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Background

- Risk/benefit ratio to using the sitting position for posterior fossa craniotomies
 - Benefit: excellent surgical exposure and improved venous drainage, decreasing intracranial pressure and bleeding
 - Risk: Increased risk of venous air embolism (VAE) due to the pressure gradient between surgical site and heart
- Patent foramen ovale (PFO) is traditionally considered a contraindication to the sitting position, as it poses risk of paradoxical air embolism
- Alternative positions (prone or lateral decubitus) may reduce VAE risk but can compromise surgical access
- This case series explores the management and outcomes of two patients undergoing sitting craniotomy, one with and one without a PFO, to reexamine whether PFO should remain an absolute contraindication to the seated position

Case Presentation

Two patients underwent posterior fossa craniotomies in the sitting position.

Case 1: A 66-year-old male presented with a ruptured arteriovenous malformation requiring decompression. Intraoperative transesophageal echocardiography (TEE) confirmed **no PFO**. The procedure proceeded in the sitting position with standard VAE precautions, including precordial Doppler monitoring and adequate hydration. No VAE or hemodynamic instability occurred, and the patient had an uncomplicated postoperative course.

Case 2: A 27-year-old female with no significant medical history presented emergently for resection of a pinealoma causing mass effect. Given the urgency, **preoperative TEE was not performed**. Continuous intraoperative TEE revealed an incidental **PFO**, but the multidisciplinary team elected to proceed in the sitting position. Enhanced monitoring and mitigation strategies were implemented, including continuous TEE surveillance, end-tidal CO₂ monitoring, and placement of a central venous catheter in the right atrium for potential air aspiration. The patient remained hemodynamically stable throughout surgery, with no VAE detected or postoperative complications observed.



Figure 1

Sitting position setup for posterior fossa craniotomy.

Patient (Case 1) positioned in the sitting posture with appropriate padding and head fixation to optimize surgical exposure and minimize venous air embolism risk.

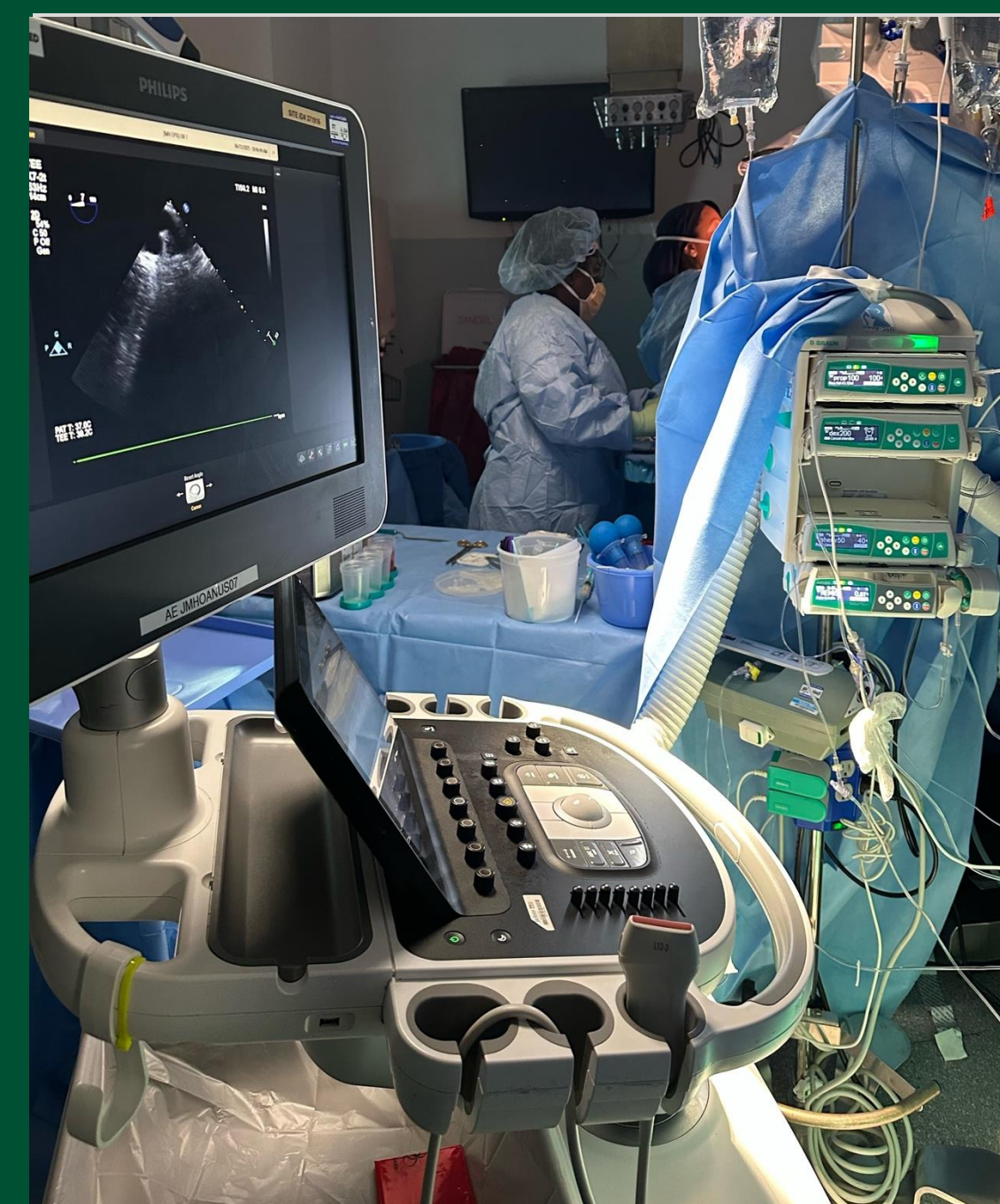


Figure 2

Continuous intraoperative TEE monitoring for VAE detection.

Real-time transesophageal echocardiography used throughout the craniotomy for vigilant surveillance of venous air embolism, demonstrating a multidisciplinary approach to intraoperative risk mitigation.



Figure 3

Intraoperative view during sitting craniotomy for AVM rupture.

Neurosurgeon performing decompression in the sitting position; enhanced surgical visibility and field drainage highlight the advantages of this approach for posterior fossa lesions.

Discussion

- The **sitting position** provides optimal surgical exposure and hemostasis for posterior fossa lesions but remains controversial due to the risk of VAE
- Potential for paradoxical embolism is not rare; **PFO prevalence** in the general population is approximately 25–30%
- Treating PFO as a contraindication to the sitting position may be overly conservative given advances in intraoperative monitoring and preventive strategies

Individualized risk assessment should guide decision-making, considering:

- Shunt size and direction (right-to-left vs. bidirectional)
- Presence of pulmonary hypertension or elevated right atrial pressures
- Urgency of surgery and exposure needs
- Institutional experience with sitting craniotomies

Risk mitigation strategies include:

- Continuous TEE for early VAE detection
- Central venous catheter for immediate aspiration if air is detected
- Maintenance of adequate hydration and positive end-expiratory pressure (PEEP) to reduce venous entrainment
- Multidisciplinary planning among anesthesia, neurosurgery, and critical care teams

Conclusion

- The presence of a PFO should not always preclude the sitting position in posterior fossa craniotomy
- With vigilant monitoring and preventive strategies, surgery may be performed safely in select patients
- Individualized risk-benefit assessment—rather than a blanket contraindication—should guide perioperative decision-making

References

1. Laban JT, Rasul FT, Brecker SJ, Marsh HT, Martin AJ. Patent foramen ovale closure prior to surgery in the sitting position. *Br J Neurosurg*. 2014 Jun;28(3):421-422. doi:10.3109/02688697.2013.865709
2. Klein J, et al. A systematic review of the semi-sitting position in neurosurgery and the incidence/severity of paradoxical embolism in patients with a patent foramen ovale. *Journals*. 2018; (details as per SciDirect). doi:10.1016/S1878-8750(18)30834-9
3. Hajat Z, Venkatraghavan L, McGuire G. Patent foramen ovale and elective posterior fossa craniotomy in the park-bench position: How should we proceed? *J Neurosurg Anesthesiol*. 2019 Apr;31(2):263-264. doi:10.1097/ANA.0000000000000482