

Airway complications during gastrointestinal endoscopy using propofol in a rural hospital

Kelsey S. Flores¹, Jungbin A. Choi, BA¹, Kathleen N. Johnson, BS¹, David P. Vaneenenaam Jr., BS¹, Hannah M. Harris, BS², Daniel J. Forest, MD³, Yvon F. Bryan, MD⁴

1-Department of Anesthesiology, Wake Forest School of Medicine, Winston-Salem, North Carolina, USA.

2-East Carolina University Brody School of Medicine, Greenville, North Carolina, USA.

3-Department of Anesthesiology, Novant Health Forsyth Medical Center, Winston-Salem, North Carolina, USA.

4-Department of Anesthesiology, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire, USA.

Correspondence: Yvon F. Bryan, MD, Department of Anesthesiology, Dartmouth-Hitchcock Medical Center, 1 Medical Center Drive, Lebanon, NH 03766, USA; Telephone: 603-650-6719; E-mail: yvon.f.bryan@hitchcock.org; yvon.f.bryan@dartmouth.edu

Abstract

Background: Simple endoscopies such as esophagogastroduodenoscopy (EGD) and colonoscopies are common procedures that require the use of sedation or general anesthesia. The risk of airway complications for these procedures depends on the type of medications administered. Wide variation exists in reported rates of airway complications for endoscopic procedures. This retrospective study analyzed airway interventions and desaturations during simple endoscopy procedures performed by anesthesia-based teams (ABT) using propofol in a rural hospital.

Methodology: An IRB approved retrospective study was conducted at Wake Forest Baptist Lexington Medical Center (LMC). Patients over age 18 who underwent an EGD, colonoscopy, or both from July to December 2017 were included. Demographics, comorbidities, airway interventions, incidence of desaturation, the mean doses of propofol, and duration of procedures were recorded.

Results: Five hundred and thirteen patients underwent simple endoscopies (130 EGD, 320 colonoscopies, and 63 EGD/colonoscopy) at LMC. No patients required rescue intubation. One (0.2%) patient required BMV, three (0.6%) required a nasal airway, and three (0.6%) required an oral airway. 44 patients desaturated; 11 (25%) were severe and 33 (75%) moderate.

Conclusion: We found that simple endoscopies performed by ABT had a low rate of airway interventions; however, the incidence of desaturation was higher than reported by other non-anesthesia-based teams and/or when clinicians used propofol for the endoscopies.

Key words: gastrointestinal endoscopy, endoscopic procedures, propofol, anesthesia, rural health, desaturations

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1. Introduction

There are a growing number of endoscopies performed in the world each year. Simple endoscopic procedures such as colonoscopies and esophagogastroduodenoscopies (EGDs) are recommended for aging adults.¹ With the growing

geriatric population in the United States, patients are more apt to require “out of operating room” anesthesia for endoscopic procedures.²

Variation exists on which clinicians administer sedation and/or general anesthesia for endoscopies. The clinicians vary from general practitioners, endoscopists, endoscopy-trained nurses, nurse

anesthetists and anesthesiologists.³ In addition, variability occurs in the airway techniques used and medications administered. The doses and medications administered for endoscopies depends on the experience of the clinician and their skill with advanced airway management. Early et al reported that 16.9% of patients may undergo endoscopies without sedation, however the majority of patients require medications.⁴ The most commonly used sedatives and analgesics for endoscopy procedures are midazolam, propofol, and fentanyl, respectively.⁵ The deeper the sedation and the more comfortable the patient may be however, increases the risk of respiratory complications proportionately.⁵

Regardless of the technique used by the clinician, and/or medications administered, avoidance of airway complications is paramount. Previous studies have been performed in large academic medical centers or specialized GI practices, and not in rural hospitals. We sought to determine the incidence of airway interventions, complications, and desaturations; the mean doses of propofol used; and the duration of the procedures in simple endoscopies performed by anesthesia-based teams using propofol in a small rural hospital.

2. Methodology

An Institutional Review Board (IRB) approved, retrospective study with waiver of consent was performed at Lexington Medical Center (LMC) in Lexington, North Carolina, part of Wake Forest Baptist Health. This study included all patients over the age of 18 who underwent an EGD, colonoscopy, or both procedures together from July to December 2017. Prior to the study, in September 2015, the Department of Anesthesiology began an Anesthesiology-Based Team (ABT) program consisting of an anesthesiologist and a certified registered nurse anesthetist to administer a propofol-based anesthetic for all endoscopic procedures. Prior to this, nurses and physicians administered sedation for these procedures. In addition, a quality initiative (QI) was developed during this time to measure the variability in anesthetic practice along with the incidence of airway complications. The QI demonstrated a large variability in anesthetic techniques administered during endoscopic

procedures at LMC. This observation led to the development of the retrospective study.

The following demographic data were recorded: age, height, weight, BMI, gender, and ASA status. Diagnosis, comorbidities, type of endoscopic procedure(s) performed (EGD, colonoscopy, or both EGD and colonoscopy), and any airway interventions and devices used as rescue for intubation and/or ventilation were also recorded. An airway intervention was defined as the need to intubate, and ventilation was defined as the need to bag mask ventilate and/or to insert a nasal or oral airway. A complication with oxygenation was defined as moderate if SpO₂ was 80-89% and severe if <79%. Any aspiration events were also recorded. Medications administered were recorded including those administered preoperatively and intraoperatively. Propofol doses were reported as mcg/kg/min (calculated by addition of bolus and infusion doses). The times measured included the total time in the endoscopic suite, the time of the respective endoscopic procedure and the time during anesthesia. Data was supplemented by notes entered in the electronic medical chart by nurses, nurse anesthetists and anesthesiologists. Data was then compiled using RedCap data processing software.

2.1. Statistical analysis

The mean, standard deviation, and range were calculated for continuous variables. The number (n) and percentage (%) were calculated for non-continuous variables.

3. Results

3.1. Demographics

Five-hundred and thirteen patients underwent simple endoscopies at LMC: 130 EGD, 320 colonoscopies, and 63 EGD/colonoscopy. Demographics and diagnoses are reported in Tables 1 and 2, respectively.

3.2. Airway management

Intubation: Four (0.7%) patients were intubated for their respective EGDs. All were planned intubations at the discretion of the anesthesiologists, and with two due to a food bolus and GI bleed, respectively.

Ventilation: One (0.2%) patient required BMV, three (0.6%) required a nasal airway, and three (0.6%) required an oral airway.

Oxygenation: Forty-four (8.6%) patients desaturated. Incidence of desaturation was 7.7%, 8.8%, and 9.5% for EGD, colonoscopy, and EGD/ colonoscopy, respectively (see Table 3).

Aspiration: No patients aspirated.

3.3. Techniques

The mean dose of propofol for all endoscopic procedures was 120.43 ± 49.52 mcg/kg/ min. The

mean propofol dose was 115.6 ± 58.8 mcg/kg/min for EGD, 122.5 ± 46.1 mcg/kg/min for colonoscopy, and 119.9 ± 45.7 mcg/kg/min for EGD/colonoscopy (see Table 4).

The mean length of procedure time for all was 22.47 ± 13.2 min. The mean length of procedure was 9.8 ± 6.3 min for EGD, 25.0 ± 11.2 min for colonoscopy, and 35.5 ± 13.2 min for EGD/ colonoscopy (see Table 5).

Table 1: Demographic data

Variable	Total (n = 513)	EGD (n = 130)	Colonoscopy (n = 320)	EGD/ Colonoscopy (n = 63)
Age (y)	60.5 \pm 13.2 (18-93)	59.7 \pm 17.0 (18-93)	61.4 \pm 10.3 (18-87)	57.2 \pm 16.9 (18-87)
Weight (kg)	85.9 \pm 22.2 (41.3-215.5)	82.8 \pm 22.2 (48.1-147.9)	87.3 \pm 21.5 (45.4-215.5)	85.4 \pm 24.7 (41.3-166)
Height (m)	1.7 \pm 0.1 (1.4-2.0)	1.7 \pm 0.1 (1.5-1.9)	1.7 \pm 0.1 (1.4-2.0)	1.7 \pm 0.1 (1.5-1.9)
BMI (kg/m ²)	30.1 \pm 7.1 (10.1-66.4)	29.4 \pm 7.6 (18-54.9)	30.3 \pm 6.8 (10.1-66.4)	30.4 \pm 7.7 (17.2-48.4)
Gender [n (%)]				
Male	225 (43.9)	52 (40)	150 (46.9)	23 (36.5)
Female	228 (56.1)	78 (60)	170 (53.1)	40 (63.5)
ASA Status [n (%)]				
I-II	258 (50.3)	52 (40)	178 (55.6)	28 (44.5)
III-IV	155 (49.8)	78 (60)	142 (44.3)	35 (55.5)

Table 2-A: Diagnoses for EGD (n=130)

Diagnosis	n	%
Pain	19	14.6
Gastrointestinal Bleed	16	12.3
Family History/ Screening	14	10.8
Ulcer	13	10
Dysphagia	13	10
Esophageal Stricture	12	9.2
Dyspepsia	8	6.2
Nausea/ Vomiting	7	5.4
GERD	6	4.6
Gastritis	5	3.8
Food Bolus	4	3.1
Others (cirrhosis, esophagitis, hematuria, anemia, weight loss)	22	16.9

Table 2-B: Diagnoses for Colonoscopy (n=320)

Diagnosis	n	%
Screening	94	29.4
History of Polyps	65	20.3
Colorectal Cancer	65	20.3
Blood in Stool	21	6.6
Family History	17	5.3
Hematochezia	15	4.7
Gastrointestinal Bleed	12	3.8
Anemia	10	3.1
Abdominal Pain	9	2.8
Weight Loss	6	1.9
Constipation	4	1.3
Other (diverticulitis, colitis, change in bowel habits, irritable bowel syndrome)	18	5.6

Table 2-C: Diagnoses for EGD/ Colonoscopy (n=63)

Diagnosis	n	%
Pain	19	30.2
Screening/ Family History	14	22.2
GERD	13	20.6
History of Polyps	10	15.9
Anemia	8	12.7
Nausea/ Vomiting	8	12.7
Hematochezia	6	9.5
Dysphagia	6	9.5
Diarrhea	5	7.9
Esophagitis	4	6.3
Others*	27	42.9

*Abnormal feces, dyspepsia, diverticulitis, disorder of function of stomach, colorectal cancer, weight loss, barrett's esophagus

**Some patients had more than one diagnosis

Table 3: Desaturations (n=44)

SpO2 (%)	EGD	Colonoscopy	EGD/ Colonoscopy	Total
Severe (< 79)	4 (40)	5 (17.9)	2 (33.3)	11 (25)
Moderate (80-89)	6 (60)	23 (82.1)	4 (66.7)	33 (75)
Total	10 (22.7)	28 (63.6)	6 (13.6)	44 (100)

Table 4: Premedication and anesthetic agents used

Drugs	EGD (n = 130)	Colonoscopy (n = 320)	EGD/ Colonoscopy (n = 63)
Premedications	Midazolam	31 (23.8)	24 (38.1)
	Fentanyl	7 (5.4)	1 (1.6)
	Glycopyrrolate	69 (53.1)	34 (54)
	Other*	15 (11.5)	10 (15.9)
Intraoperative Medications	Propofol**	82 (63.1)	33 (52.4)
	Propofol and Ketamine**	47 (36.2)	30 (47.6)
	Ketamine	1 (0.8)	0 (0)

*Other medications included ondansetron and metoclopramide

**Some patients received lidocaine

Table 5: Times (min)

Time in	EGD (n=130)	Colonoscopy (n=320)	EGD/ Colonoscopy (n=63)	Total (n=513)
In-room	23.5 ± 9.0 (13-70)	36.9 ± 12.9 (12-138)	48.3 ± 13.8 (24-109)	34.9 ± 14.3 (12-138)
Anesthesia	20.4 ± 10.6 (10-102)	33.3 ± 12.2 (12-131)	43.9 ± 13.5 (22-109)	31.3 ± 14.0 (10-131)
Procedure	9.8 ± 6.3 (3-44)	25.0 ± 11.2 (6-100)	35.5 ± 13.2 (15-85)	22.5 ± 13.2 (3-100)

*Other medications included ondansetron and metoclopramide

**Some patients received lidocaine

4. Discussion

We found that all simple endoscopies were safely completed by anesthesia-based teams (ABT) using propofol in a rural hospital. None of the patients were intubated as rescue other than those whose initial airway plan was intubation for their respective EGD. However, we found our incidence of desaturations was higher than previously reported in other studies. Our findings demonstrate that propofol may be used safely by ABT for simple endoscopies in small rural hospitals.

Desaturation events during endoscopies in the literature range from as low as 0.0014% to 9%.⁶⁻¹⁰ However, no standardized definition of desaturation exists in regards to the duration, severity, and/or frequency of desaturation events. Goudra et al. found a 0.005% incidence, defined as desaturation events that were life-threatening and that required immediate intervention.⁷ We did not have life-threatening hypoxic events despite a higher incidence of desaturations overall. Similar to other studies, the need for airway intervention due to ventilation was minimal. We found a 1.4% incidence of BMV or placement of an airway (oropharyngeal and/or nasal), while Gouda et al. found a 1.2% incidence.⁶ None of the patients required intubation as a rescue technique during their endoscopic procedure and this was similar to other studies.^{6,8} Regardless of personnel or medications administered for endoscopies, the need for urgent airway management rescue was minimal.

Propofol doses were difficult to compare as studies differed in their form of administration, including bolus, infusion, and target controlled administration.⁹ Additionally, the efficiency and efficacy of the endoscopic procedure was difficult to compare as studies do not clearly define duration of the procedure. However, Hong et al. reported a mean time of colonoscopy procedure as 12 min, while our average colonoscopy procedure time was 25 min.¹¹ In their study, all procedures were performed by one endoscopist, whereas there were different personnel from different specialties performing our endoscopies.

Goudra et al. reported the most commonly associated adverse events during EGD were cardiorespiratory events, including cardiac arrest, while bleeding was

more frequent in colonoscopies.⁷ We did not have any of these complications. Additionally, they stated that the use of a core group of anesthesiologists for endoscopy may have facilitated reduction of adverse events with proactive approaches to airway management.⁷ Anesthesia-based teams may reduce the incidence of complications during simple endoscopies due to their preparedness in airway management and skill in administering medications. Therefore, patients with risk factors, such as obesity and hypoventilation syndromes, may benefit from ABT compared to endoscopists and RN only based teams. As the need for simple endoscopies increases, the demand of rural centers to perform them in patients with higher comorbidities may result in increased adverse events. Previous studies show that GI Suites have higher risk of adverse airway events than large academic centers.¹² Similarly, the incidence of airway events in our rural hospital was higher other studies performed at tertiary care centers.

Our study had several limitations as it was a retrospective study in a small rural hospital in North Carolina. We did not include advanced or complex endoscopies, such as endoscopic retrograde cholangiopancreatography (ERCP). Also, it was difficult to determine the specific reasons for desaturations and/or need for airway intervention related to the doses of propofol.

5. Conclusion

In conclusion, we found that simple endoscopies performed by anesthesia-based teams may be performed in a safe and efficacious manner in a small, rural hospital. Our study may assist with the infrastructure for undergoing clinical research specific in rural hospitals and provide a model to other rural institutions. As the indications for endoscopies, aging population, and number of comorbidities increases, the need for more centers outside of large academic urban centers to perform safe, efficacious procedures will be paramount. Furthermore, our study finds that small rural hospitals may safely perform endoscopies without the need for patients to travel to larger tertiary hospitals.

6. Conflict of interest

None declared by the authors.

7. Authors' contribution

All authors contributed equally to the conduct of the study and the preparation of the manuscript.

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