LATIN Neurosurgery
ISSN: 3086-0725



Review

# Epidural hematoma of the posterior fossa: a review

## *Hematoma epidural de la fosa posterior: una revisión*

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### *ABSTRACT*

**Introduction:** *Posterior fossa epidural hematoma (PFEDH) is an uncommon lesion, accounting for 0.1%–0.3% of all traumatic brain injuries (TBI) and 4%–15% of all epidural hematomas. Despite its low incidence, PFEDH represents the most common traumatic space-occupying lesion of the posterior fossa and may deteriorate abruptly and fatally, making early recognition of paramount clinical importance.* **Objective:** *To conduct a comprehensive review of the literature on PFEDH, addressing its epidemiological, pathophysiological, clinical, diagnostic, therapeutic, and prognostic aspects.* **Methods:** *A narrative review of the literature was conducted using the PubMed/MEDLINE, LILACS, and SciELO databases, employing MeSH descriptors including "epidural hematoma," "posterior cranial fossa," "craniocerebral trauma," and "neurosurgery," used alone or in combination. Original articles, case series, case reports, and review articles published between 1960 and 2012 in English, Portuguese, Spanish, and French were included. Study selection was guided by clinical relevance and contribution to the understanding of the epidemiological, diagnostic, and therapeutic aspects of PFEDH, without the application of formal methodological quality assessment criteria.* **Results:** *PFEDH predominantly affects young male adults, with falls and traffic accidents constituting the main mechanisms of injury. In 85% of cases, the hemorrhagic source is venous, arising from injury to the sigmoid or transverse sinuses associated with occipital bone fracture. The clinical presentation is frequently insidious and nonspecific, encompassing headache, nuchal rigidity, vomiting, and progressive impairment of consciousness. Computed tomography (CT) of the skull is the imaging modality of choice, revealing a biconvex hyperdense collection in the posterior fossa. Associated intracranial lesions are present in up to 87% of cases. Surgical treatment is indicated in the majority of patients; conservative management may be considered in highly selected cases. The reported mortality rate ranges from 4.7% to 20%.* **Conclusion:** *PFEDH is an uncommon but potentially fatal neurosurgical emergency. Early CT-based diagnosis and timely surgical intervention are the primary determinants of reduced morbidity and mortality. Prognosis depends fundamentally on the Glasgow Coma Scale score at admission, hematoma volume, presence of associated intracranial lesions, and time elapsed before surgical intervention.*

**Keywords:** *hematoma, epidural, cranial; cranial fossa, posterior; craniocerebral trauma; neurosurgery; craniotomy.*

### *RESUMEN*

**Introducción:** *El hematoma epidural de la fosa posterior (HEFP) es una lesión poco frecuente, que representa entre el 0,1% y el 0,3% de todos los traumatismos craneoencefálicos (TCE) y entre el 4% y el 15% de todos los hematomas epidurales. Aunque infrecuente, constituye la causa más común de traumatismo con efecto de masa en la fosa posterior y puede evolucionar de forma súbita y fatal, por lo que su detección precoz es de vital importancia clínica.* **Objetivo:** *Realizar una revisión exhaustiva de la literatura sobre el HEFP, abordando sus aspectos epidemiológicos, fisiopatológicos, clínicos, diagnósticos, terapéuticos y pronósticos.* **Métodos:** *Revisión narrativa de la literatura en las bases de datos PubMed/MEDLINE, LILACS y SciELO, utilizando los descriptores MeSH: «hematoma epidural», «fosa*

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*Received Apr 7, 2026*
*Corrected May 4, 2026*
*Accepted May 18, 2026*

LATIN Neurosurgery
ISSN: 3086-0725

*craneal posterior», «traumatismo craneoencefálico» y «neurocirugía», solos o en combinación. Se incluyeron artículos originales, series de casos, informes de casos y artículos de revisión publicados entre 1960 y 2012 en inglés, portugués, español y francés. La selección de los estudios se basó en su relevancia clínica y su contribución a la comprensión de los aspectos epidemiológicos, diagnósticos y terapéuticos de la HEDFP, sin aplicar criterios formales para evaluar la calidad metodológica.* **Resultados:** *El HEDFP afecta predominantemente a hombres jóvenes, siendo las caídas y los accidentes de tráfico los principales mecanismos. En el 85% de los casos, el origen es venoso, debido a lesiones en los senos sigmoideos o transversos asociadas a fracturas del hueso occipital. El cuadro clínico suele ser insidioso e inespecífico, con cefalea, rigidez de nuca, vómitos y disminución del nivel de conciencia. La tomografía computarizada (TC) craneal es la prueba de elección, que muestra una colección hiperdensa biconvexa en la fosa posterior. Se observan lesiones intracraneales asociadas hasta en el 87% de los casos. El tratamiento es quirúrgico en la mayoría de los casos; en casos muy selectos se puede optar por un tratamiento conservador. La tasa de mortalidad varía entre el 4,7% y el 20%.* **Conclusión:** *El HEDFP es una urgencia neuroquirúrgica rara pero potencialmente mortal. El diagnóstico precoz mediante TC y la intervención quirúrgica oportuna son cruciales para reducir la morbilidad y la mortalidad. El pronóstico depende principalmente de la puntuación en la Escala de Coma de Glasgow al ingreso, el volumen del hematoma, la presencia de lesiones asociadas y el tiempo transcurrido hasta la intervención.*

**Palabras clave:** *hematoma epidural craneal; fosa craneal posterior; traumatismo craneoencefálico; neurocirugía; craneotomía.*

## 1. INTRODUCTION

Epidural hematoma (EDH) is most commonly located in the supratentorial compartment and is typically associated with direct trauma to the temporal bone, resulting in laceration of the middle meningeal artery or its branches[1,2]. Posterior fossa epidural hematoma (PFEDH) occurs as a complication in 0.1% to 0.3% of all traumatic brain injuries (TBI) and represents 4% to 15% of all EDHs[1-20], it has been reported as the most common traumatic space-occupying lesion of the posterior fossa[1,21]. Falls represent the leading cause, particularly in childhood[4,5,17,22-24], followed by traffic-related accidents[22,25-27].

## 2. METHODOLOGY

A narrative review of the literature was conducted using the PubMed/MEDLINE, LILACS, and SciELO databases. The following MeSH terms were used alone or in combination: "epidural hematoma," "extradural hematoma," "posterior cranial fossa," "posterior fossa hematoma," "traumatic brain injury," "posterior fossa surgery," and "neurosurgery." Studies published between 1960 and 2012 were considered for inclusion. Original articles, case series, case reports, and review articles written in English, Portuguese, Spanish, and French addressing the epidemiology, clinical presentation, diagnosis, and treatment of PFEDH were selected based on clinical relevance and contribution to the understanding of the subject. No formal methodological quality appraisal criteria were applied, consistent with the narrative review design. Articles focused exclusively on supratentorial EDH or other intracranial lesions without specific data on the posterior fossa were excluded. The reference lists of retrieved publications were also manually searched to identify additional relevant studies not captured by the electronic database search. Data on demographic characteristics, etiology, clinical features, imaging findings, treatment modalities, and outcomes were extracted and synthesized in a narrative format.

## 3. RESULTS AND DISCUSSION

PFEDH occurs more frequently in males and young adults[2,4,19,22,26-30]. In the pediatric population, there is a slightly higher incidence compared to adults[22,25-27]. PFEDH may develop beneath a calvarial fracture following mild TBI[31-33]. In approximately 85% of cases, the origin of bleeding is venous, resulting from injury to the sigmoid or transverse sinus secondary to trauma to the occipital bone[2,14]. The hematoma is generally unilateral, and bilateral PFEDH is an uncommon occurrence[34,35].

According to the temporal profile of symptom onset, PFEDH may be classified as acute (symptoms developing within the first 24 hours), subacute (symptoms appearing between two and seven days), or chronic (symptoms emerging more than seven days after trauma)[7,19,36]. Several authors have attributed the

venous source of bleeding as a factor explaining the occurrence of chronic PFEDH[2,14].

Diagnostic difficulty arises from the rarity of this lesion and the atypical neurological presentation[19]. Symptoms may develop slowly or with considerable delay. However, this is a condition that can deteriorate abruptly owing to herniation of the cerebellar tonsils through the foramen magnum, with potentially fatal consequences[2,4,7,37].

The clinical course of PFEDH is variable, ranging from uneventful recovery to sudden death[1,10]. For this reason, early imaging is of vital importance to enable a timely diagnosis and appropriate treatment[1]. The most frequently reported symptoms include headache, nuchal rigidity, vomiting, and deterioration of the level of consciousness[19]. Altered consciousness may be present and depends on hematoma size, the rate of hematoma formation, and the presence of associated intracranial lesions. Soft-tissue swelling in the occipital and retromastoidal region (Battle's sign) is present in the majority of PFEDH cases[4]. Mahajan et al.[38] demonstrated that nuchal rigidity and somnolence are common clinical findings. In the presence of occipital trauma and occipital fracture, CT scanning should be performed to allow early diagnosis of PFEDH, facilitate appropriate treatment, and improve prognosis[37]. The identification of a fracture line in the occipital region mandates hospital admission, rigorous clinical observation, and serial CT monitoring[19,28,29]. Early diagnosis is fundamental for a favorable clinical outcome. Lui et al.[29] advocate CT imaging in all TBI patients presenting with occipital cephalohematoma, retromastoidal ecchymosis (Battle's sign), or fracture of the occipital bone — a recommendation corroborated by others[7].

Between 40% and 90% of PFEDH cases are associated with occipital bone fracture, which is generally ipsilateral to the hematoma[1,14,27,28,39-42]. PFEDH is typically associated with linear occipital fracture, diastatic fracture of the lambdoid suture, or both[2,4].

CT scanning has become the diagnostic and management investigation of choice for PFEDH[2,19]. On CT, the hematoma typically appears as a biconvex hyperdense lesion[2,4]. A high-density membrane along the medial margin of a biconvex hypodense area — which enhances following contrast administration — may be observed (Figures 1, 2 and 3)[43]. This finding is generally detected

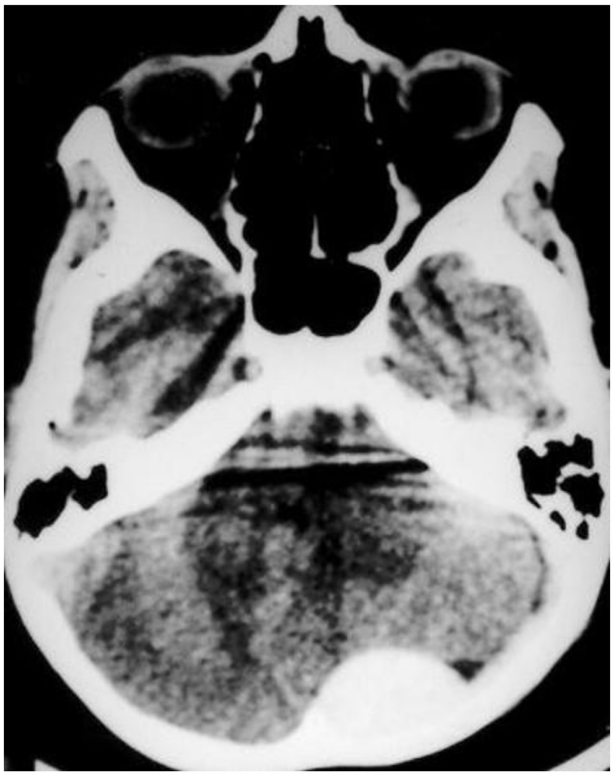

**Figure 1.** Non-contrast CT scan of the head demonstrating a hyperdense lesion on the left side of the posterior fossa.

**Figure 2.** Non-contrast cranial CT scan showing a biconvex hyperdense lesion located on the right side of the posterior fossa, consistent with acute epidural hematoma.

LATIN Neurosurgery
ISSN: 3086-0725

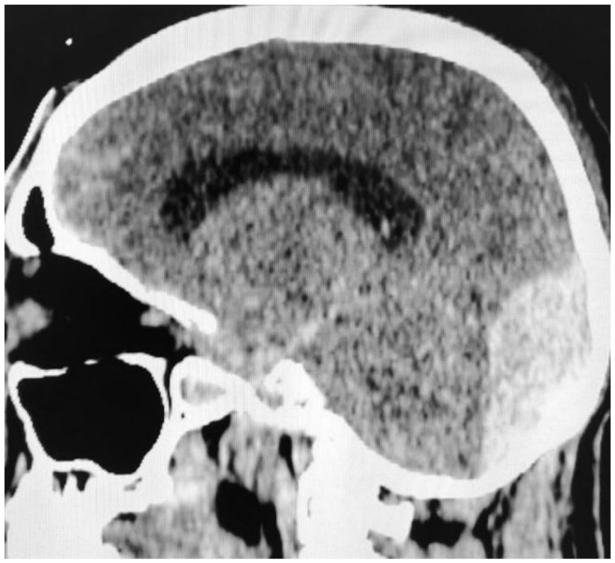

**Figure 3.** Non-contrast sagittal cranial CT scan demonstrating a hyperdense lesion located in the posterior fossa.

two or more days after trauma and is thought to represent early granulation tissue formation within the dura mater[24]. CT also demonstrates the mass effect of the hematoma through partial or complete obliteration of the perimesencephalic cisterns or displacement of the fourth ventricle[4]. Mixed-density hematomas may also be encountered, and the liquid component observed intraoperatively may represent liquefied hematoma or a mixture with cerebrospinal fluid following dural laceration[24]. Supratentorial extension may occur[44]. In small PFEDHs that do not exhibit a biconvex configuration owing to limited volume, magnetic resonance imaging (MRI) may be more sensitive in delineating the dura mater between the cerebellar parenchyma and the hematoma, and in detecting associated lesions or venous sinus thrombosis potentially related to PFEDH[45]. Associated intracranial lesions are present in approximately 87% of cases, including cerebral contusion, intracerebral hematoma from a contrecoup mechanism located in the frontal or temporal lobe, supratentorial extradural hematoma, subarachnoid hemorrhage, subdural hygroma, and subdural hematoma[2,14,20,43,46,47]. The medical literature reports a low incidence of hydrocephalus and/or ventricular dilatation in PFEDH[5,7,11,13,21,22,42,48].

Between 50% and 66% of PFEDH cases in adults present with supratentorial extension, and are accordingly designated as mixed PFEDH[29,42,44,49,50]. In children, however, PFEDH tends to remain confined to the posterior fossa[24,51]. Associated intracranial lesions occur in 50% to 87.5% of cases[20,42,52,53], and are most commonly contusions or intraparenchymal hematomas of the frontal lobe as a result of the contrecoup mechanism[7,35,53].

Considerable controversy exists regarding the optimal management of PFEDH, specifically whether conservative or surgical treatment is more appropriate[3,6,15,37,42,54,55]. Clinical decision-making is generally based on neurological findings and CT imaging[4]. Neurological status, GCS score at admission, clot thickness, compression of the fourth ventricle, and ventricular dilatation on initial CT are important determinants of the treatment approach[27]. Conservative management of PFEDH has yielded excellent results in carefully selected patients[54-56]. Bor-Seng-Shu et al.[7] used a GCS score of 15 combined with the absence of mass effect and associated lesions as criteria for conservative treatment in their series. Spontaneous resolution has also been reported in the literature.

PFEDH with a GCS score below 9 and a hematoma volume greater than 10 mL constitutes an indication for immediate surgical intervention, regardless of the neurological status. The limited volume of the posterior fossa predisposes to early neurological deterioration, and hydrocephalus is visible on CT in approximately one-third of cases[19]. Surgical treatment is the standard of care, with conservative management reserved exclusively for very small hematomas in selected patients[27].

Some authors have proposed surgical indications based on tomographic criteria, including obliteration of the perimesencephalic cisterns, displacement of the fourth ventricle, midline shift greater than 5 mm, hematoma volume greater than 10 mL, thickness greater than 15 mm, and the absence or minimal degree of associated intracranial injury[37,57,58]. Roka et al.[19] recommended surgical intervention in cases of low GCS score, hematoma larger than 10 mL, hydrocephalus, or fourth ventricular displacement. Hydrocephalus occurs in approximately 30% of cases and does not invariably necessitate ventricular shunting[44]. Cannoni et al.[48] reported their experience with 21 cases of traumatic posterior fossa hematomas, four of whom developed hydrocephalus and required external ventricular drainage. The choice between osteoplastic craniotomy and craniectomy — or a combination of both — depends on hematoma size and operative findings[19].

Prognosis depends on the clinical course and the level of consciousness at the time of surgical intervention. Patients with a GCS score between 13 and 15 generally have a favorable prognosis[4]. Arterial hemorrhage leads to rapid and voluminous hematoma formation, producing swift neurological deterioration and an unfavorable outcome. Venous hemorrhage, by contrast, results in a more gradual hematoma expansion beneath the fracture line, with progressive symptom development and a generally favorable prognosis following surgical drainage[2,7]. Hayashi et al.[28] reported an association between vomiting and acute neurological deterioration in patients with occipital trauma, and concluded that patients presenting with occipital fracture and vomiting must be closely observed and monitored with serial CT, even when the initial scan is normal, to exclude the delayed development of PFEDH. Khwaja and Hormbrey[2] identified three significant factors associated with mortality: failure to achieve early diagnosis, level of consciousness at the time of surgical intervention, and the presence of associated brainstem lesions. Early diagnosis has consistently been regarded as an important prognostic determinant[37]. In acute presentations, the mortality rate ranges from 12% to 70%[19,20], while the overall reported mortality rate varies between 4.7% and 20%[4,6,8,29,37,42,59].

## 4. CONCLUSIONS

PFEDH is a rare lesion in the context of TBI in general, characterized by a frequently subtle and nonspecific neurological presentation. It occurs most commonly in young male adults who have sustained traffic-related accidents. Fracture of the occipital squama is present in the majority of cases. CT scanning of the skull is the imaging modality of choice and should be promptly performed in patients exhibiting clinical features such as retromastoidal soft-tissue swelling (Battle's sign) or occipital bone tenderness. Surgical treatment is the mainstay of management for most PFEDH cases and is effective in preventing significant morbidity and mortality. Prognosis depends on neurological status (GCS score at admission and hematoma volume), clinical course, associated intracranial lesions, and time elapsed before surgical intervention. The routine availability and timely use of CT imaging has considerably reduced the morbidity and mortality associated with this condition.

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LATIN Neurosurgery
ISSN: 3086-0725

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***Funding:*** *none.*
***Conflict of interests:*** *none.*