Successful Anesthesia Management of Left Fronto-Temporal Craniotomy for Intracranial Vascular Malformation (IVM)

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Abstract

Introduction: Stroke is an ischemic/embolic or hemorrhagic cerebrovascular event that can occur at any time. Meanwhile, intravenous or endovascular intra-arterial thrombolysis is the current standard therapy for intracranial intravascular clots, embolic occlusion of a major intracranial vessel occasionally requires microsurgical embolectomy. In particular, when the embolus is a large atherosclerotic plaque or foreign body (such as a balloon or microcoil from endovascular treatment), surgery may be the treatment of choice.

Case history: This is a 70 years old female patient who came with a chief complaint of ‘failure to communicate of 12 hrs duration’ and diagnosed to be recurrent 2° stroke+old R side stroke+type II DM+HTN.

Discussion: Several studies have demonstrated that patients who received general anesthesia for treatment are less likely to have a good outcome than those managed with local anesthesia. This may be due to preintervention risk not included in the stroke severity measures.

Summary: Neuroanaesthesia is a dynamic and rapidly advancing sub-specialty where anesthetic technique can have a real impact on both operative conditions and patient outcomes. Advanced airway skills, multimodal monitoring, and the management of challenging and complex cases are required on a regular basis.

Conclusion: Preintervention risk should always be minimized and blunted to avoid stroke severity and also to avoid irreversible ischemic damages. Additionally, preoperative routine medication with statins and b-blockers should be continued during the perioperative period and also panprol infusion should be considered to replace N₂O, Mannitol 0.5 g/kg-1 g/kg, Furosemide 0.3 mg/kg for better lumbar CSF drainage and brain relaxation.

Control of blood pressure is critical for this patient to have successful outcomes and progress and also to avoid the risk of postop hemorrhage. This is mainly because an acute ↑↑ BP →↑↑ transmural pressure across the aneurysmal wall → ruptures of the aneurysm and course body temperature should be maintained normothermic to have good recovery and progress.

Keywords: Neurosurgery • Anesthesia • Intracranial Vascular Malformation • Craniotomy

Introduction

Stroke is an ischaemic/embolic or hemorrhagic cerebrovascular event that can occur at any time. Meanwhile, intravenous or endovascular intra-arterial thrombolysis is the current standard therapy for intracranial intravascular clots, embolic occlusion of a major intracranial vessel occasionally requires microsurgical embolectomy [1,2]. In particular, when the embolus is a large atherosclerotic plaque or foreign body (such as a balloon or microcoil from endovascular treatment), surgery may be the treatment of choice [3].

Case History

This is a 70 years old female patient who came with a chief complaint of ‘failure to communicate of 12 hrs duration’ and diagnosed to be recurrent 2° stroke+old R side stroke+type II DM+HTN. After admission to the neurosurgery department of Myingsung Christian Medical (MCM) Center in Addis, the patient successfully underwent left temporo-frontal craniotomy with drainage and decompression of hematoma. Intraoperatively her vital sign remained stable until emergency time but she had poor respiratory effort and oxygen-dependent from the machine. Fortunately, the patient withstood the procedure well and transferred to the main ICU stable. Finally, the patient withstood the ICU stay well and recovered in ICU with a close under observation.

Hx: She had a previous Hx of stroke 10 years back, which resulted in right-sided weakness and she had some cardiac surgery for narrowed vessels. She had been taken globenemide and ASA but not on any of the anti HTN medications. At a time she was unconscious but no abnormal body movements

P/E: G/A; sub-critical condition

V/S: BP-140/76, PR-145, RR-20, T⁰-ATT HEENT; some palmar pallor, NIS, LGS; no LAP, Resp fine crepitation both lung, CVS; S1 and S2 well heard, NS;


Pupil: 3 mm-4 mm and sluggish reaction

Additional investigations

Electrolyte: (Na-137, K-3.6, Cl-100) Thyroid profile: (T3-0.87, T4-95.32, TSH-0.87) and some other imaging workup results found included CT (pctechial hemorrhages in left frontal-temporal) which shows possible recurrent stroke same side (L) and from CXR-dilated cardiac vessels.

Basic investigations

CBC, PT, PTT, INR, and OFT all were in the normal range
Anesthetic technique done was General Endotracheal Anesthesia with standard induction (GETA), and for induction after Thiopental 2 mg/kg-5 mg/kg or propanol 2 mg/kg-3 mg/kg provides amnesia and ↓ CBV by inducing cerebral vasodilation. Fentanyl 7 mcg/kg-10mcg/kg blunts the response to laryngoscopy and provides analgesia for the first hours. High-dose opiates used as a primary anesthetic technique do not alter CBF or CMRO₂ enough to provide any special benefits. Vecuronium (0.15 mg/kg), rocuronium (0.6 mg/kg-1 mg/kg), or pancuronium (0.1 mg/kg), provide muscle relaxation for intubation and patient positioning. Occasionally the patient may be in a stereotactic frame and ET intubation must be accomplished before anesthesia is induced, because the frame partially occludes the mouth, making conventional laryngoscopy impossible. Awake oral fiberoptic intubation of the trachea is the easiest method for accomplishing this [5].

Positing was patient is supine, head turned laterally in three-point fixation, a roll under shoulder on the side of the operation. Anesthetic hoses and all monitoring/vascular catheter lines are directed toward the patient’s feet or side. Make sure that all will reach the foot of the operating table. SCDs are used to minimize DVT. Remifentanil (2 mcg/kg-4 mcg/kg iv bolus) should be used to minimize ↑ BP during skull pinning (4).

Standard monitoring should be considered including; Core temp: deep esophageal best Arterial line CVP line, triple lumen UO Blood glucose (100 mg-180 mg) direct monitoring is essential for rapid control of BP. Transducer should always be placed at the level of the head rather than the heart since CPP is arterial pressure at the brain level minus CVP or ICP, whichever is higher. Monitoring CVP via a near right atrial catheter is desirable in virtually all patients to assess the adequacy of fluid therapy, for infusion of vasoactive drugs and aspiration of VAE. Localization of the catheter can be determined by CXR, ECG tracing, noting P-wave changes, or pressure-wave contour and value as the catheter is withdrawn from the right atrium [5].

Intraoperative the patient was maintained with Isoflurane ≤ 1% or sevoflurane ≤ 2% (limit to 1/2 MAC maximum if EP monitoring is used) with 1:1 O₂/N₂O. With EP monitoring, a remifentanil infusion (0.05 mcg/kg/min-0.15 mcg/kg/min) may be necessary to supplement the anesthetic. Propofol (75 mcg/kg/min-150 mcg/kg/min) by continuous infusion may be administered to provide ↓ CBV and ↓ CMRO₂, and allow for the reduction in inhalation agent concentration or elimination of N₂O. Mild hypothermia (33°C) provides additional cerebral protection. Additional neuromuscular blocking drugs are usually not necessary but can be administered if patient movement is of concern. Induced hypotension is often useful during IVM resection. Following resection, induced hypertension (e.g. 80 mmHg) may be requested to inspect hemostasis [2].

Brain Relaxation and adequate control of ICP were achieved with Hyperventilation to PaCO₂=30 mmHg Limit isoflurane ≤ 1%. While Maintaining euvoolemia, PaCO₂→1 cerebral vascular volume→↑ working space and lessens the need for vigorous retraction of brain tissue. ↓ PaCO₂ also improves the regional distribution of CBF by preferentially diverting blood to potentially ischemic areas of the brain [5].

If AVM is superficial, decreasing brain volume is less important, and the first four techniques listed (at left) are usually sufficient. If AVM is deep, additional listed therapies may be needed [3].

In the emergence period and at the start of dural closure, a propanol infusion (if used) was discontinued at the start of the scalp closure. The patient’s BP generally will increase and titration of β-adrenergic blocking drugs (e.g. labetalol or esmolol) and/or vasodilators (e.g. SNP) may be needed. The inhalation agents can be D/C’d at the time of dressing.
application. Most patients will breathe spontaneously and can be extubated uneventfully while on the remifentanil infusion. If the brain has not been injured by the surgical procedure, the patient should awaken within 10 min after cessation of remifentanil administration [5].

Close regulation of BP during induction and before excision of AVMs is important, both to prevent bleeding (↑ BP) and to avoid ischemia 2° steal (↓ BP). After surgical excision is underway, however, modest decreases in MAP (< 20% below normal) using isoflurane, alone or in combination with esmolol and/or SNP, should be used to prevent excessive bleeding. Responses to vasoactive drugs are much easier to regulate if the patient is euvolemic [6,7].

Summary

Neuroanaesthesia is a dynamic and rapidly advancing sub-specialty where anesthetic technique can have a real impact on both operative conditions and patient outcomes. Advanced airway skills, multimodal monitoring, and the management of challenging and complex cases are required on a regular basis. And it is bringing physiology and pharmacology to life whilst working as part of a dedicated team when managing critically ill patients [8-10].

The goals of anesthesia for this operation are:

- Maintain optimum CPP (cerebral MAP minus cerebral venous pressure or ICP, whichever is greater), although it may be necessary to ↓ CPP rapidly if intracranial hemorrhage occurs during surgery.
- Decrease intracranial volume (blood and tissue) to optimize working space for surgeons within the cranial compartment, thereby minimizing the need for surgical retraction of brain tissue.
- Decrease metabolic rate and CMRO2 with the expectation that the brain will tolerate hypotension and ischemia if sudden decreases in MAP and, hence, CPP become necessary.

Close regulation of BP is essential. If the patient begins to cough on ETT, either it should be removed or cough reflex suppressed with iv lidocaine (0.5 mg/kg-1 mg/kg). The patient is placed in a bed in a 30° head-up position and transported to ICU for monitoring overnight. Supplemental O2 should be administered and close regulation of BP maintained (typically at~10% below baseline values). Prophylactic antiepileptics (e.g. metoclopramide 10 mg-20 mg and ondansetron 4 mg) should be given 30 min before extubation.

Conclusion

Preintervention risk should always be minimized and blunt to avoid stroke severity and also to avoid irreversible ischemic damages. Additionally, preoperative routine medication with statins and b-blockers should be continued during the perioperative period and also propofol infusion should be considered to replace N2O. Mannitol 0.5 g/kg-1 g/kg, Furosemide 0.3 mg/kg for better lumbar CSF drainage and brain relaxation.

Control of blood pressure is critical for this patient to have successful outcomes and progress and also to avoid the risk of postop hemorrhage. This is mainly because an acute ↑↑ BP →↑ transmural pressure across the aneurysmal wall → rupture of the aneurysm and of course body temperature should be maintained normothermic to have good recovery and progress.

References


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