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ORIGINAL ARTICLE

Traumatic posterior fossa hematomas

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PURPOSE
Posterior fossa epidural hematomas are much less common than supratentorial epidural hematomas. The incidence of posterior fossa epidural hematomas among intracranial epidural hematomas has been reported to be 4% to 7%. Seven cases of posttraumatic posterior fossa epidural hematomas diagnosed by computed tomography (CT) are reported with radiological and clinical findings.

MATERIALS AND METHODS
This study consisted of 7 posterior fossa epidural hematoma cases, out of 585 severe head trauma patients admitted and hospitalized in an 18-month period. The patients were evaluated regarding age, gender, type of trauma, cranial CT and Glasgow coma score in admittance, treatment and follow-up.

RESULTS
Average age was 24.2 years and 85.7% of the cases were male. All cases had occipital fracture. Fifty-seven percent of the cases had only occipital fracture and posterior fossa epidural hematoma. All of the cases in this group were neurologically intact except for one who had a Glasgow coma score of 9 in admission. Two cases of this group were conservatively treated. In the others posterior fossa epidural hematomas got larger and they were treated surgically; these two cases recovered after surgery. Three of the 7 cases had the supratentorial region lesions; one of these cases died before operation. Two of them were treated surgically, one of them died and the other showed recovery after surgery.

CONCLUSION
Acute posterior fossa epidural hematomas are usually symptom-free initially. After this silent period, clinical deterioration is quick to become fatal in most of patients. Surgery can be life-saving when performed in a timely manner. Therefore, CT should always be performed when an occipital trauma is diagnosed.

Key words: • computed tomography • epidural hematoma • posterior cranial fossa • occipital fracture

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Most of the traumatic intracranial pathologies are supratentorial in location. In posterior fossa where traumatic conditions are seen less frequently, epidural hematoma is the most commonly encountered post-traumatic pathology. It has been reported that those located in the posterior fossa constitute only 4%-7% of all epidural hematomas (1, 2). This rare condition can cause severe clinical pictures by quickly increasing in size and brain stem compression. Therefore, early diagnosis of posterior fossa epidural hematoma (PFEH) is very important prognostically (3). Obtaining cranial CT for detecting PFEH that have not caused any clinical findings yet is especially of vital importance. In this study, we evaluated 49 cases that were hospitalized for traumatic posterior fossa conditions during an 18-month period and we included 7 cases with PFEH in our study group. Clinical findings during diagnosis and after treatment, and associated posterior fossa and supratentorial traumatic pathologies of the cases were discussed in the light of the literature.

Materials and methods

Cranial CT examinations of 585 patients who were admitted to our neurosurgery department after severe cranial trauma were evaluated at the time of their admission to the emergency unit during a period of 18 months. Forty-nine cases with traumatic posterior fossa conditions were included in this study. Among the traumatic posterior fossa conditions, epidural hematomas were detected in 7 patients (14.2%). These 7 cases with posterior fossa epidural hematoma were evaluated with regard to age, sex, mechanism of trauma, associated supratentorial and traumatic posterior fossa conditions detected in CT, and Glasgow coma scores (GCS) at presentation, during and after treatment. In all cases, epidural hematoma was diagnosed with CT (General Electric ZXI, Milwaukee, Wisconsin, USA). Axial CT slices were obtained at 15^o angle to the orbitomeatal line with a section thickness of 5 mm for the posterior fossa. Supratentorial sections were obtained in neutral position with 10 mm section thickness. If deemed necessary, thinner sections were added to the studies at the levels of observed pathology. In cases with epidural hematoma in the posterior fossa, associated findings detected in the posterior fossa and the supratentorial area were recorded. Glasgow Coma Scale was used to evaluate the level of consciousness at presentation and clinical status of these patients after treatment or during follow-up (4).

Results

Of the 585 patients who were admitted to our neurosurgery department due to severe cranial trauma during a period of 18 months (January 2003-July 2004) cranial CT examinations showed traumatic posterior fossa conditions in 49 cases (8.4%). Among the traumatic posterior

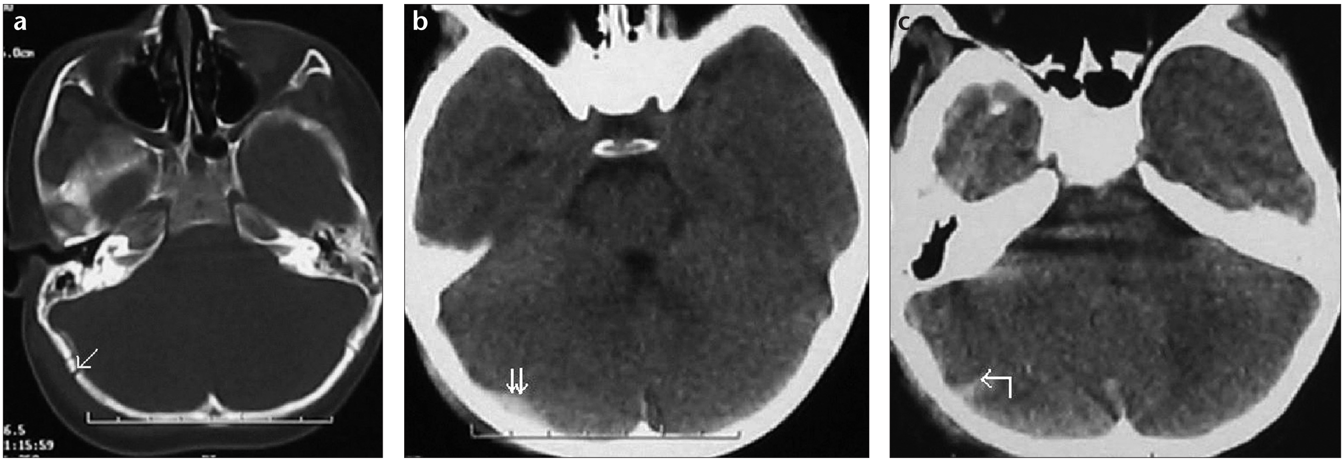

Figure 1. a-c. Five-year-old female patient. CT images. Right occipital bone fracture *(arrow,* **a***)*, acute epidural hematoma *(double arrows,* **b***)* at posterior right cerebellar hemisphere and parenchymal contusional hemorrhage *(angled arrow,* **c***)*.

fossa conditions, epidural hematomas were detected in 7 cases (14.2%) (Table). Of the 49 cases, 29 (59.1%) had only occipital fractures, 19 (38.7%) had occipital fractures associated with supratentorial and/or traumatic posterior fossa condition, one (2%) had post-traumatic subarachnoid hemorrhage. Of the patients with PFEH, 6 (85.7%) were male and one (14.3%) was female. Ages of the patients ranged between 5-35 (mean, 20.4). Causes of injury were falling (four cases), motor vehicle accident (two cases) and non-motor vehicle accident (one case). Of all the patients with PFEH diagnosed with CT, all (100%) had occipital fracture (Figure 1), one (14.2%) had associated cerebellar contusional hemorrhage (Figure 1), one (14.2%) had cerebellar hematoma (Figure 2). Of the 7 patients with PFEH, 3 had (42.8%) associated supratentorial traumatic pathology. These pathologies were right frontal lobe contusional hemorrhage and subarachnoid hemorrhage in two cases (Figure 3) and one had frontal fracture, pneumocephaly and occipital hematoma (Figure 4).

When all cases were taken into account, GCS ranged between 6 and 15 at presentation. The lowest E, M, V (E: eyes, M: motor, V: verbal) was E1M5Ve and belonged to a case with occipital depressed fracture, cerebellar epidural hematoma, right frontal contusional hemorrhage and subarachnoid hemorrhage. The highest E, M, V was E4, M6, V5 and belonged to a case with right occipital fracture and epidural hematoma (Table). Four of the 7 cases with epidural hematoma were operated based on clinical and radiologic evaluation. Three of these cases showed clinical and radiological improvement whereas one case was lost due to respiratory arrest. Two patients, for whom surgery was not planned, were followed up clinically and with CT and hematomas in these cases decreased in size. One case was lost due to cardiopulmonary arrest before he could be operated on. When all cases were considered, the mortality rate was 28.5%. There was no mortality in the cases that were decided to be followed up based on clinical and radiological evaluation. One case (25%) was lost in the group of patients that were operated on. When all cases of occipital fractures were taken into account, the rate of associated epidural hematoma was found to be 14.5%.

Discussion

Epidural hematoma is seen in 1% of patients who present with head trauma. Most of these cases are associated with calvarial fractures. However, epidural hematoma can develop without a fracture. Owing to the increased plasticity of the bones, the rate of developing epidural hematoma without a fracture is higher in children. Epidural hematoma generally develops

Table. Ages, associated pathologic conditions, Glasgow coma scores at presentation and after treatment in seven cases with PFEH

Case	Age	Pathologic condition on CT	Presentation GCS	Discharge GCS
1	12	Right occipital linear fracture, epidural hematoma at this location	E4,M6,V5	E4,M6,V5
2	5	Right occipital fracture and epidural hematoma at the same location	E4,M6,V5	E4,M6,V5
3	28	Left occipital fracture and epidural hematoma at the same location	E4,M6,V5	E4,M6,V5
4	35	Right occipital fracture and epidural hematoma at the same location	E2,M5,V2	E4M6V4
5	21	Right temporooccipital suture separation, right occipital fracture, epidural hematoma in posterior fossa, subarachnoid hemorrhage, right frontal lobe contusional hemorrhage	E3,M5,V4	E4,M6,V4
6	24	Hematoma with a diameter of 2 cm in the left cerebellar hemisphere, left occipital fracture and epidural hematoma, contusional hemorrhage in the right frontal lobe and subarachnoid hemorrhage	E1,M5,V2	NA (exitus)
7	18	Frontal fracture, pneumocephaly, left occipital depressed fracture and epidural hematoma, hematoma in the left occipital lobe	E1,M5,Ve	NA (exitus)

PFEH: posterior fossa epidural hematoma, GCS: Glasgow coma score, E: eyes, M: motor, V: verbal; NA: not applicable

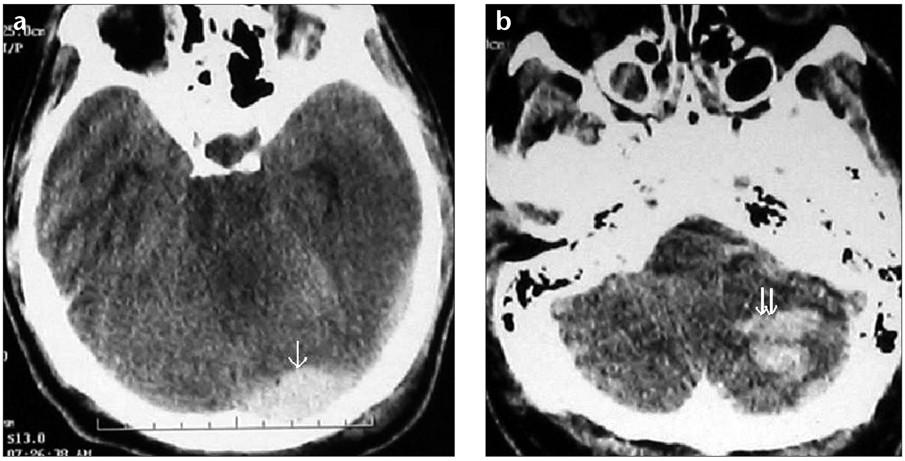

Figure 2. a, b. Twenty-four-year old male patient. CT images. Acute epidural hematoma *(arrow,* **a***)* at posterior left cerebellar hemisphere and hematoma *(double arrows,* **b***)* in left cerebellar hemisphere parenchyma.

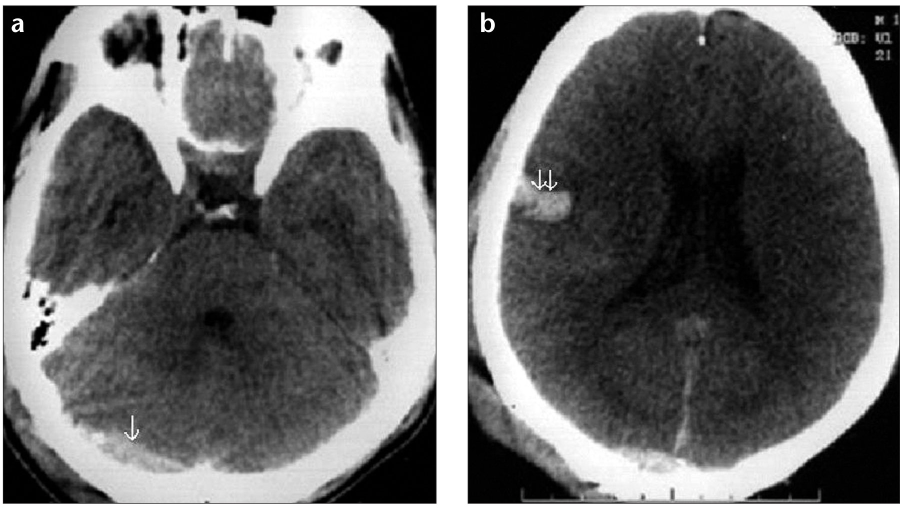

Figure 3. a, b. Twenty-one-year old male patient. CT images. Acute epidural hematoma *(arrow,* **a***)* at posterior right cerebellar hemisphere and traumatic parenchymal hematoma *(double arrows,* **b***)* in right parietal lobe.

by separation of the periosteal dura from the calvarium and rupture of the interposed vessels after trauma. The rupture of the vessel causes a rapid increase in the size of the hematoma. However, if the venous structures are involved, late and chronic clinical pictures may develop. The injured artery is usually the middle meningeal artery in temporoparietal trauma and the anterior ethmoidal artery in frontal trauma (5). PFEH, which is reported to constitute 0.1%-0.3% of all cranial traumatic conditions, is of venous origin in 85% of the cases and develops as a result of injury to the transverse or sigmoid sinuses secondary to occipital fracture (6). The classical history of an epidural hematoma is a short interval of posttraumatic unconsciousness followed by a "lucent period" that lasts for hours, which in turn is followed by somnolence and development of potentially fatal neurological findings secondary to compression. Diagnosing epidural hematoma in the lucent period is life-saving. The treatment of epidural hematoma is surgical except for very small hematomas that are followed-up (7).

Since most of the PFEHs are of venous origin and expand slowly, it takes longer for the clinical picture to develop in PFEH and it is of vital importance to use imaging methods for early diagnosis. Currently, CT has replaced the skull series that were used in order to detect calvarial fractures in patients with posterior fossa trauma. Acute epidural hematoma is seen as a biconvex hyperdense mass located between the brain and the bone on non-enhanced CT. If the blood continues to accumulate rapidly, one can see hypodense areas within the lesion. On MR imaging, acute epidural hematoma is seen as a localized extra-axial collection between the dura and the inner table. Imaging of the dura as a line with very low signal between the hematoma and the brain parenchyma is pathognomonic for epidural hematoma. While it is not always possible to differentiate small epidural hematomas that have not formed a biconvex shape yet due to small volume, demonstration of dura between the parenchyma and the hematoma is diagnostic on MR imaging. Also, MR imaging is more sensitive in the detection of associated parenchymal conditions or dural venous sinus thromboses possibly associated with PFEH (5, 8). In recent studies, it has been reported that with diffusion-weighted MR images with very short acquisition times, dural venous sinus thrombus and early ischemic changes could easily be demonstrated, but no additional benefit from the diffusion-weighted imaging has been defined in the evaluation of acute epidural hematoma (9). Since obtaining an MR imaging study is difficult in unstable trauma patients, the initial imaging of choice and the most commonly used method is still unenhanced CT. In our study, of the 49 patients with a traumatic posterior fossa condition, 59% had only occipital fracture. When this group of patients is excluded from the study, the rate of epidural hematoma in the group with traumatic pathology associated with occipital fracture is found to be 35%. Other conditions include subarachoid hemorrhage in 15%, occipital and temporal fracture in 15%, supratentorial subdural hematoma in 10%, cerebral edema in 5%, cerebellar parenchymal pathology in 5%, supratentorial parenchymal hematoma in 5%. When the patients with only occipital fractures are excluded, in concordance with the literature, the most commonly encountered posterior fossa traumatic pathology was epidural hematoma. In the literature it has been reported that, PFEHs are most commonly encountered in the first decade (3, 10). In our study only two of the 7 cases were children. However, since our hospital does not have a pediatrics department this result may be misleading. All of our cases with PFEH had ipsilateral occipital fractures.

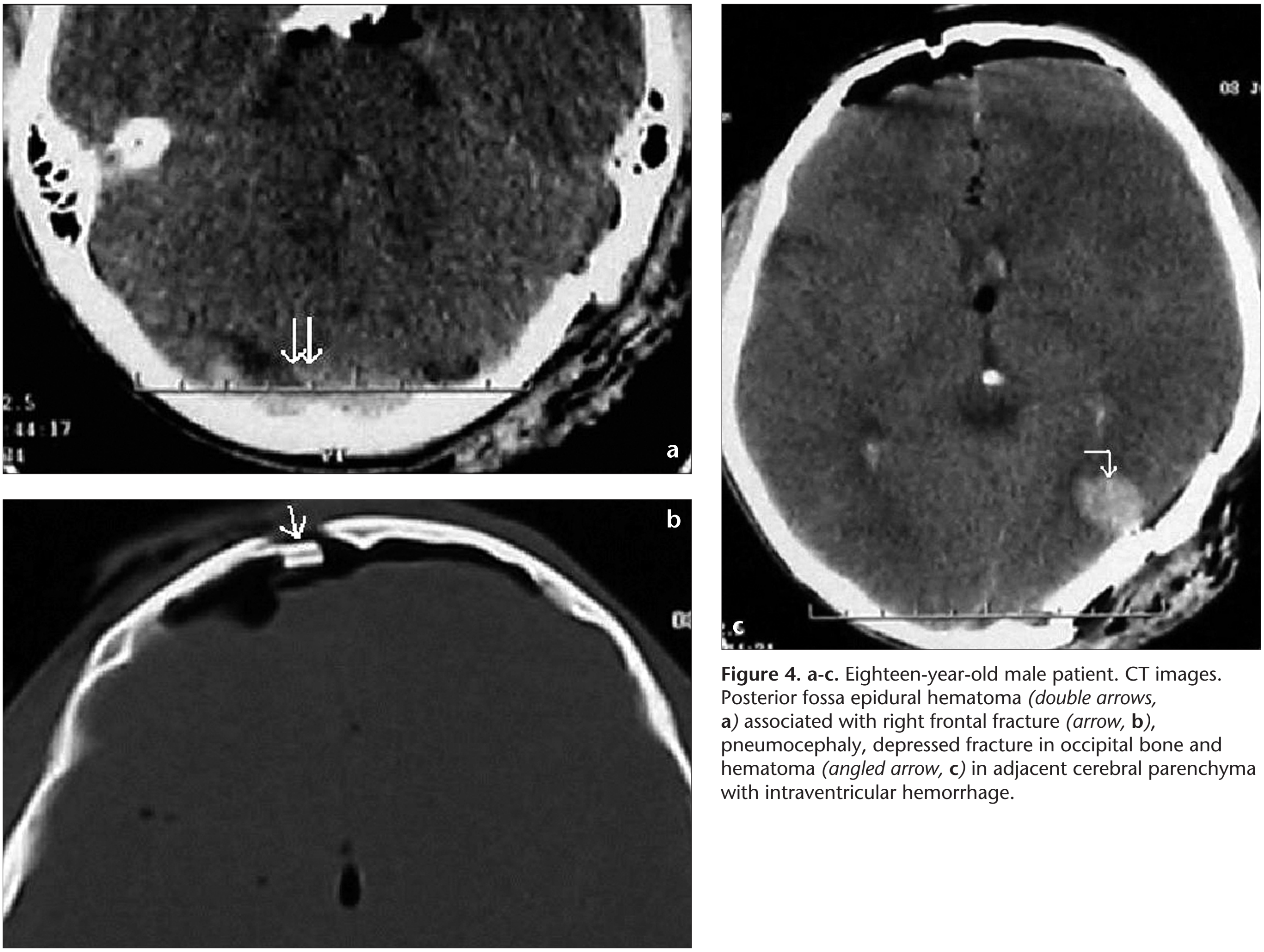

Figure 4. a-c. Eighteen-year-old male patient. CT images. Posterior fossa epidural hematoma *(double arrows,* **a***)* associated with right frontal fracture *(arrow,* **b***)*, pneumocephaly, depressed fracture in occipital bone and hematoma *(angled arrow,* **c***)* in adjacent cerebral parenchyma with intraventricular hemorrhage.

As previously reported, occipital fracture is a good marker to detect the localization of the PFEH (2, 6, 11-14). Of the four cases with PFEH but without any associated traumatic pathology, three had a GCS of E4,M6,V5 and completely normal neurologic examination at presentation. Only one case was E2,M5,V2. Two of these 4 cases were treated conservatively, whereas two cases including the one with low GCS and another with increased hematoma size on follow-up CT were operated on. All four cases had complete recovery after treatment and follow-up. For this reason, obtaining a CT after trauma to detect early stage small PFEHs and to have the chance of early treatment is of vital importance. Especially, all of the patients who have occipital fractures on skull series should have cranial CT to detect a possible PFEH.

Three of the seven patients had supratentorial pathology associated with PFEH. These associated lesions were contusion in the frontal lobe, and subarachnoid hemorrhage in two cases, fracture in the frontal bone and hematoma in the left occipital lobe in one case. In the literature, supratentorial pathologies associated with PFEH are reported to be seen in 50%-87.5% of the cases (11, 15, 16). These lesions, as in our cases, are usually seen in the form of contusion and parenchymal hematoma in the frontal lobe and form as a result of counter-coup mechanism (16-18). GCSs of these three cases were 6, 9, 12 at presentation. One of these cases was lost before he could be operated on. While one of the cases that were operated recovered, the other died. To determine and define in detail the supratentorial pathologies, which are rather deterministic in terms of prognosis, is important. By having a short acquisition time, allowing demonstration of occipital fractures that are associated with great majority of PFEHs, defining the size and mass effects of the hematoma and providing visualization of possible supratentorial conditions that are reported to be associated with half of the cases in the literature, cranial CT examination has earned a place as an effective imaging method (11, 19). Early cranial CT examination should be performed routinely in patients who do not have any neurological findings as well. Furthermore, considering small occipital fractures can be overlooked during physical examination and plain film studies, patients with cranial trauma involving the posterior fossa should definitely be examined with cranial CT. By effectively demonstrating early PFEHs without clinical findings and the associated pathologies, and allowing early treatment, CT can be life-saving.

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