JNI Jurnal Neuroanestesi Indonesia

Case Report

Perioperative Craniotomy Excision of Dextra Subtemporal Tumor with Thiopental, Sufentanyl and Invasive Monitor

Guruh Perkasa, Iwan Dwi Cahyono, Aditya Pradana Kartinofan

Department of Anesthesiology and Intensive Therapy, Faculty of Medicine Universitas Jenderal Soedirman–Prof. Margono Soekarjo General Hospital, Purwokerto, Indonesia

Received: May 25, 2024; Accepted: June 20, 2024; Publish: June 27, 2024

correspondence:perkasaguruh90@gmail.com

Abstract

Intracranial masses can arise from a variety of aetiologies, including congenital, neoplastic, infectious, or vascular processes, each requiring distinct diagnostic and management considerations. Establishing the presence or absence of intracranial hypertension is a critical component of the preoperative evaluation for patients undergoing craniotomy for mass lesions. Hemodynamic is an examination of the physical aspects of blood circulation, cardiac function and physiological characteristics of peripheral vasculature. A 74 year old man was admitted to the hospital because of cephalgia, and left limb weakness. Previously, the patient often felt headaches that came and went since six months ago. Three days before being admitted, the patient felt weak in his left limb and experienced decreasing in consciousness. The patient was given thiopental because the onset of action of thiopental was very short. Administration of intravenous doses of thiopental can cause cerebral vasoconstriction. Sufentanil was administered as an analgesic, because sufentanil is an opioid that has a rapid onset and analgesic potential, compared to fentanyl, intravenous and sufentanil is 5–10 times stronger. This efficacy to maintain adequate cerebral perfusion pressure (CPP), reduce cerebral blood flow (CBF), maintain normal autoregulation, reduce cerebral metabolic rate for oxygen ($CMRO_2$). Arterial cannulation with continuous transduction is considered the gold standard for blood pressure monitoring during anaesthetic procedures. Rapid fluctuations in blood pressure can occur due to patient positioning, surgical manipulation, and the effects of anaesthetics drugs, and close monitoring of these changes is crucial for maintaining hemodynamic stability. The impact of anaesthetic management on CBF is also an integral component of neuroanesthesia, as increases in CBF are associated with increases in cerebral blood volume (CBV). An effective neuro-anesthesia management program that incorporates both invasive blood pressure monitoring and optimization of cerebral perfusion that can help preserving hemodynamic stability and improving outcomes for patients undergoing craniotomy surgery.

Keywords: Brain Tumors, intracranial Pressure, invasive monitoring

J. neuroanestesi Indones 2024;13(2): 99–107

1. Introduction

Tumors can cause intracranial volume effects not only due to their own mass but also due to surrounding vasogenic cerebral edema. Therefore, an understanding of the pathophysiology of intracranial pressure increases, whether localized or generalized, as well as the maintenance and regulation of intracerebral perfusion is necessary for the anesthesia of supratentorial tumors.[1] A comprehensive understanding of the patient's neuro and general condition, the intended intervention, and the comprehensive integration of these factors are necessary for the preoperative assessment determination of the anesthetic strategy for a specific neurosurgical intervention. Because brain perfusion and oxygenation ultimately depend on cardiovascular

doi: https://doi.org/10.24244/jni.v13i1.603
ISSN (Print): 2088-9674 ISSN (Online): 2460-2302

JNI is accredited as Sinta 2 Journal: https://sinta.kemdikbud.go.id/journals/profile/796

How to cite: Perkasa G, et al, "Perioperative Craniotomy Excision of Dextra Subtemporal Tumor with Thiopental, Sufentanyl and Invasive Monitor".

and respiratory functions, it is imperative that their function be optimized prior to operation. Certain intracranial pathological condition.[2] Due to the lengthy nature of neurosurgery procedures, it is crucial to keep an eye on the duration of the procedure and the medications being used to maintain anesthesia. Brain tissue, blood, and cerebrospinal fluid make up the intracranial component. Monroe Kellie's law states that although the volume composition of these three components may vary, the intracranial volume remains constant, meaning that the total volume remains constant.[2]

Despite being costly, risky, and requiring technical expertise for placement and management, arterial cannulation with continuous transduction is still the accepted reference standard for blood pressure monitoring. Its superiority over non-invasive methods for the early identification of interoperative hypotension was amply supported by the 1993 Australian Incidence Monitoring Study. The application of waveform analysis to physiological monitoring has grown in popularity recently. Eather and associates first suggested it more than 50 years ago, recommending that patients who were sedated have their "arterial pressure and pulse pressure contour" monitored. Through a range of pharmacological and nonpharmacological effects, anesthesia has a significant impact on the intracranial environment. These outcomes depend on the condition of the extracranial and intracranial environments (e.g. cerebral compliance, the existence or lack of a pathologic condition within the brain, and the overall state of volemics).[1]

II. Case

Anamnesis

A 74 year old man was admitted to the hospital complained of headaches since 6 months earlier. Headaches were sometimes accompanied by dizziness and were felt to come and go, this complaint had been worsen since 3 days earlier and was accompanied with weakness in the left limb. The patient was previously treated at Majenang Regional Hospital because his left limb felt weak. Previously, the patient often had headaches that came and went since 6 months earlier. Three days before being treated at the Majenang Regional Hospital, the patient felt weak in his left limb. During the treatment process the patient experienced a decrease in consciousness so he was referred to Margono Soekarjo General Hospital

Physical Examination

In physical examination, glasgow coma scale (GCS) 13 (E3M6V4), blood pressure (BP): 140/100 mmHg, heart rate (HR): 87x/minute, temperature: 36,7 °C, respiratory rate (RR) 22x/minute, and visual analog scale (VAS) score of 7. The patient

Table 1. Laboratory examination results on February 20, 2024

Laboratory	Results	Normal Value
Hemoglobin	13.9 g/dl	10.9 – 14.9
Hematocrit	43 %	34 – 45
Leukocytes	10,400/mm3	4,790 – 11,340
Platelets	174,000/µL	216,000 – 451,000
Urea	52.7 mg/dl	15 – 40
Creatinine	0.89 mg/dl	0.0 – 0.9
Albumin	Not inspected	3.97 – 4.94
PT	Not inspected	11.7 – 15.1
APTT	Not inspected	28.6 – 42.2
SGOT	Not inspected	<31
SGPT	Not inspected	<31
Blood Sugar	95.8 mg/dl	80 – 139
Sodium	120 mmol/L	136 – 145
Potassium	3.8 mmol/L	3.5 – 5.1
Chloride	79 mmol/L	97 – 107
Calcium	8.84 mg/dl	8.6 – 10.3
	February 24, 2024	
Laboratory	Results	Normal Value
PT	13.4	11.7 – 15.1
APTT	29.5	28.6 – 42.2
SGOT	40.3	<31
SGPT	30.5	<31
Sodium	136 mmol/L	136 – 145
Potassium	4.28 mmol/L	3.5 – 5.1
Chloride	100 mmol/L	97 – 107
Calcium	8.72 mg/dl	8.6 – 10.3
HbsAg	Non reactive	Non reactive

was initially referred to neurosurgery due to loss of consciousness. Isocoric pupil 3mm/3mm. Direct light reflek and indirect light reflek was positive. Muscle strength inferior and superior 5/5

Supporting examination

The result from the CT scan of the brain showed suspected of being a brain mass with extensive infarction, then days later the patient had an MRI of the head with Inhomogeneous solid mass with

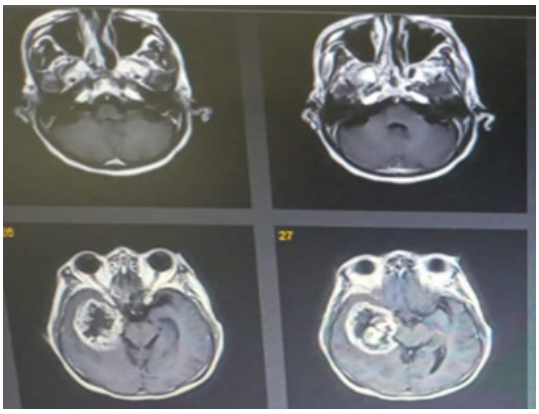
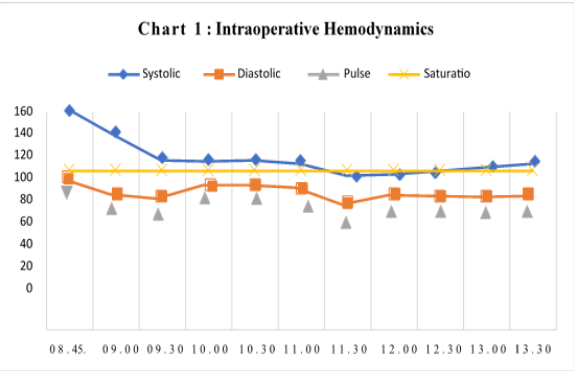


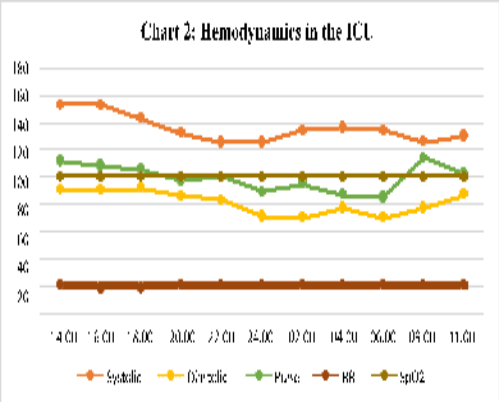
Figure 1. MRI of the Brain before Surgery

nectoric area in the right temporal lobe, measuring 4.8x6.1x5.4cm, suspected glioblastoma, increased intracranial pressure and Chest X-ray result silghtly cardiomegaly and bronchopneumonia, ECG examination results normal sinus rhytm. Examination on the patient's blood sample indicated that there were hyponatremia. Then the patient was corrected the hyponatremia and planned for tumor excision surgery.



Anesthesia Management

Patient was in the OR for the cranio surgery excision tumor with invasive monitoring.



Preinduction condition: consciousness E4 M6 V4, blood pressure 160/86 mmHg, pulse 72 beats/minute, RR 18 x/minute, temperature 36.8 °C, SpO_2 100%. The patient underwent general anesthesia using the ETT technique, using a nonkinking ETT no. 7.5 semi-closed breath control system. Premedication: ondansetron 4 mg IV, Dexamethasone 5 mg IV. Preemptive analgesia: sufentanyl 15 mcg IV. Induction: thiopental 250 mg IV. Muscle relaxant: rocuronium 40 mg IV. Fresh gas flow (FGF) 3 L/minute, maintenance with sevoflurane gas 2% ratio O_2 60% and air 40%, VT 400 ml, RR 15 x/minute, MV 6000 ml, sufentanyl 12.5 mcg/hour syringe pump, and rocuronium 20 mg/hour syringe pump.

Post Surgical Management in ICU

Following surgery, the patient was moved to the ICU (Intensive Care Unit). The patient was still using a ventilator on the first day, and on the

Figure 2. Clinical Post-operative Patient while in the room

second, the patient underwent weaning, or having the ventilator removed. The following chart shows the progress of the patient's condition while being

treated in the ICU with GCS E4M6V5.

In-room Care
Patient hemodynamics during treatment in the room was stable and in good condition after 2 days of treatment in the ICU and 5 days treatment in the room, patient was allowed to go home.

III. Discussion

The most common reason for craniotomies is brain neoplasms. Glial cells (glioblastoma, oligodendroglioma, or Astrocytoma), ependymal cells (ependymoma), or supporting tissue (meningioma, schwannoma, or choroidal papilloma) are the usual sources of primary tumors. Medulloblastoma, neuroblastoma, and astrocytoma are examples of childhood tumors. Intracranial masses show symptoms and signs that are consistent with growth rate, location, and intracranial pressure (ICP) regardless of the cause. Although they may be relatively large in size, slow-growing masses frequently do not exhibit symptoms for a long period, while fast-growing masses may do so even when they are still relatively small.[1]

Preoperative Assessment: Detailed understanding of the patient's overall and neurological health, the intended intervention, and the comprehensive integration of these elements are necessary to determine the best anesthetic plan for a given neurosurgical procedure. The participating neurosurgeon should be consulted regarding the patient and the intended intervention. Because cerebral perfusion and oxygenation ultimately depend on cardiovascular and respiratory functions, it is imperative that their function be optimized prior to surgery. Certain intracranial pathological conditions, such as the impact of elevated intracranial pressure on cardiac conduction, modify cardiovascular function. Significant blood loss can be resulted from supratentorial surgery (particularly for meningiomas and metastases), and hypovolemia and hypotension can be harmful during neurosurgery. Neuroanesthesiologists should be aware that surgical positioning and hyperventilation—which is frequently used to regulate ICP, CBF, CBV, and cerebral tension—put extra strain on the respiratory and cardiovascular systems. Lastly, the primary tumor itself may impair cardiorespiratory function, particularly in neurosurgery for metastases (e.g. g. lung metastases account for 40% of all cases), as do side effects from radiation or anticancer chemotherapy.[1]

Apart from enabling surgery, anesthetists also have to administer neuroanesthesia to regulate brain volume and intracranial pressure (ICP), employ brain protection techniques to shield nerve tissue from damage and ischemia, and control bleeding during the procedure. Hypoxemia, hypercapnia, anemia, and hypotension are among the critical conditions that must be avoided during surgery as they can negatively impact the central nervous system and surgical outcomes. To avoid ICP, brain autoregulation and the CO_2 response must be preserved. A mean arterial pressure (MAP) range of 50–150 mmHg is required to sustain cerebral blood flow (CBF). When CBF exceeds this threshold, the cerebral perfusion pressure (CPP) will be passively followed, regardless of the maximum dilatation or constriction of the cerebral blood vessels. Blood vessel constriction will be harmed by the pressure if CBF is sharply lowered (MAP 150 mmHg), causing CBF to spike. In addition to cerebral edema and possible cerebral hemorrhage, there is damage to the blood-brain barrier.[3]

Securing the head, usually with Mayfield pins, provides a strong, albeit brief, nociceptive stimulus. Preliminary titration in depth of anesthesia is necessary to prevent the related sympathetic response (usually an increase in remifentanil levels). Remifentanil or analgesic concentrations can be lowered after pinning in order to facilitate positioning and surgical preparation. When wearing Mayfield pins, excessive neck flexion can impede lymphatic and venous drainage. It is recommended to adopt a 15^{o} head-up position to help counteract the positional effects on intracranial pressure. If prone positioning is necessary, the anesthetist may decide to temporarily disconnect monitoring in order to facilitate effective positioning. Following

this, monitoring can be rearranged and restarted for the duration of the procedure. For posterior fossa tumors, craniotomy in the sitting posture is preferred to enable better surgical access. Reduced cerebral perfusion pressure, venous air embolism, and even quadriplegia as a result of pressure on and stretching of the spinal cord with prolonged neck flexion are risks associated with this position. High suspicion must go hand in hand with careful pressure-point attention during positioning, even though it is uncommon.[4]

In supratentorial neurosurgery, preventing secondary brain injury is the primary consideration when inducing anesthesia. Thus, sympathetic and blood pressure control (e.g., preventing hypoxia and hypercapnia), ventilation control, G. prevent cranial venous outflow obstruction (head position), a sufficient depth of anesthesia, and antinociception to prevent CNS arousal are key components. This meticulous attention to detail helps prevent undesired increases in intracranial pressure (ICP) and lowers cerebral perfusion pressure while also improving the patient's intracranial pressure-volume curve and ensuring appropriate cerebral perfusion. The two primary objectives of anesthesia during supratentorial surgery are (1) neuroprotection via preservation of an ideal intracranial environment and (2) control of brain tension via regulation of CBF and CMR (also known as the "chemical brain retractor concept"). Achieving a good depth of anesthesia and antinociception, prophylactic antiepileptic medication, and management of the aftermath of CNS surges, if they happen, using antihypertensives and sympatholytics are all necessary to achieve the first goal of preventing cerebral excitation. Keeping the demand and supply of cerebral substrates in balance, along with taking appropriate neuroprotective action in the event of a mismatch, are the secondary goals (note: 5–10% of patients experience ischemia under retractors). A basic approach is employed by certain anesthesiologists. on the basis of multiple experimental studies proving its effectiveness following brain damage, passive hypothermia (35 °C) to offer neuroprotection. On the other hand, research on clinical patients has not shown that hypothermia has any advantageous effects. Hypothermia further interferes with the coagulation cascade and platelet function. Thus, the risk of transfusion and blood loss can increase even with mild hypothermia (<1°C).[2] The prevention of problems affecting brain tissue, blood, and cerebrospinal fluid is a key component of good neuroanesthesia. Techniques for inhaling anesthesia have gained widespread acceptance in the field of neurosurgical management; however, they have the potential to increase CBF and ICP by decreasing vascular resistance,particularly cerebral vascular resistance. Procedures for inhaling anesthetics will raise intracranial pressure (ICP) in cases where it is already elevated. This will lower ICP and raise the possibility of cerebral ischemia, which can result in brain damage.[3]

The advancements in CT scanning and MRI imaging methods have greatly simplified the assessment of supratentorial lesions. These enable early, accurate lesion localization and provide a rough indication of the likely histological diagnosis. The following details should be looked at in the scans: mass size; venous distortion or obstruction; midline shift; degree of edema; degree of contrast enhancement; and proximity to the venous sinus. Whether the tumor is growing in a quiet or expressive region of the brain affects the mass's size in part. Silent tumors have the potential to enlarge to such an extent that they significantly impair intracranial dynamics before they manifest. Determining the extent of intracranial space occupation is crucial; volatile agents, for instance, should be used cautiously if the midline structures shift by more than 10 mm. A relatively minor lesion could become a more significant issue depending on the amount of edema. The level of abnormal or damaged tissue is indicated by the degree of enhancement with intravenous radiographic contrast. The contrast was able to reach the tumor's stroma because of damage to the blood–brain barrier (BBB) in the lesion. In angiography, cerebral veins draining the tumor often fill early during the arterial or capillary phases of the angiogram, reflecting the fast flow, and a vascular tumor may have low vascular resistance. When resection is performed, a tumor of this kind may cause significant bleeding, particularly if it is close to a vein. More

accurate information on the location and size of the tumor will be available with the growing availability of metabolic imaging techniques like PET, MR spectroscopy, and single photon emission tomography (which uses thallium-201, which is specifically taken up by tumor cells but not by necrotic areas). Before undergoing a craniotomy, patients who are suspected of having an astrocytoma should have a stereotactic biopsy to confirm the histological diagnosis.[6]

The majority of perioperative and postoperative complications seem to be medical in nature, and elderly patients are more likely to experience them. The functional course and survival of elderly individuals are greatly impacted by postoperative complications. Age alone is frequently not associated with complications in multivariable models adjusted for frailty, comorbidities, and poor baseline performance status. These factors may be stronger predictors of adverse events than age alone. Reduced functional status prior to surgery is a significant risk factor for additional functional decline. Meningioma rarely requires immediate medical attention, so patients can receive the time necessary to receive the best possible care. Careful patient selection, minimally invasive techniques, efficient perioperative care, and multidisciplinary evaluation for patients with medical concerns may all help to minimize this excess risk and yield results comparable to younger cohorts. An older patient's lower rate of adverse events in more recent surgical series could be explained by a greater consideration of these factors. There is not enough data to justify the routine application of the various scoring systems that have been proposed to help with preoperative risk stratification of elderly patients.[7]

The goal of intraoperative blood pressure management is to maintain an acceptable CPP during craniotomy by controlling mean arterial pressure (MAP) or central venous pressure (CVP) when CVP is greater than ICP. We recommend aiming for a CPP between 65 and 80 mmHg. For an uncomplicated patient, a target range of 75 to 90 mmHg is appropriate, assuming a normal ICP (or CVP) range of 5 to 10 mmHg. CBF autoregulation usually occurs within a MAP range of 60 to 150 mmHg, with some individual variation. Outside this range, there is a risk of ischemia at low pressures and edema or hemorrhage at high pressures because the brain cannot adapt to changes in perfusion pressure. The CBF increases or decreases passively in response to changes in pressure. With fault tolerance, we aim for a MAP that is above the lower limit of autoregulation.[8]

Even though arterial cannulation with continuous transduction is costly, risky, and requires technical expertise for placement and management, it is still the accepted reference standard for blood pressure monitoring. Eather and associates first recommended monitoring "arterial pressure and pulse pressure contour" in anesthetized patients more than fifty years ago.[4] Circumstances requiring precise beat-to-beat blood pressure control, such as end-organ disease, the need for arterial blood gas measurements or another repeat blood analysis, and current or anticipated induced hypotension or wide blood pressure deviations are indications for invasive arterial blood pressure monitoring with arterial catheterization.

The radial artery is used in these patients because of its superficial location and significant collateral blood flow, which makes it easier to cannulate. Five percent of patients have insufficient collateral blood flow and incomplete palmar arches. An easy-to-use but unreliable technique for determining whether radial artery cannulation is safe is Allen's test. The patient exsanguinated by clenching a fist during this test. The patient relaxed the pale hand as the operator applied fingertip pressure to occlude the radial and ulnar arteries. Within five seconds of releasing pressure on the ulnar artery, redness on the thumb indicated collateral flow through the palmar arch. If the color takes five to ten seconds to return to normal, the test results may be questioned or there may not be enough collateral circulation (more than ten seconds). The Allen test is one that many practitioners regularly avoid using because of its dubious utility. As an alternative, palpation, Doppler probe, plethysmography, or pulse oximetry can be used to identify blood flow distal to radial artery occlusion. These techniques

for evaluating collateral circulation adequacy do not require patient cooperation, in contrast to Allen's test. [1]

Brain metabolic rate of oxygen ($CMRO_2$) and cerebral blood flow (CBF) are correlated. Known as flow–metabolism coupling, this phenomenon states that a change in the cerebral metabolic oxygen demand will correspondingly increase or decrease CBF. A rise in CBF will raise ICP, which could have an impact on CPP because the skull is a closed space. Among the class of induction drugs are thiopental, propofol, etomidate, and midazolam, which are intravenous anesthetics that can lower ICP and CBF. In addition to propofol infusion syndrome, propofol can also result in hypotension and hypertriglyceridemia. On the other hand, propofol has been demonstrated to be a medication that effectively controls intracranial pressure (ICP). The amount that lowers cerebral blood flow and lowers the brain's metabolic rate by 40% is possible. Thiopental is the most often utilized option among all the classes of induction medications that have been discussed. Belonging to the barbiturate class, thiopental is an intravenous anesthetic. Thiopental was administered to the patient in this instance due to its brief onset of action. Thiopental administered intravenously may result in hypotension, bradycardia, and cerebral vasoconstriction in addition to lowering blood pressure. Low arterial pressure and cardiac output are the effects of thiopental at high doses.[3,4]

When sufentanil is given intravenously, it has an analgesic effect that is 5–10 times stronger than fentanyl, and it has an extradural effect that is 3–5 times stronger. This is because sufentanil is an opioid with a rapid onset and analgesic potential. Its strong lipid solubility and blood-brain barrier-crossing capacity account for the majority of its effectiveness. While it's true that muscle relaxants raise CBF, rocuronium and vecuronium are the ones that do so the least, which makes them the preferred medications for neurosurgical procedures. In this instance, 40 mg of rocuronium were administered to the 55 kg patient. In this instance, rocuronium was selected as the muscle relaxant of choice due to its competitive nature, exhibiting the quickest onset of action (45 to 90 seconds) and intermediate duration of action. The effects of rocuronium on the heart are negligible. Rocuronium has a mild vagolytic effect when used in high doses. The liver and kidneys both remove rocuronium, though to varying degrees.[5]

Sevoflurane 2% is the inhalation anesthetic used, and its oxygen to water ratio is 60%. To avoid PaO_2 pressures higher than 200 mmHg, a flow rate of 60% oxygen is utilized. Since N_2O can directly dilate cerebral blood vessels and raise CBF—an effect that can be mitigated by hyperventilation ($PaCO_2$ 30–35 mmHg)—it was not administered to this patient. N_2O may cause vacuolization of the mitochondria and endoplasmic reticulum while having no protective effect on brain neurons, according to certain studies. GABA receptor disinhibition can also be entirely reversed by N_2O. The use of N_2O in patients deficient in folic acid can hinder cell electrophysiological recovery and cause degeneration of the spinal cord. N_2O can cause hypocapnia when used with other inhalation anesthetics, but the side effects can differ. Apart from desflurane, isoflurane, and sevoflurane, all volatile anesthetics are cerebral vasodilators and lower CMR. At two minutes of minimum alveolar concentration (2 MAC), which is the concentration at which maximum metabolic depression is reached, these three agents produce good EEG results.[2]

It is best to avoid hypo-osmolality (target osmolality, 290 to 320 mOsm/kg), which can worsen brain edema, and hyperglycemia (glycemia >10 mmol/L), which exacerbates the effects of cerebral ischemia. Aqueous solutions with hypo-osmolar solutions (e.g. G. one should steer clear of lactated Ringer's solution (254 mOsm/kg). Maintaining a hematocrit above 28% is recommended. After the procedure, fluids should be warmed to ensure normothermia, which is necessary to measure anesthesia awareness.[2] For the purpose of brain relaxation, furosemide or loop diuretics are also administered at a dose of 0.5–1 mg/kgBW. The patient's head can be raised to a temperature of 15 to 30 degrees Celsius as another measure to stop their ICP from rising. For every 10°C drop in temperature, mild hypothermia, or a temperature between 33 and

35°C, can result in a 5% reduction in blood flow to the brain. The patient's head is kept in a neutral, supine position following surgery—it is not tilted to the left or right, nor is it overextended.[2,4]

The primary concern when administering anesthesia during elective supratentorial neurosurgery is preventing further brain damage. Controlling ventilation will prevent hypoxemia and hypercapnia, and sympathetic and blood pressure control will also help. G. preventing cranial venous outflow obstruction (head position), maintaining an appropriate depth of anesthesia, and antinociception to prevent CNS arousal are all crucial. This meticulous attention to detail lowers cerebral perfusion pressure, guarantees appropriate cerebral perfusion, helps prevent undesired increases in ICP, and improves the patient's intracranial pressure-volume curve. The anesthesia room should provide adequate anxiolysis, adequate fluids (5 to 7 mL/kg NaCl 0.9 percent), ECG leads, capnometer, pulse oximeter, and noninvasive blood pressure monitor, as well as the placement of intravenous and arterial lines under local anesthesia and the induction of general anesthesia. Fentanyl 1 to 2 µg/kg or sufentanil or remifentanil, preoxygenation and hyperventilation, propofol 1.25 to 2.5 mg/kg or thiopentone 3 to 6 mg/kg for induction, non-depolarizing muscle relaxants: vecuronium, rocuronium or cisatracurium, control ventilation with $PaCO_2$ 35 mmHg Propofol 50 to 150 µg/kg/min or isoflurane 0.5% to 1.5% (or sevoflurane or desflurane) for maintenance therapy and fentanyl (or alfentanil, sufentanil or remifentanil) 1 to 2 µg/kg/hour (or bolus) for analgesia, local anesthesia or intravenous remifentanil 0.5 to 1 µg/kg for cranial pinhead placement and skin incision, appropriate head-up position; there is no jugular compression of the vessels, relaxation of the brain. If necessary, mannitol 0-5-0-75 g/kg. In the event that lumbar drainage is required, normovolemia can be treated without the use of lactated Ringer's solution by using either 6.0 percent starch or 0.9 percent NaCl.[2]

IV. Conclusion

Patients face difficulties associated with supratentorial tumors due to localized and widespread pressure, while surgeons face challenges in surgical exposure because the brain is susceptible to damage from retraction and mobilization. Therefore, knowledge of the pathophysiology of localized or generalized rising intracranial pressure (ICP), control and maintenance of intracerebral perfusion, and prevention of secondary systemic brain impairments are required for anesthesia of supratentorial tumors. Preoperative Assessment: A detailed understanding of the patient's general and neurological health status, the intended procedure, and the comprehensive integration of these elements are required to determine the best anesthesia plan for a particular neurosurgical procedure. Neuroanesthesia treatment includes maintaining adequate cerebral oxygen delivery (CDO_2), lowering CBF, maintaining normal autoregulation, lowering $CMRO_2$, and loosening and relaxing the brain tumor to maintain stable hemodynamics.

It is important to take into account the artery side of the circulation. An established aspect of neuroanesthesia is monitoring the impact of anesthetic agents and procedures on cerebral blood flow (CBF), as increases in CBF are typically accompanied by increases in cerebral blood volume (CBV). These patients receive thiopental because it can lower ICP and CBF and has a very brief onset of action. Since rocuronium is a competitive muscle relaxant with the quickest onset of action (45 to 90 seconds), an intermediate duration of action, and negligible cardiovascular side effects, it was selected in this particular instance. Because sufentanil is an opioid with a quick onset and analgesic potential, it can be administered as an analgesic. For instance, intravenous sufentanil is 5–10 times stronger than fentanyl, and it is 3–5 times stronger in the extradural space. Its strong lipid solubility and blood-brain barrier-crossing capacity account for the majority of its effectiveness. Although isoflurane, sevoflurane, and desflurane also lower CMR, all volatile anesthetics are cerebral vasodilators. Therefore, since sevoflurane lowers CMR, its use in this patient is appropriate

V. Acknowledgement

We would like to thank Prof. Dr. Margono Soekarjo Hospital for helping and facilitating our study.

VI. Disclosure

The authors have diclared that no conflict of interest and no source of funding in this study.

References

1. Butterworth JF, Mackey DC, Wasnick JD. Morgan and Mikhail's Clinical Anesthesiology. 6th ed. New York: McGraw Hill. 2018.

2. Cottrell JE, Patel P. Cottrell and Patel's Neuroanesthesia. 6th ed. 2017.

3. Kulsum K, Suryadi T. Neuro-anesthetic management of craniotomy-surgery in removal tumor multiple meningioma patients: a case report. Open Access Macedonian J M Sc. 2021 28; 9(C):146-150. Doi: https://doi.org/10.3889/oamjms.2021.6371

4. Keown T, Bhangu S, Solanki S. Anaesthesia for craniotomy and brain tumour resection. 19th World of Congress Anaesthesiologist. Marocco. 2022. Available in: https://resources.wfsahq.org/atotw/anaesthesia-for-craniotomy-and-brain-tumour-resection

5. Kannabiran N, Bidkar PU. Total intravenous anesthesia in neurosurgery. J Neuroanaesthesiol Crit Care. 2018;5:141-49. Available in: https://www.researchgate.net/publication/328587898_Total_Intravenous_Anesthesia_in_Neurosurgery: Doi: 10.1055/s-0038-1673544

6. Goma H. Anesthetic considerations of brain tumor surgery. In: Abujamr AL, editors. Diagnostic Tecniquesand Surgical Management of Brain Tumors. InTech. 2011.365-384. Avalaible in: https:researchgate.net/publication/221916991

7. Amoo M, Henry J, Farrell M, Javadpour M. Meningioma in the elderly. Neurooncol Adv. 2023; 5(Suppl 1): i13–i25. Doi: 10.1093/noajnl/vdac107

8. Kim BG, Jeon YT, Han J, Bae YK, Lee SU, Ryu JH, et al. The neuroprotective effect of thiopental on the postoperative neurological complications in patients undergoing surgical clipping of unruptured intracranial aneurysm: A retrospective analysis. J. Clin. Med. 2021;10(6):1-8. Doi: https:// doi.org/10.3390/jcm10061197

9. Doko RPD. Comparison of cost-effectiveness analysis (CEA) between sevoflurane inhalation anaesthetic and propofol total intravenous anesthesia (TIVA) in craniotomy surgery: A literature review. Bali Med J. 2023; 12(2):1790-795. Doi: https:// doi.org/10.15562/bmj.v12i2.4390. Available from: https://www.balimedicaljournal. org/index.php/bmj/article/view/4390

10. Kim DK, Yoon SH, Kim JY, Oh CH, Jung JK, Kim J. Comparison of the effects of sufentanil and fentanyl intravenous patient controlled analgesia after lumbar fusion. J Korean Neurosurg Soc. 2017; 60(1): 54-59. doi: 10.3340/jkns.2016.0707.007