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Traumatic Posterior Fossa Extradural Haematomas (PFEDH)

E C M Wang, A Y T Lim, T T Yeo

ABSTRACT

Objectives: While posterior fossa extradural haematomas (PFEDH) may lead to rapid neurological deterioration and death because of brainstem compression, prompt treatment often leads to a good outcome. The non-specific clinical signs and the rarity of this lesion in craniocerebral trauma adds to the difficulty in diagnosis. The aim of this study was to identify features which could lead to an early diagnosis.

Method: Seventeen patients with posterior fossa extradural haematomas were operated on over 4 1/2 years, accounting for 7.5% of the 226 surgically operated extradural haematomas in the Department of Neurosurgery, Tan Tock Seng Hospital, Singapore. Four patients were excluded from this study due to non-availability of the case records. The remaining 13 patients formed the study group in this retrospective analysis.

Results: The majority of cases (77%) presented acutely within 24 hours. The mechanism of injury varied from a fall in 7 cases, a road traffic accident in 4 cases and assault in 2. Nine patients had evidence of external injury to the occiput, 8 patients had skull fractures, and diastasis of the lambdoid suture was seen in 2 cases. Presence of aerocele was noted in the CT scan of 4 cases. All 9 cases admitted with a high GCS score of more than 8 had a very good outcome.

Conclusion: An early CT scan head is recommended if a combination of the following features is present: occipital soft tissue injury, drowsiness, occipital fracture or diastasis of the lambdoid suture.

Keywords: posterior fossa extradural haematoma, drowsiness, occipital fracture, aerocele, lambdoid suture

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INTRODUCTION

Extradural haematomas of the posterior fossa are a rare but serious complication of head injuries. Extradural haematomas (EDH) occur in less than 2% of patients admitted with craniocerebral trauma[1], while in most series, posterior fossa extradural haematomas themselves account for 4% to 12.9% of all EDH[2].

The clinical diagnosis of PFEDH is difficult as the presentation and signs are non-specific. The signs and symptoms of PFEDH are due to medullary compression, cerebellar dysfunction and raised intracranial pressure. The classical manifestations of supratentorial extradural haematomas such as a lucid interval, lateralising signs and Cushing's response are absent[3]. If PFEDH are not detected on time, compression of brain stem structures may lead to rapid deterioration. On the other hand, early surgical intervention leads to a good outcome[4]. PFEDH may be missed with fatal consequences if one is not alert to its possibility[5]; hence the aim of this study was to identify features which could lead to an early diagnosis.

METHODS

From January 1991 to August 1995, there were 226 cases of surgically operated extradural haematomas in the Department of Neurosurgery, Tan Tock Seng Hospital, Singapore. Of these, 17 cases (7.5%) were posterior fossa extradural haematomas. Four cases have been excluded from this study because of non-availability of records. The remaining 13 cases were studied retrospectively.

Clinical findings were assessed upon admission and the level of consciousness classified according to the Glasgow Coma Scale (GCS)[6]. The clinical course was classified into acute, subacute and chronic varieties as described by Hooper[7]. Acute cases present within 24 hours of trauma, subacute cases become apparent 24 hours to 7 days later while chronic cases some weeks or months later. The diagnostic investigation in 12 out of 13 cases was carried out by way of a CT scan. The other case was diagnosed by MRI in another hospital. All cases were surgically evacuated. The outcome of each case was assessed using the Glasgow Outcome Scale (GOS)[8] between 3 to 6 months post-injury.

RESULTS

The ages of the patients ranged from 4 to 38 years with a mean age of 23. Twelve out of the 13 patients were males. The modes of trauma were a fall in 7 cases, a road traffic accident in 4 cases and assault in 2. In 10 cases, the PFEDH was the only significant intracranial injury. Ten cases followed an acute course; 3 cases were classified as subacute. There were no cases falling into the chronic category (Table I).

The incidence of PFEDH was 7.5% of all surgically operated EDH. The clinical presentation of all the cases was generally non-specific. Three out of 13 cases (23.1%) were not involved in any episode

Table I

No.	Mode of Injury	LOC	GCS on arrival	Neurological findings	Clinical course	BP stable	Other injuries	Occipital soft tissue injury	Skull X-ray
1.	RTA	Y	14	nil	Acute	Y	Lacerations, base of skull #	nil	nil
2.	Fall	Y	6	Power 3 both UL, O both LL	Acute	Y	# C5, #-dislocation L2, # L3	Occipital laceration	nil *
3.	Fall	N	15	nil	Subacute	Y	nil	nil	not done
4.	Assault	Y	14	nil	Acute	Y	nil	Occipital laceration	Fracture
5.	Fall	Y	12	nil	Acute	Y	nil	Occipital laceration	Fracture
6.	Fall	N	14	nil	Acute	Y	nil	nil	nil *
7.	RTA	Y	15	nil	Subacute	Y	Haematoma – periorbital & left shoulder	Haematoma	nil
8.	Assault	Y	3	Pupils 2/2 fixed, no gag, no doll's	Acute	Hypotensive	Multiple stab wounds	Occipital laceration	nil *
9.	Fall	Y	4	Pupils 5/5 fixed, power 3 bilaterally, hypereflexia	Acute	Y	nil	Occipital laceration	Fracture
10.	RTA	Y	15	nil	Acute	Y	# right ankle	Abrasions over occiput	Diastasis of lambdoid suture
11.	Fall	N	15	nil	Subacute	Y	nil	Haematoma over occiput	Diastasis of lambdoid suture *
12.	RTA	Y	7	Aniscoria, right hemiplegia	Acute	Y	nil	Haematoma over left occiput	Fracture
13.	Fall	Y	12	nil	Acute	Y	nil	Haematoma over occiput	nil

* Fracture seen only intra-operatively RTA – road traffic accident
\# Fracture

of unconsciousness. In 76.9% (10 out of 13) of the cases, however, some form of superficial injury in the occipital region was present and took the form of either a laceration or a haematoma (Table I). A specific history of a blow to the back of the head was present in 3 out of 13 cases (23%).

Fracture of the occipital bone was also a common feature being detected in 61.5% (8 out of 13) of the PFEDH's at operation. However, only 4 out of these 8 fractures were seen on X-ray of the skull. Diastasis of the lambdoid suture was noted in 2 cases.

A CT scan revealed supratentorial occipital extension of the haematoma (Fig 1a) in 7 cases (53.8%) while 3 cases (23.1%) had other significant supratentorial lesions. Aerocele was seen in 4 out of 8 of the scans associated with a fracture (Table II). A mass effect caused compression of the basal cistern and fourth ventricle (Fig 1b) concurrently in 8 out of 12 cases.

In 5 out of 13 (38.5%) cases, bleeding was noted intra-operatively to have been of venous origin. However, in 6 out of 13 (46.2%) cases, the source of bleeding could not be seen.

Arterial bleeding was found only in 1 case while in another case, oozing from the dura was believed to have contributed to the PFEDH.

There was no obvious correlation between the size of the haematoma, the course of the injury and the GCS on admission (Table III).

DISCUSSION

Extradural haematomas are classically located in the temporal region[1], often as a result of a torn middle meningeal vessel secondary to temporal bone fracture. While bleeding in over 50% of cases is due to the middle meningeal artery, the middle meningeal vein is the source of the haematoma in 30% of cases. Less common sources are the diploic veins or torn dural venous sinuses. Posterior fossa extradural haematomas, however, do not present like the classical extradural haemorrhages in the supratentorial compartment. The typical findings of headache, lucid interval, hemiparesis and aniscoria are often not present. This difference has been attributed to the location of the haematoma and also to the source of bleeding[9]. Bleeding is thought to be venous[2] in most cases.

The symptoms and signs of a PFEDH are usually varied and non-specific[10-12]. In acute presentations, with the onset of symptoms within 24 hours, there is compression of brainstem structures which may lead to rapid deterioration[11]. The clinical course is that of increasing stupor, respiratory abnormalities, marked flaccidity and hypotonia of the extremities[13].

In subacute presentations, with the onset of symptoms within 24 hours to 7 days, there is slower expansion of the extradural haemorrhage, permitting accommodation of brainstem and cerebellar structures. Cerebellar and medullary dysfunction occur, along with hydrocephalus[11]. Clinically, there

Table II

No.	Clinical course	Site	Supra-tentorial extension	Midline shift	Comp. of basal cisterns	Comp. of 4th ventricle	Hydro-cephalus	Other clots	GCS	Aerocele
1.	Acute	Left PF & occipital	Occipital	Mild	Yes	Mild	No	nil	14	nil
2.	Acute	Left PF & occipital	Occipital	Yes	Yes	Yes	Yes	nil	6	nil
3.					MRI					
4.	Acute	Right PF & occipital	Occipital	Mild	Yes	No	No	nil	14	nil
5.	Acute	Right PF & occipital	Occipital	No	Yes	Yes	No	nil	12	Present
6.	Acute	Left PF	nil	No	Mild	No	No	nil	14	nil
7.	Subacute	Left PF	Left occipital	No	Yes	Yes	No	nil	15	Present (left temp.)
8.	Acute	Bilateral PF & occipital	Occipital	No	Yes	Yes	No	nil	3	nil
9.	Acute	Right PT to PF	Right PT, no occipital	No	Yes	Yes	No	Right PT	4	nil
10.	Acute	Left Pf & occipital	Occipital	Mild	No	No	No	nil	15	nil
11.	Subacute	Left PF & occipital	Left occipital	No	No	No	No	nil	7	Present
12.	Acute	Left PT, left PF	Left occipital	No	Yes	Yes	No	Left PT	7	Present
13a.	Acute	PF	nil	No	Yes	Yes	No	Left FT	12	nil
13b.	Acute	PF	nil	Mild	Yes	Yes	Yes	Left FT	12	nil

PF : Posterior Fossa
PT : Parietal Temporal

Table III

GCS	No. of cases	(%)	Good result	(%)	Moderate disability	(%)	Severe disability	(%)	Death	(%)
15 – 14	7	(54)	7	(100)	0		0		0	
13 – 8	2	(15)	1	(50)	1	(50)	0		0	
7 – 3	4	(31)	2	(50)	0		1	(50)	1	(25)

are cerebellar signs, nystagmus and truncal ataxia; there is also neck stiffness and long tract signs.

The chronic course with the onset of symptoms appearing weeks or months after the trauma are rare[2,12]. None of the cases in this study presented with a chronic course.

Our experience echoes the findings of other series with regard to the sequence of neurological findings in PFEDH. It must be noted, however, that in most cases, cerebellar involvement was not specifically excluded and that examination was directed more towards the deterioration of conscious level and lateralising signs. One point of interest is that unilateral mydriasis was only noted in 1 out of 13 patients who also had a left parietal-temporal extradural haematoma (case 12) while the incidence in the literature ranges from 10% to 21.4%[12]. Mydriasis is attributed to third nerve compression by cerebellar herniation through the incisura.

The most consistent feature was an external injury to the occiput. Ten out of 13 cases (76.9%) had evidence of local trauma to the back of the head (Table III). Evidence of an occipital laceration, haematoma or abrasions should direct the physician to exclude a PFEDH[11]. An occipital laceration or haematoma found on either side of the midline has also been reported as being a reliable indicator for the location of the haematoma on the same side[2].

Thus, the combination of loss of consciousness and drowsiness with occipital soft tissue injury should arouse the highest degree of suspicion of a PFEDH. These features may have been overlooked in Case 8. He was a 23-year-old Malay male who was assaulted and was admitted in a deep coma (GCS of 3), his pupils were 2 mm in diameter, fixed bilaterally and brain stem signs were absent. He underwent an immediate thoracotomy as he was hypotensive with deep lacerations over the thorax. An occipital laceration detected on admission did not arouse suspicion and a CT scan of the brain was done only 8 hours after the thoracotomy. This showed a PFEDH. It was evacuated but the patient died 4 days later.

A specific history of direct trauma to the back of the head is also significant[11,13]. Three out of 13 cases (23.1%) had a history of a direct blow to the occiput. Of these, one case (Case 6) did not have any evidence of soft tissue injury to the occiput. He was a 6-year-old Chinese boy who fell backwards while trying to climb into a baby cot, hitting his occiput. He subsequently vomited several times and complained

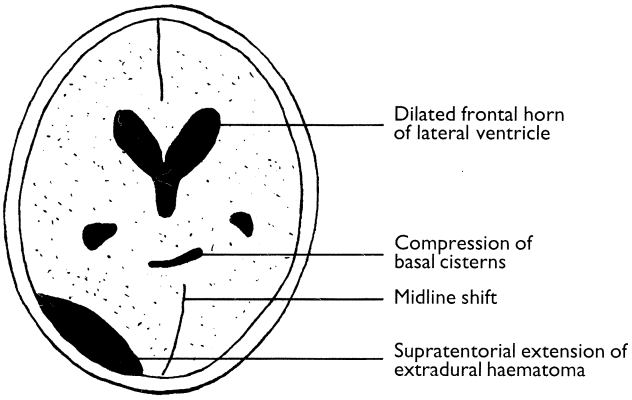

Fig 1a – Line drawing to illustrate a supratentorial extradural haematoma with compression of the basal cisterns and midline shift. The frontal horn of the lateral ventricle is dilated (hydrocephalus).

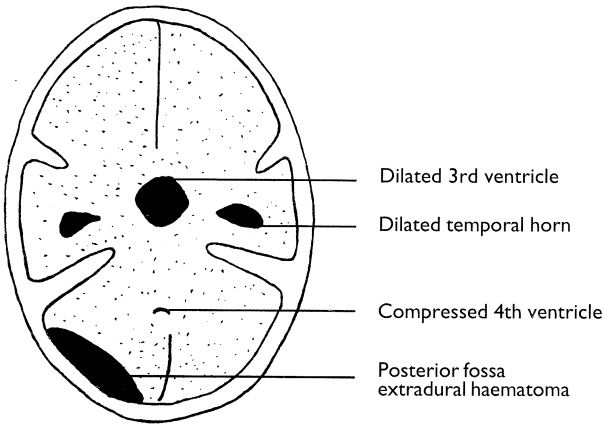

Fig 1b – A posterior fossa extradural haematoma with compression of the 4th ventricle. There is dilatation of the 3rd ventricle and temporal horn (hydrocephalus).

of giddiness and headache. On admission, the patient was slightly drowsy but clinically stable. He could obey commands and was orientated. In this case, a specific history of occipital trauma, coupled with significant findings of drowsiness, vomiting and headache, warranted an early CT scan of the head which was done an hour after admission. This revealed a small PFEDH. Craniotomy and evacuation of the haematoma were done several hours later. The patient recovered fully with no neurological deficits found at 6 months.

Occipital fractures (Fig 2) occur in about 58% – 70% of PFEDH[11,12] and should arouse the suspicion of the examining physician. However, in our series, only 4 out of 13 (30.8%) cases had a fracture diagnosed on skull X-ray, with another 4 (30.8%) being diagnosed intra-operatively. In children, we do not recommend CT scan for all cases with an occipital fracture (especially so when there are no other significant findings like drowsiness, headache or vomiting) as the latter occur commonly in children and only 1% to 3% of them develop PFEDH[9,11]. This is not so in adults. Fischer and Kim[13] reported an incidence of 9.2% of PFEDH in fracture of the occipital bone in adults. A more sensitive indicator of PFEDH is the presence of a fracture line that crosses the lateral sinus[14]. Diastasis of the lambdoid suture is also an important radiological sign[11] and was seen in 2 cases.

Case 11 illustrates the difficulty in diagnosing PFEDH. He was a 15-year-old Chinese male admitted after falling and hitting the back of his head on the ground during a basketball game. He sustained a haematoma over the left occiput but there was no loss of consciousness. The neurological examination was unremarkable and there was no fracture seen on skull X-ray. He remained well after being admitted and observed for a day but returned 6 days later with vomiting, headache and neck stiffness. A CT scan showed a PFEDH. Retrospective viewing of the skull X-ray showed diastasis of the lambdoid suture.

The advent of CT scanning has had a great impact on the prognosis of PFEDH[15]. The time interval from admission to operation has been decreased from an average of 4 days to half a day[9]. The mortality has decreased from 50% to 10% – 15%[10].

The EDH is seen as a bi-convex, hyperdense lesion in the posterior fossa. Supratentorial extension is a common feature[10,12]. The mass effect caused by the haematoma results in compression of the basal cisterns and the fourth ventricle. The lesion is characteristically described as hyperdense, but we found that in 2 early scans done soon after the trauma (Cases 12 and 13), the EDH were almost isodense with the cerebellum.

In Case 13, a 19-year-old Chinese male who fell from a height of 4 to 5 metres, hit his occiput and lost consciousness for 5 minutes. His GCS score on admission was 12, he sustained an occipital haematoma and CT scan of the head showed left temporal lobe contusions with a left frontal lobe clot.

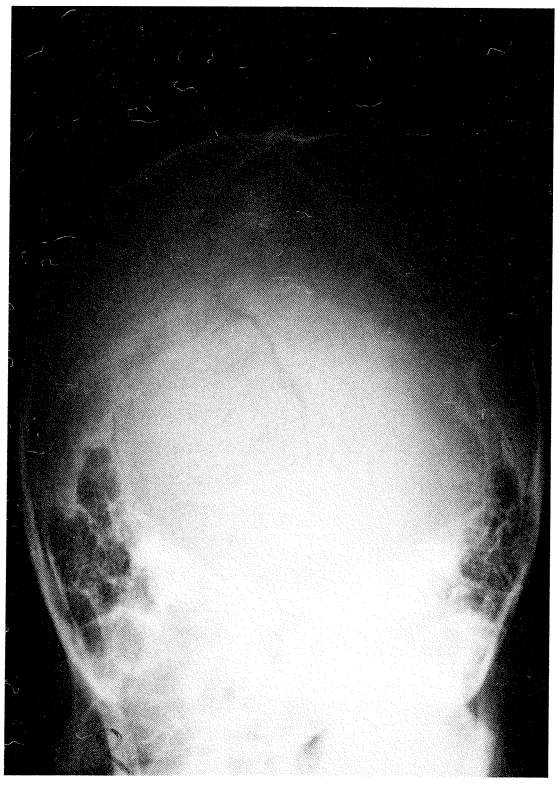

Fig 2 – Skull X-ray showing a fracture of the occiput.

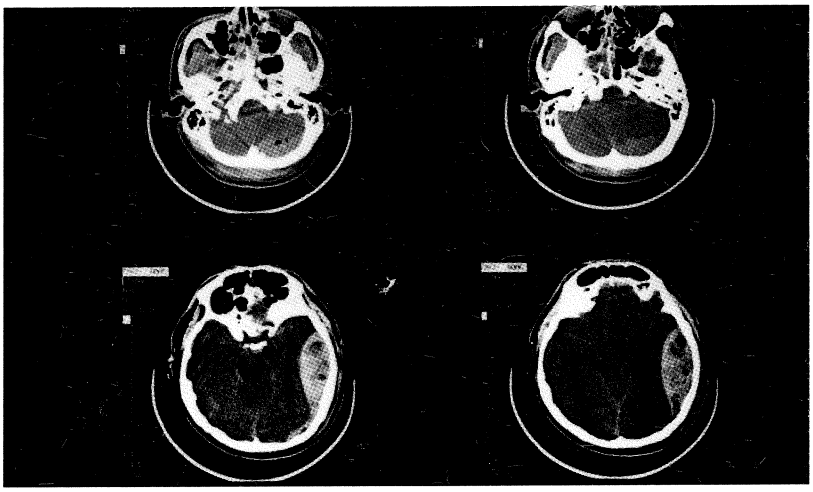

Fig 3 – (Case 12). There is a large left parieto-temporal EDH together with an isodense PFEDH delineated by presence of aerocele.

An ill-defined area of increased attenuation of the left cerebellar hemisphere was not noted. Only a temporal lobectomy was done. The patient deteriorated 2 days post-operatively and a repeat CT scan of the head showed a definite left PFEDH.

Case 12, a 38-year-old Chinese male, was admitted following a road traffic accident. His GCS score was 7 on admission. His pupils were unequal and there was right hemiplegia. CT scan showed a large left parieto-temporal EDH but a rather isodense PFEDH delineated by an aerocele was missed (Fig 3). Thus, only an evacuation of the parieto-temporal EDH was performed. A post-operative scan done 4 days later revealed an obvious hyperdense haematoma in the left posterior fossa and left occipital area. Subsequently, a second craniotomy had to be done. Aerocele is therefore also an important feature. It was seen in 4 out of 7 (57.5%) of scans in which a fracture was present. The value of repeat scanning has been emphasised[16] . In other series, 15% of PFEDH were detected only at the second examination[11].

A tear in the venous sinuses is the commonest site of bleeding in PFEDH[13]. It was the source in 5 out of 7 of our cases where bleeding was noted. Other sites include the occipital branch of the vertebral artery, distal branches of the middle meningeal artery and fracture site bleeding[12].

Outcome in our study was related to the GCS score on admission (Table III). Lui and Lee[10], in a review of 89 cases, cited the following as additional good prognostic factors: haematoma localised to the posterior fossa only, the absence of intracranial haematomas and an age below 16 years. In our study, this was shown to be true. All 6 cases who were below 16 years of age had a good outcome. Of the 3 cases with other intracranial haematomas present, one had severe disability while the other was moderately disabled. Although only 2 cases had a localised PFEDH alone, they had a good outcome.

CONCLUSION

Posterior fossa extradural haematoma is a potentially lethal complication of head injuries. The key to diagnosis is a strong index of suspicion[12]. The physician should be alerted when the following features are present: blow to the occiput, drowsiness, occipital soft tissue injury, occipital fracture or diastasis of the lambdoid suture. Early CT scanning is the optimal investigation and has greatly improved prognosis. Presence of aerocele in the CT scan is a significant feature.

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