Endoscopist controlled administration of propofol: an effective and safe method of sedation in endoscopic procedures

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ABSTRACT

Objectives: propofol is a short-acting, hypnotic agent that is increasingly being used for gastrointestinal endoscopic sedation. There are concerns about the use of propofol by non anesthesiologists due to its potential for respiratory and cardiovascular depression. This report describes our experience concerning effectiveness and safety of propofol administered in endoscopic procedures by the endoscopist and the assistant nurse.

Methods: in this prospective study, a total of 102 consecutive endoscopies (60 colonoscopies and 42 upper endoscopies) performed under sedation with propofol were included. In 27 (26.47%) endoscopies propofol was administered alone and in 75 endoscopies (73.53%) it was combined with benzodiazepines and/or opioids. Seventy-six (74.51%) endoscopies were performed in patients under 65 years of age and 26 (25.49%) in patients over 65 years of age. Ninety-one (89.22%) endoscopies were performed in patients with low surgical risk (ASA I-II) and 11 (10.78%) in patients with high surgical risk. The medication was administered by the endoscopist that performed the procedure and the assistant nurse.

Results: the mean dose of propofol used was 72.14 mg for gastroscopies and 71.33 for colonoscopies ($p = 0.92$). The mean dose of propofol when infused alone was 84.81 mg whereas in combination with benzodiazepines/opioids was 66.93 mg ($p = 0.06$). The doses of propofol required were lower for those colonoscopies in which midazolam and/or meperidine was combined and in patients over 65 years of age ($p = 0.006$ y $p = 0.001$, respectively). Eleven (10.8%) minor complications were reported, and managed by the own endoscopist. Patients had no memories of the procedure. The tolerance rated by the endoscopist was excellent-good, fair, bad-very bad in 83, 5 and 12% of the gastroscopies and in 79, 8 and 13% of the colonoscopies respectively. Nevertheless bad tolerance did not hinder the completion of the procedure in any case.

Conclusions: the administration of propofol by the endoscopist and the assistant nurse, is an effective and safe method of sedation in patients of low and high-risk as well as in elderly pa-

tients. The doses of propofol required for an adequate sedation were lower in patients over 65 years of age and for colonoscopies in which medication was combined.

Key words: Propofol. Sedation. Midazolam. Meperidine.

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INTRODUCTION

Sedation and analgesia in gastrointestinal endoscopy is a common and increasing practice due to growing social pressure. Conventional sedation with benzodiazepines and opioids is being replaced by the use of propofol (1), as a single agent or in combination with standard sedatives, due to its ultrashort onset of action, its short plasma half-life and the faster recovery from sedation (2). This property makes it the ideal agent for use in ambulatory endoscopy, as it reduces post procedure surveillance (3-5). The most feared adverse effects of propofol are the respiratory depression, and the risk of hypotension and bradycardia (6). Besides, there is not an antidote for propofol. For these reasons, the administration of propofol has been primarily restricted to anesthesia and intensive care specialists. Many studies address the safe and effective administration of propofol in endoscopic procedures, controlled by the endoscopist, the trained nurse or the own patient using a target-controlled infusion of propofol, in healthy patients as well as in high-risk patients (7-34). To the best of our knowledge this is the first publication in our country, of endoscopic sedation with propofol, controlled by the endoscopist and the assistant nurse.

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MATERIAL AND METHODS

1. We developed a protocol based on the one published by Cohen et al. (35) and applied it prospectively. One hundred and two endoscopies were performed under sedation with propofol. They were carried out in 87 patients, from January 2004 to March 2005, excluding patients with known allergy to eggs, soybean or propofol as well as those suffering from obstructive sleep apnea, history of seizure disorder, short neck, inability to adequate mouth opening, and history of difficult intubation. The medication was delivered by the endoscopist performing the procedure, qualified in both basic and advanced life support skills and with the collaboration of the assistant nurse, also trained in resuscitation skills. Full resuscitation equipment was available within the endoscopy unit at all times.

Characteristics of patients concerning gender, age and ASA status were recorded (36). After completion of the procedure the following data were registered: type of endoscopic procedure, duration, indication, therapeutic procedure performed, if the exploration had been complete and if not, the reason why it had not been completed. Medication and dosage administered were also recorded. All complications that happened during the procedure were described. The adverse effects monitored were pain at the injection site or phlebitis, desaturation ($\text{SaO}_2 < 90\%$), bradycardia (< 60 HR) and tachycardia (> 110 HR), as well as the need for volume expansion, use of antidotes (anexate or naloxone) and the need for assistance or resuscitation. The tolerance of the patient was rated by the endoscopist on a five point scale 1-5 (1 = excellent, 2 = good, 3 = fair, 4 = bad, 5 = very bad). Besides, every patient was asked after the procedure if they had any memories of the procedure and if they would request the same mode of sedation in future endoscopies. The recovery time was not registered as every patient was observed for 30 minutes after completion of procedure, as determined in our protocol and irrespective of the method of sedation. The results are presented as mean and percentage and statistically analyzed with the t student test or Fisher's exact test, respectively. A p value ≤ 0.05 was regarded as statistically significant.

2. *Patient monitoring.* All patients were monitored continuously by using an automated device for oxygen saturation (alarm if the oxygen saturation fell below 90), heart rate (alarm if the heart rate declined to less than 60 HR or exceeded 110 HR) and, when required, electrocardiograph, while the blood pressure was assessed at 3-minute intervals. The assistant nurse monitored chest excursion, depth of sedation and level of pain.

3. *Drug administration.* Intravenous access was established with an 18 to 20 gauge angiocatheter in the right forearm. During the procedure 500 cc of saline solution were infused through an "y" connector. An initial bolus of 20 mg of propofol was infused, followed by boluses of

10 mg every 30 seconds until an adequate level of sedation was achieved, keeping oxygen saturation over 90%. Some patients received combined medication according to the endoscopist preference. In these cases patients less than 65 years of age were given 50 mg of meperidine and 2 mg of midazolam whereas those over 65 years of age were given 25 mg of meperidine and 1 mg of midazolam. Medications were adjusted according to the patient conditions and the endoscopist criteria. All patients were given oxygen at 4 l/min by nasal cannula.

RESULTS

The characteristics of the patients are shown in table I. Fifty-eight out of 102 (56.8%) endoscopies were performed in women. Mean age was 49.7 years with a range of [18-77]. Seventy-six (74.51%) endoscopies were performed in patients under 65 years of age and 26 (25.49%) in patients older than 65 years of age. Ninety-one (89.22%) endoscopies were performed in patients with low surgical risk (ASA I-II) and 11 (10.78%) in patients with high surgical risk. Propofol was administered as a single agent in 27 endoscopies (26.47%) and was combined with midazolam and/or meperidine in 75 (73.53%). The mean dose of propofol (Table II) was 72.14 mg for gastroscopies and 71.33 for colonoscopies ($p = 0.92$). The mean dose of propofol when used as a single agent (Table II -1) was 84.81 mg whereas when combined with midazolam and/or meperidine (Table II-2) was 66.93 ($p = 0.06$). Gastroscopies in which comedication was not used required less doses of propofol (61 versus 75.62 mg), but the difference was not statistically significant ($p = 0.4$). The doses of propofol required for colonoscopies were significantly lower when combined with midazolam and/or meperidine: 60.46 versus 98.82 mg ($p = 0.006$). Patients over 65 years of age (Table III) required lower doses of propofol: 53.07 versus 78.02 mg, with a statistically significant difference ($p = 0.001$). The mean dose of midazolam was 3.5 mg for gastroscopies and 4 mg for colonoscopies. The mean dose of meperidine was 50 mg for gastroscopies and 52 mg for colonoscopies (Table IV).

Patients had no memories of the procedure and all patients said that they would be willing to receive the same mode of sedation if the procedure were repeated. The endoscopist (Table V) rated the patient tolerance as excellent-good, fair, bad-very bad in 83, 5 and 12% of the gastroscopies and in 79, 8 and 13% of the colonoscopies, respectively. Nevertheless the bad tolerance of the patient did not hinder the completion of the examination in any case. There were three cases of uncomplete colonoscopies (5%) that were due to technical difficulties (dolico-colon) in one case and to complications in two cases (both sedation related). We recorded 11 (10.8%) minor complications (Table VI), solved by the own endoscopist, and that consisted of two vasovagal reactions treated with atropine (1.9%), a paradoxical reaction to midazolam

Table I. Characteristics of patients

Age (years)	49.7 [18-77]
Female/male	58 (56.8%) / 44 (43.2%)
ASA	
I	61 (59%)
II	30 (29%)
III	3 (3%)
IV	8 (8%)

Table II. Propofol dosage (mg)

	n	Mean	Minimum	Maximum
Gastroscopy	42	72.14	20	200
Colonoscopy	60	71.33	20	200

Table II (1). Propofol dose (mg) as a single agent

	n	Mean	Minimum	Maximum
Overall	27	84.81	30	200
Gastroscopy	10	61	30	120
Colonoscopy	17	98.82	30	200

Table II (2). Propofol dosage (mg) when combined with meperidine/midazolam

	n	Mean	Minimum	Maximum
Overall	75	66.93	20	200
Gastroscopy	32	75.62	20	200
Colonoscopy	43	60.46	20	160

Table III. Propofol dosage (mg)

	n	Mean	Minimum	Maximum
Under 65 years	76	78.02	20	200
Over 65 years	26	53.07	20	130

Table IV. Meperidine/midazolam dosage (mg)

	Colonoscopy		Gastroscopy	
	Nº	Dose (mg)	Nº	Dose (mg)
Meperidine	41	52 [50-100]	28	50
Midazolam	42	4 [1-7]	32	3.5 [2-5]

(0,9%) and 8 (7,8%) episodes of mild desaturation that were corrected by an increase in oxygen flow rate or the administration of antidotes. We registered a lower percentage of complications (Table VI-1, VI-2, VI-3) when propofol was used alone (3.7 *versus* 13.33%), in patients over 65 years of age (7.69 *vs.* 11.84%) and in high risk patients (9.09 *vs.* 10.99%), albeit these differences were not statistically significant ($p = 0.28$, $p = 0.72$, $p = 0.85$ respectively). No patient needed endotracheal intubation. No cases of propofol-induced pain at the injection site or signs of phlebitis were recorded.

DISCUSSION

The administration of benzodiazepines and opioids as sedative agents by the endoscopist during endoscopic procedures is a common and accepted practice. These drugs are being replaced or associated with propofol (1) due to its advantages over benzodiazepines and opioids: faster onset of action, shorter plasma half-life, deeper levels of sedation and faster recovery from sedation (2-5,37-45). A recent study shows that propofol sedation simplifies the technical performance of colonoscopy compared to conventional sedation (46). There are concerns (47-49) about the administration of propofol by non anesthesiologists because of its adverse effects (respiratory depression, hypotension and bradycardia) (6), the narrow therapeutic window, and the lack of an antagonist for propofol. A recent study found that the use of propofol delivered by anesthesiologists was associated with a lower risk of adverse events (50). This data differs from a recent publication by Gangy et al. (51) that identified the administration of propofol as an independent risk factor for cardiovascular complications in gastrointestinal endoscopic procedures; in this study propofol was administered exclusively by anesthesiologists. This finding could be related to the use of larger doses of propofol by them (52) (deep sedation *vs.* moderate sedation). However, there was no difference in adverse events when propofol delivered by non-anesthesiologists was compared to conventional drugs by non-anesthesiologists (53), and there are no cases reported of endotracheal intubation or death due to the administration of propofol by this group. There are many publications addressing the effectiveness and safety of propofol administered by gastroenterologists, nurses supervised by gastroenterologists and the own patient with a target controlled infusion of propofol (7-31,35,40-46). These studies have included low and high risk patients (including cirrhotic patients who are undergoing variceal screening by gastroscopy) (25,32,33) as well as basic and advanced endoscopic procedures (8,10,12,15,22,27,34,40). In this study we have reported a percentage of minor complications of 10.8%, in 11 patients, that were resolved by the own endoscopist by the use of antidotes such as midazolam and meperidine; and the administration of atropine in two cases. There was a percentage of 7.8% of desaturations, that was managed by

Table V. Endoscopic procedure

	Nº		Nº
Colonoscopy	60	Gastroscopy	42
Biopsy	5 (8%)	Biopsy	17 (40%)
Polypectomy	24 (40%)	Dilation	3 (7%)
Complete examination	57 (95%)	Banding	6 (14%)
Tolerance		PEG	1 (2%)
1. Excellent	1 (2%)	Foreign body extraction	1 (2%)
2. Good	46 (77%)	Tolerance	
3. Fair	5 (8%)	1. Excellent	0 (0%)
4. Bad	5 (8%)	2. Good	35 (83%)
5. Very bad	3 (5%)	3. Fair	2 (5%)
Mean duration time [range] (min)	37 [15-65]	4. Bad	5 (12%)
		5. Very bad	0 (0%)
		Mean duration time [range] (min)	21 [10-30]

Table VI. Complications in endoscopic procedures

Description	Age (y)	Gender	ASA	Propofol (mg)	Midazolam (mg)	Meperidine (mg)	Treatment
Colonoscopy							
Vasovagal reaction	70	M	I	60	5	50	Atropine
Paradoxic reaction to midazolam	49	M	I	100	7	50	Anexate
Desaturation	42	M	I	50	5	50	Anexate + Naloxone
Desaturation	77	F	II	120	2	50	Oxygen
Desaturation	59	F	I	20	5	50	Anexate
Vasovagal reaction	33	M	I	120			Atropine
Gastroscopy							
Desaturation	39	F	I	60	5	50	Anexate
Desaturation	54	F	IV	50	5	50	Anexate + Naloxone
Desaturation	64	F	I	30	3	50	Anexate
Desaturation	35	F	I	110	3	50	Anexate + Naloxone
Desaturation	58	M	I	80	2	50	Anexate + Naloxone

oxygen administration in one case and by the administration of anexate and/or naloxone. This percentage of desaturations is comparable to data reported by other investigators. Cohen et al. (35) noted a 9% of desaturations in 819 endoscopic procedures under sedation with propofol. We did not find a higher incidence of complications in elderly patients nor in high risk patients as reported in previous studies (25,32,33). Twenty-six endoscopies were performed in patients over 65 years of age, with a percentage of complications of 7.69% compared with the 11.84% of complications in the 76 endoscopies performed in patients under 65 years of age, although this difference was not statistically significant. Eleven endoscopies were performed in high-risk patients (ASA III-VI), with a 9.09% of complications compared with the

10.99% of complications recorded in the 91 endoscopies performed in low-risk patients (ASA I-II), with a non statistically significant difference. Supporting previous reports we registered lower doses of propofol required in elderly patients ($p = 0.001$) and in those colonoscopies ($p = 0.006$) in which propofol was combined with meperidine and/or midazolam (16,54,55). No patient required endotracheal intubation.

Assistance of an anesthesiologist for every patient undergoing an endoscopic procedure is not warranted and is cost prohibitive (52). The American Society of Anesthesiologists stated that propofol should be administered only by persons qualified to rescue patients from any level of sedation including general anesthesia (56). Thus, the endoscopist must be specifically trained in the adminis-

Table VI (1)

	No combination	Combination	Overall
No complications	26	65	91
	96.3%	86.67%	89.22%
Complications	1	10	11
	3.7%	13.33	10.78%
Overall	27	75	102
	26.47%	73.53%	100%

Table VI (2)

	< 65 years	> 65 years	Overall
No complications	67	24	91
	88.16%	92.31%	89.22%
Complications	9	2	11
	11.84%	7.69%	10.78%
Overall	76	26	102
	74.51%	25.49%	100%

Table VI (3)

	ASA I-II	ASA III-IV	Overall
No complications	81	10	91
	89.01%	90.91%	89.22%
Complications	10	1	11
	10.99%	9.09%	10.78%
Overall	91	11	102
	89.22%	10.78%	100%

tration of propofol and should be qualified in life support skills (56-59). The administration of sedation by the endoscopist that performs the endoscopic procedure or the assistant nurse, in the absence of another person dedicated solely to the monitoring of the patient and administration of the sedation, is safe and effective as results from our study and previous publications (15,35). Further prospective studies comparing the administration of propofol *versus* other methods of sedation in endoscopic procedures, controlled or not by anesthesiologists, and with a larger number of patients are needed before this practice can be recommended for general use.

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