guidelines. Furthermore, safety and efficacy data regarding the use of propofol in the hands of gastroenterologists are also reviewed. Although there are no studies comparing the safety and efficacy of propofol administration by anesthesiologists versus non-anesthesiologists for sedation during endoscopy, there is strong evidence that propofol administration by non-anesthesiologists is safe and efficacious for the majority of patients undergoing routine endoscopic procedures.

\textbf{Introduction}
Propofol sedation for endoscopic procedures has dramatically increased in recent years. Its favorable pharmacokinetic profile compared to traditional sedation with benzodiazepines and opioids makes propofol a better choice, especially if deep sedation is targeted. However, propofol administration by endoscopists is discussed controversially within the medical community because anesthesiologists claim it is unsafe and often cite the warning contained in the package insert that propofol should be given only by persons trained in the administration of general anesthesia. This package insert, however, was written before evidence accumulated that non-anesthesiologists could administer propofol safely for endoscopic procedures.

However, the data currently available, including some meta-analyses, show comparable or even higher safety profiles for propofol used under careful conditions versus other agents.

\textbf{Recommendations from National Guidelines Regarding the Use of Propofol Sedation during Gastrointestinal Endoscopy}
The main recommendations regarding the use of propofol in endoscopy from the recent non-anesthesiology guidelines are summarized in table 1 [1–7]. However, only one set of guidelines [4] was conducted from the respective national societies of gastroenterology and anesthesi-
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All guidelines state that the endoscopist himself is not able to administer propofol and monitor the patient. Therefore, there must be one additional person whose sole responsibility is to administer the sedative drug(s) and monitor the patient. This person can be an anesthesiologist (monitored anesthesia care, MAC), a specially trained physician (gastroenterologist-directed propofol sedation, G-DPS) or a specially trained nurse (nurse-administered propofol sedation, NAPS). The mode of propofol administration is mainly influenced by law. Therefore, its use is restricted for anesthesiologists in some countries (e.g. most states of the US, France, etc.).

Although there are no strong supporting data, these guidelines and a position statement recently published jointly by four American gastroenterology and hepatology societies regarding non-anesthesiologist administration of propofol for gastrointestinal endoscopy [8] state there is no clinical benefit of providing MAC for low-risk patients undergoing routine endoscopy. Moreover, for ERCP and EUS, non-anesthesiologist administration of propofol is more cost-effective than standard sedation with benzodiazepines and opioids [8]. MAC should be reserved for unfit patients and/or for interventional procedures (table 1).

**Table 1.** Recent guidelines from national gastroenterology, endoscopy and surgery societies regarding propofol sedation for gastrointestinal endoscopy

<table>
<thead>
<tr>
<th>Guideline from society, year</th>
<th>NAPS allowed</th>
<th>Limitations for NAPS</th>
<th>When to consider MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASGE, 2008 [1]</td>
<td>yes (physician supervised)</td>
<td>n.s.</td>
<td>ASA ≥III, emergency and complex procedures, factors for difficult airway management present</td>
</tr>
<tr>
<td>AGA, 2007 [2]</td>
<td>yes</td>
<td>n.s.</td>
<td>ASA &gt;III, high-risk patients, complex procedures</td>
</tr>
<tr>
<td>SAGES, 2009 [3]</td>
<td>n.s.</td>
<td>n.s.</td>
<td>ASA &gt;III</td>
</tr>
<tr>
<td>GSDMD, 2009 [4]</td>
<td>yes</td>
<td>ASA &gt;II, complex procedures, factors for difficult airway management present</td>
<td>ASA ≥III, complex procedure or factors for difficult airway management present</td>
</tr>
<tr>
<td>CAG, 2008 [5]</td>
<td>yes</td>
<td>none</td>
<td>ASA ≥III, complex procedures, factors for difficult airway management present</td>
</tr>
<tr>
<td>SSGE, 2006 [7]</td>
<td>yes</td>
<td>complex procedures</td>
<td>ASA ≥III in case of deep sedation, factors for difficult airway management present</td>
</tr>
</tbody>
</table>

**Propofol Sedation Administered by Non-Anesthesiologists**

During the last decade, it has been demonstrated that propofol administered by non-anesthesiologists has comparable safety to what has been reported for endoscopists administering standard sedation. Two meta-analyses [9, 10] showed that the safety profile of G-DPS is equivalent or even superior to traditional sedation with benzodiazepines plus opioids with respect to the risks of hypoxemia, hypotension and bradycardia for (mainly) diagnostic upper and lower gastrointestinal endoscopy. These meta-analyses [9, 10] also showed that there are clear benefits of propofol sedation over traditional sedation regarding the time for induction of sedation as well as the recovery time and the quality of endoscopy. However, patient satisfaction varied between studies.

Furthermore, six randomized trials [11–16] confirmed an equal safety profile of propofol compared to traditional sedation and a significantly better patient cooperation and recovery time during ERCP with the use of propofol as a single agent for sedation (table 2).

Large trials [17–21] that included more than 72,000 patients who underwent diagnostic endoscopic procedures...
showed that well-trained nurses can administer endoscopic sedation with propofol safely (NAPS) as well. No deaths were reported and patients required assisted ventilation in about 0.2% of the cases, while hypotension (defined as systolic blood pressure < 90 mm Hg) occurred in 0–2% of them.

Currently, there are no studies comparing the safety and efficacy of propofol administration by anesthesiologists versus gastroenterologists for sedation during endoscopy. In a recently published world-wide safety registry [22] of endoscopist-directed propofol sedation that included 223,656 published and 422,424 unpublished prospectively evaluated cases, short-time mask ventilation was necessary in 489 of 569,220 cases (0.1%) with available data, 11 cases required endotracheal intubation and 2 patients had transient neurological disorders without long-term sequelae, while 4 deaths (all probably not sedation-related) occurred. All deaths occurred during or following an upper gastrointestinal endoscopy in patients with significant comorbidities who would be considered high-risk cases for sedation [22]. There were no mortalities in patients undergoing colonoscopy and no mortalities in procedures that involved patients classified as American Society of Anesthesiologists (ASA) class I or II [22]. Furthermore, the investigators estimated the added cost of using MAC for all cases in order to prevent all deaths to roughly be USD 5.3 million [22].

Given the very low rate of adverse events with NAPS or G-DPS, it does not seem likely that MAC could further improve the safety of propofol sedation during routine endoscopy in low-risk patients at a sensible cost.

In summary, there is a lot of evidence, mainly from gastroenterology literature, that G-DPS and NAPS are safe and efficacious as is routine for endoscopic sedation for the vast majority of patients. There is also some evidence that these approaches might be cost-effective for the same population. Some exceptional scenarios in which MAC may be more appropriate for endoscopic sedation have been recommended in the published guidelines.

Table 2. Results from 6 randomized studies comparing sedation with propofol to the use of traditional sedation for ERCP

<table>
<thead>
<tr>
<th>Reference</th>
<th>Drug regimen</th>
<th>n</th>
<th>Sedation efficacy</th>
<th>Patient safety</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muller et al. [11]</td>
<td>propofol plus fentanyl versus dexametomidine</td>
<td>26</td>
<td>*</td>
<td>*</td>
<td>n.a.</td>
</tr>
<tr>
<td>Riphaus et al. [12]</td>
<td>propofol versus midazolam plus pethidine</td>
<td>155</td>
<td>*</td>
<td>NS</td>
<td>**</td>
</tr>
<tr>
<td>Vargo et al. [13]</td>
<td>propofol versus midazolam plus meperidine</td>
<td>75</td>
<td>NS</td>
<td>NS</td>
<td>**</td>
</tr>
<tr>
<td>Krugliak et al. [14]</td>
<td>propofol versus midazolam</td>
<td>32</td>
<td>**</td>
<td>–</td>
<td>**</td>
</tr>
<tr>
<td>Jung et al. [15]</td>
<td>propofol versus midazolam</td>
<td>80</td>
<td>*</td>
<td>NS</td>
<td>n.a.</td>
</tr>
<tr>
<td>Wehrmann et al. [16]</td>
<td>propofol versus midazolam plus pethidine</td>
<td>198</td>
<td>**</td>
<td>NS</td>
<td>**</td>
</tr>
</tbody>
</table>

*p < 0.05; **p < 0.01 in favor of propofol. NS = No significant difference; n.a. = not analyzed.

References


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