Article published online: 2023-05-18

Pin Site Epidural Hematoma Masquerading as Intractable Brain Swelling: A Diagnostic Dilemma

Ashwini Reddy[1] Nidhi Panda[1] Rajeev Chauhan[1] Shalvi Mahajan[1] Sandeep Mohindra[2]

[1] Division of Neuroanesthesia, Department of Anesthesia and Intensive Care, Postgraduate Institute of Medical Education and Research, Chandigarh, India
[2] Department of Neurosurgery, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Address for correspondence Rajeev Chauhan, MD, DM, Department of Anesthesia and Intensive Care, Postgraduate Institute of Medical Education and Research, Sector-12, Chandigarh 160012, India (e-mail: dr.rajeevchauhan@gmail.com).

Indian J Neurotrauma 2024;21:80–82.

Abstract

Head fixation devices are frequently used to immobilize the position of the head in neurosurgery. We report a rare complication of a four-pin Sugita device causing epidural hematoma (EDH) in a young adult male undergoing transcranial excision of a craniopharyngioma manifesting intraoperatively as an intractable tense brain. Decreased bone mineral density secondary to the metabolic consequences of craniopharyngioma could have increased the susceptibility to breach of the bony cortex. The index case highlights the essential role of a preoperative computed tomography (CT) scan review for the thickness of the cranial vault and the identification of weaker zones in high-risk groups.

Keywords
- cranial epidural hematoma
- Sugita head frame
- craniopharyngioma
- intraoperative brain bulge

Key Message

- Complications secondary to the usage of the Sugita head pin fixation device are rare and seen most often in the pediatric population.
- Craniopharyngioma leads to decreased bone mineral density
- which increases the susceptibility to breach of the skull vault.
- Preoperative computed tomography scan review for thickness of the cranial vault in high-risk populations is essential.

Head fixation devices with pins are frequently used to stabilize and maintain the position of the head during neurosurgery. The complications secondary to their usage are relatively uncommon and most often seen in the pediatric population. We report an unusual case of an epidural hematoma (EDH) secondary to the use of a four-pin Sugita head fixation device in a young adult male undergoing transcranial excision of a craniopharyngioma. There were no signs of increased intracranial pressure (ICP) clinically or radiologically preoperatively. After induction of anesthesia, the patient's head was fixed with a four-pin Sugita frame by the neurosurgeon. Around 10 minutes after the head fixation, there were two self-resolving episodes of bradycardia of 40 beats/min (baseline heart rate was 54 beats/min).

Post right pterional craniotomy, the surgeon observed a tense brain with gradually increasing swelling of the underlying brain. An immediate search for the cause ensued and airway obstruction, head rotation, jugular venous drainage obstruction, bronchospasm, etc., were ruled out. The patient was on total intravenous anesthesia with propofol and fentanyl infusion. The plane of anesthesia and analgesia was deepened and the head end of the patient was elevated by 15 degrees. Mannitol (60g) intravenous bolus was given over 20 minutes and the patient was

article published online
May 18, 2023

DOI https://doi.org/10.1055/s-0043-1768173.
ISSN 0973-0508.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

hyperventilated to target a partial pressure of carbon dioxide of 28 to 30 mm Hg. However, the brain swelling continued to increase unabated, forcing the surgeon to temporarily abandon the procedure, pack the operative site, and obtain an emergent computed tomography (CT) scan, which revealed a temporal EDH in the contralateral side of the craniotomy where the superior left-sided skull pin had been tightened against the temporal cranial vault as seen in ►**Fig. 1a**. There was hypotension (blood pressure: 90/60 mm Hg) with tachycardia (98 beats/min) along with anisocoria at this stage with the patient's left pupil being 5 mm, dilated, and fixed. The patient then underwent an emergency decompressive craniotomy. There was a breach of the underlying inner cortex of the exposed bone with a dural laceration and an EDH volume of 50 mL was evacuated. However, the postoperative course was complicated by multiorgan dysfunction leading to death on postoperative day 4.

Head fixation devices with pins are extensively used and the Sugita four-pin head frame is commonly used in our institute. It is a semicircular head fixation device anchored to the outer table of the skull vault with four pins, each of which must be screwed separately compared to the Mayfield device where the pressure of three pins is controlled with one torque screw permitting an equal dispersal of forces. The recommended torque screw force for the Mayfield system is 60 to 80 lb for adults, unlike the Sugita system, which does not have an integrated force gauge to guide the surgeon during pinning.[1]

Complications related to the usage of head pins are quite uncommon ranging from 0.65 to 1.1% and are frequently seen in the pediatric population due to the variability and inconsistency in the thickness of the developing cranial vault, especially the squamous temporal bone, frontal sinus, and coronal suture.[2] Thinning of the cranial vault may also be seen in adults with long-standing intracranial hypertension or those on high-dose antiepileptic drugs,[2] both of which were absent in our patient. The coagulation profile was also reported to be normal.

Craniopharyngioma has many metabolic consequences, one of which is lower bone mineral density. Late induction of puberty in these patients prevents the attainment of normal peak bone mass, ultimately leading to an increased prevalence of fractures.[3] This may have been an important contributing factor in our patient whose preoperative CT

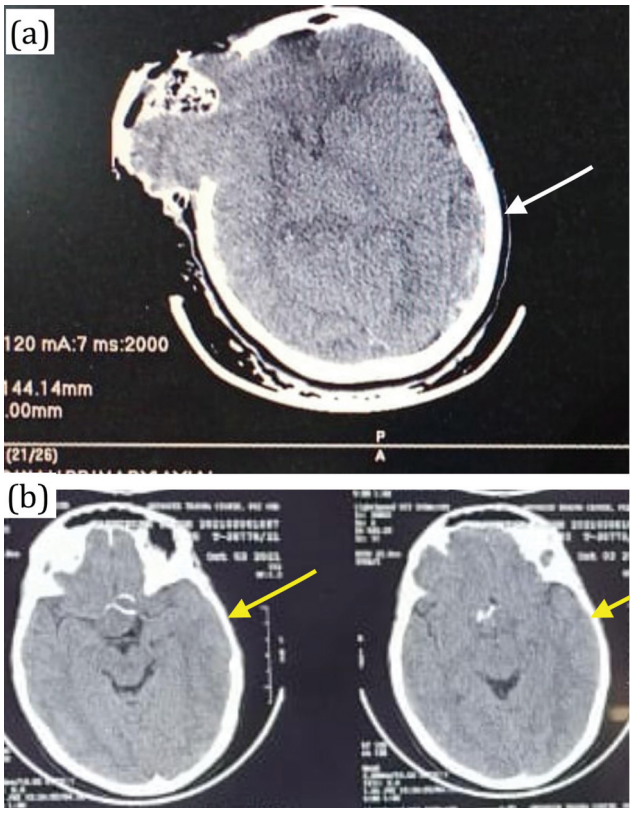

Fig. 1a : Computed tomography (CT) scan showing right pterional craniotomy and the presence of a left temporal parietal epidural hematoma. (**b**) Preoperative CT scan revealing decreased thickness of the left temporal squamous portion of the cranial vault.

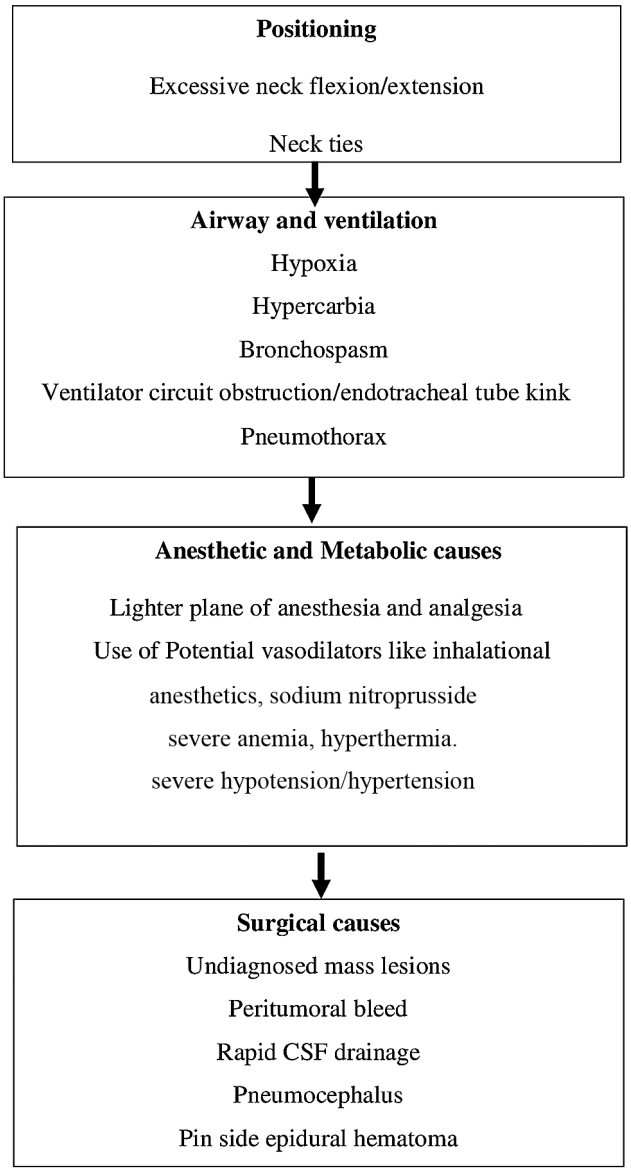

Fig. 2 Structured checklist for the diagnosis of the cause of intraoperative tense brain. (Adapted from Li et al).[4]

scan showed decreased thickness of the cranial vault in the temporal region as shown in ►**Fig. 1b**.

Hematoma was present on the contralateral side of the craniotomy; therefore, it could not be diagnosed early and this gradually expanding hematoma caused intractable brain swelling unresponsive to all measures. Intractable brain bulge post craniotomy can be secondary to a multitude of causes. We followed a novel structured checklist for accurate rapid diagnosis of the cause of intraoperative tense brain comprising four main categories, that is, positioning, airway and ventilation, anesthetic, and surgical causes as shown in ►**Fig. 2**. In retrospect, the administration of mannitol may have proven counterproductive as it might have facilitated an increase in the size of the swelling. The episodes of bradycardia early on were an indication of a new emerging intracranial event, which was not given due importance as it resolved by itself and was assumed to be due to the trigeminal cardiac reflex response. Anisocoria also could not be assessed early, due to difficulty in accessing the patient's face under the surgical drapes.

Rapid cerebrospinal fluid drainage or tumor excision can sometimes cause acute decompression, leading to the stripping of the dural veins and the formation of an EDH. However, in our case, the event happened early, even before the tumor was accessed.

Many modifications of head pin fixation systems have been described like the use of rubber plugs, plaster of Paris cast interface, and usage of six pins or a padded horseshoe headrest simultaneously to equally disperse the forces.[2] These modifications still do not completely eliminate the risk of slippage of the pins.

We recommend that, in the future, attention be paid to checking the thickness of the skull vault in the preoperative CT scan before the application of the skull pins in high-risk patients, and the weaker zones should be avoided as far as possible. Warning signs like bradycardia should not be taken lightly and should lead to an exhaustive search for the cause. Intraoperative CT scans and magnetic resonance imaging are of immense value in the early diagnosis of these cases.

Authors' Contributions

A.R. helped in collection of data, literature review, and manuscript preparation. R.C. helped in literature review, manuscript preparation, editing, and review. S.M. helped in manuscript preparation, editing, and review. N.P. helped in manuscript preparation, editing, and review. S.M. helped in data collection, manuscript preparation, editing, and review.

Patient Consent

Written informed consent has been obtained from the patient's kin for the publication of this case as a letter to editor.

Funding

None.

Conflict of Interest

None declared.

References

1 LoPresti MA, Nguyen J, Lam SK. Pinning in pediatric neurosurgery: the modified rubber stopper technique. J Neurosurg Pediatr 2020; 26(01):98–103
2 Parenrengi MA, Adhiatmadja F, Arifianto MR, Apriawan T, Fauzi AA, Servadei F. Bilateral skull fracture with massive epidural hematoma secondary to pin-type head fixation in a pediatric patient: case report and review of the literature. Int J Surg Case Rep 2019;62:43–49
3 Lamas Oliveira C. Consecuencias metabólicas del craneofaringioma y su tratamiento. Endocrinol Nutr 2013;60(09):529–534
4 Li J, Gelb AW, Flexman AM, Ji F, Meng L. Definition, evaluation, and management of brain relaxation during craniotomy. Br J Anaesth 2016;116(06):759–769