

Modified sevoflurane-based sedation technique versus propofol sedation technique: A randomized-controlled study

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ABSTRACT

Background: The aim of this study was to evaluate the safety and efficacy of sevoflurane-based sedation technique for colonoscopy in geriatric patients as compared with that using propofol. **Materials and Methods:** Sixty elderly patients, who were scheduled for colonoscopy, participated in this controlled prospective study and were randomly allocated into two groups; P and S. The patients were sedated using either propofol in P group or sevoflurane in S group. Complications (including apnea, the need for airway intervention, occurrence of general anesthesia [GA], hemodynamic instability and others), the fentanyl requirement and the times of the procedure, recovery, and discharge were recorded in both groups. **Results:** The patients in P group had more frequent apnea attacks, need for airway intervention and occurrence of GA compared to the patients in S group. However, both groups were comparable regarding the other measured variables. **Conclusion:** For geriatric colonoscopy, sevoflurane can provide safe and effective sedation alternative to propofol.

Key words: Colonoscopy, sedation, sevoflurane

INTRODUCTION

The geriatric patients is most rapidly growing age group,^[1] as a result of the parallel decline in mortality and fertility rates.^[2] Even in the absence of any discernible disease, the aging process results in a progressive functional decline in all major systems.^[1] Colonoscopy is one of the most commonly performed outpatient procedures for the diagnosis, serial surveillance, and treatment of gastrointestinal disorders.^[3] It is usually performed under deep sedation using intravenous (IV) sedative and analgesic agents.^[4,5] The purpose of anesthesia is to provide adequate analgesia, amnesia and control of the patient behavior with a rapid and complete recovery. Propofol, an ultra-short-acting sedative agent, has been used widely for endoscopy. It can provide safe and effective sedation for all gastrointestinal procedures;^[6] However, the related airway

obstruction and apnea may be risky, especially in geriatric patients. Sevoflurane (fluorinated methyl isopropyl ether) is a nonpungent inhalational anesthetic with a rapid induction and quick elimination.^[7] Because of these characteristics, sevoflurane was successfully used for sedation.^[7] The aim of this study was to evaluate the safety and efficacy of sevoflurane-based sedation technique for colonoscopy in geriatric patients as compared with that using propofol.

MATERIALS AND METHODS

The Ethical Committee of Burjeel Hospital approved this prospective randomized study. Sixty patients (American Society of Anesthesiologists I-II, ≥ 60 years old), who were scheduled for colonoscopy during a 6-month period (October 2013-March 2014), formed the study group, and their informed written consents were obtained. The patients with body mass index >35 kg/m² or obstructive sleep apnea were excluded. The patients were randomly allocated (using closed envelope technique) into two groups; P and S. All patients were sedated using either propofol in P group or sevoflurane in S group.

On arrival to the endoscopy room, an IV line was inserted, the basic standard monitoring lines were applied (non-invasive blood pressure [BP], oxygen saturation

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[SaPO₂], electrocardiogram) and the basal readings were recorded. In both groups, 0.5 mg/kg propofol IV was administered. In P group, a clear plastic mask was applied. In S group, a nasal airway was inserted and connected to a semi-closed anesthesia circuit (Datex-Ohmeda Aespire view) (GE Healthcare 3030 Ohmeda Drive P.O. Box 7550 Madison, WI 53707-7550 U.S.A.). A low flow rate of 4 L/min of 100% O₂ was started for both groups. A capnogram sample line was placed under the oxygen mask in P group and connected to the circuit in S group. The sedation was maintained using propofol increments (0.25 mg/kg) in P group and with sevoflurane (started at 1%) in S group. The sevoflurane concentration and the frequency of propofol increment injection were adjusted to achieve a sedation level 3 of observer alertness assessment score (OAAS) [Table 1]. Fentanyl 25 mcg supplementation was used in the event of pain.

Apnea, the need for airway intervention, the occurrence of general anesthesia (GA) and other complications (laryngospasm, oxygen desaturation, and postoperative nausea and vomiting [PONV]) were recorded. The mean arterial blood pressure (MBP), heart rate, SaPO₂ and respiratory rate (RR) were recorded at four intervals; baseline, insertion of colonoscope, cannulation of the cecum, and at the end of the procedure. The fentanyl requirement and the times of the procedure, recovery, and discharge were also recorded. Apnea was defined as a lack of spontaneous respiratory effort for 20 s, detected by visual monitoring and capnogram. Airway intervention was defined as any action taken to improve and/or restore ventilation including; jaw thrust, insertion of nasal or oral airway, and ventilatory-assist maneuvers. The airway intervention was undertaken on the judgment of the operator anesthetist. When unarousable, the patient was considered to have GA. Oxygen desaturation was defined as SaPO₂ <90% for >60 s. The procedure time was defined as the time between colonoscope insertion and withdrawal. The recovery and discharge times were defined as the time between withdrawal of the colonoscope until postanesthesia care unit (PACU) transfer (OAAS = 5) and until the patient discharge from PACU (ability to walk unassisted), respectively.

Statistical analysis

Based on previous results (dd), a sample size estimate was calculated. A study comprised of 20 patients per group, and a $P = 0.05$ was determined to have a 0.95 power at two tail alpha of 0.05. Data is given as mean (standard deviation). Statistical comparisons between the two groups were performed using Student's *t*-test for normally distributed data; proportions were analyzed by Fisher's exact test. A two-sided error level of $P < 0.05$ was considered statistically significant. All statistics were analyzed using a statistical software package

(GraphPad InStat, version 3.00 for Windows; GraphPad Software Inc., San Diego, California, USA).

RESULTS

One patient in each group was excluded for poor bowel preparation while the other 58 patients completed the study [Table 2]. The patients in P group had more frequent apnea attacks, need for airway intervention, and occurrence of GA compared to the patients in S group [Figure 1]. The other complications (including laryngospasm, nausea, vomiting, oxygen desaturation, and significant change of MBP, heart rate, and RR) were infrequent and comparable in both groups [Figures 2 and 3]. Both groups were also comparable as regarding the fentanyl requirements [Figure 3], procedural time, recovery time, and discharge time [Table 2].

DISCUSSION

The purpose of this study was to evaluate the safety and efficacy of a modified sevoflurane-based sedation technique for colonoscopy in geriatric patients. The safety was assessed by the frequency of apnea, degree of desaturation, the need for airway intervention and occurrence of GA, laryngospasm, and the hemodynamic instability. The effectiveness was determined by the ability to achieve grade 3 OAAS with early recovery and discharge.

Table 1: observer alertness assessment score

Response	Score
Responds readily to name spoken in normal tone	5 (alert)
Lethargic response to name spoken in normal tone	4
Responds only after name is called loudly or repeatedly	3
Responds only after mild prodding or shaking	2
Does not respond to mild prodding or shaking	1
Does not respond to noxious stimuli	0

Table 2: The patients' characteristics and procedural data

Data	S group (n = 29)	P group (n = 29)	P value
Gender (male/female) (%)	21 (72.4)/8 (27.6)	19 (65.5)/10 (34.5)	0.777
ASA (I/II) (%)	16 (55.2)/13 (44.8)	17 (58.6)/12 (41.4)	1.00
Age (year)	69.2 (5)	71.1 (6)	0.195
Weight (kg)	82.3 (20.1)	83.4 (17.5)	0.841
Procedure time (min)	35.1 (16.4)	33.2 (14.5)	0.632
Recovery time (min)	7.3 (4.3)	6.1 (3.6)	0.254
Discharge time (min)	43.2 (26)	40.1 (21.2)	0.619

Values are presented as mean (SD) or number (%). ASA: American Society of Anesthesiologists; SD: Standard deviation

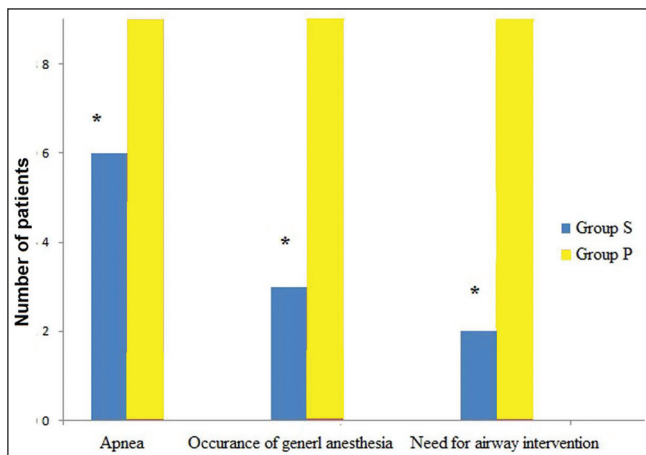


Figure 1: The frequencies of apnea, occurrence of general anesthesia and need for airway intervention (*Significant values)

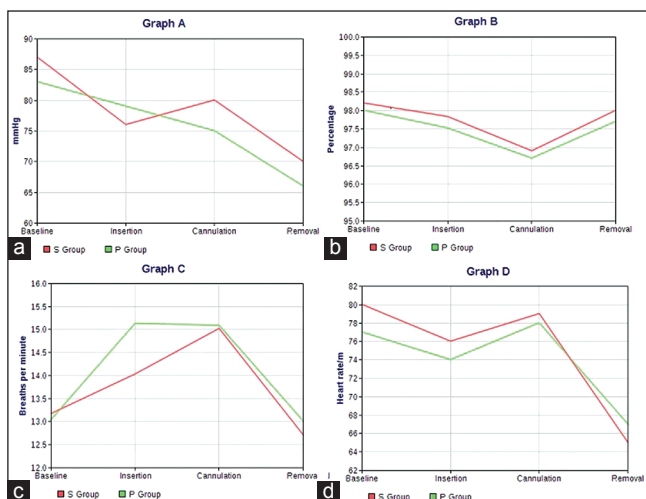


Figure 2: The vital date: No significant difference regarding the mean arterial pressure (a), oxygen saturation (b), respiratory rate (c) and heart rate (d) at the four measured intervals

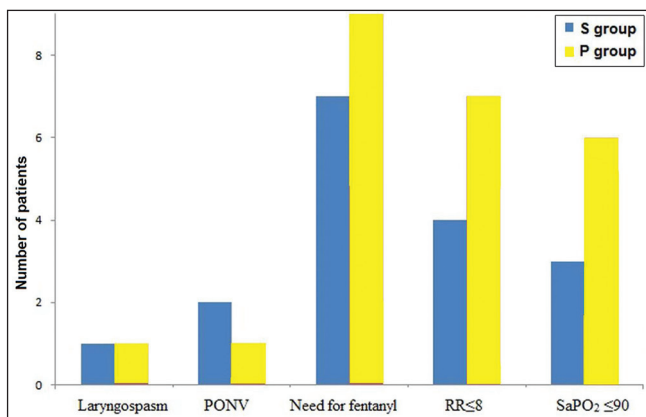


Figure 3: Frequency of other complications. PONV: Postoperative nausea and vomiting; RR: Respiratory rate; SaPO₂: Arterial oxygen saturation

organ function furthermore, in some patients, there is a wide disparity between their chronologic and physiologic ages.^[8] The patients' safety is of utmost and important priority during anesthesia and/or sedation. Many sedation techniques have been described for colonoscopy.^[9] Sevoflurane sedation has been used safely during administration of regional or local anesthesia;^[7] however, to our knowledge, it has not been used for colonoscopy yet. Propofol is considered as the standard agent for sedation in colonoscopy. Compared to other traditional sedative agents, propofol can provide an adequate depth of sedation with rapid recovery, high postanesthesia recovery score, and good patient cooperation.^[10] It also decreases the incidence of PONV and improves the patient's satisfaction.^[10] Therefore, propofol sedation has been considered as a safe technique that can be administered by nurses under physician-endoscopist monitoring.

In this study; the apnea, occurrence of GA and the need for airway intervention were more frequent with the use of propofol than that with sevoflurane. This difference may be due that propofol lacks any analgesic activity and so a high dose is required to perform a painful procedure.^[11] This usually results in a deep level of sedation, respiratory and cardiac depressions.^[11] When propofol sedation is administered by nonanesthesia personnel, the incidence of occurrence of GA (or a deeper sedation level) may reach up to 88%. This increases the risk of respiratory depression, airway obstruction, and hemodynamic instability.^[12] The use of propofol may be also associated with oxygen desaturation (SaPO₂ ≤ 90%) which incidence may reach 9%. The use of supplemental oxygen delays the occurrence of hypoxemia and consequently the detection of apnea during which the CO₂ level may rise to a dangerous level.^[11] Therefore the CO₂ monitoring is important to allow early detection and intervention; however, its exact value is false low (because of dilution occurring in the nasopharynx and under the open O₂ mask).^[11] In this study, both groups were comparable as regards the hemodynamics stability. In contrast, some studies showed that propofol was associated with significant hypotension (BP decrease >20 mmHg) in 27% of patients.^[13] Even a very low dose of propofol (0.4 mg/kg) was associated with 17 mmHg decrease in BP.^[14] This may be attributed to a combination of decreases in basal sympathetic nerve activity (SNA) and in the reflex control of SNA.^[15] Minimizing the sedation recovery time may improve acceptance of colonoscopy use for cancer screening and prevention.^[16] In this study, both group had a comparable the recovery and discharge times.

The elderly population represents a heterogeneous group of individuals with widely variable functional and reserve capacities. Aging is associated with a gradual deterioration of

All the above drawbacks may have more serious consequences in geriatric patients (with associated comorbidities) and supportive intervention may be necessary.

In spite of the sevoflurane safety, it was delivered using a nasal airway which is a convenient way and well tolerated. However careful insertion is required.

CONCLUSION

In colonoscopy, sevoflurane can provide safe and effective sedation alternative to propofol.

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