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ORIGINAL ARTICLE

Pediatric Posterior Fossa Epidural Hematomas

Pediatrik Posterior Fossa Epidural Hematomlar

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ABSTRACT

Aim: Posterior fossa epidural hematoma (PFEDH) in the pediatric age group is a very rare condition and the treatment method is still a matter of debate. The aim of this study is to evaluate the observation results in the management of pediatric patients with PFEDH in our tertiary care hospital and to investigate the importance of the relationship of the hematoma with the cerebral venous sinuses, which has not been investigated before in the literature, in the treatment decision.
Materials and Methods: This is a retrospective study conducted at Selcuk University, Faculty of Medicine. All patients (≤ 17 years) diagnosed with PFEDH between January 2010 and May 2022 were included in this study. Demographic data, clinical signs, trauma type and symptoms at presentation, CT findings, type of treatment, and outcomes were collected. CT findings including hematoma thickness, hydrocephalus, presence of fourth ventricular compression, relation with cerebral venous sinuses and other associated brain injuries were evaluated.
Results: The patient group consists of two girl and six boy. The most common cause of PFEDH was a fall from a height resulting in a blow to the back of the head in four patients. Vomiting was the most frequent presenting symptom. Four patients had a relation between cerebral venous sinuses and hematoma, and two of these patients underwent surgical treatment.
Conclusion: In addition to criteria such as hematoma thickness, GCS, hydrocephalus, and compression of the fourth ventricle, we determined that the relationship of hematoma with venous sinuses is a criterion to be evaluated.

Key words: Posterior fossa, Epidural hematoma, Pediatrics

ÖZ

Amaç: Pediatrik yaş grubunda posterior fossa epidural hematom (PFEDH) çok nadir görülen bir durumdur ve tedavi yöntemi halen tartışmalıdır. Bu çalışmanın amacı üçüncü basamak hastanemizde PFEDH'li çocuk hastaların yönetiminde gözlem sonuçlarını değerlendirmek ve literatürde daha önce araştırılmamış olan hematomun serebral venöz sinüslerle ilişkisinin önemini araştırmaktır. , tedavi kararında.
Gereç ve Yöntem: Bu, Selçuk Üniversitesi Tıp Fakültesi'nde yürütülen retrospektif bir çalışmadır. Ocak 2010 ile Mayıs 2022 arasında PFEDH tanısı alan tüm hastalar (≤ 17 yaş) bu çalışmaya dahil edildi. Demografik veriler, klinik belirtiler, travma tipi ve başvuru sırasındaki semptomlar, BT bulguları, tedavi tipi ve sonuçlar toplandı. Hematom kalınlığı, hidrosefali, dördüncü ventriküler kompresyon varlığı, serebral venöz sinüslerle ilişkisi ve diğer ilişkili beyin yaralanmalarını içeren BT bulguları değerlendirildi.
Bulgular: Hasta grubu iki kadın ve altı erkekten oluşmaktadır. PFEDH'nin en yaygın nedeni, dört hastada başın arkasına darbe ile sonuçlanan bir yükseklikten düşme idi. Kusma en sık başvuru semptomuydu. Dört hastada serebral venöz sinüsler ile hematom arasında ilişki vardı ve bu hastalardan ikisine cerrahi tedavi uygulandı.
Sonuç: Hematom kalınlığı, GKS, hidrosefali, dördüncü ventrikül basısı gibi kriterlere ek olarak hematomun venöz sinüslerle ilişkisinin değerlendirilmesi gereken bir kriter olduğunu belirledik.

Anahtar Kelimeler: Posterior fossa, Epidural hematom, Pediatrik

Introduction

Posterior fossa epidural hematoma (PFEDH) is rarely seen among traumatic brain injuries, their rate among all epidural hematomas ranges between 1.2% and 15% for all age groups (1-3). PFEDHs may have a slightly higher incidence among the pediatric age group (4, 5). Because of the risk of nonspecific symptoms and neurological deterioration in children, early computed tomography (CT) scanning resulted in an increased incidence of lesions and possibly a better prognosis (6-8). PFEDH treatment is still controversial. While it is conservative for most PFEDH patients, some patients require immediate surgical treatment. In this study, we present data from 8 pediatric patients with PFEDH who were treated surgically or conservatively over 12 years. The aim of this study is to evaluate the observation results in the management of PFEDH in our tertiary care hospital and to investigate the importance of the relationship of the hematoma with the cerebral venous sinuses, which has not been investigated before in the literature, in the treatment decision.

Materials and Methods

All pediatric patients (≤ 17 years of age) diagnosed with PFEDH between January 2010 and May 2022 were included in this study. Clinical and radiographic data were obtained from electronic hospital records and analyzed retrospectively. Demographic data, clinical signs, trauma type and symptoms at presentation, CT findings, type of treatment, and outcomes were collected. At admission, CT scans of all suspected patients with a history of head trauma were obtained.

The Glasgow Coma Scale (GCS) was used to assess neurological status at admission, during and after treatment. CT findings including hematoma thickness, hydrocephalus, presence of fourth ventricular compression, relation with cerebral venous sinuses and other associated brain injuries were evaluated.

The treatment decision was made according to the clinical condition of the patient as well as the thickness of the hematoma. Patients with hematoma thickness ≤ 10 mm, without compression on the fourth ventricle, without hydrocephalus, were treated conservatively. Patients with large hematoma thickness (≥10 mm) or the presence of fourth ventricle compression or hydrocephalus or a GCS score of less than 14 (Unless there is another accompanying intracranial injury to explain low GCS) were treated surgically.

At presentation, a neurosurgeon and pediatric emergency physician performed an initial neurological examination for all patients. All patients with evidence of PFEDH were admitted to the neurosurgery or pediatric intensive care unit. Neurological assessments were performed every 30 minutes for the first 24 hours; Then, hourly GCS examinations were performed on all patients. Follow-up CT scans were performed after 2 h and 6 h of admission or if any neurological deterioration occurred. Surgery was performed on patients in cases of neurological regression or increased intracranial pressure. Postoperative CT scan was done for all patients.

Results

The patient group consists of two girl and six boy. The age of the patients was between 6 months and 16 years. The mean time the interval between trauma and admission at the hospital was 3 hours. It was a minimum of 2 hours and a maximum of 96 hours.

The most common cause of PFEDH was a fall from a height resulting in a blow to the back of the head in four patients (50%). Another remarkable reason is the motorcycle accident (37.5%). The patients did not wear a helmet at the time of the accident. 7 patients (87.5%) were brought to the hospital within 24 hours after injury, and one patient (12.5%) within 96 hours.

GCS scores were used to evaluate the consciousness levels of the patients at the time of admission. Four patients (50%) had a GCS score of 15, two patients had a GCS score of 13-14 (12.5%), and two patients had a score of less than 12. Symptoms and clinical presentation findings were headache in four patients (50%), vomiting in five patients (62.5%), loss of consciousness in three patients (37.5%), one patient was asymptomatic (12.5%), otorrhea in two patients (25%) and two patients (25%) had rhinorrhea. Non-contrast head CT scans including bone window settings were obtained in all patients. Epidural hematoma was present in the posterior cranial fossa in all cases. The thickness of the hematomas varied from 4 to 15 mm. The mean thickness of the clot was 6,83 mm in the conservative group, and 14 mm in the surgical group.

One patient had bilateral, six patients had left, one patient had right lateralizing hematoma. Occipital bone fractures were observed in six patients (75%), and three patient (37,5%) had contusion. Pneumocephalus was seen in five patients (62.5%) and traumatic subarachnoid hemorrhage in three patients (37.5%). Four patients had a relation between cerebral venous sinuses and hematoma, and two of these patients underwent surgical treatment. Three patient has epidural hematoma other than posterıor fossa. Clinical and radiological features are summarized in Tables 1 and 2.

Surgery was performed immediately in one patient (72.5%), and surgery was performed in one patient after increased hematoma in the follow-up of trauma. (Figure 1)

One patient had a GCS of 15 although there was a compression effect on the fourth ventricle. Hydrocephalus did not develop. The thickness of thehematoma did not increase in the patient who was followed up as GCS 15 andsurgery was not performed. One patient had a GCS of 9, but this patient also had subarachnoid and epidural hematomas and diffuse axonal injury. There was no pressure on the fourth ventricle, there was no hydrocephalus, and conservative treatment was applied.

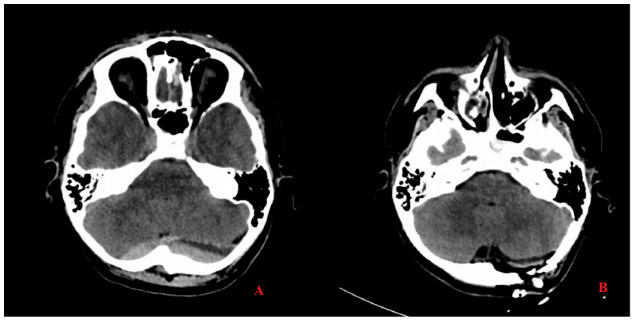

Figure 1: A) Preoperative CT scans revealing a large bilateral PFEDH in a 16-year old boy, displacing the fourth ventricle B)Postoperative CT scans obtained in the same patient

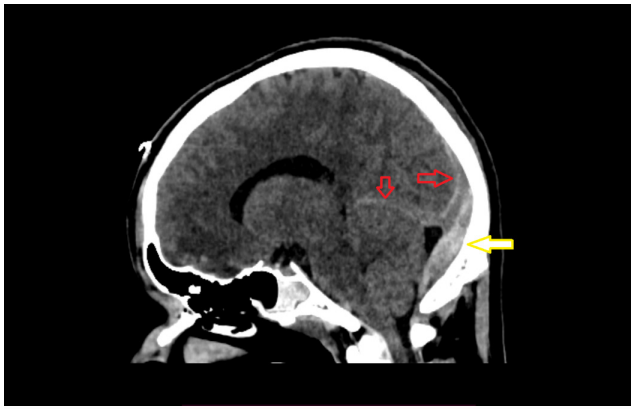

Figure 2: Red arrows: Superior sagittal sinüs and straight sinüs Yellow arrow: Relation of cerebral venous sinuses with hematoma

Table 1: Summary of clinical fetaures of patients with PFEDH

Clinical Features	Treatment		Total (%) (n=8)
	OP (N=2)	NO OP (N=6)	
Admission GCS score			
3-7	0	0	0
8-12	2	1	3(37.5)
13-15	0	5	5(67.5)
The interval between trauma and admission			
<24 h	2	5	7(87.5)
24-48 h	0	0	0
>48 h	0	1	1(12.5)
Trauma type			
Fall from a height	0	4	4(50)
Motor vehicle accident	2	1	3(37.5)
Hit by a stick	0	1	1(12.5)
Symptoms & signs			
Headache	2	2	4(50)
Vomiting	2	3	5(62.5)
Loss of consciousness	2	1	3(37.5)
Asymptomatic	0	1	1(12.5)
Rhinorrhea	1	1	2(25)
Otorrhea	1	1	2(25)

Table 2: Summary of radiological fetaures in patients with PFEDH

Radiological Features	Treatment		Total (%) (n=8)
	OP (N=2)	NO OP (N=6)	
Thickness of hematoma (mm)			
<5	0	2	2(25)
5-10	0	4	4(50)
>10	2	0	2(25)
Laterality			
Right	0	1	1(12.5)
Left	1	5	6((75)
Bilateral	1	0	1(12.5)
Accompanying lesions			
Occipital bone fracture	2	4	6(75)
Contusion	2	1	3(37.5)
Pneumocephalus	2	3	5(62.5)
Traumatic SAH	2	1	3(37.5)
Subdural hematoma	0	0	0
IVH	0	0	0
Epidural hematoma	1	2	3(37.5)
Others bone fracture	1	2	3(37.5)
Relation with cerebral venous sinuses	2	2	4(50)
Mass effect			
4th ventricle compression	2	0	2(25)
Ventriculomegaly	2	0	2(25)

Discussion

Traumatic posterior fossa epidural hematoma (PFEDH) is a very rare clinical condition. It constitutes 1.2-15% of all epidural hematomas in the literatüre (2). After the introduction of CT scanning, the incidence and diagnosis of PFEDH in the pediatric age group have increased in the literature (2, 8, 9). In this 12-year single-center study, we describe our experience in the surgical and conservative management of pediatric patients with PFEDH.

In our study, we found that male patients were predominantly affected more, which was consistent with the literature (2, 10). The most common cause of pediatric PFEDHs is falling, our study is consistent with the literature (1, 8). Motorcycle accident was the second most common cause in our study. It was especially common in older children who did not use helmets.

The interval between trauma and admission at the hospital was less than 24 hours in the majority of patients (87.5%). One patient had an admission 96 hours later. The patient was asymptomatic. In addition, patients who required surgery were among the patients who applied within the first 24 hours.

In our study, most of the patients (67,5%) had mild head trauma (GCS 13-15), and three patients had moderate head trauma. Cases of severe head trauma have been reported very little in the literature (2, 8, 9, 11). The GCS score at admission is an important factor affecting prognosis and mortality in children with PFEDH. However, it should be considered that low GCS may also occur due to other accompanying intracranial injuries. In addition, we think that CT scanning should be performed in all patients with head trauma who are suspected of trauma from the occipital region. Because some patients with PFEDH had a GCS score of 15 and patients were asymptomatic. In patients treated conservatively, sequential follow-up CT scans should be performed, particularly within the first 72 hours of admission, which is most critical for hematoma growth. The first follow-up CT images of our conservatively treated patients were taken two hours after the trauma, then at the sixth hour, and at the twenty-fourth hour if there was no increase in the hematoma to rule out hematoma enlargement.

Occipital bone fractures are present in approximately 85% of PFEDH patients and have been frequently reported in the literature (1, 8). In one study, the authors reported that 79.2% of patients had PFEDH-related occipital bone fractures (11). In our study, occipital bone fractures were detected in 75% of the patients. The presence of such a fracture is a reliable indicator for the development of a hematoma.

The incidence of bilateral hematoma is a relatively rare finding (10). Bilateral hematoma was detected in only one patient in our study, with a percentage of 12.5%, which is consistent with other studies. The incidence of mass effects such as hydrocephalus in pediatric PFEDH patients is rare and the presence of PFEDH-related hydrocephalus is an indicator for poor prognosis (9). In our study, hydrocephalus occurred in two patients and both were treated surgically. In addition, PFEDH may be associated with other concomitant traumatic intracranial lesions, including brain contusion, subarachnoid hemorrhage, epidural hematoma. We detected associated lesions in four of our patients (50%), similar to previous reports (1, 11).

The proximity or relation of the hematoma with the cerebral venous sinuses is very important in surgical decision making. In our study, epidural hematomas were related with cerebral venous sinuses in four patients.(Figure 2) Our patients who required surgery were in this patient group. We found that epidural hematoma originated from cerebral venous sinuses in patients underwent surgery. Generally, epidural bleeding was controlled with primary dura suspension sutures. However, even if a conservative treatment decision is made in hematomas related with cerebral venous sinuses, the patient should be followed very closely. In addition, PFEDH related with cerebral sinuses should not be taken in the sitting position during surgery due to the risk of air embolism, and should preferably be taken in the prone position. Additional examinations should be performed in terms of cerebral venous sinus injury, and preoperative preparations should be made according to venous sinus injury, if necessary.

The mainstay treatment of PFEDH is surgical evacuation (9). However, criteria for emergency surgery or conservative treatment are controversial (1, 12). Most studies list indications for surgery such as hematoma thickness > 10 mm, fourth ventricular compression/ displacement, and the presence of hydrocephalus. (1, 2, 10). Chaoguo et al. (11) suggested that patients with a hematoma volumes≥15 mL or the presence of fourth ventricle compression/displacement and/or obstructive ventriculomegaly should be immediately evacuated. Prasad et al. (8) concluded that patients who underwent a CT scan showing a hematoma volume>20 mL or fourth ventricle compression/ displacement with or without ventriculomegaly should be surgically treated. We consider it impractical to use the hematoma volume. Especially bilateral hematomas, even if the volume is large, may not cause a compression effect because the hematoma spreads over a large area. In addition, it is very difficult to calculate the volume in routine CT (4-5 mm interval) in an emergency situation. Like Sencer et al. (1) we used hematoma thickness instead of volume as a surgical criterion in our study. Sencer et al. reported that all patients with a hematoma thickness≤of 5 mm were treated conservatively. Additionally, Kaushik and Sandip (13) have analyzed the previously published studies about PFEDH and suggested that a hematoma thickness more than 10 mm, cisternal obliteration, 4th ventricle distortion, and brainstem compression are indications for immediate surgical evacuation.

In this study, all patients with hematoma thickness ≥ 10 mm or obstructive hydrocephalus and a GCS score below 14 were evacuated with surgical treatment. However, these criteria alone are not sufficient. For example, low GCS may be due to other accompanying intracranial injuries. Because other intracranial injuries accompanying PFEDH are quite common. Compression to the fourth ventricle is also a very important criterion, but it can be followed conservatively as long as it is not accompanied by brain stem compression or hydrocephalus. Pediatric age group is a very wide age range, as patients under 18 years of age. It is quite difficult to evaluate a one-month-old baby and a 17-year-old patient with the same criteria. A 1-month-old patient may require surgery with a hematoma thickness of 4 mm, but a 16-year-old patient may require conservative treatment with 10 mm. For this reason, in the pediatric patient group, each patient should be evaluated separately and the treatment method should be decided.

In our study, in addition to these criteria, we think that the relationship of hematoma with cerebral venous sinuses may be effective in surgical decision making. Epidural hematomas of all the patients we underwent surgery were related with cerebral venous sinuses. No increase in hematoma thickness was observed during follow-up in non-related hematomas. We think that it would be useful to evaluate the relationship of hematoma with cerebral venous sinuses, especially in the patient group who have difficulty in deciding the treatment.

The criteria for conservative management differ from one study to another (1, 8). However, if conservative treatment is decided, frequent brain CT scans should be followed up. Because clinical progress is silent and slow, but the deterioration is sudden and quick to become fatal if not promptly treated. Early recognition is therefore extremely important.

Conclusion

There is still no clarity in the treatment decision of patients with PFEDH in the pediatric group. Many studies have been conducted on conservative and surgical treatment criteria. In addition to criteria such as hematoma thickness, GCS, hydrocephalus, and compression on the fourth ventricle, we determined that the relationship of hematoma with venous sinuses is a criterion that should be evaluated. In the pediatric group, For the surgical decision in the pediatric group, each patient should be evaluated separately. Delayed surgery may increase the risk of death in patients with PFEDH. Therefore, to reduce morbidity and mortality, we suggest that surgery should never be delayed after the surgeon decides that the hematoma needs

to be surgically drained. In case of suspicion, surgical treatment should be applied without delay.

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