Case Report

Anesthesia Considerations in Patients with Heart Failure who will Undergo Glioblastoma Tumor Removal Surgery

I Wayan Suranadi, Anak Agung Gde Agung Adistaya, Bianca Jeanne
Department Anesthesiology, Pain Management, and Intensive Care, Faculty of Medicine Universitas Udayana/ Prof. dr. I.G.N.G. Ngoerah General Hospital
Received: March 28, 2025; Accepted: April 17, 2025; Publish: June 21, 2025
correspondence: anestesiekonof@gmail.com

Abstract

Perioperative complications in neurosurgery encompass a range of issues, including hemodynamic instability, significant bleeding, extended procedure durations, and unusual patient positioning. Additionally, fluctuations in carbon dioxide levels, whether hypercapnia or hypocapnia, can contribute to secondary brain injury. Hemodynamic instability is particularly likely during critical moments such as laryngoscopy and intubation, head pins, and the manipulation of the scalp, bone, and dura mater. Patients with congestive heart failure (CHF) and other cardiovascular comorbidities require special attention throughout the entire surgical process, from the preoperative period through to postoperative care. Here, we present a case study on the successful anesthesia management of a patient with moderate heart failure undergoing glioblastoma tumor removal surgery. This case underscores the necessity of individualized anesthetic approaches and vigilant monitoring to minimize risks and ensure patient safety in complex neurosurgical procedures. The main goal of anesthesia in CHF patient undergo neurosurgical procedure are to maintain cerebral perfusion pressure, decrease Intracranial Pressure, Cardiovascular monitoring, maintain hemodynamic stability using vasopressor, inotrope, and fluid balance, and special consideration of position and long surgical time. By carefully managing these perioperative challenges, we can improve outcomes for patients with significant comorbidities undergoing high-risk surgeries.

Keywords: Anesthesia, congestive heart failure, neuroanesthesia, neurosurgical procedures

J. neuroanestesi Indones 2025;14(2): 103–107

Introduction

PPatient with moderate to severe heart failure and history of coronary artery diseases cannot afford the hemodynamic disturbance caused by perioperative complication and hypotensive effect of anesthesia in patients with moderate to severe heart failure and a history of coronary artery disease present significant challenges during neurosurgery due to their limited cardiovascular reserve. These individuals cannot tolerate hemodynamic disturbances that may arise from perioperative complications or the hypotensive effects of anesthetic agents. Any substantial drop in blood pressure can severely compromise perfusion to vital organs, including the heart and brain, leading to potentially life-threatening outcomes.[1,2] One of the most critical concerns during neurosurgery is intracranial pressure (ICP) management. An elevated ICP demands an increase in cardiac output to maintain adequate cerebral perfusion pressure. However, this increased workload can strain an already weakened heart, potentially worsening the heart failure. The delicate balance between maintaining sufficient brain perfusion and preventing cardiac decompensation is a central focus of intraoperative care.[3]

Therefore anesthesiologists must carefully regulate both cerebral and cardiac parameters.

doi: https://doi.org/10.24244/jni.v14i2.653
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: Suranadi IW, et al, "Anesthesia Considerations in Patients with Heart Failure Who will Undergo Glioblastoma Tumor Removal Surgery".

While it is essential to maintain adequate cerebral perfusion to avoid neurological damage, it is equally important to minimize the myocardial oxygen demand to prevent further ischemic injury to the heart. This requires a nuanced approach to anesthesia management, fluid therapy, and cardiovascular support to ensure stability of both neurological and cardiac functions throughout the surgical period during neurosurgery. The high intracranial pressure increases the cardiac workload to maintain the cerebral perfusion, while on the contrary, anesthesiologist must maintain the cardiac oxygen demand to avoid further damage to the heart.[4,5]

Case

History

A 55 years old male diagnosed with glioblastoma, with comorbidity of heart failure and history of coronary artery disease who had undergone successful primary PCA 1 year prior.

Patient had history of CAD 1 vessel disease at the LAD with total occlusion at proximal part and 70% stenosis at the distal part which was treated successfully by primary PCI 1 year ago. But this cause moderate hypokinesis basal anterior, basal anterior septal, basal inferior septal, basal inferior, mid anterior, mid inferior septal, mid inferior and akinesis in mid anterior septal, apical anterior, apical septal, apical inferior, apical lateral, and apex.

Patient consumed aspirin 80mg/ 24 hours, clopridogel 75mg/ 24 hours, rosuvastatin 20 mg/ 24 hours, bisoprolol 1.25mg / 24 hours, and ramipril 5mg/ 24 hours. The clopidogrel had been stopped since 7 days ago, and patient did not undergo any bridging therapy (no atrial fibrillation, DVT, or heart valve prosthesis). The patient also had a poorly controlled diabetes with HBA1C value was 14% which was treated with 4 unit of short acting insulin three times a day and 14 unit once a day with long-acting insulin

Physical Examination

Patient symptoms included dyspnea on effort but other than that patient could do simple daily tasks alone without complain such as walking a short distance around the house and taking care of himself. Patient baseline hemodynamics were normal. The blood pressure fluctuated from 120–150/60–90 mmHg with regular heart rate of 60–65 bpm. No murmurs or gallops were observed. Peripheral oxygen saturation was 98% in room air.

Supporting Examination

Echocardiography revealed that the left ventricle was mildly dilated and LVEF BP was only 34.3% with also decrease in diastolic and moderate hypokinesis and akinesis that was mentioned above. MRI shows multiple tumor mass intraaxial supratentorial in right frontoremporoparietal lobe with the largest size was +/- 3.32 x 2.88 x 2.75 cm. There was a midline shift to the left of about 0.72 cm. The blood work result showed a mild reduced of kidney function with BUN 25.9 mg/ dl and creatinine serum 1.15mg/dl, but urine production was normal. The results of the remaining blood work was unremarkable

Anesthesia Management

We administered premedication with ranitidine and midazolam 1 mg in the preparation room. In the operation room before we put the arterial line, a maintenance dose of dexmedetomidine 0.4 mg/kgbw/hour was given until patient was moderately sedated (RAAS -3). Basic and more invasive hemodynamic monitoring was done during the operation, including a 5-lead ECG, pulse oximetry, NIBP, $ETCO_2$, arterial line, and jugular CVC.

We used a moderate dose of opioid using sufentanil 0.4 mcg/kgbw (30 mcg), TCI propofol schnider mode with target effect 1–1.5 mcg/ml, intravenous lidocaine 80mg. For intubation, rocuronium 0.5 mcg/kgbw (40 mg) was used as a muscle relaxant. A number 8 tube was inserted and connected to the pressure mode ventilator. After intubation, scalp block was done at both side of the head using bupivacaine 0.25 % + lidocaine 2% with total volume 20 ml Intraoperatively, the side stream $ETCO_2$ was maintained between 30 and 35 mmHg. Patient hemodynamic was maintain within patient's baseline limit. For maintenance, TCI propofol

target effect 1–2 mcg/ml, dexmedetomidine maintenance (0.4–0.8 mcg/kgbw/hour), and intermittent dosage of rocuronium and sufentanil was used intraoperatively. Patient underwent a craniotomy tumor removal in the supine position. Surgery was performed for 7 hours and there was a significant bleeding approximately 1700ml, three bags of packed red blood cell was transfused intraoperatively, but patient's hemodynamic status could be maintained without vasopressors or inotropese.

Post-surgical Management

The patient was not extubated in the operating room and was immediately transferred to the ICU for postoperative care. Hemoglobin post operative was 9.8 and patient was then extubated in the ICU on the same day. Patient recovery was uncomplicated and was discharged from the ICU after two days of monitoring.

Discussion

A throughout cardiovascular history including, history of symptoms, other comorbidities, physical status/METS Score, medical invasive intervention, history of medication, and the latest echocardiography is important to gained preoperatively. From physical examination, knowing the base hemodynamic profile is important for understanding the cardiovascular reserve.[1,6] Based on current information, the anesthesiologist can determine whether the patient is eligible for elective neurosurgerya. Any medical intervention should be performed to improve cardiac function before the operation.

Some medications should be continued until one day before the operation such as bisoprolol and aspirin. Some medications, such as ACE inhibitor/ ARB may cause vasoplegic and refractory hypotension in some patients and are preferred to be discontinued 2 days before the operation. Clopidogrel or warfarin should be discontinued 5–8 days before operation, or replaced by bridging therapy in a high risk patient.[7,8] Other condition such as hypo/ hyperglycemia, anemia, and imbalanced electrolyte should be corrected before operation. Intraoperative considerations are listed in Table 1. It is crucial to maintain cerebral perfusion pressure by keeping the mean arterial pressure stable intraoperatively. Induction must be performed slowly, considering that this patient could not tolerate extreme hemodynamic

Table 1. Intraoperative Consideration for CHF Patients undergoing Craniotomy Tumor Removal.[7]

Maintain cerebral perfusion pressure	• Delivered induction agent slowly while monitor the hemodynamic • Maintain MAP (±20% baseline) and ICP • Prepare the antihypertension, vassopressor, Inotropic agent • ICP monitoring if available, brain cerebral perfusion monitoring (continuous transcranial doppler/ TCD)
Decrease ICP	Hyperventilation + monitoring $ETCO_2$, maintain jugular vein, pharmacologycal (Manitol,NaCl 3%), burst suppression as neuroprotector
Consideration in patient with CHF	Strategy: decrease ICP, control the heart rate and rhytm, isovolemic fluid balance
Cardiovascular monitoring	5 leads ECG, Pulse oximetry, NIBP, $ETCO_2$, Arterial line, and Jugular CVP
Hemodynamic stability	Avoid conditions where anesthesia depth is inadequate, analgetic is inadequate, hypoxemia, hypercarbia and hypovolemia
Special Consideration	Patient potition and tumor location

disturbance. Patients with left ventricular dysfunction and a history of CAD will find it difficult to maintain MAP, which may increase the cardiac workload and O_2 consumption. The strategy is to maintain MAP while reducing ICP, controling heart rate and rhythm, and maintaining isovolemic fluid balance.[8,9] Invasive intraoperative monitoring is mandatory to ensure patient's safety. The arterial line provides beat-to-beat hemodynamic information. Jugular/subclavian central venous catheter is used to measure the CVP and as an access for vasopressors and inotropes. In some positions that have a high risk for air embolism, CVC can be used to aspirate the air trapped in the vasculature. Some drugs must be prepared and ready for use such as vasopressors, inotropes, antihypertensives, venodilators, and anti-arrythmia.[6]

Maintenance of cerebral blood flow can also be achieved by reducing intracranial pressure. Hyperventilation is not recommended because the vasoconstrictor effect only lasts for a period and can compromise cerebral perfusion. Monitoring the $ETCO_2$ with the target between, maintaining the neck position and ensuring jugular vein drainage. Pharmacologically, NaCl 3%, mannitol, and furosemide can also be used to reduce ICP. Burst suppression for neuroprotection using propofol, thiopental, or etomidate can also be used to reduce $CMRO_2$ and cerebral blood flow.[1,2] Avoiding conditions that cause sympathetic instability such as inadequate depth of anesthesia, inadequate analgesia, and hypovolemia. Anesthesia agents included TIVA, opioid-based induction, fast-acting opioid (sufentanil/ remifentanyl), induction agent (etomidate, low-dose propofol), and maintenance agent (TCI propofol, <1 MAC sevoflurane). Dexmedetomidine prevents sympathetic surges, neuroprotective effects, analgesia and anesthesia sparring effects.[4,9]

Postoperatively, if there are no contraindications, early and smooth extubation is preferred to evaluate neurological deficits that may occur after surgery. Adequate pain management postoperative is also very important to avoid sympathetic stress. Postoperative echocardiography and ECG should be performed to evaluate cardiac function. Management of complications such as seizures, shivering, and pneumonia (HAP/ VAP) should be performed to ensure the maximal outcome of the patient.[10]

Conclusion

The declining function of the two major organs causes dilemmas for anesthesiologist. Maintaining a stable intracranial pressure is crucial for maintaining good cerebral perfusion without compromising heart function. Invasive hemodynamic monitoring is also mandatory for patients with cardiac comorbidities who undergo non-cardiac surgery. Both preserving cardiac function and brain perfusion cannot be separated because both eventually affect each other.

References

1. Bhatt R, Khanna P. Anesthetic considerations in cardiac patients undergoing neurosurgery. J Neuroanaesthesiolog Crit Care. 2019;8(1); 1–8. doi:10.1055/s-0039-1692734

2. Chowdhury T, Petropolis A, Cappellani RB. Cardiac emergencies in neurosurgical patients. Biomed Res Int. 2015;2015:1-14. doi: 10.1155/2015/751320.

3. Hammill BG, Curtis LH, Bennett-Guerrero E, O'Connor CM, Jollis JG, Schulman KA, et al. Impact of heart failure on patients undergoing major noncardiac surgery. Anesthesiology 2008;108(4):559–67. Doi: 10.1097/ALN.0b013e31816725ef

4. Hedge J, Balajibabu PR, Sivaraman T. The patient with ischaemic heart disease undergoing non cardiac surgery. Indian J Anaesth 2017;61(9):705–71. Doi; 10.4103/ ija.IJA_384_17

5. Kaul TK, Tayal G. Anaesthetic considerations in cardiac patients undergoing non cardiac surgery. Indian J Anaesth 2007;51(4):280–86.

6. Fleisher LA, Fleischmann KE, Auerbach AD,

Barnason SA, Beckman JA, Bozkurt B, et al. 2014 ACC/ AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014;130(24):2215–245. Doi: 10.1161/CIR.0000000000000105

7. Kristensen SD, Knuuti J, Saraste A, Anker S, Bøtker HE, De Hert S, et al. 2014 ESC/ ESA guidelines on non-cardiac surgery: cardiovascular assessment and management: the Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA). Eur Heart J. 2014;35(35):2383–431. Doi: 10.1093/eurheartj/ehu282

8. De Hert S, Staender S, Fritsch G, Hinkelbein J, Afshari A, Bettelli G, et al. Pre-operative evaluation of adults undergoing elective noncardiac surgery: updated guideline from the European Society of Anaesthesiology. Eur J Anaesthesiol 2018;35(6):407–65. Doi: 10.1097/EJA.0000000000000817.

9. 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):287–94. Doi 10.4103/0019-5049.156868

10. Myburgh JA, Upton RN, Grant C, Martinez A. The effect of infusions of adrenaline, noradrenaline and dopamine on cerebral autoregulation under propofol anaesthesia in an ovine model. Intensive Care Med 2003;29(5):817–24. Doi: 10.1007/s00134-003-1684-4