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Rapid resolution of a traumatic venous epidural hematoma in a 3-year-old child: illustrative case

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BACKGROUND Posterior fossa epidural hematoma rarely occurs in children after traumatic head injury. There is ongoing discussion about appropriate treatment, yet the radiological features regarding the time to resorption of the hematoma or required follow-up imaging are rarely discussed.

OBSERVATIONS The authors presented the case of a 3-year-old child who was under clinical observation and receiving analgetic and antiemetic treatment in whom near-complete hematoma resorption was shown by magnetic resonance imaging as soon as 60 hours after diagnosis. The child was neurologically stable at all times and showed no deficit after observational treatment. Hematoma resorption was much faster than expected. The authors discussed hematoma drainage via the sigmoid sinus.

LESSONS Epidural hematomas in children can be treated conservatively and are resorbed in a timely manner.

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KEYWORDS pediatric; trauma; epidural hematoma; observation; resorption

Posterior fossa epidural hematoma (PFEDH) rarely occurs in children after traumatic head injury and comprises ~5% of epidural hematomas (EDHs) in children. Incidence has become slightly higher, mostly because of more sensitive radiological diagnostics.[1] Especially in cases of venous hematoma of the posterior fossa, there is ongoing discussion as to whether surgery or observation is the appropriate treatment. Few reports describe the time to resorption in conservatively treated cases or give recommendations concerning the timing of follow-up imaging.

Illustrative Case

A 3-year-old boy was admitted to an external facility after occipital trauma, having fallen against a wall. The child soon presented deficits of consciousness, nausea, and vomiting. An external computed tomography (CT) scan disclosed PFEDH, posterior to the transverse sinus, displacing it anteriorly and extending supratentorially (Fig. 1A–C). The occipital fracture crossed the transverse sinus (Fig. 1D).

The child was transferred to our hospital for further evaluation and treatment and arrived at the emergency department 4 hours after the initial event and 2 hours after first CT scan. Although in stable cardiorespiratory condition with a Glasgow Coma Scale score of 15, the boy was slightly somnolent and without focal neurological deficits. A strabism had been prevalent for months, according to the child's mother. There were no further sequelae of the trauma. A focused assessment with sonography in trauma ultrasound did not display internal injuries. During evaluation, the child regained full consciousness and reported pain in his neck, specifically in the cervicothoracic region. The interdisciplinary team decided to perform magnetic resonance imaging (MRI) of the head and spine, which excluded spinal injury. The EDH presented with a constant volume of ~12 mL (Fig. 2). Because of the suspected venous genesis of the bleeding, with oozing from a lesion in the transverse sinus, together with the stable neurological state, an observational approach was chosen.

The child remained neurologically unchanged. Prolonged vomiting and nausea were treated symptomatically and stopped during course of treatment. No additional neurological deficit occurred. After initial CT and stable hematoma volume in the 4-hour MRI

ABBREVIATIONS CT = computed tomography; EDH = epidural hematoma; MRI = magnetic resonance imaging; PFEDH = posterior fossa epidural hematoma.
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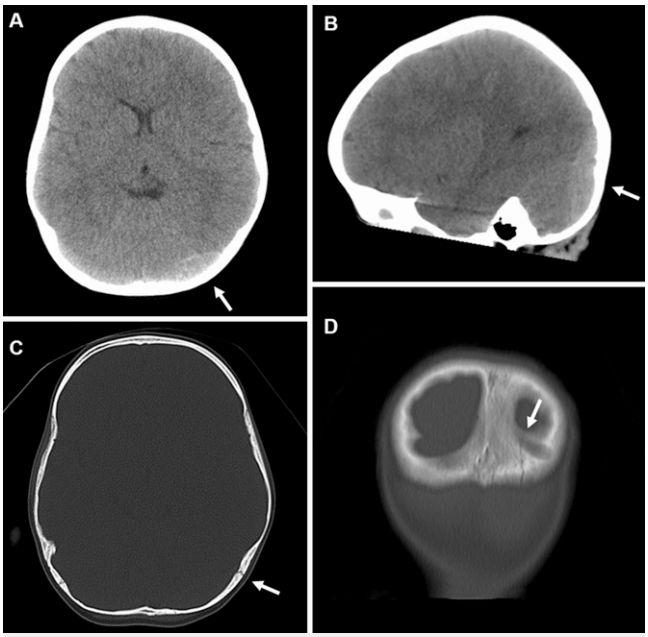

FIG. 1. CT scan approximately 1 hour after initial trauma **A:** Axial CT showing the left occipital PFEDH, reaching the supratentorial space (*arrow*). Volume ~11 cm^3. Sagittal (**B**) and axial (**C**) images of bone window with parasagittal fracture (*arrows*). **D:** Coronal image. Bone window showing the fracture line crossing the sinusoidal groove of the occipital bone (*arrow*).

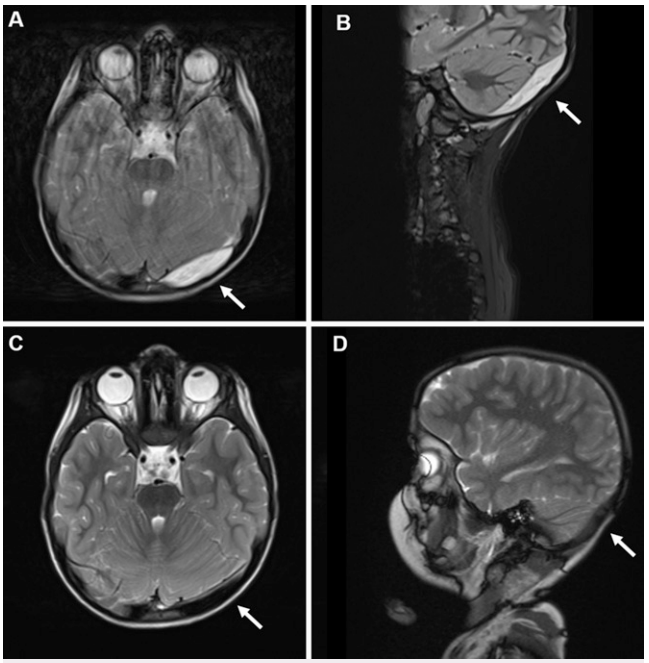

FIG. 2. MRI scans approximately 4 hours after initial trauma (**A and B**) and 60 hours after initial trauma (**C and D**). Prevalent strabism. **A:** Axial view, T2-weighted image. The PFEDH is visualized with an approximate volume of 12 mL (*arrow*). **B:** Sagittal view. Extension to the supratentorial space, crossing the transverse sinus (*arrow*). **C:** Axial MRI at follow-up showing the resorption of the hematoma (*arrow*). Residual volume of the now T2-hypointense clot is 4.5 mL. **D:** Sagittal T2-weighted image confirming near-complete absorption (*arrow*).

control imaging, we decided for further surveillance. Follow-up imaging 60 hours later as an elective control before discharge displayed near-complete resorption of the hematoma. Hematoma volume decreased from ~12 mL to ~4.5 mL. The child was discharged from hospital after an additional 48 hours of observation.

Discussion

EDH is a well-known sequela of blunt trauma to the head in children. PFEDH comprises <10% of all EDH in children and is considered to be rare.[1] There is an ongoing discussion regarding whether to choose surgical evacuation or conservative treatment, taking into account neurological deficits, increasing size, and absolute volume of the hematoma as well as its localization. Increased cerebellar pressure and brainstem compression have been described as life-threatening complications that require surgical evacuation.[2,3] In neurologically stable patients, observational treatment remains a valid option.[4] In younger infants, specific clinical parameters for conservative treatment have been proposed.[5] Although intraoperative blood loss after injury of the transverse or sigmoid sinus can be a critical complication, fatal outcomes have been rarely described.[6] Further rare complications are venous sinus thrombosis[7] and chronification.[8]

Observations

In the present case, the child showed no focal neurological deficit but suffered from cerebellar nausea. Hematoma volume was considerable but did not result in undue displacement of cerebellar structures and remained in the range of volume amenable to conservative treatment. Prasad et al. reported an average volume of 37.1 mL (18–100 mL) in surgically treated patients whereas the observational group averaged 10.3 mL (8–16 mL).[9] Other studies proposed a critical volume of 10 mL as indication for surgical treatment[10] or hematoma thickness of >5 mm. To the best of our knowledge, follow-up studies and imaging have not been regularly conducted, and in particular, no distinct time-point recommendations have been proposed. Because there is little understanding regarding the time in which complete resorption of PFEDH in children can occur, the almost complete disappearance after 2.5 days provides important background information.

Nonetheless, the time course of resorption is rather astonishing, given the proposed venous or sinusoidal origin of the bleeding, probably tamponading itself. Low sinusoidal pressure prevented further growth of the hematoma once pressure equilibrium was established. Furthermore, we suppose sinusoidal drainage largely contributed to fast resorption, leading to quick recovery. The proposed principle has been used before in minimally invasive techniques of hematoma evacuation, supported by urokinase instillation.[11] Liquid PFEDH has been proposed as a specific entitiy,[12] but extraordinary resorption has not been described.

Further details of the natural course of venous EDH must be gathered to help in integrative decision-making regarding operative treatment based on clinical and radiological criteria. Although angiography has been used in the diagnosis of EDH, to our knowledge there is no direct proof of the clot actually being drained by the transverse sinus.[13,14] Phase-contrast MR venography can be a future option to clarify flow state inside the hematoma, although fluid velocity may be too slow by far.[15]

Lessons

According to the MRI scans presented here, resorption of hematoma can be quite fast and nearly complete. Regardless of the time of resorption, observational treatment remains a valid option in pediatric venous PFEDH. In this specific case, potential surgical risk and trauma outweighed the short period of hematoma presence. The observations and conclusions in this case are limited by its unique character and the specific location behind the transverse sinus. Additionally, fast resorption does not support observational treatment in cases with neurologically symptomatic hematoma. Regardless of how fast the hematoma is reabsorbed, surgical evacuation should always be favored in cases with neurological deficits because it is reportedly faster in any case.

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References

1. Sencer A, Aras Y, Akcakaya MO, Goker B, Kiris T, Canbolat AT. Posterior fossa epidural hematomas in children: clinical experience with 40 cases. *J Neurosurg Pediatr.* 2012;9(2):139–143.
2. Sheng H-S, You C-G, Yang L, et al. Trephination mini-craniectomy for traumatic posterior fossa epidural hematomas in selected pediatric patients. *Chin J Traumatol.* 2017;20(4):212–215.
3. Chaoguo Y, Xiu L, Liuxun H, Hansong S, Nu Z. Traumatic posterior fossa epidural hematomas in children: experience with 48 cases and a review of the literature. *J Korean Neurosurg Soc.* 2019;62(2): 225–231.
4. Jamous MA, Samara QA, Jbarah OF, Ahmed YB. Management of traumatic posterior fossa epidural hematomas in pediatrics: our experience and review of the literature. *Childs Nerv Syst.* 2021; 37(9):2839–2846.
5. Baş NS, Karacan M, Doruk E, Karagoz Guzey F. Management of traumatic epidural hematoma in infants younger than one year: 50 cases—single center experience. *Pediatr Neurosurg.* 2021;56(3): 213–220.
6. Berker M, Cataltepe O, Ozcan OE. Traumatic epidural haematoma of the posterior fossa in childhood: 16 new cases and a review of the literature. *Br J Neurosurg.* 2003;17(3):226–229.
7. Singh S, Ramakrishnaiah RH, Hegde SV, Glasier CM. Compression of the posterior fossa venous sinuses by epidural hemorrhage simulating venous sinus thrombosis: CT and MR findings. *Pediatr Radiol.* 2016;46(1):67–72.
8. Krishnan P. Late decompensation after a prolonged lucid interval in chronic posterior fossa extradural hematoma. *Indian Pediatr.* 2015;52(4):342–343.
9. Prasad GL, Gupta DK, Sharma BS, Mahapatra AK. Traumatic pediatric posterior fossa extradural hematomas: a tertiary-care trauma center experience from India. *Pediatr Neurosurg.* 2015;50(5): 250–256.
10. Bor-Seng-Shu E, Aguiar PH, de Almeida Leme RJ, Mandel M, Andrade AF, Marino R Jr. Epidural hematomas of the posterior cranial fossa. *Neurosurg Focus.* 2004;16(2):ECP1.
11. Lu Z, Zhu G, Qiu Y, Cheng X. Minimally-invasive aspiration and drainage for management of traumatic epidural hematoma straddling transverse sinus. *Neurol India.* 2013;61(2):111–116.
12. Han K, Li Z, Yin H, Yao W, Lan X, Bo Y. Liquid posterior fossa epidural hematoma in pediatric trauma: a single-center case series. *J Neurol Surg A Cent Eur Neurosurg.* 2018;79(5):380–385.
13. Le Guyader J, Besson G, Blain F, Bellet M. Angiographic signs of extra-dural hematomas of the posterior fossa. Article in French. *Sem Hop.* 1980;56(17-18):837–841.
14. Fukumitsu T, Yamashita J, Miwa Y, Murata T, Tokuriki Y. Vertebral angiography in diagnosis of traumatic hematomas of the posterior fossa. Article in Japanese. *Neurol Med Chir (Tokyo).* 1976;16(5 pt 2): 397–403.
15. Sakamoto D, Fukuya S, Harada A, Utsunomiya H. Two pediatric cases of epidural hematoma in the posterior fossa with extension along the sigmoid sinus groove: MR evaluation. *Acta Radiol Open.* 2020;9(2):2058460120902894.

Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Wilhelmy, Meixensberger, Nestler. Acquisition of data: Wilhelmy, Kasper, Nestler. Analysis and interpretation of data: Wilhelmy, Wende, Kasper, Ablefoni, Nestler. Drafting the article: Wilhelmy, Bode. Critically revising the article: all authors. Reviewed submitted version of manuscript: Wilhelmy, Wende, Bode, Meixensberger. Approved the final version of the manuscript on behalf of all authors: Wilhelmy. Statistical analysis: Wilhelmy. Administrative/technical/material support: Wilhelmy, Ablefoni. Study supervision: Wilhelmy.

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