Original Research Article

Indian Journal of Anesthesia and Analgesia
November – December 2020;7(6)
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.7620.71

A Comparitive Evaluation of Propofol, Sevoflurane and Desflurane for Neuroanaesthesia in Patients Undergoing Elective Supratentorial Craniotomies

B Sowbhagyalaxshmi[1], P Krishna Prasad[2], M Santhi Sree[3]

Author's Affiliation: [1]Professor and HOD, [2,3]Associate Professor, Department of Anaesthesiology, Rangaraya Medical College, Kakinada, Andhra Pradesh 533001, India.

Corresponding Author: P Krishna Prasad, Associate Professor, Department of Anaesthesiology, Rangaraya Medical College, Kakinada, Andhra Pradesh 533001, India.

E-mail: santhisreemulam@gmail.com

How to cite this article:

B Sowbhagyalaxshmi, P Krishna Prasad, M Santhi Sree. A Comparitive Evaluation of Propofol, Sevoflurane and Desflurane for Neuroanaesthesia in Patients Undergoing Elective Supratentorial Craniotomies. Indian J Anesth Analg. 2020;7(6):1365–1372.

Abstract

Aim: To compare the effects of propofol, sevoflurane and desflurane in patients undergoing supratentorial craniotomies under general anaesthesia with regard to, perioperative haemodynamic stability, emergence and recovery characteristics.

Materials and Methods: A prospective randomized study of 150 adult patients belonging to both sexes undergoing elective supratentorial craniotomies under general anaesthesia were takenup for study and divided into three groups of 50 each. Group P : Anaesthesia was induced with Inj. Thiopentone sodium and maintained with 66% nitrous oxide (N_20), in 33% oxygen (0_2) and Propofol (3-6mg/kg/hr) Group S: Anaesthesia was induced with Inj.Thiopentone sodium and maintained with 66% nitrous oxide (N_2O) in 33% oxygen (O_2) and Sevoflurane. (1-2%) Group D: Anaesthesia was induced with Inj. Thiopentone sodium and maintained with 66% N_2O and 33% O_2 and Desflurane. (4-6%). The effects of Propofol, Desflurane and Sevoflurane on haemodynamics and recovery characteristics were observed.

Results: In Desflurane Group the mean time taken for response to verbal commands was 4.61±0.47 min, spontaneous eye opening was 5.3±0.49 min,to squeezing fingers and lift limb was 6.17 ± 0.31 min. While the mean time taken for extubation was 7.72±0.53 min and time taken to orientation to place, name was 9.38±0.52min. These desflurane values are very much lower than the other two groups.

Conclusion: We conclude that Desflurane as the inhalational agent ensures faster recovery in the early postoperative period as evident from significant decrease in the time required for extubation and the time required to achieve a modified Aldrete score of ≥ 9 when compared to patients receiving Sevoflurane and Propofol.

Keywords: Desflurane; Sevoflurane; Propofol; Emergence; Recovery.

Introduction

Anaesthesia for neurosurgery is a challenge. The ideal anaesthesia for neurosurgical procedures must have the following characteristics.[1] Reduction of cerebral metabolism, Neuroprotection, Haemodynamic stability, Preservation of cerebral autoregulation, Minimal effect on ICP, Early emergence and recovery. Both intravenous and inhalational anaesthetics are used. In the present scenario three agents, which are very popular for use in the neurosurgical patients are propofol, sevoflurane and desflurane.[2] The present preliminary study was carried out to assess and

compare the effects of propofol, sevoflurane and desflurane on intraoperative haemodynamics, and emergence characteristics in patients undergoing elective supratentorial craniotomies.

Aims and Objectives

Aim: To compare the effects of propofol, sevoflurane and desflurane in patients undergoing supratentorial craniotomies under general anaesthesia with regard to:

Primary Objectives

1. To assess perioperative haemodynamic stability.
2. To assess the emergence and recovery characteristics

Secondary Objectives: To compare side effects like drowsiness , nausea and vomiting .

Material and Methods

Study Design: A prospective randomized study of 150 adult patients belonging to both sexes undergoing elective supratentorial craniotomies under general anaesthesia were carried out at RangarayaMedical College Kakinada from December 2016-August 2018.

Selection of Subjects: Age group ranging from 20–60 yrs.

ASA Grade 1–3

Either sex

Glasgow Coma Scale (GCS) ranging from 12–15.

The subjects are divided into 3 groups - Group P, Group S, Group D by computer generated randomization table.

Group P: Patients anaesthesia maintained by Propofol.

Group S: Patients anaesthesia maintained by Sevoflurane.

Group D: Patients anaesthesia maintained by Desflurane.

Exclusion Criteria: Pts with ischemic and/or congestive heart disease

Pts with Chronic obstructive pulmonary disease

Pts with Hepatic and Renal dysfunction

Pts with known Drug allergy or abuse

Pts using CNS depresents drugs and anti psychotics

Pts with severe obesity (BMI>30).

Surgery related complications like - vascular injury, massive intraoperative bleeding or injury to vital structures necessitating elective postoperative mechanical ventilation.

Preanaesthetic Evaluation and Consent

All the patients posted for surgery underwent a preanaesthetic evaluation which consisted of detailed history regarding present complaints, past medical history, history of previous surgeries or anaesthesia, physical examination and routine investigations. Other relevant investigations such as 2D echo were done if indicated in that particular case. Selected patients were explained about the study in their own language and a written informed consent was taken to participate in the study.

Patients undergoing surgery were kept nil by mouth for a minimum of 6 hours for solid food and 2 hours for clear liquids before starting of surgery. They were premedicated with Tab. Rantidine 150mg , Tab. Alprazolam 0.5mg orally on the night before surgery.

Anaesthesia technique: On the morning of the surgery, anaesthesia machine and monitors were checked. Emergency drugs tray was kept ready. After shifting the patient into the operation theatre, patients were monitored for baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, ECG (lead II) and oxygen saturation using multi parameter monitor. An two 18 G I.V. cannulas was secured and an infusion of dextrose normal saline was started at a rate of 10ml/kg body weight .

Inj. Ondansetron 0.1mg/kg IV, Inj. Fentanyl 1mcg/kg IV, Inj.Midazolam 0.01mg/kg IV are given as premedication.

Group P: Anaesthesia was induced with Inj. Thiopentone sodium and maintained with 66% nitrous oxide (N_20), 33% oxygen (0_2) and Propofol (3–6mg/kg/hr).

Group S: Anaesthesia was induced with Inj. Thiopentone sodium and maintained with 66% nitrous oxide (N_2O) , 33% oxygen (O_2) and Sevoflurane.(1–2%)

Group D: Anaesthesia was induced with Inj. Thiopentone sodium and maintained with 66% N_2O , 33% O_2 and Desflurane.(4–6%).

Preoxygenation was done with 100% O_2 for 3–5 min using closed circuit. Patient was induced with Inj. Thiopentione sodium 5–7 mg/kg IV till

loss of eyelash reflex .After confirming adequate mask ventilation, Inj. Vecuronium bromide– 0.1 mg/kg IV was given and ventilated with 50% N_2O and 50% O_2 Laryngoscopy and Intubation was done with appropriate size, cuffed portex endotracheal tube. Closed circuit was connected to endotracheal tube and bilateral equal air entry was confirmed and endotracheal tube was secured. Anaesthesia was maintained with O_2 : N_2O (50:50) at 2 L/min + Sevoflurane 1–2% or Desflurane4–6% or Propofol 3–6mg/kg/hr infusion as per the group the patient was assigned to using mind ray A6 machine compatible with Sevoflurane, Desflurane vapourizers and propofol infusion. The Dial concentration or infusion pump was adjusted to control mean arterial pressure (MAP) and heart rate (HR) within 20% range of the preoperative values. Ventilation was controlled using closed circle absorber system and end tidal carbon dioxide ($etco_2$) was maintained between 30–45 mm Hg using volume control mode (VCV) of ventilation. Incremental doses of muscle relaxant, Inj.Vecuronium Bromide were given in doses of – 0.025 mg/kg IV and .Intraoperative fluids were given as per the requirement of the patient.

At the end of surgery, after the last skin suture was placed, N_2O and volatile agent or propofol infusion were discontinued, patient was ventilated with 100% oxygen with fresh gas flow of eight to ten liters/min till patient establishes spontaneous respiration. Then reversal was done with Inj. Neostigmine 0.05mg/kg IV and Inj. Glycopyrrolate 0.01 mcg/kg IV.Patients were extubated once they fulfilled the extubation criteria and were hemodynamically stable. Early recovery characteristics were assessed. Patients were then shifted to post-anaesthesia care unit (PACU).

1. Heart rate, Systolic blood pressure, Diastolic blood pressure,Mean Arterial Pressure and SpO_2 were recorded before induction, after induction, every 5 min for initial 15 min and every 15 min till the end of surgery and then postoperatively every 5 min till the modified Aldrete score was >9
2. Following emergence times were noted:
   i. Time taken for response to verbal command (Time taken from discontinuation of the inhalational agent or intravenous agent to the patient's response to verbal commands.
   ii. Time taken for spontaneous eye opening (time taken from discontinuation of the inhalational agent or intravenous agent to spontaneous eye opening).
   iii. Time taken to squeeze fingers and lift limb (time taken from discontinuation of the inhalational agent or intravenous agent to squeeze fingers and lift limb).
   iv. Extubation time (from the time of administering reversal agent to removal of endotracheal tube).
3. After extubation, orientation was assessed Time taken to state name, place of stay and date of birth (i.e, from the time of extubation to the time patient states name, place of stay and date of birth)
4. Duration of surgery (defined in this study as the time period from incision to the application of last skin suture)
5. Duration of anaesthesia (from the time of induction to discontinuation of the inhalational agent or intravenous agent)
6. In the post - anaesthesia care unit (PACU) intermediate recovery was assessed by the modified Aldrete score every 5 min. till the score became greater than 9 [time taken to achieve modified Aldrete score of >9 is defined in this study as the time when patient was shifted to PACU till he/she reaches modified Aldrete score of > 9].

Recovery Scores: In 1995, Aldrete published the modified Aldrete score.[29] In this score, the variable colour is replaced by saturation/spo_2.

Modified Aldrete Score: Modified Aldrete Score of ≥9 indicates good intermediate recovery.

Oxygenation	SPO_2>92% on room air	2
	Spo_2>90% on oxygen	1
	Spo_2<90% on oxygen	0
Respiration	Breathes deeply and coughsfreely	2
	Dyspnoeic, shallow or limited breathing	1
	Apnoea	0
Circulation	BP±20mmhg of normal	2
	BP±20–50mmhg of normal	1
	BP morethan±50mmhg of normal	0
Consiousness	Fully awake	2
	Arousable on calling	1
	Not responsive	0
Activity	Moves all extremities	2
	Moves two extremities	1
	No movement	0

7. Patients were observed for adverse effects like drowsiness, nausea, vomiting, respiratory tract irritation in the form of cough and were treated accordingly depending on severity.

Observation and Results

In this prospective, randomized study, 150 adult patients admitted to Rangaraya Medical College And Government General Hospital Kakinada, undergoing elective supratentorial craniotomies under general anaesthesia were randomly given Desflurane or Sevoflurane or Propofol as maintenance agents .The effects of Propofol, Desflurane and Sevoflurane on haemodynamics and recovery characteristics were observed.

Statistical Analysis: The descriptive summary of variables will be presented through frequency distributions as well as mean±sd. Quantitative variables are expressed as mean±sd and compared between groups using Unpaired t-test and within groups across follow-ups using paired t-test. Qualitative variables are compared using Chi-square test. A p-value <0.05 is considered statistically significant. The data was tabulated in MS Excel and analysis performed using Statistical Package for Social Sciences (SPSS) version 16.0 software.

Demographic Data: All the three groups have patients aged between 20–60 yrs .The difference in age groups between the three groups was statistically insignificant. There is no statistically significant difference between patients age, gender, weight and duration of surgery.

Haemodynamic Characteristics: The difference in the mean heart rate between the three groups in the intraoperative period was statistically insignificant(p value>0.05). The changes in the mean heart rate were within ±20% baseline values. (Table 1).

Table 1: Changes In Intraoperative Mean Heart Rate (BPM).

Heart Rate	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	mean	±sd	mean	±sd	P vs S	P vs D	S vs D
Baseline	88.58	±4.93	89.66	±4.74	88.52	±4.63	0.134	0.475	0.114
5min	87.84	±6.3	89.66	±7.58	88.22	±6.02	0.097	0.379	0.148
10min	87.92	±6.39	89.52	±6.08	87.82	±6.89	0.101	0.470	0.097
15min	87.74	±5.5	89.34	±6.54	88.56	±6.51	0.094	0.249	0.276
30min	86.70	±5.68	88.62	±6.1	88.54	±6.76	0.053	0.072	0.475
60min	86.06	±5.57	86.36	±5.64	87.26	±6.37	0.395	0.159	0.228
90min	84.38	±4.93	84.28	±4.06	84.74	±5.93	0.456	0.371	0.326
120min	83.08	±3.92	82.18	±4.2	83.56	±4.9	0.135	0.295	0.067
180min	82.17	±3.48	82.74	±3.64	82.33	±4.93	0.258	0.439	0.333
240min	84.18	±2.99	83.60	±5.51	82.48	±4.9	0.372	0.145	0.217
300min	84.60	±4.51	81.29	±5.28	84.64	±4.13	0.141	0.494	0.076
Postop 5min	91.12	±8.27	90.26	±8.31	88.80	±6.03	0.303	0.056	0.159
Postop 10min	88.72	±6.89	88.88	±7.21	86.98	±7	0.455	0.107	0.092
Postop 15min	91.12	±8.13	89.40	±6.87	89.60	±5.69	0.128	0.141	0.437

Table 2: Changes In Intraoperative Mean SBP (mmHg).

Blood Pressure (Systolic)	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	mean	±sd	mean	±sd	P vs S	P vs D	S vs D
Baseline	120.16	±10.62	121.58	±9.96	122.68	±10.1	0.246	0.113	0.292
5min	117.80	±8.15	117.62	±17.61	118.90	±10.03	0.474	0.274	0.328
10min	125.68	±10	126.72	±7.37	125.04	±8.42	0.278	0.365	0.145
15min	127.52	±11.68	128.40	±7.95	126.60	±7.89	0.330	0.323	0.129
30min	125.86	±14.03	129.08	±8.46	126.92	±6.96	0.084	0.317	0.083
60min	130.00	±11.12	129.66	±7.84	128.08	±7.09	0.430	0.153	0.147
90min	127.42	±11.83	127.38	±9.06	124.88	±7.96	0.492	0.105	0.073
120min	123.14	±13.31	122.64	±7.18	125.14	±8.47	0.408	0.186	0.057
180min	123.08	±9.47	123.34	±10.11	126.07	±9.39	0.467	0.175	0.131
240min	120.00	±11.95	118.24	±6.81	120.67	±7.76	0.310	0.436	0.163
300min	120.00	±8.16	115.63	±4.78	120.38	±7.44	0.131	0.469	0.076
Postop 5min	118.60	±9.69	118.40	±9.55	120.12	±9.12	0.459	0.211	0.180
Postop 10min	123.20	±5.87	123.20	±6.21	124.70	±7.6	0.500	0.136	0.141
Postop 15min	118.00	±9.04	117.60	±8.94	119.74	±8.96	0.412	0.168	0.117

Table 3: Changes in The Intraoperative Mean DBP (mmHg).

Blood Pressure (Diastolic)	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	Mean	±sd	mean	±sd	P vs S	P vs D	S vs D
Baseline	78.60	±9.48	80.76	±8.76	78.16	±3.64	0.120	0.380	0.028
5min	76.20	±8.3	77.00	±9.6	75.42	±5.22	0.328	0.288	0.155
10min	75.20	±8.39	77.08	±10.07	75.72	±10.07	0.157	0.390	0.251
15min	75.20	±7.89	77.28	±10.24	76.96	±7.97	0.129	0.135	0.431
30min	75.80	±7.31	76.48	±11.73	75.54	±8.31	0.364	0.434	0.322
60min	76.40	±8.51	77.60	±13.6	75.32	±8.7	0.299	0.266	0.160
90min	77.60	±8.22	78.02	±9.33	75.30	±12.19	0.406	0.136	0.107
120min	77.40	±8.53	78.52	±8.31	76.43	±9.67	0.254	0.298	0.125
180min	78.46	±6.89	78.68	±7.58	75.46	±11.78	0.463	0.201	0.086
240min	77.50	±8.86	77.81	±6.01	79.59	±9.65	0.457	0.305	0.246
300min	80.00	±8.16	76.25	±5.28	74.44	±8.82	0.177	0.154	0.311
Postop 5min	80.20	±6.85	79.80	±6.85	79.34	±6.71	0.385	0.264	0.368
Postop 10min	76.40	±8.02	77.20	±8.34	75.02	±7.13	0.313	0.183	0.082
Postop 15min	82.40	±5.91	82.20	±5.82	80.70	±9.44	0.432	0.141	0.170

Table 4: Changes in Intraoperative Oxygen Saturation (SPO_2).

SpO_2	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	mean	±sd	mean	±sd	P vs S	P vs D	S vs D
Baseline	98.71	±0.85	98.58	±0.7	98.78	±1.09	0.208	0.359	0.140
5min	98.94	±0.81	98.66	±0.63	98.88	±1.08	0.030	0.384	0.108
10min	98.69	±0.77	98.80	±0.86	99.02	±1.06	0.259	0.042	0.128
15min	98.96	±0.73	98.88	±0.92	99.10	±0.97	0.315	0.209	0.124
30min	97.00	±12.72	99.24	±0.77	98.98	±0.84	0.108	0.137	0.056
60min	98.80	±0.76	98.92	±0.8	99.04	±0.92	0.222	0.079	0.245
90min	98.60	±0.64	98.72	±0.78	98.94	±1.22	0.202	0.042	0.143
120min	98.78	±0.76	98.72	±0.61	99.00	±1.23	0.332	0.142	0.076
180min	98.18	±0.94	98.03	±0.72	99.0	±1.06	0.259	0.042	0.128
240min	98.40	±0.52	98.64	±0.64	99.08	±1.09	0.315	0.209	0.124
300min	98.50	±0.58	98.71	±0.49	99.09	±0.98	0.108	0.137	0.056

Table 5: Early Recovery Profiles (Min).

Time Taken for	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	mean	±sd	Mean	±sd	P vs S	P vs D	S vs D
Response to verbal commands	7.34	±0.58	9.53	±0.53	4.61	±0.47	<0.001	<0.001	<0.001
Spontaneous eye opening	7.75	±0.45	10.3	±0.57	5.3	±0.49	<0.001	<0.001	<0.001
Squeesing fingers and lifting limb	8.05	±0.57	11.16	±0.58	6.17	±0.31	<0.001	<0.001	<0.001
Extubation time	8.52	±0.96	11.81	±0.63	7.72	±0.53	<0.001	<0.001	<0.001
Orientation to time place	9.21	±0.38	12.62	±0.64	9.38	±0.52	<0.001	0.038	<0.001

The difference in the mean systolic blood pressure between the three groups in the intraoperative period was statistically insignificant. (Table 2).

The difference in the mean diastolic Blood pressure between the three groups in intraoperative period was statistically insignificant. (Table 3).

The difference in the Mean Arterial Pressure between the three groups in intraoperative period was statistically insignificant (p >0.05) (Fig 1).

From the above data intra operative oxygen saturation between three groups was statistically insignificant (Table 4).

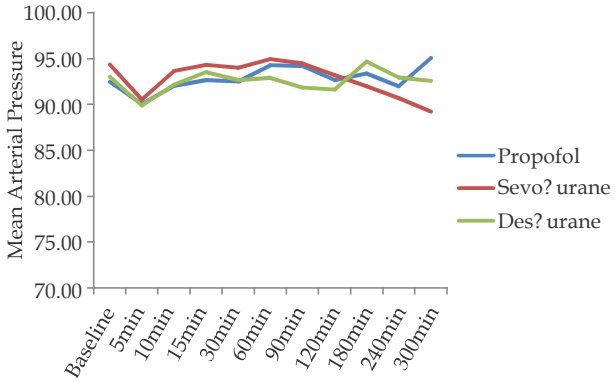

Fig. 1: Showing mean arterial pressure between groups.

Table 6: Modified Aldrete Scores at 5Min and 10Mins.

	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	mean	±sd	mean	±sd	P vs S	P vs D	S vs D
MAS 5	6.78	±1.2	5.49	±0.54	8.74	±0.69	<0.001	<0.001	<0.001
MAS 10	7.82	±1.24	6.47	±0.5	9.62	±0.52	<0.001	<0.001	<0.001

Table 7: Time Taken For Modified Aldert Score>9.

	Propofol		Sevoflurane		Desflurane		p-values		
	mean	±sd	mean	±sd	mean	±sd	P vs S	P vs D	S vs D
MAS >9	10.97	±1.42	14.61	±1.13	9.64	±0.66	<0.001	<0.001	<0.001

(Table 5) shows the early recovery profiles between three groups. In Desflurane Group the mean time taken for response to verbal commands was 4.61±0.47min, spontaneous eye opening was 5.3±0.49min,to squeezing fingers and lift limb was 6.17 ±0.31min .While the mean time taken for extubation was 7.72±0.53min and time taken to orientation to place ,name was 9.38±0.52min.These desflurane values are very much lower than the other two groups

The early recovery proflie as indicated by the above observed parameters were significently faster in Group D compared to other two groups with p value being <0.005 indicating significant difference.

The intermediate recovery profile indicated by modified Aldrete score at 5min and 10min interval and time taken to achieve modified Aldrete score of >9 was significantly faster in Group D compared to Group P and Group S with P VALUE <0.001 which is highly significan (Table 6). The mean time taken to achieve modified Aldrete score of >9 in Group D was when compared to Group S and Group P indicating faster intermediate recovery in Desflurane group compared to Sevoflurane and Propofol group.Side effects are very less in number and there was no statistically significant difference between the three groups (p value >0.05) (Table 7).

Discussion

The goals of anaesthesia in neurosurgical patients are providing haemodynamic stability throughout the procedure ,providing slack brain to surgeon and facilitating early emergence and recovery.

The preservation of stable haemodynamics in supratentorial craniotomies is crucial for postoperative morbidity and mortality. Autoregulation of Cerebral Blood Flow (CBF) refers to the intrinsic control over vascular smooth muscle tone in the cerebral vessels as the body maintains a relatively constant blood flow to the brain despite variation in the systamic Mean Arterial Pressure across a range of 50 to 150mmhg.

In this range of Mean Arterial Pressure cerebral blood flow is kept constant in the presence of changing cerebral perfusion pressure. The importance of cerebral blood flow autoregulation lies in its relationship to Intra Cranial Pressure. If the cerebral blood flow increases the cerebral blood volume increases and that leads to increase in intra cranial pressure. Conversely a reduction in cerebral blood flow may produce a reduction in cerebral blood volume and intracranial pressure.

Recovery from general anaesthesia is a period of intense stress and strain for the patient. The stressful events increases the cerebral oxygen consumption and cerebral blood flow.This leads to increase in intra cranial pressure thus promoting cerebral insults.

The main aim for a rapid awakening strategy after craniotomy with general anaesthesia is that an early recognition of postoperative neurologic complications and it is essential to limit potentially dangerous consequences and improve patient outcome.[3]

Anaesthetic agents in this study appear to subserve the objectives of maintaining haemodynamic stability, providing adequate brain condition and providing early emergence. considering the observations of our study, it is reasonable to interpret that propofol, sevoflurane and desflurane are acceptable for use in practice of neuroanaesthesia.

Regarding the haemodynamic parameters, changes in HR, SBP, DBP and MAP, SPO_2 when compared to the baseline values, there was statistically insignificant difference between the three groups at various intervals during maintenance of general anaesthesia till the patients were extubated. The changes in the mean heart rate, systolic blood pressure and diastolic pressure were within ±20% of the baseline values in the three groups. Similar findings were observed in the studies conducted by Priska Bastola,Hemanth Bhagat And Jyostsna WIG4 in 2015.

The stable haemodynamics during the maintenance period and the lack of any difference

between the three groups in our study was predictable, since the study was designed to maintain mean arterial pressure (MAP) within 20% of the baseline values by varying the inspired concentration of the volatile anaesthetic agents and intravenous agent.

Cerebral vasodilatation and increased ICP are concerns with the use of inhalational anesthetics in patients with intracranial pathologies. Desflurane is supposed to have more cerebral vasodilation and intracranial pressure raising potential than isoflurane and sevoflurane. However, these drawbacks with the use of desflurane have been found to have little clinical significance. Propofol decreases CBF and $CMRO_2$, as well as ICP.

We measured the ICP intraoperatively and compared the hemodynamic parameters during the perioperative period between the two groups. Our study results have shown that the ICP and hemodynamic parameters in the three groups were comparable.and our study correlates with the study conduced by Fragaet et al5.

Recovery profiles: We studied different criteria for early and intermediate recovery profiles:We observed in our study that there was a statistically highly significant difference between Desflurane and Sevoflurane groups regarding all the parameters in the recovery profile with patients in group D having shorter recovery time compared to patients in group P andGroup S.

Extubation time: In our study, we switched off the volatile agents and intravenous agent at the application of last skin suture.Our data analysis revealed that the time to extubation (from the time of administering reversal agent to the removal of endotracheal tube) was consistently less in the Desflurane group as compared to the Sevoflurane group and Propofol group which was statistically highly significant.

Desflurane gives the fastest recovery from anaesthesia and would become the choice for neurosurgery which coincides withmetaanalysis done by Dexter F etal[6].

In our study, we observed that the patients in Group D, consistently opened their eyes to verbal command faster than the patients in Group S and Group P. Also, as compared to the patients in Group S, Group P the patients in Group D were able to verbalise faster and thiscoincides with a study conducted by La Colla et al[7].

In the study conducted by Hemant Bhagat, Ishwar Bhukal, Neeru Sahni, Puneet Khanna, Sunil K Gupta[8] they concluded that both desflurane and propofol are comparable as anesthetic agents for patients undergoing CP angle tumor resection in terms of hemodynamics, brain relaxation scores and response to surgical stimulus and the use of desflurane in these patients associated with faster emergence when compared with propofol. which is comparable with our study.

Modified Aldrete score: In our study, the patients who received Desflurane had significantly higher mean modified Aldrete score at 5min.and 10min. After extubation, the patients were monitored and observed until they achieved a modified Aldrete score of ≥ 9. Analysis of the recovery profiles revealed that the patients who were enrolled in the group that received Desflurane achieved a modified Aldrete score of ≥ 9 faster when compared to the patients in the Sevoflurane and Propofol groups. These results were similar toSonia Kapil Nidhi Panda Sujay Samanta Asish Kumar Sahoo[9] study. In the study conducted by Jeffrey L Apfelbaum MD et al[10] they compared postanaesthetic and residual recovery of desflurane verses propofol anaesthesia and founded that awakening and early recovery for as long as one hour after anaesthesia is faster with Desflurane than Propofol but there were no difference in time to home readiness or in residual effects .

Conclusion

From our study entitled A comparitive evaluation of Propofol, sevoflurane and desflurane in neuroanaesthesia- in patients undergoing supra tentorial craniotomies under general anaesthesia-A prospective randomized study". The patients receiving Desflurane opened their eyes and verbalised sooner. It was also not associated with any significant adverse effects.Desflurane or Sevoflurane or Propofol administration has no negative effects on the intraoperative as well as the early postoperative haemodynamic parameters and provided cardiovascular stability when titrated to maintain within 20% of the baseline values.

We conclude that Desflurane as inhalational agent ensures faster recovery in the early postoperative period as evident from significant decrease in the time required for extubation and the time required to achieve a modified Aldrete score of ≥ 9 when compared to patients receiving Sevoflurane and Propofol.

References

1. Schifilliti D, Grasso G, Conti A, Fodale V. Anaesthetic-related neuroprotection: intravenous or inhalational agents? CNS Drugs. 2010;24:893–97.
2. Magni G et al, A comparison between sevoflurane and desflurane anesthesia in patients undergoing craniotomy for supratentorial intracranial surgery. AnesthAnalg. 2009;109:567–71.135–137,158–160.
3. Nicholau D. The Post Anesthesia care unit. Gelb AW, Leslie K, Stanski DR, Shafer SL. Monitoring the Depth of AnesthesiaIn: Miller RD, Eriksson LI,Fleisher LA, Wiener-Kronish JP, Young WL. Miller's Anesthesia , 8thEdition. Philadelphia: Churchill Livingstone;2010.2707–2.
4. Priska Bastola, Hemant Bhagat, Jyotsna Wig Year 2015 | Volume : 59 | Issue :5| Page :287–2942015 IJA compared propofol, sevoflurane and desflurane for neuroanaesthesia.
5. Fraga, Marcialand Rama-Maceiras, Pablo and Rodiño, Sara and Aymerich, Humberto and Pose, Pilar and Belda, Francisco. (2003). The Effects of Isoflurane and Desflurane on ICP, Cerebral Perfusion Pressure, and Cerebral Arteriovenous Oxygen Content Difference in Normocapnic Patients with Supratentorial Brain Tumors. Anesthesiology. 98.
6. Dexter F1, Bayman EO, Epstein RH statistical modeling of average and variabilty time to extubate for metaanalysis for comparing desflurane and sevoflurane anaesthesia analogfeb1;200–.
7. L La Colla A. Albertin G. La Collamagano Faster wash-out and recovery for desflurane vssevoflurane in morbidly obese patients when no premedication is used BJA: British Journal of Anaesthesia, Volume 99, Issue 3, 1 September 2007, Pages 353–358.
8. Hemant Bhagat, Neeru Sahni, , Puneet Khanna, Sunil K Gupta. Prospective randomized evaluation of propofol and desflurane in patients undergoing surgery for cerebellopontine angle tumors .Anaesth pain and intensive care2015;19(4);478–48432.
9. Sonia Kapil Nidhi Panda Sujay Samanta Asish Kumar Sahoo. AnesthAnalg. 2009 Aug;109(2): 567–71.
10. Jeffrey L. Apfelbaum, MD, J. Lance Lichtor, MD, Bradford S. Lane, BA, Dennis W. Coalson, MD, and Kari T. Korttila, MD, PhD. Awakening, Clinical Recovery, and Psychomotor Effects After Desflurane and Propofol Anesthesia. AnesthAnalg 1996; 83:721–725.