

Complication Rate of Propofol-Based Deep Sedation for Colonoscopy in Marked Obesity Patients

Somchai Amornyotin, Siriporn Kongphlay

Somchai Amornyotin, Department of Anesthesiology and Siriraj GI Endoscopy Center, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand

Siriporn Kongphlay, Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand

Correspondence to: Amornyotin Somchai, Associate Professor of Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Email: somchai.amo@mahidol.ac.th

Telephone: +66-2-4197990

Fax: +66-2-4113256

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ABSTRACT

AIM: To evaluate and compare the complication rate of propofol-based deep sedation (PBDS) for colonoscopy in marked obesity (BMI > 30) and non-obesity (BMI < 25) patients in a teaching hospital in Thailand.

METHODS: We undertook a retrospective review of the sedation service records of adult patients who underwent colonoscopic procedures from December 2009 to April 2011. All patients were classified into two groups according to the body mass index (BMI). In group A, the patients had BMI < 25. In group B, the patients had BMI > 30. The primary outcome variable was the overall complication rate. The secondary outcome variables were sedation and procedure-related complications during and immediately after the procedure.

RESULTS: After matching age, gender, ASA physical status, sedation time and indications of procedure, there were 100 colonoscopic procedures in group A and 33 colonoscopic procedures in group B. All sedation was given by residents or

anesthetic nurses directly supervised by staff anesthesiologist in the endoscopy room. There were no significant differences in patients' characteristics, sedation time, indication of procedure, overall complication rate, anesthetic personnel and mortality rate between the two groups. However, upper airway obstruction in group B was relatively higher than in group A. All complications were easily treated, with no adverse sequelae.

CONCLUSION: PBDS for colonoscopic procedure in marked obesity patients by trained anesthetic personnel with appropriate monitoring was relatively safe and effective. The complication rate of this technique in marked obesity (BMI > 30) patients was not different or worse than in non-obesity (BMI < 25) patients. Serious complications were rare in our population.

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Key words: Deep sedation; Propofol; Complication; Colonoscopy; Marked obesity

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INTRODUCTION

Colonoscopy is a highly invasive GIE procedure. It causes considerable pain discomfort to the patients. Sedative and analgesic drugs are usually utilized for this procedure. To date, there have been different clinical practices in regards to the use of these sedative agents^[1-3]. Generally, a combination of sedative and analgesic is the most common practice. Subsequently, multi-drug regimens exist

including opioids, benzodiazepines, ketamine and propofol. In Thailand, most invasive GIE procedures including colonoscopies are generally performed with the deep sedation technique^[4-6]. Midazolam is frequently used because it has an anxiolytic effect and a short duration of action. Propofol is a strong and short hypnotic drug with more rapid recovery time. In addition, a subanesthetic dose of ketamine is appropriate for procedural sedation and analgesia^[7]. However, ketamine is usually given in combination with other sedatives and/or analgesics. To date, the use of a combination of ketamine and propofol (ketofol) for procedural sedation is increasing^[8].

Generally, marked obesity patients are predominantly vulnerable to sedation-related complications^[9]. There have been few studies directly comparing the complication rate of propofol-based deep sedation (PBDS) for colonoscopy in marked obesity patients and normal weighted patients. At Siriraj GI Endoscopy Center, it is routine practice to sedate the patients undergoing colonoscopic procedures with propofol in combination with a low-dose opiate and/or other sedatives. Administration of sedative and analgesic drugs, although normally safe, is not without risk. Moreover, sedation-related complication rate of PBDS regimen is significantly higher than the combination of benzodiazepine and opiate regimen. The study, therefore, was designed to evaluate and compare the complication rate of PBDS for colonoscopic procedure in marked obesity (BMI > 30) and non-obesity (BMI < 25) patients in a teaching hospital in Thailand.

METHODS

Patients

We undertook a retrospective review of the sedation service records of adult patients who underwent colonoscopic procedures from December 2009 to April 2011 at Siriraj GI Endoscopy Center, Faculty of Medicine Siriraj Hospital, Mahidol University. All patients were classified into two groups according to the body mass index (BMI). In group A, the patients had BMI < 25. In group B, the patients had BMI > 30. Inclusion criteria were the adult patients who underwent colonoscopic procedures by using PBDS technique during the study period. Exclusion criteria were the patients had BMI 25-30, patients with predicted difficult airway management, patients with baseline oxygen saturation < 95%, and patients with severe cardiorespiratory instabilities as well as full stomach cases. The primary outcome variable was the overall complication rate. The secondary outcome variables were sedation and procedure-related complications during and immediately after the procedure.

Endoscopy-related procedure

The colonoscopic procedures were performed by fellows in gastroenterology and staff endoscopists. All endoscopies were done by using an Olympus video endoscope (CF-Q 180AL, Olympus Corporation, Tokyo, Japan). The successful completion of the procedure was defined as the successful cecal intubation. After completion of the procedure, admission was made into the recovery room service for at least two hours to rule out immediately post-endoscopic complications. The procedure-related complications were defined as British Society of Gastroenterology^[10].

Sedation-related procedure

Appropriate monitoring was used for all patients. Cardiovascular monitoring included continuous electrocardiogram, heart rate, and oxygen saturation measurements and five-minute interval non-

invasive blood pressure measurements from blood pressure cuff device. Ventilation monitoring included continuous respiratory rate measurements and interval observation of patterns of respiration, chest movement, and signs and symptoms of airway obstruction. Level of consciousness was also periodically assessed. End-tidal carbon dioxide monitoring with capnography was not used during sedation. No other premedication drugs were administered before the procedure.

The sedative agents used were propofol, midazolam and fentanyl. All patients were oxygenated with 100% O₂ via nasal cannula and sedated by well-trained anesthetic personnel directly supervised by a staff anesthesiologist in the endoscopy room. Anesthetic personnel included residents in anesthesiology and anesthetic nurses who were well trained in the use of intravenous sedation technique and airway management. All sedated patients were sedated in deep sedation level, according to the guideline of the American Society of Anesthesiologists (ASA)^[11].

Sedation-related complications

Sedation-related complications such as hypotension, bradycardia, hypoxia or airway obstruction were noted. Serious complications defined as prolonged desaturation or apnea more than 20 seconds. We used these criteria in defining sedation-related complications: hypo/hypertension and brady/tachycardia measured as changes in blood pressure and heart rate, respectively, of more than 20% of baseline values. Hypoxia was defined as oxygen saturation (SpO₂ < 90%).

Statistical Analysis

Results were expressed as mean±SD or percentage (%), when appropriate. Comparisons between the complication rate of PBDS for colonoscopy in marked obesity (BMI > 30) and non-obesity (BMI < 25) patients were compared by using with Chi-square tests (for categorical variables), Chi-square tests for trend (for ordinal variables), and two-sample independent t-test (for continuous variables). The statistical software package SPSS for Window Version 11 (SPSS Inc., Chicago, IL) was used to analyze the data. All statistical comparisons were made at the two-sided 5% level of significance.

RESULTS

After matching age, gender, ASA physical status, sedation time and indications of procedure, there were 100 patients in group A and 33 patients in group B. Table 1 summarized the patients' characteristics of the two groups. The mean age in group A was 57.9±14.2 years and the mean age in group B was 58.3±8.9 years. There were no significant differences in age, gender, ASA physical status, sedation time and indications of procedure between the two groups.

Table 2 showed the overall complication rate, sedation and procedure-related complications and anesthetic personnel in both groups. Overall, sedation-related complications including respiratory and cardiovascular-related complications as well as procedure-related complications were not significantly different between the two groups. The majority of the sedation-related complications were the cardiovascular-related adverse events including hypotension. Unsurprisingly, two patients (6.1%) in group B and none in group A developed upper airway obstruction ($p=0.013$). However, all of these complications in both groups were transient and under the care of an anesthesiologist. Consequently, procedure-related complications in both groups were none.

All colonoscopic procedures were successfully completed. The mean dose of sedative agents was demonstrated in Table 3. Propofol,

midazolam and ketamine were the sedative agents used in both groups. Mean dose of propofol and ketamine was not significantly different between the two groups. Additionally, mean dose of midazolam in group A was relatively greater than in group B.

DISCUSSION

Colonoscopy is a painful and unpleasant procedure. In addition, colonoscopy in obese patients represents a challenging issue for endoscopists. Opiates, benzodiazepines, and propofol in various

combinations are administered to the patients to offer deep sedation^[1,4,6,12,13]. Propofol is an effective sedative drug in advanced GIE procedures. However, propofol has a narrow margin of safety. It induces a deeper level of sedation and causes more severe cardiorespiratory depression. A combination of propofol and low dose opioid and/or sedatives diminishes the total dose of these sedative drugs and decreases serious complications.

To date, deep sedation is commonly used for the colonoscopic procedure and then becomes important in helping patient's tolerance during the procedure. Patients requiring deep sedation frequently receive propofol. The risk factors of sedation-related complications include the type, dose and mode of administration of sedative agents, as well as the patient's age and underlying medical diseases^[14]. Most common complications during colonoscopy are cardiorespiratory adverse events including hypotension, bradycardia, hypoventilation, apnea and hypoxia. The addition of ketamine in the PBDS regimen could reduce the total amount of propofol and other sedatives. This might be reduced cardiorespiratory adverse events.

The primary objective of the study was to evaluate and compare the complication rate of PBDS for colonoscopy in marked obesity (BMI > 30) and non-obesity (BMI < 25) patients. Our result showed that the complication rate of PBDS technique in marked obesity patients was not different or worse than in non-obesity patients. Serious complications were rare. Our overall complication rate in performing deep sedated colonoscopy for marked obesity patients is comparable to that overall complication rate in non-obesity patients. This might be due to a lower mean dose of midazolam in marked obesity patients. In addition, administration of propofol in our study is continuously titrated by using a syringe pump.

Several factors predicting complications caused by colonoscopy have been reported. Sedation-related complications are commonly associated with cardiovascular and respiratory systems^[15]. However, cardiorespiratory-related complications have been variably defined according to the definitions. In the Clinical Outcomes Research Initiative (CORI) database, cardiorespiratory complications occurred in 0.9% of procedures and made up 67% of the unplanned events during or after endoscopic sedation^[16]. Obesity could profoundly change respiratory function. This might be associated with an increase rate of sedation-related complications. Several previous studies confirmed that obesity was one of the possible predictive factors of sedation-related complications including arterial oxygen desaturation in patients underwent colonoscopy^[17]. Consequently, advanced age, higher ASA physical status scores, the presence of comorbidities, and sedation are the risk factors of cardiorespiratory-related adverse events.

Cardiorespiratory events account for about half of the adverse events during endoscopies^[18]. Overall complication rate in these two groups was relatively higher than our previous report^[12]. In the present study, we observed 41 (41.0%) and 15 (45.5%) cardiorespiratory events in non-obesity and marked obesity patients, respectively. This higher complication rate in these two groups may be several explanations. We used these criteria in defining sedation-related complications: hypo/hypertension and brady/tachycardia measured as changes in blood pressure and heart rate, respectively, of more than 20% of baseline values. Hypoxia was defined as oxygen saturation < 90%. In addition, the targeted depth of sedation level in our study was deep sedation. Thus, the complication rate in these two groups was significantly higher than in mild and moderate sedation groups.

The data regarding the complication rate of propofol-based deep sedation for colonoscopic procedure in marked obesity patients are

Table 1 Characteristics of patients, sedation time and indications of procedure (mean, SD and percentage).

	Group A (n=100)	Group B (n=33)	P value
Age (yr) (mean, SD)	57.9 (14.2)	58.3 (8.9)	0.552
Gender (%):			0.093
Male	47 (47.0)	10 (30.3)	
Female	53 (53.0)	29 (69.7)	
Weight (kg) (mean, SD)	57.0 (9.4)	83.0 (11.5)	<0.001 ¹
Body mass index (mean, SD)	21.6 (2.3)	32.9 (3.4)	<0.001 ¹
ASA physical status (%)			
I	31 (31.0)	10 (30.3)	
II	61 (61.0)	17 (51.5)	
III	8 (8.0)	6 (18.2)	
Sedation time (min) (mean, SD)	33.0 (16.1)	29.4 (16.8)	0.053
Indications of procedure (%)			0.427
Colon tumor	44 (44.0)	14 (42.4)	
Bowel habit change	15 (15.0)	5 (15.2)	
Lower gastrointestinal hemorrhage	14 (14.0)	4 (12.1)	
Surveillance	7 (7.0)	3 (9.1)	
Abdominal pain	6 (6.0)	2 (6.1)	
Others	14 (14.0)	5 (15.2)	

Group A: BMI < 25; Group B: BMI > 30; BMI: Body Mass Index;

¹ considered to be of statistical significance.

Table 2 Overall complication rate, sedation and procedure-related complications and anesthetic personnel (n, %).

	Group A (n=100)	Group B (n=33)	P value
Overall complication rate	41 (41.0)	15 (45.5)	0.653
Sedation-related complications	41 (41.0)	2 (6.1)	0.653
Respiratory system	1 (1.0)	0	0.090
Hypoxia	1 (1.0)	2 (6.1)	0.564
Upper airway obstruction	0	13 (39.4)	0.013 ¹
Cardiovascular system	40 (40.0)	10 (30.3)	0.951
Hypotension	36 (36.0)	3 (9.1)	0.551
Hypertension	2 (2.0)	0	0.063
Bradycardia	2 (2.0)	0	0.413
Procedure-related complications	0		1.000
Anesthetic personnel		14 (42.4)	0.728
Residents	39 (39.0)	19 (57.6)	
Anesthetic nurses	61 (61.0)		

Group A: BMI < 25; Group B: BMI > 30; BMI: Body Mass Index;

¹ considered to be of statistical significance.

Table 3 Sedative agents used in both groups.

	Group A (n=100)	Group B (n=33)	P value
Propofol			
N (%)	100 (100.0)	33 (100.0)	
Mean (SD) (mg/kg)	3.9 (1.8)	3.1 (1.6)	0.253
Midazolam			
N (%)	100 (100.0)	33 (100.0)	
Mean (SD) (mg/kg)	0.03 (0.00)	0.02 (0.00)	<0.001 ¹
Ketamine			
N (%)	46 (46.0)	19 (57.6)	
Mean (SD) (mg/kg)	0.4 (0.2)	0.4 (0.2)	0.074

Group A: BMI < 25; Group B: BMI > 30; BMI: Body Mass Index;

¹ considered to be of statistical significance.

limited, and there are no large prospective studies that address safety. The previous studies reported the incidence of serious complications within 30 days after screening or surveillance colonoscopies were uncommon. The risk of complications increased with preprocedure warfarin use and performance of polypectomy with cauterization^[19]. Moreover, the study of Levin and colleagues quantified the magnitude and severity of colonoscopy complications in 16,318 patients 40 years of age or older underwent colonoscopy. Their study demonstrated that serious complications occurred in 0.8 per 1000 colonoscopies without biopsy or polypectomy and in 7.0 per 1000 colonoscopies with biopsy or polypectomy^[20]. Although our study did not directly assess procedure-related complications, we did not observe any serious complications during or after the procedures. It is clear that appropriate selection of patients and the use of standard monitoring, including an assessment of blood pressure, heart rate, respiratory rate, pulse oximetry, and electrocardiogram for deep sedation in marked obesity patients are very important and will most likely reduce the rate of serious complications. Additionally, propofol administered by anesthetic personnel for colonoscopic procedure is safe and effective.

Our study used ketamine as an analgesic agent for deep sedation in marked obesity patients. The previous study demonstrated that a combination of ketamine and propofol (ketofol) provided better sedation quality than a combination of fentanyl and propofol, with less cardiorespiratory depression and appears to be a safe and useful technique for sedating obese patients underwent invasive GIE procedures^[21]. Furthermore, the preferred effect of low-dose ketamine on the combination of other sedative drugs for colonoscopic procedure has been confirmed by Tuncali and colleagues^[22]. Their randomized, double-blinded, placebo-controlled study demonstrated that a low-dose ketamine combined with propofol, midazolam and fentanyl for sedation in colonoscopic procedure resulted in better quality of sedation and more hemodynamic stability as well as less adverse effects.

There are several limitations in this study. First, our study was a retrospective review of the sedation service records of adult patients who underwent colonoscopic procedures. Its reliance on self-reported data is limited. These data may tend toward an underestimation of unpleasant data. Second, the colonoscopic procedures were performed by variety of endoscopists, including fellows in training. Therefore, the varied experience may have biased the result of the study. However, the effect of this may be small because of an equal number of fellows performed endoscopic procedures in both groups. Third, this study was investigated in the small number of patients. Fourth, our sedation practice used only basic monitoring, which did not include the use of end-tidal carbon dioxide for ventilation monitoring. Therefore, respiratory-related complications may have been underestimated. Fifth, the design of our study aimed that deep sedation level was the target. It could not be generalized to the other sedation levels. However, in a place with limited resources for monitoring, like Thailand, we relied greatly on the clinical assessments^[23]. Overall, despite these limitations, we are confident that these findings are generalizable to the practice of colonoscopic procedure that used PBDS technique.

In conclusion, PBDS for colonoscopic procedure in marked obesity patients by trained anesthetic personnel with appropriate monitoring was relatively safe and effective. The complication rate of this technique in marked obesity (BMI > 30) patients was not different or worse than in non-obesity (BMI < 25) patients. Serious complications were rare in our population. Although, upper airway obstruction in marked obesity patients developed more frequently

than in the normal weight patients, it was transient and was not difficult to manage.

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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Peer reviewer: Francis Seow-Choen, Director, Seow-Choen Colorectal Centre, 290 Orchard Road, Paragon #06-06 Singapore.