Comparison of Bispectral Index-Guided Administration of Desflurane and Propofol for Endoscopic Transnasal Transsphenoidal Resection of Pituitary Tumors

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Abstract

Background Use of short-acting anesthetic agents such as propofol and desflurane allows rapid awakening and prompt neurological assessment of patients undergoing endoscopic transnasal transsphenoidal resection of pituitary tumors. However, there are no studies comparing the effect of these two agents in these patients. We performed this study to compare the intraoperative hemodynamics and postoperative recovery characteristics of patients undergoing endoscopic transnasal transsphenoidal (TNTS) pituitary tumor surgery using bispectral index (BIS)-guided administration of desflurane and propofol.

Materials and Methods In this prospective, randomized trial, 60 patients undergoing endoscopic TNTS pituitary surgery were randomized to receive BIS-guided administration of either propofol (Group P) or desflurane (Group D) for the maintenance of anesthesia. Heart rate (HR), mean arterial pressure (MAP), intraoperative complications, time to emergence, extubation, cognition, and modified Aldrete score were evaluated. Statistical analysis was performed using STATA 12.0. Categorical and continuous variables were compared between the groups using Fisher's exact test and *t*-test, respectively. Emergence from anesthesia and hemodynamics at various stages of surgery was compared between the groups using Wilcoxon rank sum test. The *p*-value < 0.05 was considered statistically significant.

Results The HR was significantly higher at all stages of surgery in group P ($p = 0.01$). MAP was comparable between the groups at various time points ($p > 0.05$). Both emergence time (8.5 vs. 15 minutes; $p < 0.00$) and extubation time (10 vs. 17.5 minutes; $p < 0.00$) were significantly shorter in Group D compared with Group P. Modified Aldrete score at 5 and 10 minutes after extubation was higher with desflurane than propofol, but early cognition was comparable between the two groups.

Conclusion The hemodynamics and early cognition score were comparable in patients receiving propofol or desflurane. Desflurane provides rapid emergence and recovery when compared with propofol.

Keywords
- endoscopic transnasal transsphenoidal pituitary tumor surgery
- bispectral index
- postoperative cognition
- propofol
- desflurane

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Introduction

Availability of minimally invasive surgical techniques in neurosurgery has increased the emphasis on quick recovery from anesthesia, early postoperative neurological assessment, and early ambulation. Both inhalational and intravenous agents have been used for anesthesia in neurosurgical patients.[1-3] However, neither is clearly superior to other under most circumstances. Endoscopic pituitary surgery is a short surgery and quick recovery from anesthesia is desirable. However, patients with acromegalic and cushingoid features are prone to postoperative airway complications.[4,5] Further, insertion of nasal pack at the end of the procedure requires patients to breathe through mouth. Hence, these patients must be fully awake and cooperative at the time of tracheal extubation. Use of short-acting anesthetic agents such as propofol and desflurane allows rapid awakening for early neurological assessment.[6,7] This is useful in avoiding airway complications in postoperative period in these patients. Earlier, comparative trials of propofol with sevoflurane have shown mixed results.[8,9] Studies comparing propofol and desflurane anesthesia in patients undergoing pituitary surgery are lacking. There is evidence that bispectral index (BIS)-guided techniques ensure reduced recovery time over standard clinical practice.[10]

We performed this study to compare intraoperative hemodynamics and postoperative recovery characteristics in patients undergoing endoscopic TNTS pituitary tumor surgery using BIS-guided administration of desflurane and propofol. We hypothesized that desflurane will result in earlier emergence from anesthesia as compared with propofol. Our primary outcome measures were to compare hemodynamics and emergence from anesthesia between propofol and desflurane. The secondary outcome measures were to compare the modified Aldrete score and modified version of short orientation memory concentration test.

Materials and Methods

This prospective, randomized study was approved by the Institute Research Ethics Committee and was registered at clinicaltrials.nic.in (CTRI/2017/11/010470). Written informed consent for participation in the study was obtained from all patients. We enrolled 60 patients aged between 18 and 65 years of either gender and American Society of Anesthesiologists (ASA) physical status I and II scheduled to undergo endoscopic TNTS resection of pituitary tumor, from October 2015 to June 2017. We excluded patients with history of previous pituitary surgery, patients with psychiatric disorder, history of drug abuse, poorly controlled hypertension, ischemic heart disease, pituitary apoplexy, and history of allergy to any of the planned anesthetic medications for the study.

All patients underwent a preanesthetic checkup that included complete history and physical examination and relevant investigations. Regular medications for any comorbid illness, if any, were continued till the day of surgery and no other sedative premedication was given to any of the patients. Demographics, tumor characteristics, presenting symptoms, and comorbidities were noted for all the patients. In the operating room, standard monitors for electrocardiogram, noninvasive blood pressure, and pulse oximeter were attached prior to induction of anesthesia. BIS sensors (BIS Quatro sensor; Covidien, Mansfield, MA, United States) were applied on the patient's forehead according to manufacturer's instructions. BIS values were recorded only when the signal quality index was > 50% and electromyography value < 30.

Patients were randomized using computer-generated sequence of numbers and were allocated using opaque sealed envelopes, by an investigator not involved in intraoperative care to one of the two groups; Group D: anesthesia was maintained with desflurane in oxygen:nitrous oxide mixture (2:1) ratio with flow rate of 2 L/min, Group P: anesthesia was maintained with propofol infusion at 6 to 12 mg/kg/h along with oxygen:nitrous oxide mixture (1:2) ratio with flow rate of 2 L/min.

Baseline values of heart rate (HR) and mean arterial pressure (MAP) were calculated as the mean of three measurements taken before induction. All the patients were preoxygenated with 100% oxygen for 3 minutes before induction. General anesthesia was induced with fentanyl 2 µg/kg and propofol 2 to 2.5 mg/kg intravenously (IV) till loss of verbal contact. Tracheal intubation was facilitated using rocuronium 1 mg/kg. After tracheal intubation, mechanical ventilation was initiated and adjusted to achieve a $PaCO_2$ between 35 and 40 mm Hg. An additional bolus dose of fentanyl 1 µg/kg was given just before skull pin insertion. Pin insertion sites were also infiltrated with 2% lignocaine. Anesthesia was maintained with desflurane in Group D and propofol in Group P along with nitrous oxide and oxygen mixture (2:1) (Datex Ohmeda S/5 Advance Datex-Ohmeda Division; Instrumentarium Corp. Helsinki, Finland) in both the groups. BIS was used to guide the administration of desflurane or propofol. The target range of BIS during maintenance was 40 to 50. Local anesthesia of nose was obtained in all patients by placing pledgets soaked in 10 mL of 2% lignocaine with adrenaline (1:100,000). Body temperature was monitored using skin temperature probe and maintained between 35 and 36°C with a convective device blanket. Fentanyl 1 µg/kg was administered hourly till surgical hemostasis was achieved after tumor excision. Rocuronium was given 0.2 mg/kg every 30 minutes to maintain neuromuscular relaxation.

Heart rate values > 25% of baseline were counted as tachycardia and those < 25% of baseline was counted as bradycardia. It was managed by the attending anesthesiologist as per standard anesthesia protocol. MAP was maintained within 25% of baseline. MAP value > 25% of baseline was counted as hypertension and MAP value < 25% of baseline was counted as hypotension, respectively. Hypotension or hypertension lasting for more than a minute was treated with bolus of ephedrine and esmolol, respectively. The hemodynamic variables and BIS were noted during various stages of the surgery: (1) before and after intubation (preintubation and postintubation—maximum rise within 3 minutes of tracheal intubation, (2) At the time of three pin insertion (maximum rise), (3) before and after nasal packing of saline swabs soaked in adrenaline (prenasal packing and postnasal packing—maximum rise within 3 minutes), (4) at the time of sphenoid bone and sellar ridge dissection (maximum rise), and (5) after extubation—maximum rise within 3 minutes of tracheal extubation.

Anesthetic agent (desflurane or propofol) and nitrous oxide were discontinued at removal of the endoscope by the surgeon. All patients received paracetamol 15 mg/kg i.v. and ondansetron 0.1 mg/kg i.v. Neuromuscular block was reversed with neostigmine 0.06 mg/kg and glycopyrrolate 0.01 mg/kg. Trachea was extubated after patient obeyed verbal commands, demonstrated purposeful movement, and had adequate spontaneous breathing (with tidal volume of at least 4 mL/kg). Emergence time was measured as the time between anesthetic discontinuation and the time at which patient opened his/her eyes spontaneously or on verbal commands. Extubation time was measured as the time elapsing from anesthetic discontinuation and extubation. Duration of anesthesia was defined as the time from induction to discontinuation of propofol or desflurane. Duration of surgery was measured from the time of insertion of the endoscope to its removal after the surgery. Recovery characteristics were assessed with a modified Aldrete score (0–10) at 5 and 10 minutes after tracheal extubation.[11]

A physician blinded to the regimen evaluated cognition for all patients preoperatively, at 5 and 10 minutes, after extubation using a modified self-devised questionnaire of short orientation memory concentration test in a language understood by the patient.[12] Following questions were asked: (1) What date is it today? (2) What is the current year? (3) Where are you at present? (4) Count numbers 1 to 10. (5) Count reverse numbers from 10 to 1. If the subjects were able to recall and count with minimal mistakes (1 to 3), cognition was regarded as good, with more than three errors as fair and if they were not able to recall at all, it was regarded as poor.

Sample Size Calculation

Based on a similar study, where authors found the emergence time with propofol to be 5.3 ± 1.5 minutes,[9] we hypothesized that desflurane should have a shorter emergence time by 2 minutes. Based on this assumption, we required 12 patients in each group for 80% power of the study. To compensate for possible drop-outs and exclusion because of some complications, we aimed to enroll 30 patients in each group.

Statistical Analysis

Statistical analysis was performed using STATA 12.0 (College Station; Texas, United States). Data were presented as number (percentage) or mean (standard deviation)/median (minimum—maximum) as appropriate. Baseline categorical variables and continuous variables were compared between the groups using chi-squared test/Fisher's exact test and *t*-test for independent samples, respectively. The primary outcomes, emergence from anesthesia, and hemodynamics at various stages of surgery were compared between the groups using Wilcoxon rank sum test. The hemodynamic parameters, HR, and MAP were compared between the groups over a period of time using generalized estimating equation since the observations were related. Modified version of short orientation memory concentration test was compared between the groups using Fisher's exact test and within the group at different time points using McNemar's test. The *p*-value < 0.05 was considered statistically significant.

Results

Out of 134 patients assessed for eligibility over a period of 2 years, 60 patients were enrolled and randomly allocated to the two groups: Group P and Group D comprising 30 patients each (►**Fig. 1**). The demographic profile of patients in the two groups is summarized in ►**Table 1**. The two groups were comparable with respect to age, gender, weight, ASA physical status, tumor size, and type of adenoma (functioning/

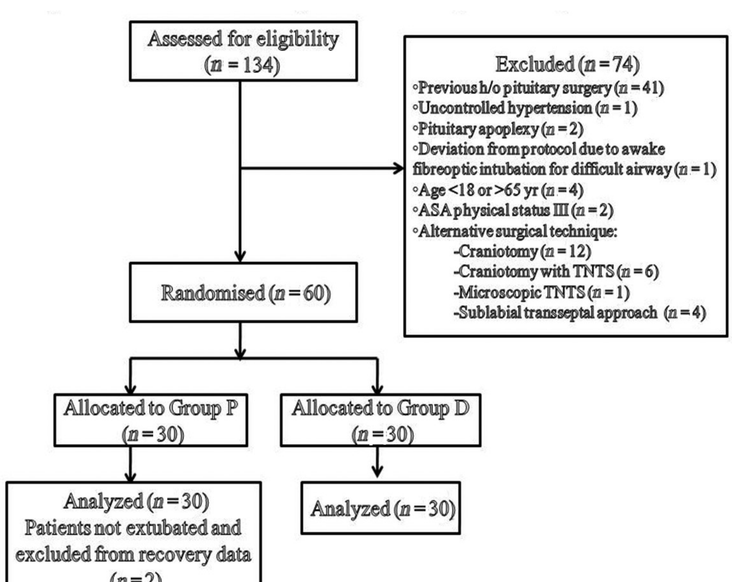

Fig. 1 Flow diagram of the study selection process. ASA, American Society of Anesthesiologists; TNTS, transnasal transsphenoidal surgery.

Table 1 Demographic data of patients undergoing endoscopic transnasal transsphenoidal pituitary surgery

	Group P (n = 30)	Group D (n = 30)	p-Value
Age (y)	41.3 ± 13.7	37.2 ± 10.1	0.19
Sex (male/female)	15/15	18/12	0.44
Weight (kg)	66.4 ± 10.1	65.3 ±11.9	0.71
ASA physical status (I/II)	15/15	15/15	1.00
Tumor size			1.00
Macroadenoma	25 (83.3%)	25 (82.8%)	
Microadenoma	5(16.7%)	5 (17.2%)	
Type of tumor			
Nonfunctioning adenoma	16 (53.3%)	15 (50.0%)	0.80
Functioning adenoma			0.7
Prolactinoma	3 (10.0%)	2 (6.7%)	
Acromegaly	9 (30.0%)	9 (30.0%)	
Cushing's disease	2 (6.7%)	4 (13.3%)	
Presenting symptoms			
Headache	20 (66.7%)	14 (46.7%)	0.12
Visual loss	18 (60.0%)	17 (56.7%)	0.79
Ptosis	0 (0.0%)	1 (3.3%)	–
Acral enlargement	7 (23.3%)	8 (26.7%)	0.77
Weight gain	2 (6.7%)	3 (10.0%)	1.00
Muscle weakness	2 (6.7%)	3 (10.0%)	1.00
Galactorrhea	1 (3.3%)	3 (10.0%)	0.61
Menstrual irregularities	3 (10.0%)	5(16.7%)	0.71
Others (infertility, hirsutism, easy bruisability hyperpigmentation, incidentaloma)	0 (0.0%)	6(20.0%)	0.02
Comorbid illness			
Diabetes	3 (10.0%)	4 (13.3%)	1.00
Hypertension	8 (26.7%)	8 (26.7%)	1.00
Hypothyroidism	7 (23.3%)	8 (26.7%)	1.00
Others (COPD, epilepsy)	2 (6.7%)	0 (0.00%)	0.49

Abbreviations: ASA grade, American Society of Anesthesiologists; COPD, chronic obstructive pulmonary disease; D, desflurane; P, propofol; SD, standard deviation.
Note: Values are mean ± SD or number or number (%).

nonfunctioning). Most common presenting symptoms were headache, visual loss, and acral enlargement. The changes in HR, MAP, and BIS values are shown in ►**Table 2**. Intraoperative surgical and anesthetic complications are summarized in ►**Table 3**.

The recovery profile and early cognition of patients in both groups are summarized in ►**Table 4**. Two patients in Group P were excluded from statistical analysis as they were electively ventilated after surgery due to surgeon request and major intraoperative blood loss, respectively. The number of patients with good cognition was higher in Group D than in Group P (24 vs. 16). Within Group P, there was significant difference in cognition at 5 and 10 minutes when compared with preoperative cognition ($p < 0.001$). Similarly, within Group D, there was significant difference in cognition at 5 ($p = 0.01$) and 10 minutes ($p = 0.03$) when compared with preoperative cognition.

Discussion

We found both propofol and desflurane comparable in their ability to blunt sympathetic responses during transnasal transsphenoidal pituitary surgery except at extubation, for which propofol maintained better hemodynamic stability as compared with desflurane. In our study, both emergence time and extubation time were significantly shorter with desflurane as compared with propofol. Early cognition was comparable between two agents.

Maintaining stable hemodynamics is an important aspect of neuroanesthesia. Sympathetic stimulation occurring during

Table 2 Comparison of HR and mean arterial pressure at various stages of surgery (mean ± SD)

Stages	Group P	Group D	*p*-Value
Baseline			
HR (bpm)	82.9 (12.4)	80.5 (12.1)	0.46
MAP (mm Hg)	95.0 (10.7)	95.5 (8.7)	0.84
BIS	96.8 (0.9)	97.2 (0.8)	0.04
Preintubation			
HR (bpm)	82.6 (10.8)	80.5 (11.7)	0.47
MAP (mm Hg)	89.7 (12.0)[a]	90.1 (10.4)[a]	0.88
BIS	45.2 (4.1)	46.2 (3.4)	0.32
Postintubation			
HR (bpm)	100.6 (20.8)[b]	99.2 (24.1)[b]	0.80
MAP (mm Hg)	99.7 (20.1)	101.1 (19.2)	0.79
BIS	45.6 (3.7)	45.8 (3.4)	0.82
Three pin insertion			
HR (bpm)	94.8 (20.0)[b]	92.7 (16.6)[b]	0.65
MAP (mm Hg)	100.7 (18.9)	88.7 (14.1)[a]	0.01
BIS	44.4 (3.0)	45.1 (3.9)	0.48
Prenasal packing			
HR (bpm)	82.8 (13.5)	74.4 (15.8)	0.03
MAP (mm Hg)	85.3 (11.4)[a]	83.5 (11.4)[a]	0.52
BIS	45.3 (3.0)	43.8 (3.3)	0.06
Postnasal packing			
HR (bpm)	85.9 (14.7)	75.3 (12.2)[b]	<0.001
MAP (mm Hg)	90.8 (14.0)	98.3 (16.1)	0.05
BIS	45.3 (3.3)	44.1 (3.4)	0.14
Sphenoid dissection			
HR (bpm)	83.5 (12.5)	75.7 (10.4)[b]	0.01
MAP (mm Hg)	94.0 (13.7)	98.8 (13.3)	0.17
BIS	45.9 ± 3.3	44.5 ± 3.0	0.08
Sellar dissection			
HR (bpm)	82.6 (12.7)	73.0 ± 10.6[b]	<0.001
MAP (mm Hg)	90.3 (13.5)	92.8 ± 12.2	0.45
BIS	45.6 (2.9)	44.8 ± 2.8	0.26
Extubation			
HR (bpm)	97.8 (15.5)[b]	108.5 (13.6)[b]	0.01
MAP (mm Hg)	100.5 (13.2)	103.4 (14.1)[a]	0.34
BIS	86.6 (4.9)	89.4 (4.7)	0.03

Abbreviations: BIS, bispectral index; bpm, beats/min; D, desflurane; HR, heart rate; MAP, mean arterial pressure; P, propofol; SD, standard deviation.
[a] $p < 0.05$ for mean blood pressure compared with the baseline value.
[b] $p < 0.05$ for heart rate compared with the baseline value.

tracheal intubation, insertion of skull pins, preparation of nasal passage, insertion of the endoscope, and bony dissection may result in sympathetic stimulation that may be harmful in patients having preexisting cardiovascular compromise. Increased blood pressure may lead to surgical field blood ooze. Due to intraoperative use of additional incremental doses of anesthetics and analgesics for blunting these vasopressor responses, achieving smooth and prompt awakening in such a patient is challenging.[13]

We used BIS-guided anesthesia to maintain a uniform depth of anesthesia and used esmolol and ephedrine to maintain MAP within 25% of baseline value. Hence, the intraoperative hemodynamic changes were measured at comparable anesthesia depth. Significant fall in the MAP observed at preintubation may be due to propofol-mediated decrease in systemic vascular resistance and decrease in the cardiac output, when used as an induction agent

Table 3 Intraoperative complications and other variables

Complications	Group P (*n* = 30)	Group D (*n* = 30)	*p*-Value
Surgical			
Cavernous sinus Injury	9 (30.0%)	11 (36.7%)	0.58
Carotid artery injury	1 (3.3%)	0 (0.0%)	–
Anesthetic			
Bradycardia	2 (6.7%)	9 (30.0%)	0.04
Tachycardia	16 (53.3%)	26 (86.7%)	0.01
Hypotension	14 (46.7%)	11 (36.7%)	0.43
Hypertension	12 (40.0%)	9 (30.0%)	0.42
Arrhythmia (VPC)	0 (0.0%)	1 (3.3%)	–
PONV	0 (0.0%)	2 (6.7%)	–
Other variables			
Fluid intake (mL)	2640 ± 969.4	2266.7 ± 626.1	0.08
Blood loss (mL)	300 (100–2000)	300 (50–1000)	0.97
Urine output (mL)	450 (150–1300)	300 (100–800)	0.06
Duration of surgery (min)	146.7 (60.8)	131.7 (37.1)	0.25
Duration of anesthesia (min)	223.9 (65.7)	194.0 (42.6)	0.04

Abbreviations: D, desflurane; P, propofol; PONV, postoperative nausea and vomiting; SD, standard deviation; VPC, ventricular premature contraction.
Note: Values are mean ± SD or number (%) or median (min-max).

Table 4 Recovery profile of patients undergoing transnasal transsphenoidal pituitary surgery

	Group P (*n* = 28)	Group D (*n* = 30)	*p*-Value
Emergence time (min)	15 (0–32)	8.5 (2–24)	<0.001
Extubation time (min)	17.5 (6–43)	10 (7–25)	<0.001
Cognition (baseline)			0.48
Good	27 (96.4%)	30 (100%)	
Fair	1 (3.6%)	0 (0.0%)	
Cognition (at 5 min)			0.09
Good	16 (57.1%)	24 (80.0%)	
Fair	10 (35.7%)	6 (20.0%)	
Poor	2 (7.1%)	0 (0.0%)	
Cognition (at 10 min)			0.05
Good	16 (57.1%)	25 (83.3%)	
Fair	10 (35.7%)	5 (16.7%)	
Poor	2 (7.1%)	0 (0.0%)	
Modified Aldrete score (at 5 min)	8.8 (0.8)	9.3 (0.7)	0.01
Modified Aldrete score (at 10 min)	9.0 (0.7)	9.7 (0.6)	<0.001

Abbreviations: D, desflurane; P, propofol, SD, standard deviation.
Note: Values are mean ± SD or number (%) or median (min-max).

in both the groups.[14] In our study, after induction, at the time of intubation, nasal packing with adrenaline soaked gauges, sphenoid and sellar dissection, both propofol and desflurane were equally effective in blunting sympathetic stimulation and preventing significant rise in MAP above baseline value. The tendency of MAP to fall below the baseline noted intraoperatively with both drugs can be explained by dose-dependent decrease in the systemic vascular resistance caused by both drugs.[15,16] However, the episodes of hypertension and hypotension requiring treatment were comparable and the amount of ephedrine and esmolol used in the two groups was also similar. We found MAP to be significantly above the baseline at extubation with desflurane. However, the MAP was better controlled at extubation in the propofol group. In an earlier study, the authors also found better hemodynamic control with propofol as compared with desflurane at extubation in lumbar surgery patients.[17]

In our study, patients having tachycardia (26/30 versus 16/30) and bradycardia (9/30 versus 2/30) were more in the desflurane group compared with the propofol group. In an earlier study, HR was found significantly higher with desflurane as compared with sevoflurane and propofol.[18] We observed HR to be significantly higher above the baseline after intubation, three pin insertion and extubation with both propofol and desflurane. Hence, no advantage was noted with one drug over other in preventing tachycardia. However, desflurane provided the advantage of maintaining lower HR during sphenoid and sellar dissection as compared with propofol. Bradycardia during pituitary tumor removal occurred in two patients, which is likely due to trigeminocardiac reflex.[19] It resolved promptly on the withdrawal of surgical stimulus and none of the patients required administration of atropine. One patient developed ventricular premature contractions on electrocardiography in the desflurane group. In a study comparing arrhythmogenicity of desflurane and isoflurane with submucosally administered epinephrine, desflurane was found to be similar to isofurane.[20] Whether desflurane increases the incidence of arrhythmia as compared with propofol during transnasal transsphenoidal pituitary surgery needs to be studied further.

Prompt awakening allows better protection of airway from aspiration, rapid neurological assessment including visual field testing.[21,22] Smooth awakening with minimal coughing helps to reduce the risk of postoperative surgical complication such as surgical bleeding and cerebrospinal fluid leakage.[23] Maintaining patent airway is especially essential in acromegalic patients and in patients with Cushing's disease who may have a difficult airway. Quicker emergence and extubation also increase the case turnover and improve resource utilization in operation theaters.

In our study, both emergence time and extubation time were significantly shorter with desflurane as compared with propofol. There are very few studies comparing desflurane and propofol in neurosurgical patients. In a study by Bastola et al, the time to emergence was comparable between desflurane and propofol after elective supratentorial craniotomy.[6] In another study, emergence was faster with propofol when compared with desflurane (9.6 ± 3.3 vs. 4.7 ± 1.3 minutes) after craniotomy for cerebellopontine angle tumor excision.[24] In comparison, we found emergence and tracheal extubation times to be longer in our patients who received propofol, that is, 8.5 and 10 minutes for desflurane, and 15 and 17.5 minutes for propofol, respectively. This difference could be due to reduction in doses of propofol infusion and desflurane at the beginning of dural closure in both of these earlier studies. Endoscopic surgery allows little time to titrate the anesthetic drug doses toward the end of surgery and we switched off anesthetics only at the removal of endoscope by the surgeon. Second, in a difficult airway case such as acromegaly and Cushing's disease, tracheal extubation is done when patient is fully awake and following commands is a norm in our practice. In our study, there were 18 acromegalic patients and 6 patients with Cushing's disease equally distributed between the two groups. In our experience, difficult airway is an important factor influencing extubation time in these patients. While the duration of surgery was comparable in the two groups, duration of anesthesia was slightly longer with propofol.

Early and predictable postoperative cognitive recovery is desirable aspect of postoperative recovery. We found postoperative cognition to be comparable between desflurane and propofol. However, the number of patients with good postoperative cognition at 5 and 10 minutes after extubation was more with desflurane. Comparable postoperative cognition between propofol and desflurane has been observed in previous studies; however, the authors in these studies had titrated the anesthetic depth to hemodynamic changes intraoperatively.[25,26] We found modified Aldrete score at 5 and 10 minutes to be better with desflurane as compared with propofol. This is in contrast to the findings of another study in which time to recover to Aldrete score > 9 was found to be comparable between propofol and desflurane.[27] The authors had not monitored the anesthesia depth and used hemodynamic changes to titrate propofol and desflurane doses.

Earlier studies have reported incidence of postoperative nausea and vomiting (PONV) to be less with propofol and higher with desflurane.[28,29] Nitrous oxide is associated with higher incidence of PONV, but we used nitrous oxide in both our groups. In our study, two patients in desflurane group complained of nausea and vomiting requiring additional doses of antiemetics. Our findings are similar to those reported in literature. Though incidence of PONV is higher with desflurane, faster emergence ensures better airway protection and minimizes the risk of aspiration.

To conclude, the hemodynamics and early cognition score were comparable in patients receiving propofol or desflurane. Desflurane provides rapid emergence and recovery when compared with propofol.

Conflict of Interest

None declared.

References

1 Todd MM, Warner DS, Sokoll MD, et al. A prospective, comparative trial of three anesthetics for elective supratentorial craniotomy. Propofol/fentanyl, isoflurane/nitrous oxide, and fentanyl/nitrous oxide. Anesthesiology 1993;78(6):1005–1020

2 Prabhakar H, Singh GP, Mahajan C, Kapoor I, Kalaivani M, Anand V. Intravenous versus inhalational techniques for rapid emergence from anaesthesia in patients undergoing brain tumour surgery. Cochrane Database Syst Rev 2016;9:CD010467

3 Lauta E, Abbinante C, Del Gaudio A, et al. Emergence times are similar with sevoflurane and total intravenous anesthesia: results of a multicenter RCT of patients scheduled for elective supratentorial craniotomy. J Neurosurg Anesthesiol 2010;22(2):110–118

4 Burn JM. Airway difficulties associated with anaesthesia in acromegaly. Br J Anaesth 1972;44(4):413–414
5 Domi R. Cushing's surgery: role of the anesthesiologist. Indian J Endocrinol Metab 2011;15(Suppl 4):S322–S328
6 Bastola P, Bhagat H, Wig J. Comparative evaluation of propofol, sevoflurane and desflurane for neuroanaesthesia: a prospective randomised study in patients undergoing elective supratentorial craniotomy. Indian J Anaesth 2015;59(5):287–294
7 Magni G, Rosa IL, Melillo G, Savio A, Rosa G. A comparison between sevoflurane and desflurane anesthesia in patients undergoing craniotomy for supratentorial intracranial surgery. Anesth Analg 2009;109(2):567–571
8 Cafiero T, Cavallo LM, Frangiosa A, et al. Clinical comparison of remifentanil-sevoflurane vs. remifentanil-propofol for endoscopic endonasal transphenoidal surgery. Eur J Anaesthesiol 2007;24(5):441–446
9 Ali Z, Prabhakar H, Bithal PK, Dash HH. Bispectral index-guided administration of anesthesia for transsphenoidal resection of pituitary tumors: a comparison of 3 anesthetic techniques. J Neurosurg Anesthesiol 2009;21(1):10–15
10 Punjasawadwong Y, Boonjeungmonkol N, Phongchiewboon A. Bispectral index for improving anaesthetic delivery and postoperative recovery. Cochrane Database Syst Rev 2007; (4):CD003843
11 Aldrete JA. The post-anesthesia recovery score revisited. J Clin Anesth 1995;7(1):89–91
12 Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. Am J Psychiatry 1983;140(6):734–739
13 Chadha R, Padmanabhan V, Rout A, Waikar HD, Mohandas K. Prevention of hypertension during trans-sphenoidal surgery–the effect of bilateral maxillary nerve block with local anaesthetics. Acta Anaesthesiol Scand 1997;41(1 Pt 1):35–40
14 Hug CC Jr, McLeskey CH, Nahrwold ML, et al. Hemodynamic effects of propofol: data from over 25,000 patients. Anesth Analg 1993;77(4, Suppl):S21–S29
15 Muzi M, Berens RA, Kampine JP, Ebert TJ. Venodilation contributes to propofol-mediated hypotension in humans. Anesth Analg 1992;74(6):877–883
16 Kapoor MC, Vakamudi M. Desflurane - revisited. J Anaesthesiol Clin Pharmacol 2012;28(1):92–100
17 Lu CH, Wu ZF, Lin BF, et al. Faster extubation time with more stable hemodynamics during extubation and shorter total surgical suite time after propofol-based total intravenous anesthesia compared with desflurane anesthesia in lengthy lumbar spine surgery. J Neurosurg Spine 2016;24(2):268–274
18 Osmanagaoglu S, Ulusoy H, Colak MS, Erciyes N. Comparison of the effects of sevoflurane, desflurane and totally intravenous anaesthesia with propofol on haemodynamic variables using Transesophageal Doppler. Indian J Anaesth 2008;527:535
19 Schaller B. Trigemino-cardiac reflex during transsphenoidal surgery for pituitary adenomas. Clin Neurol Neurosurg 2005;107(6):468–474
20 Moore MA, Weiskopf RB, Eger EI II, Wilson C, Lu G. Arrhythmogenic doses of epinephrine are similar during desflurane or isoflurane anesthesia in humans. Anesthesiology 1993;79(5):943–947
21 Dunn LK, Nemergut EC. Anesthesia for transsphenoidal pituitary surgery. Curr Opin Anaesthesiol 2013;26(5):549–554
22 Zada G, Woodmansee WW, Iuliano S, Laws ER. Perioperative management of patients undergoing transsphenoidal pituitary surgery. Asian J Neurosurg 2010;5(1):1–6
23 Choi SH, Min KT, Lee JR, et al. Determination of EC95 of remifentanil for smooth emergence from propofol anesthesia in patients undergoing transsphenoidal surgery. J Neurosurg Anesthesiol 2015;27(2):160–166
24 Bhat M, Bhagat H, Bhukal I, Sahni N, Khanna P, Gupta SK. Prospective randomized evaluation of propofol and desflurane in patients undergoing surgery for cerebellopontine angle tumors. Anaesth Pain Intensive Care 2015;19:478–484
25 Rapp SE, Conahan TJ, Pavlin DJ, et al. Comparison of desflurane with propofol in outpatients undergoing peripheral orthopedic surgery. Anesth Analg 1992;75(4):572–579
26 Lebenbom-Mansour MH, Pandit SK, Kothary SP, Randel GI, Levy L. Desflurane versus propofol anesthesia: a comparative analysis in outpatients. Anesth Analg 1993;76(5):936–941
27 Gokce BM, Ozkose Z, Tuncer B, Pampal K, Arslan D. Hemodynamic effects, recovery profiles, and costs of remifentanil-based anesthesia with propofol or desflurane for septorhinoplasty. Saudi Med J 2007;28(3):358–363
28 Wachtel RE, Dexter F, Epstein RH, Ledolter J. Meta-analysis of desflurane and propofol average times and variability in times to extubation and following commands. Can J Anaesth 2011;58(8):714–724
29 Kumar G, Stendall C, Mistry R, Gurusamy K, Walker D. A comparison of total intravenous anaesthesia using propofol with sevoflurane or desflurane in ambulatory surgery: systematic review and meta-analysis. Anaesthesia 2014;69(10):1138–1150