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Anesthetic Management of Posterior Cranial Fossa Surgery

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A B S T R A C T

Background: The posterior cranial fossa is a compact anatomical region with vital structures, making surgical interventions particularly challenging. Anaesthetic management plays a crucial role in ensuring optimal surgical access, hemodynamic stability, and prevention of complications.

Objectives: This prospective observational study aimed to evaluate perioperative anaesthetic management, methods of intracranial pressure (ICP) control, intraoperative complications, and postoperative outcomes in patients undergoing posterior fossa surgery.

Materials and Methods: Fifty patients, aged 20–60 years, ASA grade I–II, undergoing elective posterior fossa surgery were included. Standard monitoring was used, and anaesthesia was induced with thiopentone/propofol, fentanyl, and vecuronium/atracurium. Maintenance included sevoflurane in O_2–N_2O mixture with mechanical ventilation. Hemodynamic variations, ICP management, intraoperative and postoperative complications were analyzed.

Results: The majority were females (56%) with a slight preponderance in the 51–60 age group (30%). The most common pathology was cerebellopontine (C-P) angle tumors (38%), followed by brainstem tumors (28%). Prone positioning (68%) was most frequently used. Intraoperative complications included hypotension (16%), bradycardia (10%), and venous air embolism in one case (2%). Postoperatively, 34% required ventilatory support, 24% developed raised ICP, and 36% had cranial nerve palsy. Mortality was 4%.

Conclusion: Posterior fossa surgeries pose high anaesthetic risks, particularly concerning hemodynamic instability, cranial nerve deficits, and ventilatory complications. Careful perioperative planning, vigilant intraoperative monitoring, and judicious postoperative care are essential to reduce morbidity and mortality.

Keywords- Posterior Cranial Fossa Surgery; Neuroanesthesia; Intracranial Pressure; Hemodynamic Instability; Cerebellopontine Angle Tumors; Venous Air Embolism; Cranial Nerve Palsy; Postoperative Complications

INTRODUCTION

Posterior cranial fossa lesions pose unique challenges due to the presence of vital structures such as the brainstem, cranial nerves, and cerebellum in a compact compartment[1,2]. Small increases in volume, such as from a tumor or hematoma, can significantly raise intracranial pressure (ICP), leading to brainstem compression and life-threatening complications[3]. The anaesthesiologist's role is not only to provide anaesthesia and analgesia but also to maintain stable hemodynamics, ensure cerebral perfusion, minimize ICP, and allow rapid postoperative neurological evaluation[4]. Posterior fossa surgeries include excision of tumors (cerebellopontine angle tumors, brainstem lesions, cerebellar tumors), decompression for Chiari malformation, vascular surgeries, and craniovertebral junction anomalies[2,5]. Despite advances in monitoring and techniques, the risk of perioperative complications remains significant.

Materials and Methodology

This prospective observational study included 50 patients undergoing posterior fossa surgeries between 2015 and 2017. Patients aged 20–60 years, ASA I–II, scheduled for elective procedures were included. Exclusion criteria were ASA ≥III, emergency surgeries, coagulation abnormalities, and preoperative intubation[6].

Preoperative evaluation comprised neurological status, cranial nerve involvement, cardiorespiratory status, hydration, and electrolyte balance. Imaging (CT/MRI) was performed in all cases. Patients with hydrocephalus were considered for CSF diversion prior to definitive surgery[7].

Anaesthesia induction: glycopyrrolate, fentanyl, thiopentone/propofol, and vecuronium/atracurium were administered[8]. Airway was secured with a flexometallic tube. Maintenance included oxygen, nitrous oxide, and sevoflurane with muscle relaxation.

Monitoring: ECG, SpO_2, $EtCO_2$, invasive blood pressure, and CVP as indicated[9].
ICP management: mannitol, furosemide, controlled ventilation, propofol infusion, and adequate muscle relaxation[10].

Hemodynamic instability was managed with fluids, vasopressors (phenylephrine, mephentermine), and beta-blockers (esmolol)[11].

Patients were positioned according to surgical need (prone, supine, lateral, sitting) with careful padding[12]. Postoperatively, patients were shifted to ICU for monitoring; ventilatory support was continued where required.

Results

Patients were compared for demographic data (age, weight) . A sample size of 50 was selected. Data was represented in terms of frequency and percentage.

Table 1: Demographic Profile

Age Group	Male	Female	Total (%)
21–30	5	7	12 (24%)
31–40	6	8	14 (28%)
41–50	3	6	9 (18%)
51–60	8	7	15 (30%)

Table 1 shows Posterior fossa pathology was more common in older patients (51–60 years) with a slight female predominance (56%).

Table 2: Diagnosis of Posterior Fossa Lesions

Diagnosis	Number of Patients
CVJ anomalies	6 (12%)
PICA aneurysm	2 (4%)
Cerebellar lesions	9 (18%)
C-P Angle tumors	19 (38%)
Brainstem tumors	14 (28%)

Table 2 shows C-P angle tumors were the most common pathology (38%), followed by brainstem tumors (28%).

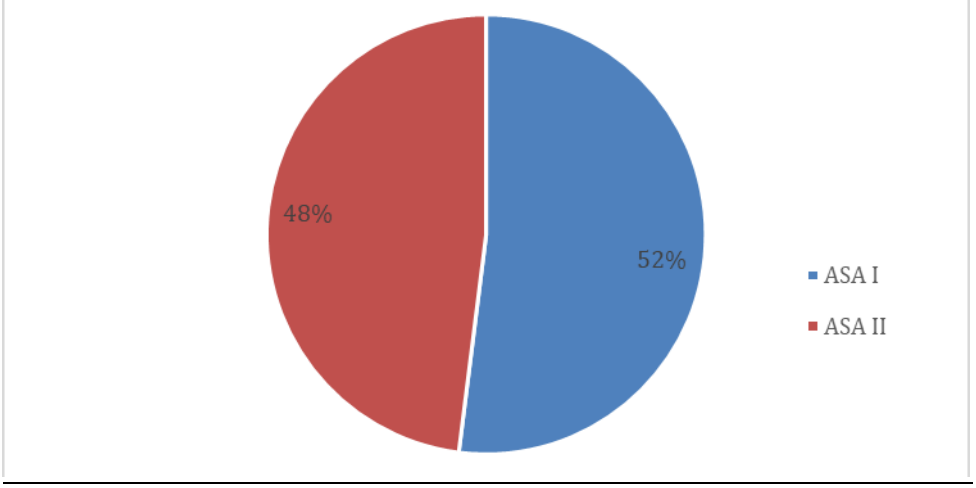


Figure 1: ASA Grading

The pie chart demonstrates the distribution of patients according to ASA physical status classification. A slight majority (52%) of patients were ASA Grade I, indicating no systemic illness, while 48% were ASA Grade II, reflecting mild systemic disease. This shows that the study population largely comprised patients with good preoperative health status, which reduced baseline anaesthetic risk.

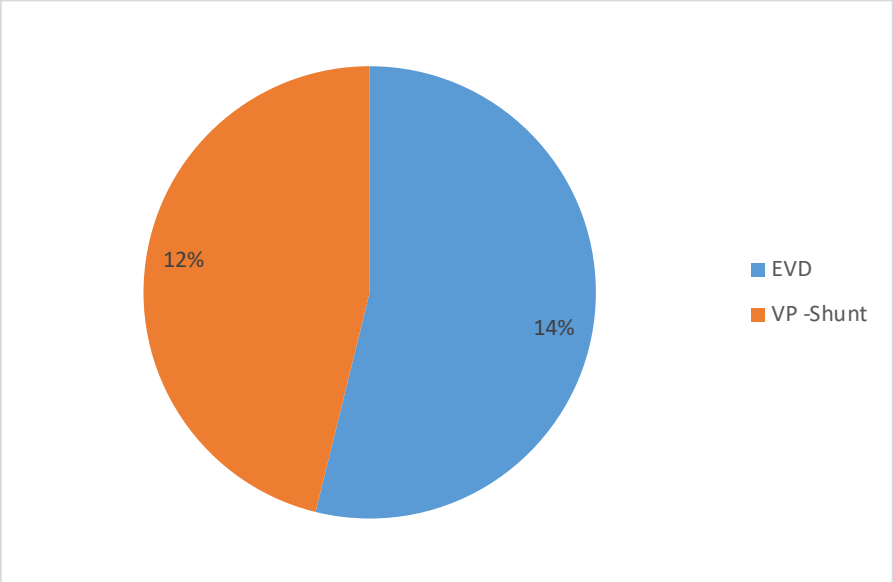
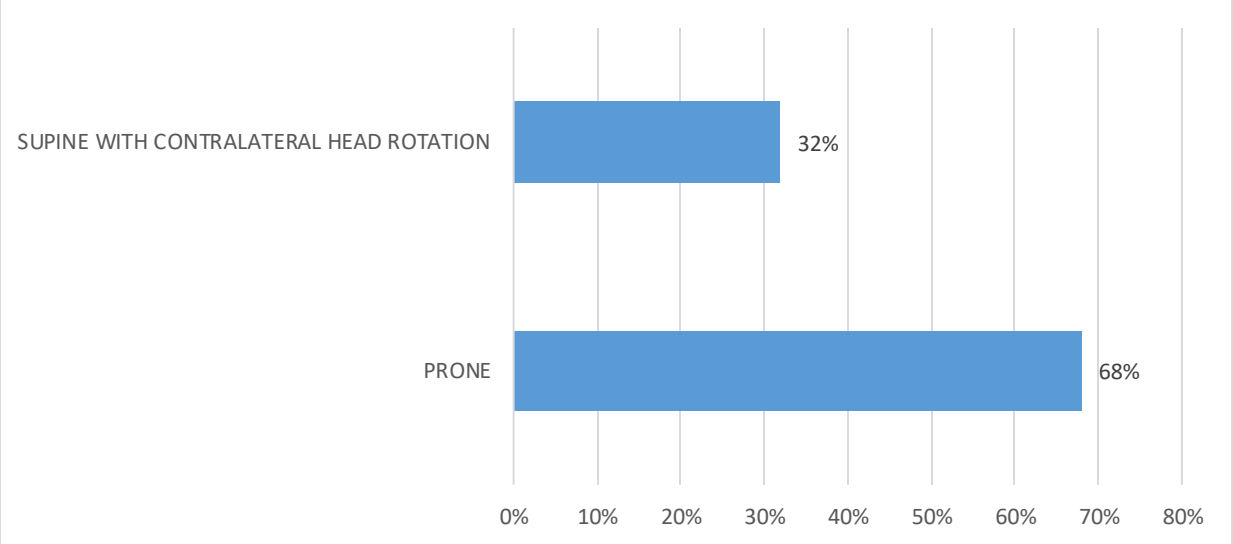


Figure 2: Methods to decrease ICP

The chart shows the distribution of cerebrospinal fluid (CSF) diversion procedures used to manage raised intracranial pressure (ICP). External Ventricular Drainage (EVD) was used in 14% of cases, while Ventriculo-Peritoneal (VP) shunt was employed in 12%. This indicates that EVD was slightly more commonly preferred for immediate perioperative ICP control compared to VP shunt

Figure 3: Intra-operative Positioning



The bar graph depicts intraoperative positioning of patients during posterior cranial fossa surgery. Prone position was most frequently used (68%), while supine with contralateral head rotation was employed in 32% of cases. This reflects the surgical requirement for optimal access and exposure, with prone position being the standard approach in the majority of procedures.

Table 3 – Intra operative Complications

Complication	Frequency (n=50)	Percentage (%)
Death	0	0.0
Arrhythmia	1	2.0

Venous Air Embolism	1	2.0
Tachycardia	2	4.0
Bradycardia	5	10.0
Hypertension	4	8.0
Hypotension	8	16.0
Hemorrhage	8	16.0

The table 3 summarizes intra-operative complications observed during posterior cranial fossa surgeries. Hemodynamic instability was the most frequent issue, with hypotension and hemorrhage each occurring in 16% of patients, followed by bradycardia in 10% and hypertension in 8%. Tachycardia was noted in 4% of cases, while arrhythmia and venous air embolism were less common (2% each). No intra-operative mortality was reported. These findings highlight the predominance of hemodynamic disturbances as the major intraoperative challenge in posterior fossa surgeries.

Table 4 - Postoperative Complications

Complication	**Frequency (n=50)**	**Percentage (%)**
Nausea and Vomiting	5	10.0
Seizure	1	2.0
Hematoma	4	8.0
CSF Leak	2	4.0
Cranial Nerve Palsy	9	18.0
Cardiac Arrest	2	4.0
Tachycardia	4	8.0
Bradycardia	3	6.0
Hypotension	4	8.0
Hypertension	3	6.0
Raised ICP	12	24.0
Tracheostomy	8	16.0
Ventilatory Support	17	34.0

The most common postoperative complication was ventilatory support requirement (34%), followed by raised ICP requiring intervention (24%) and cranial nerve palsy (18%). Tracheostomy was performed in 16% of cases. Other complications included nausea and vomiting (10%), hematoma (8%), tachycardia (8%), hypotension (8%), bradycardia (6%), hypertension (6%), CSF leak (4%), cardiac arrest (4%), and seizures (2%). These findings emphasize the high risk of respiratory and neurological complications after posterior fossa surgery.

DISCUSSION

Our findings highlight the complexity of anaesthetic management in posterior fossa surgeries. Raised ICP and cranial nerve dysfunction are common due to the anatomical compactness of this region[1,3]. Hemodynamic variations such as bradycardia, hypotension, and arrhythmias are attributed to stimulation of the brainstem and vagal nuclei[17]. The incidence of venous air embolism was low (2%), consistent with studies that show reduced risk when sitting position is avoided[18]. Cranial nerve palsy (36%) was significant, comparable to findings of Arvind Dubey et al[19]. Ventilatory support requirement was associated with brainstem pathology and intraoperative instability, consistent with previous studies[20,21].

Overall, morbidity remains high in posterior fossa surgeries, mandating careful preoperative optimization, intraoperative vigilance, and postoperative ICU management.

CONCLUSION

Posterior fossa surgeries carry high anaesthetic risk due to proximity of vital structures. C-P angle and brainstem tumors are the most common pathologies requiring surgical intervention. Intraoperative instability, venous air embolism, raised ICP, and cranial nerve palsy contribute significantly to morbidity. Meticulous anaesthetic care, perioperative planning, and vigilant ICU monitoring are essential to improve patient outcomes.

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