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Bilateral or vertex frontoparietal epidural hematoma: surgical approach and therapeutic recommendations. Proposal for the subdivision of epidural hematomas by their location.

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Summary:

75% or more of epidural hematomas are of temporary location with lesion of the middle meningeal artery, being an acute hematoma of rapid progression and high transoperative bleeding, however, it can occur in other locations with greater relevance in the posterior fossa and in the frontoparietal region with bleeding mainly from venous sinuses and that poses a surgical challenge to preserve these structures and minimize transoperative bleeding

Bilateral fronto-parietal epidural hematoma can also be considered a vertex hematoma of the skull, it is a rare presentation of epidural hematoma; It is generally due to a skull fracture in the frontal and/or parietal region that conditions tearing and bleeding of the sagittal sinus and or tributary veins, being a hematoma of slow progression, and that in its surgical management merits preserving the sagittal sinus due to its relevance in cerebral circulation, in this article 2 clinical cases are described and the recommended steps for their resolution.

Epidural hematomas in the skull can be divided into 3 locations, those in the temporo-parietal region with bleeding of parietal origin and those in the occipital and vertex region that are caused by bleeding from the venous sinuses, in this article 2 cases of frontal fracture affecting coronal and sagittal suture respectively with epidural hematoma are described, giving explicit recommendations for the management of the sagittal sinus and minimize bleeding or complications, with the main recommendation to preserve a slab of bone over the sagittal sinus and apply lifting points without direct manipulation of the venous sinus.

Key words: epidural hematoma, traumatic brain injury, skull fracture, coronal suture, sagittal suture, sagittal sinus.

Introduction:

Epidural hematoma (EDH) occurs, depending on the statistics, between 2 and 5% of severe head traumas(1), and is a true neurosurgical emergency, consisting of usually acute bleeding between the bony structures of the skull and the dura mater, its origin in most cases is due to arterial bleeding. particularly lesions of the middle meningeal artery that is lacerated as a result of a skull fracture, and there are also isolated descriptions of epidural hematomas without fracture with a kickback mechanism(2); and others of spontaneous origin on very rare occasions and always in relation to another underlying pathology. The result of this injury and bleeding is finally the formation of epidural hematoma (HED) in the temporo-parietal region in the vast majority of cases; The mechanism of injury does not involve high-energy trauma unlike other severe head traumas, however, its severity is not less as it causes rapidly evolving intracranial hemorrhage with mortality between 5.6 and 23.3% (3). 10 to 25% of epidural hematomas have another location, such as those located in the posterior or infra fossa and occipital supratentorial(4)(8), which is also associated with skull fracture in the vast majority of cases, but here the bleeding is usually due to venous sinus laceration, being the cause of HED formation in 9.7% of cases(5) in the corresponding region (mainly sagittal sinus and sinus lesions transverse) and this makes them clinically different as their progression is slower, however, ultimately just as severe. There is also spinal epidural hematoma, which is considered to be a variant of spinal cord trauma and is not the focus of this document on its approach or description.

It is surprising how little information exists regarding this topic since, despite being a frequent event in neurosurgical practice, they always represent a challenge in treatment due to the severity involved in the association of other lesions as well as the

potential for transoperative bleeding, particularly when venous sinus lesions are present.

This report presents 2 cases of frontal epidural hematoma with sagittal sinus injury and based on clinical experience, the steps for its resolution are proposed, minimizing risk and bleeding, it is also proposed to classify the location and treatment of epidural hematomas into 3 regions.

Objective:

To define epidural hematoma according to its location, and to emphasize the frontoparietal location due to its unique characteristics in surgical management.

Case Presentations:

Case 1:

A 21-year-old man was admitted referred from another hospital unit with 24 hours of evolution, mechanism of trauma with fall from a moving vehicle without protection, without any relevant history without coagulopathy, on admission drowsy cooperator with moderate headache, sign of positive raccoon eyes, no visual deficit or motor deficit, computed tomography of the skull (image 1) was performed immediately upon admission, Epidural hematoma was found in the bilateral frontoparietal region with greater extension to the left and thickness greater than 1.5 cm with a clear mass effect, bone reconstruction showed a fracture through a coronal suture.

He underwent immediate surgical management (image 2) with transoperative bleeding of approximately 600 ml, managing to preserve bone slab over sagittal sinus despite coronal fracture and performing bilateral frontal craniotomy, taking advantage of a fracture trace in the coronal border of each bone flap, and drainage of the hematoma was performed and epidural stitches with 2-0 silk were used as well as hemostatic sponges to complete hemostasis and sagittal sinus lift (image 3). Bone flaps were replaced, drainage was applied to the epidural and subgaleal bed (Image 4).

The patient was discharged from hospital with no neurological deficit or surgical complications on the 4th postoperative day.

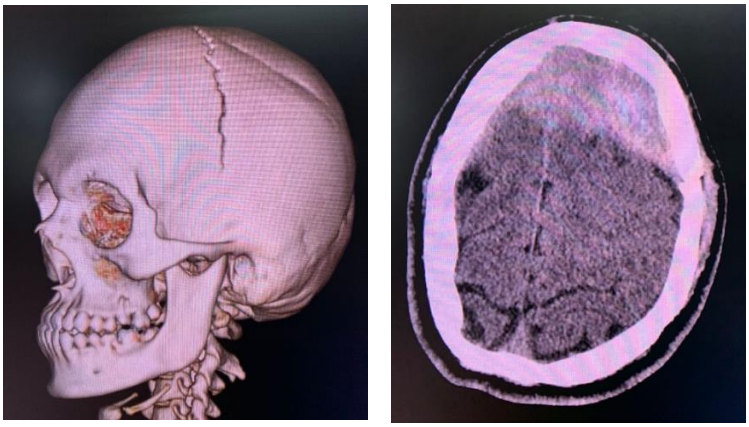

Image 1: Case 1. CT skull scan in coronal section with epidural image and linear fracture tracing partially followed by partially disconnected coronal suture.

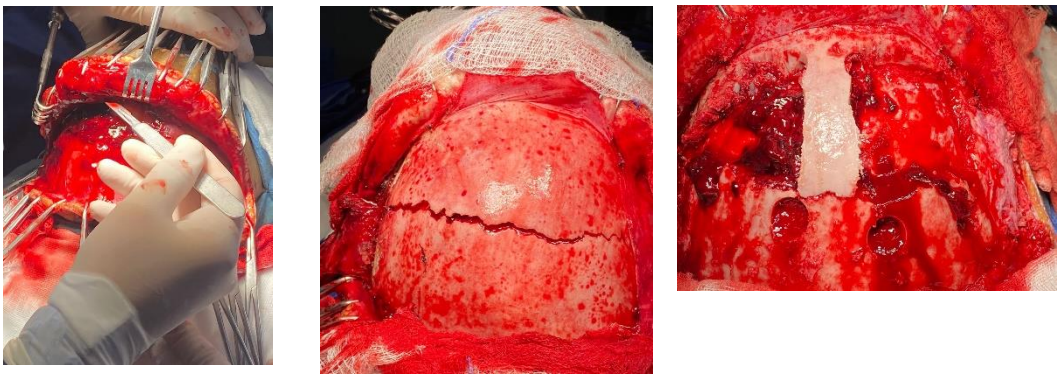

Image 2: Case 1. Coronal flap approach and dissection, coronal suture fracture tracing, and bifrontal craniotomy respecting seo flap over coronal sinus, epidural hematoma was seen in dura mater bed.

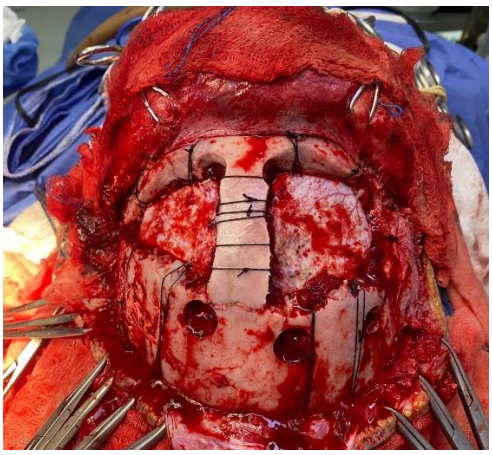

Image 3: Case 1. Reconstruction with 2-0 silk lifting points, particularly note the sagittal sinus lifts with adequate hemostasis.

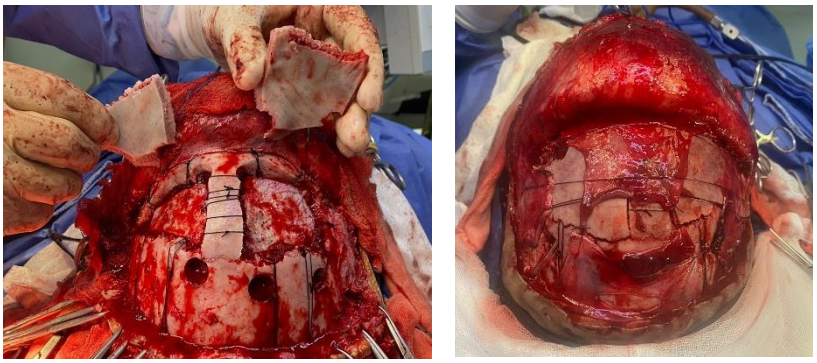

Image 4: Case 1. Reconstruction of the skull shows free bone flaps and their repositioning is more faced by aponeurotic galea.

Case 2:

A 40-year-old man, with no relevant history, no comorbidities, who was admitted with head trauma in its first hours of evolution with vertex impact trauma mechanism secondary to a fall from a height of 2 meters with loss of alertness, on admission drowsy little cooperation with left pelvic paresis 4/5, and frontoparietal subgaleal hematoma, Glasgow 13 pts. Computed tomography of the skull (image 5) showed an extensive bilateral frontoparietal epidural hematoma with a thickness greater than 2 cm that extended anteroposteriorly following a sagittal sinus with a mass effect on the frontal and parietal paramedial region and was accompanied by a right frontal hemorrhagic contusion of 2x3 cm and subgaleal hematoma. There was no fracture trace in this study.

It was decided to use immediate surgery using a bicoronal approach using a skin flap, showing a fracture that extended along the sagittal suture and the midline fontal region (metopic suture region), with minimal diastasis of the suture, it was decided to perform bilateral frontal parietal craniotomy to obtain 2 bone flaps respecting bone flap on sagittal suture at 1 cm on each side (image 6). hemostasis was performed with drainage of the hematoma and lifting points taking advantage of bone slab over sagittal sinus for dura mater lifting and attaching sagittal sinus with hemostatic sponge to seo flap and controlling bleeding (image 7), it was not considered unnecessary to perform durotomy for hemorrhagic contusion described in tomography, bone flaps were repositioned by applying bilateral epidural drainage by contraction (image 8). Transoperative bleeding of 950 ml.

His postoperative evolution was towards improvement, achieving discharge without neurological deficit 8 days after the surgical procedure.

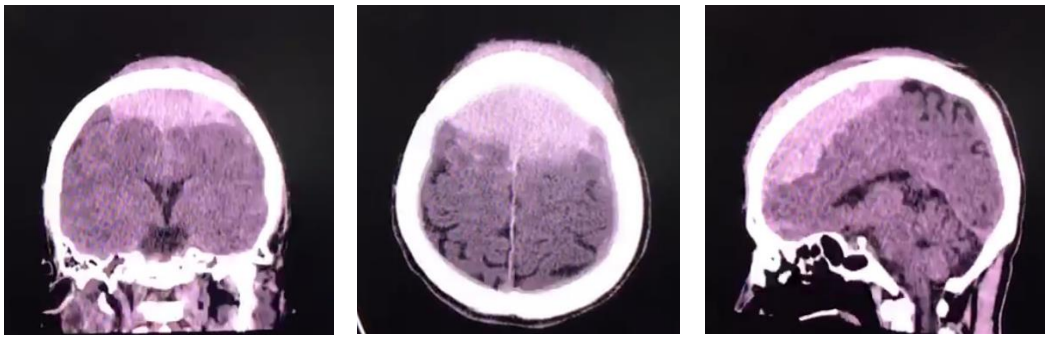

Image 5: Case 2. Computed tomography of the skull showed an epidural hematoma in coronal, axial and sagittal sections, demonstrating its clear surgical indication and the presence of subgaleal hematoma in relation to the fracture site.

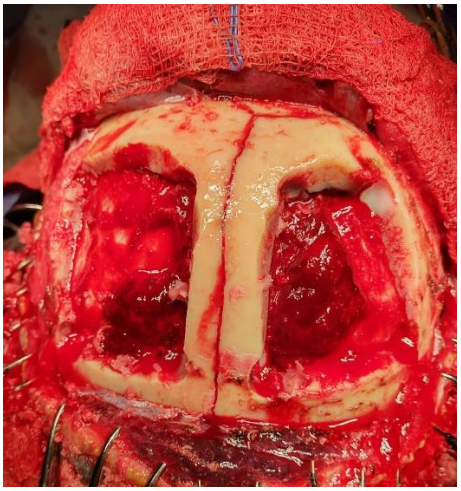

Image 6: Case 2. Bifrontal craniotomy respecting the bony flap over the sagittal sinus, note a linear fracture following a sagittal suture and in the midline (metopic) in the frontal region, with still traces of epidural hematoma in the dural bed.

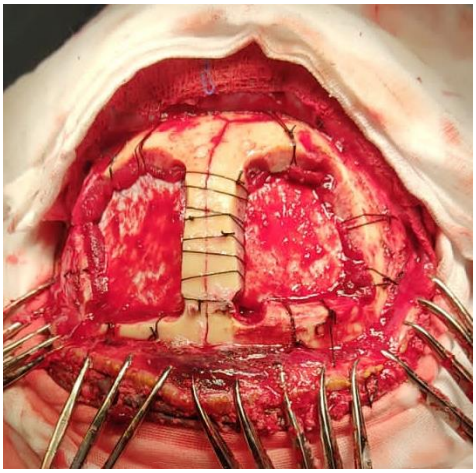

Image 7: Case 2. Dura mater lifting points with silk 2-0. See detail of dura mater lifting taking advantage of bone slab over fontal sinus and adequate drainage of epidural hematoma as well as hemostasis. The stitches are U-shaped from side to side adjacent to sagittal sinus and bone.

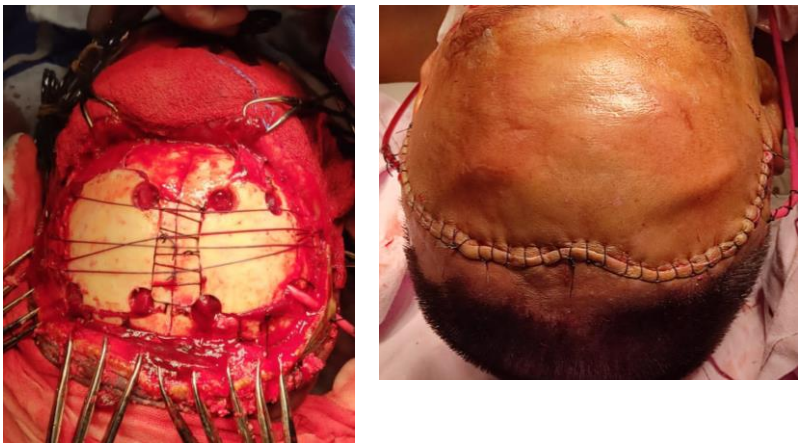

Figure 8: Case 2. Reconstruction of the skull before facing the skin flap and suture of the wound, appreciating extension of the bicoronal wound, bilateral drainage placed on the epidural bed was visualized and externalized by contract.

Discussion:

Epidural hematoma occurs in approximately 2% of all head trauma events and in 15% of fatal head injuries. The incidence is even higher among adolescents and young adults. The average age of patients is between 20 and 30 years old and it is rare after 50 to 60 years old. This is explained by the fact that as age progresses, the adhesions between the dura mater and the internal table of the adjacent bone become firmer, hindering the ability to dissect the epidural space from bleeding in this space. (7)

In this report, two cases of frontal epidural hematoma with associated fracture are described, in both cases the bleeding was of venous origin due to laceration of the sagittal sinus, the thickness of the hematoma greater than 1.5 cm and a volume greater than 30cc according to treatment guidelines (8) has a clear surgical indication both because of the increase in intracranial pressure and because of the risk of thrombosis of the venous sinus or affluent veins in case of if it is not dealt with in a timely manner.

The evidence of suspected venous sinus injury, particularly the sagittal sinus venous sinus venous sinus venous sinus venous sinus sinus venous sinus

The clinical picture of venous hematoma is different from that of arterial bleeding in the temporal fossa, since its evolution may be slower and without focalization data, which allows a significant progression of the hematoma and clinical suspicion, as well as late treatment in many cases, as is known the method of choice of diagnosis in skull tomography, where the fracture trace cannot always be appreciated(10), however, in the face of evidence of extradural hematoma in the frontal location, the presence of a fracture should be assumed both clinically and by imaging, and be prepared to observe and treat laceration of the sagittal sinus.

Based on this information, it was decided to classify epidural hematomas according to their location (Table 1), since this poses a different surgical approach and different therapeutic risks for a pathology that in 90% or more cases is of traumatic origin and has been studied in the same way in the literature.

Bilateral frontal lobe.

LOCATION	FRACTURE	AFFECTED VASCULAR STRUCTURE	IMMEDIATE REGION AFFECTED
TEMPORARY	temporal/parietal	middle meningeal artery	temporal lobe
OCCIPITAL	occipital	transverse sinus	cerebellum brainstem, occipital lobe
VERTEX (FP)	frontal/parietal	sagittal sinus	bilateral frontal lobe.

Table 1 Proposed division of epidural hematomas of the skull according to their location.

The location of the frontal epidural hematoma or vertex, which is the subject at hand, as happened in these cases, was associated with a skull fracture trace that followed a coronal or sagittal suture path, which allows us to take advantage of the fracture trace and preserve bone over the sinus as support for dural lift points and breast hemostasis by attaching it to the bone with hemostatic sponges, minimizing manipulation of this structure and without requiring another type of vein reconstruction. Other possibilities of lesions in this region are also considered, including complex fracture traits as well as multigrammed and depressed fractures that may change the proposed therapeutic approach.

Subdivision of Frontal Epidural Hemama

variable

PATH OF THE FRACTURE	AFFECTED ZONE

A) A) sagittal.	sagittal sinus sagittal suture
B) B) coronal	sagittal sinus coronal suture
C) C) multifragmented and/or depressed	variable

Table 2

As in these cases, which correspond to subtypes A and B (Table 2), management with a sagittal sinus lift without direct approach to the sinus is recommended, as recommended below, for subtype C, standard techniques of reconstruction of the sagittal sinus are recommended, as well as dural repair, if necessary, and in these cases cerebral laceration is also expected.

Recommended steps for HED fontal or vertex subtypes A and B

1.- Neutral cephalic position

2.- Bicoronal wound without extending caudally beyond the level of the zygoma (1 cm higher) since it is not necessary to reach the orbital border and it is not necessary to injure the supraorbital artery and nerves, except in cases where there is a complex fracture with collapse and injury to the orbital roof. Reflecting caudal skin flap (image 2)

3.- Identify sagittal and coronal sutures, as well as observe fracture traces and plan craniotomy, making two quadrangular frontal or frontoparietal bone flaps of 3 to 4 cm on each side and respecting a midline of 1 cm on each side, in such a way that a slab of bone is preserved over the frontal sinus regardless of the fracture trace. (Images 3, 4, 7 and 8)

4.- Proceed to drain the clot of the hematoma with hemostasis of meningeal arteries and as expected the sagittal sinus is caudally rejected and dissected by the same hematoma, the removal of the hematoma on the sagittal sinus should be left to the last, having a hemostatic sponge at hand for its immediate application on the sinus and previously having applied lifting points in the entire margin of each craniotomy and para-medial to the Sagittal sinus on each side. (image 7 and 3) In the case of mini-plates, it is valid to fix a fracture trace, particularly if it affects coronal sutures, although it is not essential.

5.-Once the clot of the epidural hematoma has been completely removed and hemostasis has been performed, the hemostasis is completed with lifting of the para-medial dura mater of the sagittal sinus, previously a cellulose hemostatic sponge 2 cm wide was applied to the sagittal sinus and along the entire uncovered section of the

sagittal sinus. A slab of bone is used on a preserved sagittal sinus to support the lifting points, which in our case are made of 2-0 silk with an atraumatic round needle.

6.- Finally, craniotomy bone flaps are repositioned and fixed in the usual way with the resources available (titanium miniplates or sutures). (image 8)

7.-Whenever it is preserved, periosteum is applied, and always apply drainage to the epidural bed on each side and subgaleal that is applied by contraction and connected to the hyperbaric system.

Conclusions:

Epidural hematoma is a neurosurgical emergency in most cases of surgical resolution. It is considered necessary to make a subdivision between the types of epidural hematoma according to their location since this implies changes in their clinical presentation and diagnosis as well as different approaches in the skull, in the case of vertex or frontal hematomas it is expected that there is laceration of the sagittal sinus and an approach that tries to preserve the sagittal sinus should be performed.

BIBLIOGRAPHY:

1 Haydar Gok ,Suat Erol Celik ,Kivanc Yangi ,Ahmed Yasin Yavuz ,Gokhan Percinoglu ,Nazmi Ugur Unlu ,Kamber Goksu. Management of epidural hematomas in pediatric and adult populations: a hospital retrospective study. World Neurosurgery, 177 (2023), Pages e686-e692

2 Farhad Bal'afif et al. Contrecoup epidural hematoma: a rare case report. Pan African Medical Journal.2022; 41(169). 10.11604/pamj.2022.41.169.31986

3 Mariarosaria Aromatario,Alessandra Torsello,Stefano D'Errico,Giuseppe Bertozzi,Francesco Sessa,Luigi Cipolloni,Benedetta,Baldari. Traumatic Epidural and Subdural Hematoma: Epidemiology, Outcome, and Dating. Medicine (Kaunas).2021 Feb; 57(2): 125.

4 Tsung-Ming Su, Chia-Cheng Lin, Chu-Mei Lan, Tsung-Han Lee, Shih-Wei Hsu, Cheng-Hsien Lu. Head Trauma Associated with Supra- and Infratentorial Epidural Hematoma: Diagnostic and Surgical Considerations. WORLD NEUROSURGERY, (2023) 176: e273-e280

5 JLV Araujo, U. do P. Aguiar, A.B. Todeschini, N. Saade and JCE Veiga, Epidemiological analysis of 210 cases of surgically treated ed traumatic extradural hematoma, Rev Col Bras Cir, vol. 39, no. 4, pp. 268-271, 2012. https://www.scielo.br/pdf/rcbc/v39n4/ en_05.pdf doi:10.1590/S0100-69912012000400005

6 S.K. Behera, S.B. Senapati, S.S. Mishra and S Das, Management of superior sagittal sinus injury encountered in traumatic head injury patients: Analysis of 15 cases, Asian J Neurosurg, vol.10, no.1, pp. 17-20, 2015. doi: 10.1007/s00701-005-0623-2.

7 Chicote Álvarez E, González Castro A, Ortiz Lasa M, Jiménez Alfonso A, Escudero Acha P, Rodríguez Borregán JC, Peñasco Martín Y, Dierssen Sotos T. Epidemiology of traumatic brain injury in the elderly over a 25 year period. Rev Esp Anesthesiol Reanim (Engl Ed). 2018 Dec; 65(10):546-551. [PubMed]

8 Khairat, A., & Waseem, M. (2023). Epidural hematoma. In *StatPearls [Internet]*. StatPearls Publishing.

9 You-Sub Kim , Seung-hoon Jung , Dong-Ho Lim , Tae-Sun Kim , Jae-Hyoo Kim , Jung-Kil Lee**Traumatic Dural Venous Sinus Injury** Korean J Neurotrauma2015 Oct; 11(2):118-23. doi: 10.13004/kjnt.2015.11.2.118. Epub 2015 Oct 31.

10 Talbott, J. F., Gean, A., Yuh, E. L., & Stiver, S. I. (2014). Calvarial fracture patterns on CT imaging predict risk of a delayed epidural hematoma following decompressive craniectomy for traumatic brain injury. *American Journal of Neuroradiology*, *35*(10), 1930-1935.