

Cardiovascular complication following intravenous sedation using propofol and fentanyl combination for gastrointestinal endoscopy

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ABSTRACT

Intravenous (IV) sedation is an acceptable anesthetic technique for gastrointestinal (GI) endoscopy. The objectives of the study were to examine the incidence of cardiovascular complication during IV sedation for GI endoscopy and determine the speed of recovery from sedation. Method: All patients underwent GI endoscopy under conscious sedation at HRH Princess Maha Chakri Sirindhorn Medical Center from December 2003 – June 2004 were identified. Their data including cardiovascular complications during and after anesthesia, recovery score during PACU admission, time to maximum recovery score, and duration of stay in PACU were recorded. Results: The cardiovascular complications found during anesthesia were hypotension of 29.7%, bradycardia of 21.2%, and oxygen desaturation of 1.8%, while the incidences during PACU admission were hypotension of 24.2%, bradycardia of 29.6%, and oxygen desaturation of 4%. Conclusion: Although the incidence of hypotension and bradycardia was found to be high, the severity was modest and not accompanied by serious cardiac morbidity and mortality.

Keywords : propofol, gastrocolonoscopy, outpatient

Endoscopy has been used to help diagnose a great number of problems in the gastrointestinal (GI) tract such as bleeding, infection, inflammation, ulcers, polyps and cancers. The anesthetic technique required for such procedure can be either general anesthesia (GA) or intravenous (IV) sedation.

Moderate level of IV sedation given by trained endoscopic nurse under supervision of an endoscopist was widely accepted for outpatient endoscopy¹. The sedative drug used by most endoscopists is meperidine, either alone or in combination with benzodiazepines²⁻⁴. Since this combination can lead to significant side effects and a relatively long recovery time³⁻⁵. In an effort to improve safety and recovery time, newer drugs are used for conscious sedation in patients having endoscopic procedures. Propofol is a potent intravenous anesthetic agent with sedative and analgesic properties⁶⁻⁹. It has proven efficacy and acceptable safety profiles in patients with known coronary artery disease and myocardial dysfunction¹⁰. There appears to be a lower incidence of oxygen desaturation, although hypotension has been described. These advantages are coupled with a short half-life and rapid recovery time.

The objectives of this investigation were to study the incidence of cardiovascular complication during IV sedation for GI endoscopy and to determine the speed of recovery.

MATERIALS AND METHODS

A retrospective review of data was obtained from the anesthesia and post-anesthesia records of the patients undergoing endoscopic procedure under IV sedation using a combination of propofol and fentanyl at HRH Princess Maha Chakri Sirindhorn Medical Center during December 2003 - June 2004. Patients with risk of aspiration and pediatric cases were excluded. Sedation related complications consist of

hypotension (systolic blood pressure \leq 90 mmHg), bradycardia (heart rate \leq 60 bpm) and hypoxemia (oxygen saturation \leq 90% by pulse oximetry). Other data including: age, sex, body weight, underlying disease, ASA physical status, type of procedure, duration of anesthesia, total doses of propofol, total doses of fentanyl, blood pressure, heart rate, oxygen saturation, recovery score at entering post anesthesia care unit (PACU), and time spent in PACU were recorded.

Statistical analysis

Descriptive data are presented as mean or percentages. To test the difference among groups, Chi-square test was used for nonparametric data. A P-value of < 0.05 was considered statistically significant

RESULTS

Two-hundred and twenty-two discrete sedation events were analyzed. All patients received preoxygenation via O₂ canular 3 L/min, intravenous bolus of fentanyl, followed by intravenous loading of propofol until patient did not respond to verbal command, or noxious stimulus. Anesthesia was maintained with intravenous infusion of titratable propofol. The endoscopic procedures consisted of 137 gastroscopies (61.7%), 53 colonoscopies (23.9%), and 32 gastrocolonoscopies (14.4%). Demographic data and mean anesthesia time were listed in Table 1. The underlying diseases recorded were hypertension, valvular heart disease, coronary artery disease, chronic obstructive lung disease, cirrhosis, and anemia. The GI endoscopies were performed to investigate the following conditions: upper and/or lower GI bleeding, dyspepsia, diarrhea, abdominal pain, and esophageal varices. Mean doses of propofol and fentanyl required during the procedure were shown in Table 2.

The overall incidences of sedation related complications during anesthesia include hypotension

of 29.7%, bradycardia of 21.2%, and oxygen desaturation of 1.2%. The complications occurred in the PACU consist of hypotension of 24.2%, bradycardia of 29.6%, and oxygen desaturation of 4%. The incidence of complications for separated procedure (gastroscopy, colonoscopy, gastrocolonoscopy) were shown in Figure 1-2.

The relation between cardiovascular complications and patients' age was shown in Table 3. The incidence of bradycardia and hypoxemia in PACU were significantly higher in patients who were older than 60 with P-value of 0.03 and 0.01 respectively.

The relation between cardiovascular complication and patients with underlying disease was shown in Figure 3. Patients with underlying medical problem were shown to have statistically significant higher incidences of hypotension and bradycardia.

During PACU admission, modified Aldrete's score was used to assess the patient's physical status and fitness for discharge. There were no significant differences in recovery score at entering PACU, time to maximum recovery score, and duration of stay in PACU between each type of procedures. (Table 4)

Table 1. Patient's demographic data and mean anesthetic time.

| | gastroscopy | colonoscopy | gastrocolonoscopy |
|---------------------------|-------------|--------------|-------------------|
| No.patient | 137 | 53 | 32 |
| age<60 | 82 | 21 | 16 |
| age≥60 | 55 | 32 | 16 |
| sex: M/F | 72/65 | 26/27 | 18/14 |
| mean body weight(kg) | 53.7 | 60.7 | 59.8 |
| underlying disease | | | |
| absent | 88 | 27 | 14 |
| present | 49 | 26 | 18 |
| ASA physical status | | | |
| 1 | 58 | 14 | 5 |
| 2 | 57 | 37 | 19 |
| 3 | 22 | 2 | 8 |
| mean anesthetic time(min) | 5-75(11.7) | 10-165(33.7) | 15-80(35.1) |

Table 2. The mean propofol and fentanyl dose during procedure.

| agents | Type of GI endoscopy | | |
|--------------------------|----------------------|-------------------|-------------------|
| | gastroscopy | colonoscopy | gastrocolonoscopy |
| propofol dose(µg/kg/min) | 14.8-550(215.5) | 52.9-282.0(131.6) | 55.3-266.7(130.5) |
| fentanyl(µg/kg) | 0.25-1.22(0.52) | 0.33-1.25(0.56) | 0.25-1.22(0.52) |

Table 3. Relation between cardiovascular complication and patient age.

| complication | Age(yr.) | |
|----------------------|-------------|--------------|
| | <60 | ≥60 |
| Hypotension | 35 [29.4 %] | 31 [30.1 %] |
| Bradycardia | 19 [15.9 %] | 28 [27.2 %]* |
| Desaturation | 1 [0.8 %] | 3 [2.9 %] |
| Hypotension at PACU | 29 [24.4 %] | 25 [24.3 %] |
| Bradycardia at PACU | 31 [26.1 %] | 35 [34.0 %] |
| Desaturation at PACU | 1 [0.8 %] | 8 [7.8 %]* |

* P<0.05

Table 4. Demonstration recovery score, Time to maximum score and time spent in PACU.

| parameters | Type of endoscopy | | |
|---------------------------------|-------------------|-------------|-------------------|
| | gastroscopy | colonoscopy | gastrocolonoscopy |
| Recovery score at entering PACU | 8.8 | 8.9 | 8.4 |
| Time to maximum score(min) | 17.19 | 18.7 | 20.0 |
| Time spent in PACU(min) | 48 | 52.0 | 48.8 |

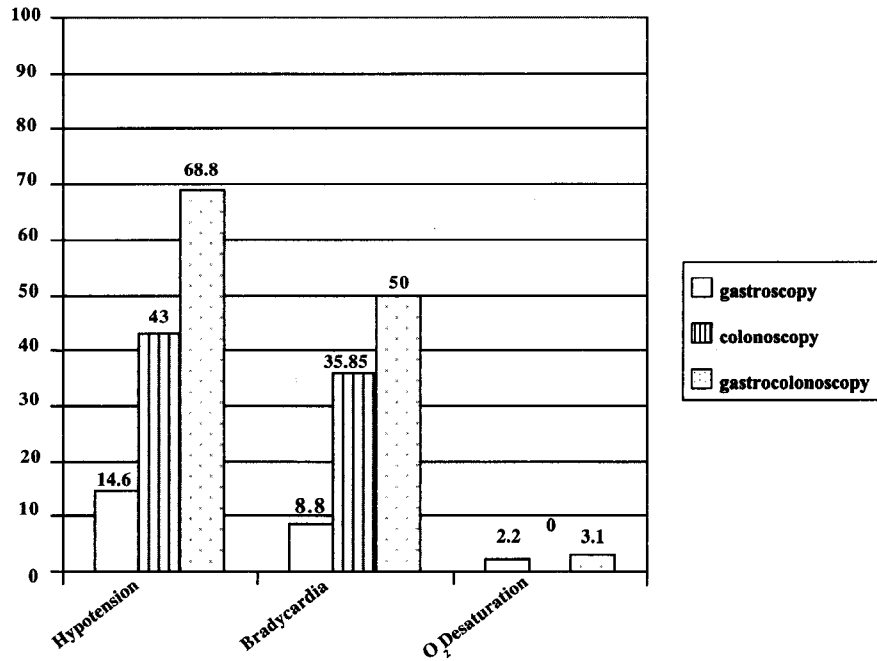


Figure 1. The incidence of complications for each procedure during IV deep sedation

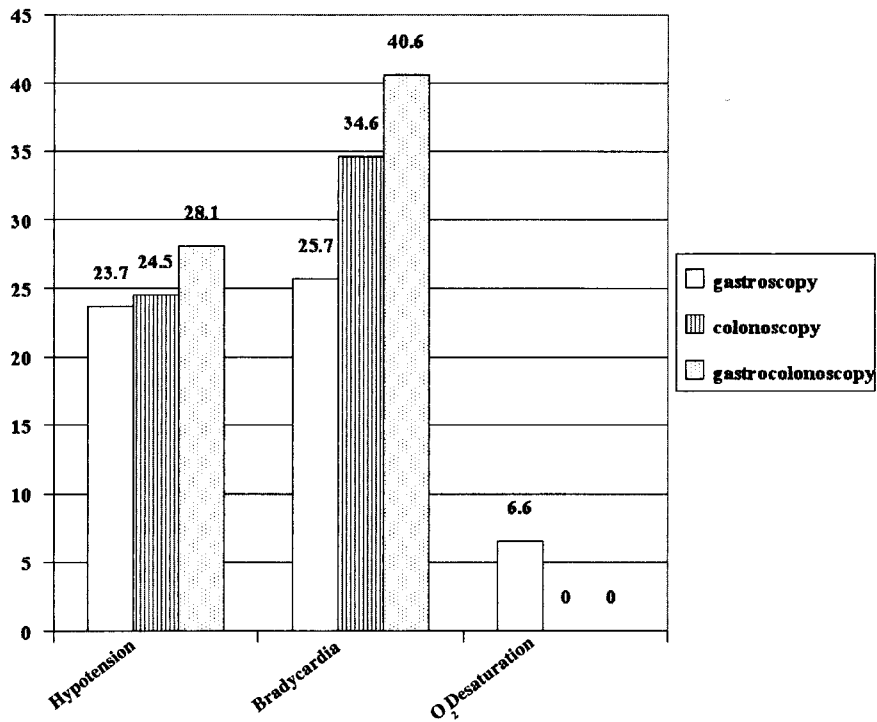


Figure 2. The incidence of complication for each procedure at PACU

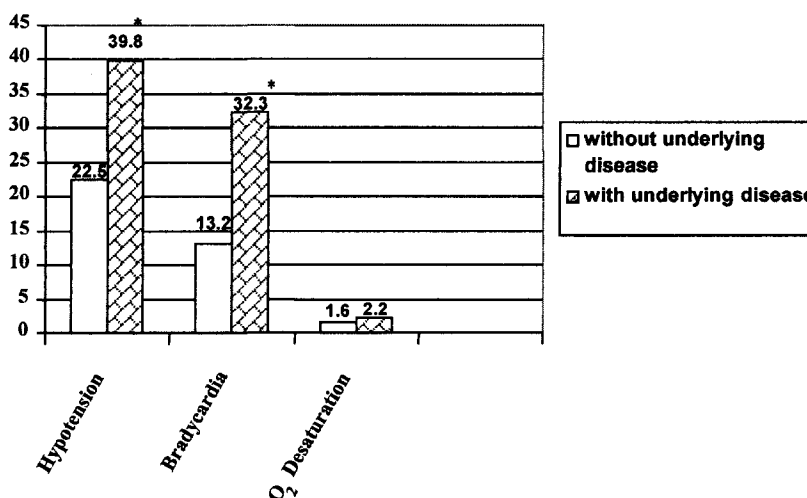


Figure 3. The incidence of complication for each patient with/without underlying disease

*P<0.05

DISCUSSION

Intravenous sedation is one of the anesthetic technique recommended for GI endoscopy especially in the ambulatory setting¹¹⁻¹². We found that IV sedation technique has been used routinely for GI endoscopy at HRH Maha Chakri Sirindhorn Medical Center. Eventhough, general anesthesia has its place in particular conditions such as pediatric patients and full stomach cases, as well as the technique of choice in some countries. A study found that in Asia only 44% of the anesthesiologists used sedation technique routinely and 53% did not believe sedation is necessary at all for patient comfort¹³. In fact, even the expert endoscopist may use different level of sedation for the same procedure depending on where the expert is performing around the world.

Supplement oxygen administration has been shown to reduce the magnitude of desaturation when given during endoscopic procedure under deep sedation¹⁴⁻¹⁵. In this study, the incidence of oxygen desaturation appeared to be low (1.2%) when compare with the study done by DAVID R(20%)¹⁶. This is probably due to early oxygen supplementation via nasal cannula before starting anesthesia, prevention of upper airway obstruction by lateral positioning,

and chin lift maneuver, either by the scrub nurse during gastroscopy or the anesthesiologist during colonoscopy.

Though the incidence of hypotension during anesthesia was found to be high (29.7%), the event can be avoided by slowing the rate of propofol injection or infusion¹⁷. There were studies showed correlation between the incidence of hypotension and patient's age¹⁸⁻¹⁹, but this correlation was not demonstrated in this study, titration the use of propofol. On the other hand, bradycardia was found to be related with patient's age. An increase in parasympathetic tone with increasing age may explain this finding.

The incidence of oxygen desaturation was also higher with increasing age especially during PACU admission. Elderly patients also have higher incidence of hypoxemia because of more severe mismatching of ventilation and perfusion from loss of lung recoil and marked reduction in the ventilatory response to hypoxia and hypercapnia, which render them more likely to have apnea and upper airway obstruction in the PACU²⁰.

Patients who have concomitant medical problems including cardiovascular, pulmonary, renal, hepatic, metabolic and neurologic disorders and morbid obesity may be at increased risk from sedation²¹⁻²². Similarly, this study found that patients with underlying diseases had higher incidence of hypotension and bradycardia during anesthesia, as well as oxygen desaturation during PACU admission.

One study demonstrated an average patient discharge time of 45 minutes after colonoscopy²³. The finding of discharge time from this study showed the same trend, though the sedation regimen was different. When modified Aldrete's recovery score was used as a criteria for discharge, the patient was ready to discharge in only 15-20 minutes after PACU admission. But the real discharge time was found to be much longer (45-60 minutes) because of the following reasons: waiting for the discharge signature from the authorized anesthesiologist, the process of bill payment, and availability of an accompanying person to drive the patient home. The service system that is one-stop and efficient may reduce the time spent in the PACU when the patient was assessed as safe for discharge.

During recovery from sedation, the incidence of oxygen desaturation was found to be significantly greater in patients having gastroscopy than the others ($P < 0.05$). We hypothesized that short procedure time (5-10 minutes) and high residual anesthetics blood level were responsible for this finding. Murrar AK et al also stated that duration of hypoxia may be prolonged well beyond the completion of the procedure²⁴.

The concept of patient-controlled anesthesia (PCA) was recently introduced as a sedation technique for endoscopy and has been proved to be an effective method for the administration of sedatives²⁵⁻²⁶. This technique has been shown to decrease patient's anxiety and the overall anesthetics requirement. When

anesthetics requirement is reduced, a faster recovery time and decreased adverse pharmacological side effects are ensured particularly the impact on cardiovascular system.

The limitation of this study must be acknowledged. Our study is retrospective, therefore some data may have been missed.

CONCLUSION

Intravenous sedation for GI endoscopy with propofol and fentanyl combination was found to be acceptable and safe for the patients. Though side effects on cardiovascular system were recognized, the severity tended to be modest. The practice of giving enriched oxygen in the inspired air before sedation, titrating the drugs to the desired effect by the qualified anesthesiologist and/or nurse anesthesiologist, and close monitoring will enhance safety and recovery time.

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