Large acute epidural hematoma from head pin fixation fracture

Vinicius Trindade Gomes da Silva¹, Louise Makarem¹, Rhuann Silva², Manoel Jacobsen Teixeira¹, and Wellington Silva Paiva¹

¹Division of Neurosurgery at University of São Paulo
²Catholic University of Pernambuco

September 20, 2023

Large acute epidural hematoma from head pin fixation fracture

Authors

Vinicius Trindade Gomes da Silva¹ – viniciustrindade@hotmail.com
Louise Makarem¹ - louisemakarem@gmail.com
Rhuann Pontes dos Santos Silva² - rhuannpontes02@gmail.com
Manoel Jacobsen Teixeira¹ – manoeljacobsen@gmail.com
Wellington Silva Paiva¹ - wellingtonpaiva@yahoo.com.br

Institutions

¹ Division of Neurosurgery at University of São Paulo.
² Catholic University of Pernambuco, Recife, Brazil.

PAIVA et al: EPIDURAL HEMATOMA FROM HEAD PIN FIXATION

Corresponding Author

Rhuann Silva MS IV
Prince St 240, Recife
Pernambuco – Brazil
Zipcode 50050035
rhuannpontes02@gmail.com

ABSTRACT Introduction Head immobilization using pin fixation is a common practice in neurosurgery during cranial surgeries. Various complications have been associated with the use of three-point skull clamps, including depressed skull fractures, middle meningeal arteriovenous fistulas, venous air embolisms, and epidural hematomas. Case Report In this case report, we conducted a posterior fossa tumor resection without any complications. Immediate postoperative CT scans revealed a large epidural hematoma resulting from a head pin fracture. The patient underwent hematoma evacuation but subsequently developed a brainstem hematoma and remained comatose, ultimately passing away two months later. Discussion Skull fractures and associated intracranial hemorrhages are rare in normal adult patients but can occur in the pediatric population due to the relative thinness of their skulls. Patients with intracranial pathologies causing sustained increased intracranial pressures and hydrocephalus may also have thin skulls, putting them at risk for pin fixation-related injuries. Therefore, it is crucial to establish proper pin placement, avoiding fracture
sites and proximity to paranasal and venous sinuses. In adults, a force of 60–80 pounds is applied across the three-point clamp to ensure secure fixation. **Conclusion** In conclusion, special attention should be given to factors such as changes in bone metabolism, including osteoporosis, chronic kidney disease, and the chronic use of steroids.

Keywords: Brain tumors, Postoperative complications, Cranial epidural hematoma, Head pin fixation, Fixation fracture.

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy

**Case report**

A 48-year-old female patient was diagnosed with Von Hippel Lindau syndrome. She had a history of bilateral pheochromocytoma resection in 1983, right cerebellar hemangioblastoma surgery in 1992, and resection of a neuroendocrine tumor of the pancreas in 2006. Two months prior to presentation, she developed a global cerebellar syndrome, and neuroimaging revealed a new left cerebellar lesion (Figure 1). We performed a posterior fossa craniotomy for tumor debulking and complete resection using a three-point head fixation system, the Sugita Head Holder, without any complications. Immediately after the surgery, she developed fixed pupils. A skull Computed Tomography (CT) scan showed a large fronto-temporo-parietal epidural hematoma with midline shift, attributed to a head pin fracture (Figure 2).

The patient underwent hematoma evacuation, but subsequent CT scans revealed a brainstem hematoma and ischemic areas (Figure 3). She remained comatose and passed away two months later.

**Discussion**

For most intracranial procedures, secure cranial fixation is essential. A pin-type head holder represents the optimal means of achieving the required stability.[3] It is a frequently employed device in neurosurgery, offering both stability and flexibility in head immobilization. [4]

The Sugita multipurpose head frame ranks among the most commonly utilized head holders in neurosurgery, offering certain advantages over other pin-based head holders. Its four-prong pin system reduces the likelihood of slippage; however, the sharp-pointed pins and a rotational fixation mechanism, as opposed to simple pressure, may potentially elevate the risk of certain complications.[3]

Complications associated with three-point skull clamps have been reported, including depressed skull fractures, middle meningeal arteriovenous fistulas, venous air embolisms, and epidural hematomas.[16] Skull fractures and accompanying intracranial hemorrhages are more prevalent among pediatric patients due to the relatively thinner nature of their skulls.[9] In contrast, in normal adult patients, skull fractures and hematomas resulting from three-pronged head clamps are exceedingly rare.[7] In fact, Palmer et al. (1994)[12] reported a post-operative epidural hematoma incidence of 0.3% in a cohort of 6,668 patients, with none of these cases attributed to the pin headrest. Intracranial pathologies causing sustained increased intracranial pressures and hydrocephalus may lead to skull thinning, heightening the risk of injury associated with pin fixation.[7]

Penetrating skull injuries due to pin headrest devices are primarily observed in children.[13] In a study conducted by Vitali and Steinbok (2008)[15], five out of 766 children (0.65%) who underwent craniotomies with pin fixation experienced depressed skull fractures and/or epidural hematomas resulting from the pin fixation. In their case series, the authors correlated these complications with factors such as the presence of a posterior fossa tumor, temporal pin application, extended surgery duration, the presence of hydrocephalus, and an age below 7 years.[15]

Epidural hematomas pose a risk of mortality and acquired neurological impairment.[1,10,11] Epidural hematomas secondary to pin fractures are infrequent, with a higher prevalence in children. In 2008, Vitali published a series of five cases of fractures in a sample of 766 children, with four of them developing epidural hematomas.[15] All children who presented with hematomas had undergone posterior fossa tumor surgery.
Yan reported a similar case in 2007, involving a substantial epidural hematoma following tumor debulking in the posterior fossa.\[16\]

Lang (2001)\[6\] reported that the average thickness of the skull in the middle of the parietal bone measured 6.32 mm (ranging from 3.5 to 6.8 mm) in adults. Letts et al. conducted a biomechanical study revealing that bones with a 2 mm thickness could support a pressure of 160 lb.\[8\]

**Conclusion**

Secondary fixation fractures are rare, underscoring the importance of precise pin positioning while avoiding fracture-prone areas, paranasal sinuses, and venous sinuses. In adult patients, a force of 60–80 lb is applied across the three-point clamp to achieve adequate fixation. Attention should be given to factors such as changes in bone metabolism, including osteoporosis, chronic kidney disease, and the chronic use of steroids. This raises concerns regarding head immobilization practices in neurosurgery.

**Authors’ Contributions**

VTGS, LM and RPSS: collected the data, conceived the analysis, and wrote and reviewed the paper; MJT and WSP: guided the preparation of the work, and wrote and reviewed the paper.

**References**


3

FIGURE LEGENDS

Figure 1: Intense contrast uptake lesion (arrow) and bulky cystic component suggesting hemangioblastoma in a patient with Von Hippel-Lindau syndrome. In A – magnetic ressonance image in axial plane. In B – Magnetic ressonance image in coronal plane.

Figure 2: In A - Postoperative skull computed tomography showing large acute epidural hematoma. In B – Computed tomography with bone window showing fracture related to head fixating pin.

Figure 3: Skull computed tomography performed after epidural hematoma evacuation. In A – Brainstem hematoma. In B – occipital ischemia suggesting brain herniation.