



Supra- and Infratentorial Extradural Hematoma: A Series of Three Cases with Literature Review

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Abstract

The extradural hematoma (EDH) of the posterior fossa is a rare clinical condition in head injury cases. The posterior fossa extradural hematoma (PFEDH) contributes to not more than 4 to 8% of all the EDH encountered in traumatic brain injury. The limited volume of the posterior fossa leads to early clinical deterioration and, if not subjected to timely intervention, may be fatal. This rapid deterioration is because of significant compression over the brainstem and cervicomedullary junction as well as obstructive hydrocephalus. The PFEDHs are often associated with fracture of the occipital bone, which may lead to the extension of hematoma in the supratentorial and infratentorial spaces. The traumatic supra- and infratentorial EDH (TSIEDH) constitutes less than 2% of all the EDH. Limited literature is available regarding TSIEDH, and the majority are in the form of isolated case reports. We share our experience of three cases over the last 5 years from a tertiary care referral institute with a literature review of TSIEDH. Two of these cases were managed nonoperatively, and one underwent surgical evacuation of hematoma. In the present study, we share our experience regarding prompt diagnosis and management of this particular subset of traumatic brain injury patients. We also describe the surgical technique for evacuation of TSIEDH. Early diagnosis and prompt surgical intervention can be life-saving as these hematomas may have a benign clinical presentation but rapid clinical deterioration.

Keywords

- ▶ extradural hematoma
- ▶ supratentorial
- ▶ infratentorial
- ▶ evacuation
- ▶ traumatic brain injury

Introduction

Extradural hematoma (EDH) is a severe and life-threatening complication associated with traumatic brain injury. It occurs in approximately 1 to 4% of cases of traumatic brain injury.^{1–3} Most EDHs are commonly seen in the supratentorial compartment, with the common mechanism being arterial bleed (like middle meningeal artery) and classically having “lucid interval” following which there is rapid deterioration in the sensorium and can have lateralizing neurological signs like pupillary asymmetry and limb weakness. In contrast, posterior fossa EDH and traumatic supra- and infratentorial EDH (TSIEDH) are very rare. Posterior fossa EDH is generally seen in children and young adults, with bleeding being a venous type. There is usually a slow hematoma expansion, and symptoms are generally non-specific. However, with the advent of imaging techniques like

computed tomography (CT), diagnosis and timely management have become better, thus improving the prognosis.⁴ There are few reports of TSIEDH in the literature, and this case series is an effort to share our management experiences of TSIEDH with cases being managed surgically and conservatively.

The present series includes three cases of TSIEDH, one of which was managed surgically and the other two cases were managed nonoperatively. Two of the patients were adult males and one was a male child. All cases suffered road traffic accidents (RTAs).

Case 1

The first case is that of a 29-year-old gentleman with an alleged history of RTA while driving a two wheeler. His Glasgow coma scale (GCS) on presentation was E4M6V5, and he had left

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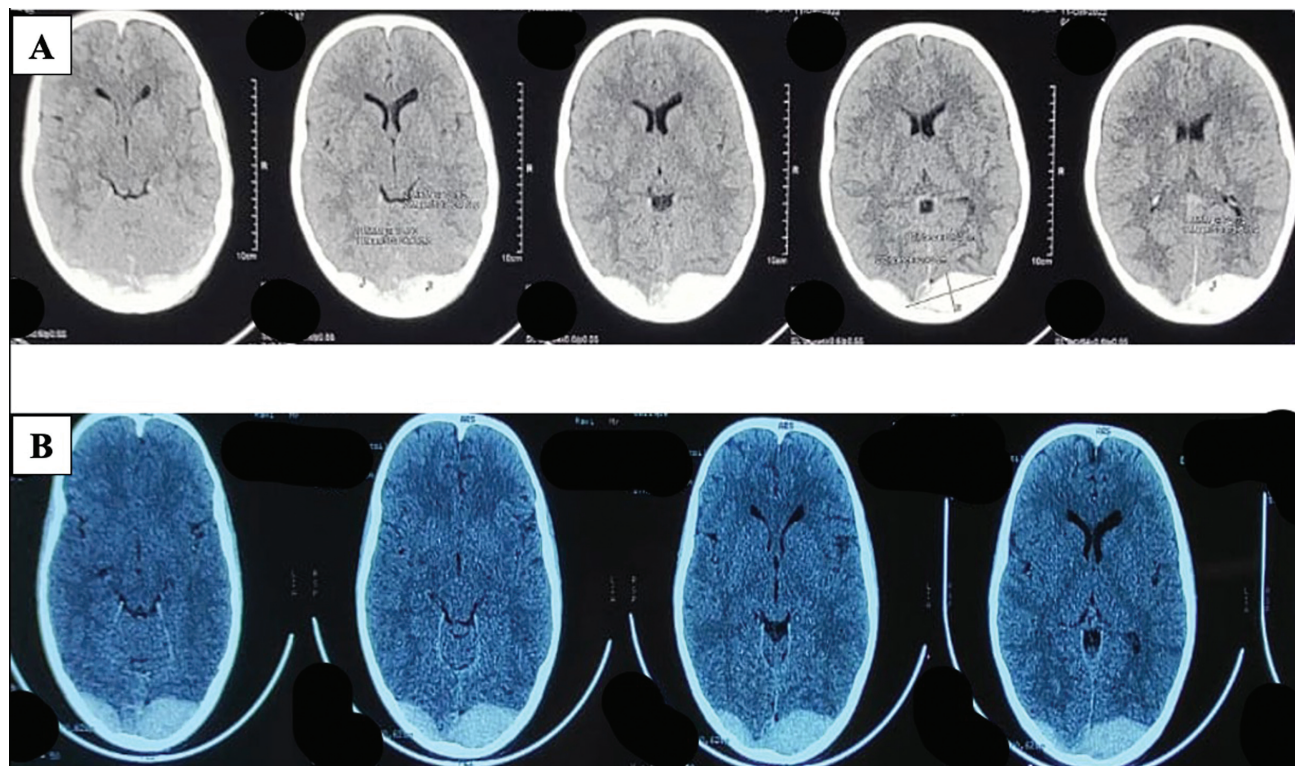


Fig. 1 Computed tomography (CT) scans done at (A) 24 and (B) 168 hours (after 7 days) posttrauma showing left occipital and suboccipital extradural hematoma (EDH). The size of the hematoma remains the same in the initial and subsequent scans.

occipital swelling. He had no pupillary asymmetry and no focal neurological deficits. Plain brain CT was suggestive of left occipital and suboccipital EDH with a linear undisplaced occipital fracture (► **Fig. 1**). He was managed conservatively in the intensive care unit (ICU) with a low threshold for surgery. He was observed closely with repeat CT.

Case 2

This is a 20-year-old gentleman with an alleged history of RTA as a pillion rider on a two wheeler. He was not wearing a helmet and had an occipital impact during the fall. He presented 12 hours posttrauma with a GCS of E3M6V4 (13/15) without pupillary asymmetry and no focal neurological deficit. Plain brain CT showed left occipital and suboccipital EDH with left linear undisplaced fracture of the occipital bone (► **Fig. 2**). He was subjected to emergency craniotomy and evacuation of the hematoma. After surgery, his GCS improved to E4M6V5. Postoperative CT scan showed complete evacuation of EDH. He had an uneventful hospital stay and was discharged on the fifth postoperative day.

Case 3

An 11-year-old boy was brought by his parents with alleged history of trauma while riding a two wheeler as a pillion. His GCS at admission was E4M6V5 (15/15) without any focal neurological deficit. CT scan of the brain done at 12 hours after trauma showed bilateral occipital and suboccipital EDH (► **Fig. 3**). His hospital course was uneventful,

with a follow-up CT scan at 6 days showing no increase in the size of the hematoma. He was discharged on the seventh day of trauma and is doing well in follow-up visits.

Operative Technique

The patient was intubated under general anesthesia during surgery. The position was prone, with the head secured on the three-pin head holder. The anatomical landmarks (midline and transverse sinus) and craniotomy site were marked with skin markers. A hockey stick incision was made. After raising the musculocutaneous flap, a separate occipital and suboccipital craniotomy was done overlying the EDH. Bone overlying the transverse sinus was left behind. Care was taken not to disturb the clot adjacent to the transverse sinus area because of inevitable bleeding from the venous sinus. As the hematoma was evacuated, dural hitches were taken. Finally, the hematoma under the bone over the transverse sinus was evacuated carefully once the dura was hitched (► **Fig. 4**). Given the anticipated transverse sinus injury, the strip of hematoma overlying the transverse sinus should be left in situ to avoid exposure of underlying sinus injury, which could result in disproportionate bleeding from the sinus. Finally, the bone flap was replaced, and the skin flap was sutured in layers.

Discussion

The incidence of TSIEDH is infrequent, constituting less than 2% of all EDH cases. The presentation of TSIEDH and posterior

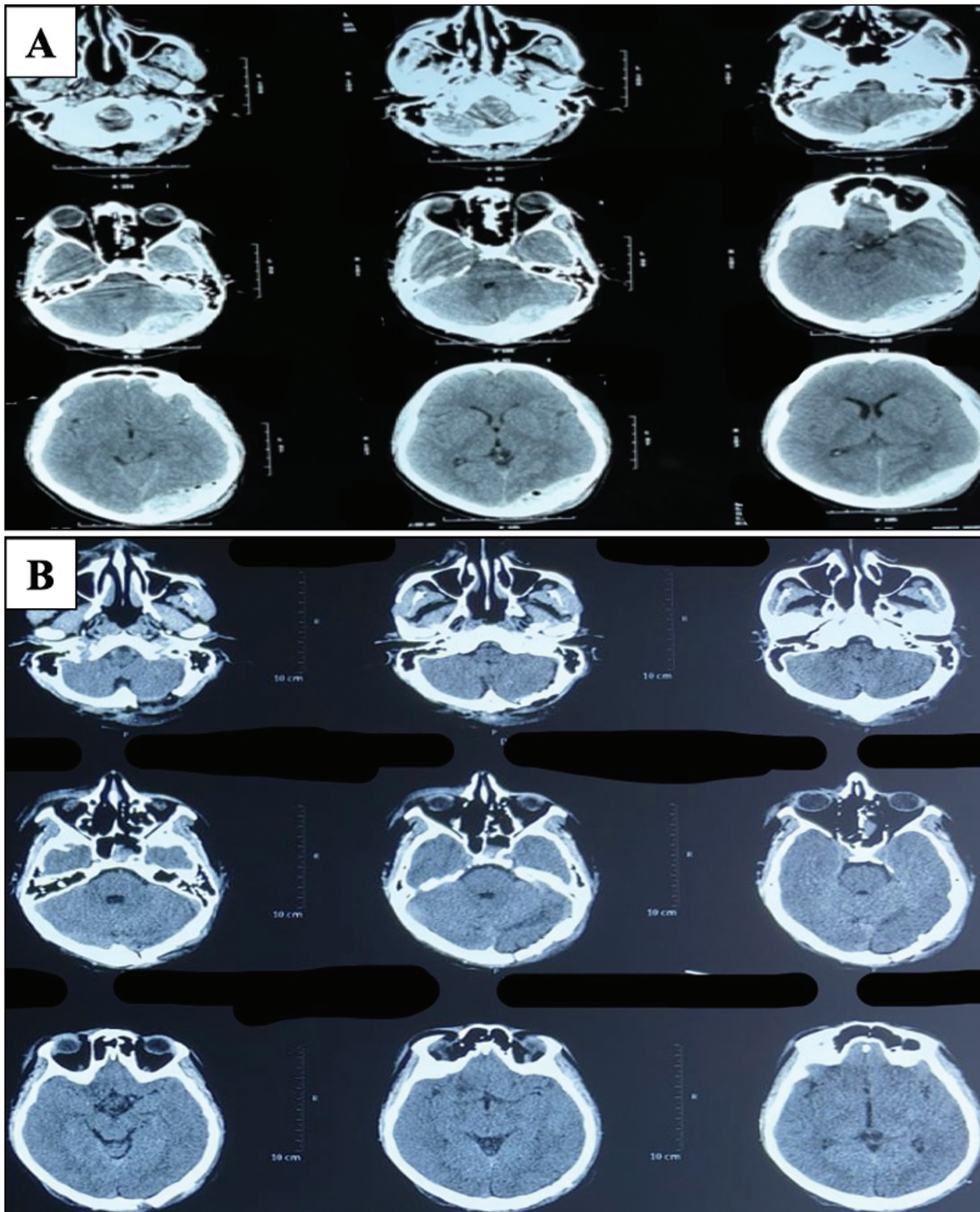


Fig. 2 (A) Preoperative plain brain computed tomography (CT) showing left occipital and suboccipital extradural hematoma (EDH). (B) Postoperative plain CT of the brain shows the postcraniotomy status with complete evacuation of EDH.

fossa EDH is also nonspecific without any lateralizing signs. However, as we have seen in the cases described earlier, clinical presentation and mechanism of injury can be suggestive of posterior fossa EDH. An external injury to the occipital region, consisting of bruising, laceration, or cephalohematoma, can be the key finding in a head trauma that becomes complicated with a TSIEDH without specific

neurological features.⁵ We recommend judicious use of the CT scan in the first 24 hours posttrauma for patients with an external injury to the occipital region even if the patient is neurologically preserved, keeping a low threshold of repeating the CT scan even without neurological deterioration. We have also observed occipital bone fracture in all three cases, which is consistent with previous studies associating

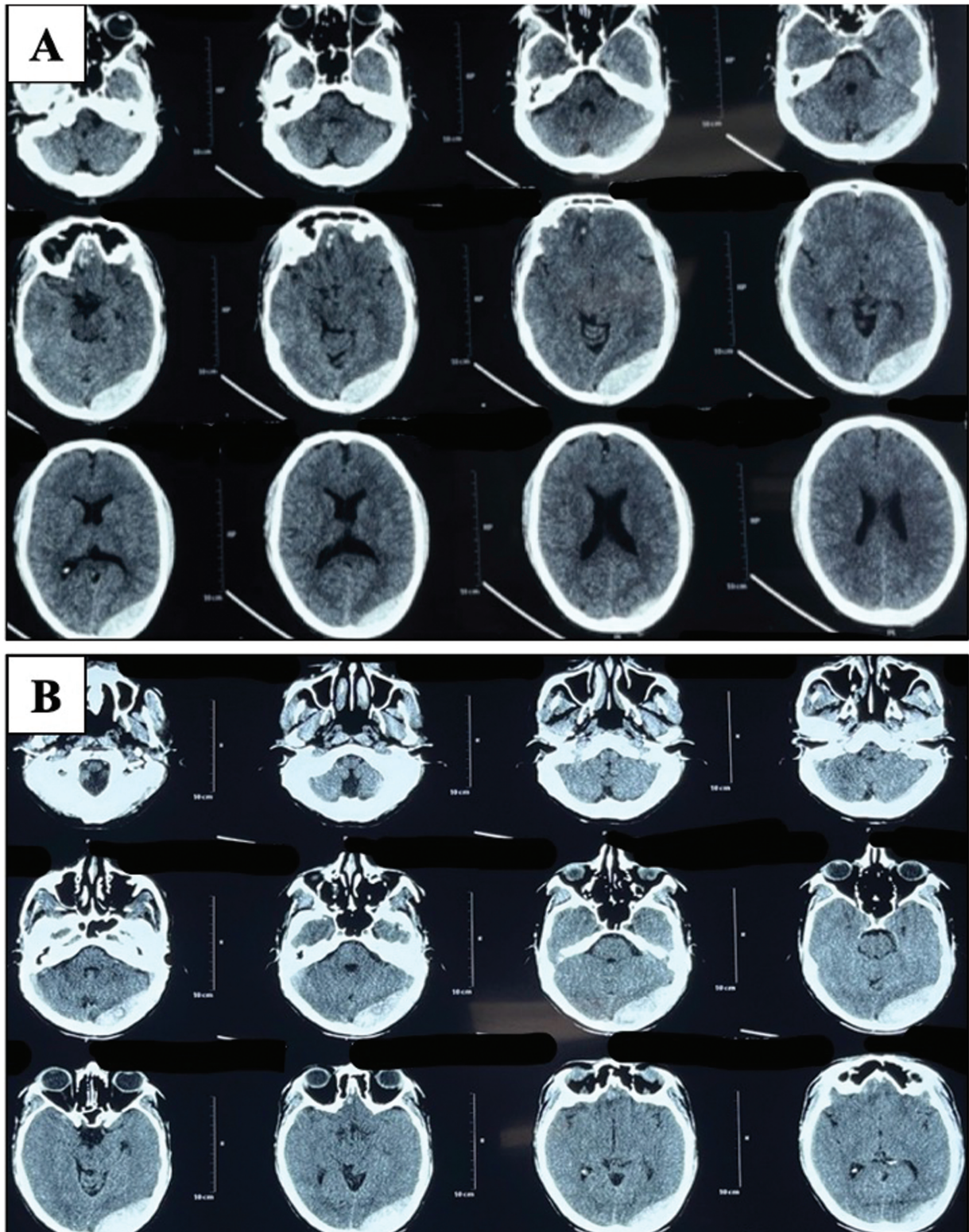


Fig. 3 Plain computed tomography (CT) of the brain done at (A) 12 hours and (B) 6 days posttrauma showing bilateral occipital extradural hematoma (EDH).

occipital bone fracture with posterior fossa EDH. The rate of occipital bone fracture or diastasis fracture of lambdoid suture ranges from 40 to 86%.³ Compared with supratentorial EDH, the source of bleeding in the posterior fossa and TSIEDH differs. The bleeding usually arises from the venous

sinuses (transverse sinus, torcula herophili, mastoid emissary vein), the posterior branches of the middle meningeal arteries, or the diploe and the small dural vessel.⁵ Venous injury causes a gradual filling of hematoma and gives a better prognosis than arterial bleeding. In our case report, the

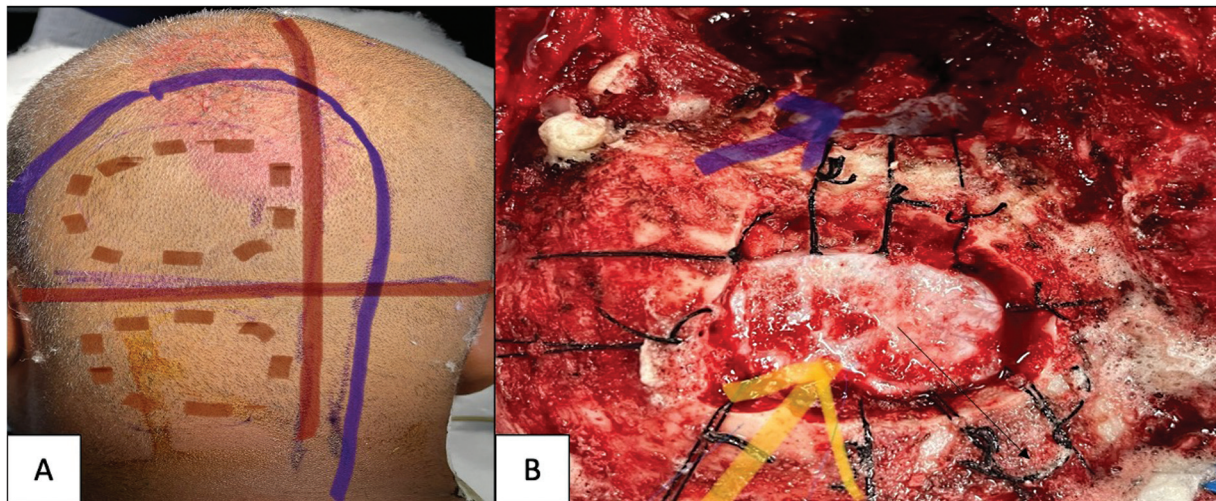


Fig. 4 (A) The patient is positioned prone on a horseshoe with adequate padding and the neck in a neutral position. The vertical and horizontal red lines show the midline and inion-mastoid lines, respectively. The solid purple line shows the hockey stick incision and the dotted line shows planned occipital and suboccipital craniotomy. (B) Intraoperative image showing the occipital craniotomy defect (yellow arrow) and the suboccipital craniotomy defect (purple solid arrow) with bone over the transverse sinus left behind.

source of bleeding was from the transverse sinus. In the cases without an obvious source of bleeding, the most likely cause of bleeding is the diploic vessels. It should also be noted that when the hematoma begins to expand, bleeding from the bridging vein can cause an additional source of bleeding, which may contribute to rapid expansion of the hematoma and sudden neurological deterioration.⁵ Diagnosis and cure of EDH of the posterior cranial fossa were possible following the first successful case of surgery reported by Coleman and Thompson in 1941.⁶ Craniotomy and surgical evacuation of hematoma is considered the standard of care. Early diagnosis and surgical intervention are essential because early hematoma evacuation leads to the removal of compression over the transverse sinus.⁷ If the transverse sinus is compressed, causing venous return disorder, the symptoms of intracranial hypertension can be significant and can rapidly form tonsillar herniation, which is difficult to resolve. The overall mortality of TSIEDH is around 17%, the operative mortality rate is 14%, and morbidity is 6%.⁴

According to Malik et al, the factors predicting outcomes are the following⁸:

- **Good prognostic factors:** Good GCS score, children, midline shift less than 5 mm, clot thickness less than 15 mm, and clot volume less than 10 mL.
- **Bad prognostic factors:** Sudden-onset, associated intracranial injuries, acute hydrocephalus (effaced the fourth ventricle and posterior cranial fossa cisterns).

In a previous case series of three patients published by Aji et al,⁹ all the patients underwent surgical evacuation of hematoma, and they concluded that clinical progression may be slow; however, deterioration is quick and fatal, so early diagnosis and prompt treatment are vital for reducing morbidity and preventing mortality. In a previous case report of a child with TSIEDH, Al-Zekri et al¹⁰ concluded

Table 1 Case reports and case series of traumatic supra- and infratentorial extradural hematoma (TSIEDH)

Sl. no	Study	Year of publication	No. of cases
1	Aji et al ⁹	July 2016	3
2	Al-Zekri et al ¹⁰	August 2019	1
3	Pathak et al ¹¹	November 2023	1

that any child with head trauma and occipital impact should be promptly evaluated for the possibility of posterior fossa EDH, which may or may not have a supratentorial component. Similarly, Pathak et al,¹¹ in a case report of delayed presentation of TSIEDH, concluded that the threshold to obtain imaging to rule out delayed hemorrhage should be low in any patient with a history of trauma in the region of a dural venous sinus. **Table 1** shows case report and case series of TSIEDH.

In our series, we managed two patients conservatively with good GCS (15/15) scores at presentation and no effacement of the fourth ventricle on CT scan. In contrast, the patient who underwent surgical intervention was drowsy and confused at presentation (GCS: 13/15) and had effacement of the fourth ventricle on CT scan.

Conclusion

EDH is a neurosurgical emergency and should be treated with urgent care and prompt surgical intervention at the earliest. Posterior fossa EDH and TSIEDH are rare EDHs comprising less than 2% of all EDHs, and their presentation and clinical progression differ from that of a supratentorial EDH. Early diagnosis can be lifesaving, and aggressive use of CT scan is mandatory in such cases. Delays in diagnosis or

treatment can be fatal. Thorough clinical evaluation, close monitoring in the ICU setup, and keeping a low threshold to repeat the CT scan to assess the progression of hematoma are the cornerstones for the management of such a dreadful yet rewarding entity in neurotrauma.

Funding

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Conflict of Interests

None declared.

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