

Vertex epidural hematoma: An analysis of a large series

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ABSTRACT

Context: Vertex epidural hematoma (VEDH) is uncommon. A high index of suspicion is required to suspect and diagnose this condition, and the surgical management is a challenge to neurosurgeons. There are only isolated case reports or small series of VEDH in the literature.

Aims: We have tried to analyze a large series of VEDH seen in our institute.

Settings and Design: Retrospective observational study.

Subjects and Methods: This is an analysis of case records of patients with VEDH during 17 years period from 1995 to 2012.

Statistical Analysis Used: Nil.

Results: Twenty nine cases of VEDH encountered over a period of 17 years have been analyzed, including 26 males and 3 females. Majority were due to road accidents. Headache, papilledema and lower limb weakness have been the major presenting features in these cases. The diagnosis was by direct coronal computerized tomography (CT) scan in most of them. Majority were managed conservatively with observation and serial imaging. Four patients who had large VEDH with altered sensorium were managed surgically. The source of bleeding was mainly from superior sagittal sinus.

Conclusions: VEDH has to be suspected when a patient presents with impact over the vertex and features of raised intracranial pressure. Direct coronal CT or magnetic resonance imaging is useful in the diagnosis. Surgery is required when the patient develops progressive deterioration in sensorium and/or with the hematoma volume more than 30 ml. The present series of 29 cases is the largest reported so far.

Key words: Extradural hematoma, vertex epidural hematoma, vertex extradural hematoma

Introduction

Vertex epidural hematoma (VEDH) is a relatively uncommon type of posttraumatic intracranial hematoma. VEDH has certain features which are distinct from EDH at other sites

and hence it is recognized as a separate entity. It is both a diagnostic and therapeutic challenge because of its unique pathogenesis and location. Hence a high index of suspicion is required to recognize this entity. It may be missed in the routine axial computerized tomography (CT) scan, because of its location. In the pre-CT era, the diagnosis was made only by venous phase of cerebral angiography. With the advent of multi-planar imaging methods, the diagnosis has become

Access this article online	
Quick Response Code:	Website: www.asianjns.org
	DOI: 10.4103/1793-5482.145555

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How to cite this article: Ramesh VG, Kodeeswaran M, Deiveegan K, Sundar V, Sriram K. Vertex epidural hematoma: An analysis of a large series. Asian J Neurosurg 2017;12:167-71.

easier. However, until date, there are only isolated case reports or small series of VEDH in the literature. The present study analyzes a series of 29 cases of VEDH, which is probably the largest series of VEDH to be reported so far.

Subjects and Methods

This was a retrospective analysis of case records of patients with VEDH, seen in the Madras Institute of Neurology, Madras Medical College and Government General Hospital, Chennai, Tamil Nadu, India, over a period of 17 years, from 1995 to 2012. The clinical features, radiological findings, management and outcome have been analyzed. We have tried to formulate certain management guidelines based on our experience with these 29 cases.

Results

Out of over 125,000 cases of head injury managed in the institute during the same period, 2200 cases was EDH. Of

these 29 were located at the vertex. The details of individual patients are shown in Table 1.

Of the 29 cases, 26 were males. Nineteen patients (65.5%) were in the age group between 30 and 40 years, 20 of them (69%) were road traffic accident victims and 9 (31%) were victims of assault. Twenty-two patients (75%) presented within the first 24 h. The remaining seven patients presented within 24-72 h of the event. Six patients presented with altered consciousness. Headache was the presenting symptom in all the patients. Five patients had papilledema. Unilateral lower limb weakness was present in five patients.

Axial CT scan was the initial mode of investigation. In these cases, VEDH was suspected because of the presence of: (a) Vault fracture running across midline, (b) vague hyper density in highest axial slices and (c) coronal suture diastasis. Fracture line running across the midline was seen in 15 patients, a vague hyper density in highest axial slices

Table 1: Details of 29 patients

Age/sex	Mode of injury	Symptom	Admission GCS	Signs	Axial CT findings	Coronal CT findings		Management
						Site	Mass effect	
26/male	RTA	HA	15	N	BPF	A	No	C
22/male	RTA	HA	15	N	BPF	M	No	C
20/male	Assault	HA	13	LW	BPF	M	Yes	C
35/male	RTA	HA	15	N	CSD	A	No	C
32/male	Assault	HA	11	P/LW	HD	P	Yes	S
32/male	RTA	HA	15	N	RPF	M	No	C
35/male	Assault	HA	15	N	HD	M	No	C
31/male	RTA	HA	15	N	CSD	M	No	C
20/male	RTA	HA	15	N	N	M	No	C
34/male	RTA	HA	15	P/LW	CSD	M	Yes	S
36/male	Assault	HA	15	N	BPF	P	No	C
26/female	Assault	HA	15	N	HD	M	No	C
32/male	RTA	HA	15	N	BPF	M	No	C
25/male	RTA	HA	13	P	HD	M	Yes	C
33/male	RTA	HA	15	N	BPF	M	No	C
35/male	RTA	HA	11	N	HD	M	No	C
35/female	Assault	HA	15	N	CSD	A	No	C
24/male	RTA	HA	15	N	BPF	M	No	C
32/male	RTA	HA	15	N	HD	M	No	C
35/male	Assault	HA	15	P	BPF	P	Yes	S
22/male	RTA	HA	15	N	HD	M	No	C
34/male	RTA	HA	15	N	BPF	M	No	C
35/male	Assault	HA	15	P/LW	RPF	A	No	RS
34/male	RTA	HA	15	N	BPF	M	No	C
23/female	RTA	HA	13	N	HD	M	No	S
32/male	Assault	HA	15	N	BPF	M	No	C
24/male	RTA	HA	15	N	BPF	M	No	C
34/male	RTA	HA	11	LW	CSD	M	No	C
32/male	RTA	HA	15	N	BPF	M	No	C

RTA – Road traffic accident; HA – Headache; LW – Lower limb weakness; P – Papilledema; BPF – Biparietal fracture; HD – Hyper density in highest axial slices; CSD – Coronal suture diastasis; A – Anterior; M – Middle; P – Posterior; C – Conservative; S – Surgical; RS – Refused surgery; N – Normal; GCS – Glasgow coma score; CT – Computerized tomography

was seen in seven patients [Figures 1 and 2]. These patients were then subjected to direct coronal CT [Figure 3]. In one patient magnetic resonance imaging (MRI) was done to diagnose VEDH. One patient had features of Paget's disease of the skull.

Initially, all patients were treated conservatively with close monitoring and with follow-up CT scans when indicated. Twenty-four (82.7%) patients showed improvement with conservative management [Figure 4]. Five patients showed either clinical deterioration or radiological increase in the volume of VEDH in the follow-up CT scan. Four patients had surgical evacuation of the VEDH.

Surgical procedure

The position of the head was kept elevated above the level of the rest of the body. Scalp flap used was either bilateral parietal flaps (with a trap door opening) or a single-scalp flap extending across the midline. Craniotomy was performed with burr holes

placed on either side of the midline and anteroposteriorly and laterally to include the margins of the hematoma. Evacuation of the hematoma was done, and the source of bleeding was usually from the superior sagittal sinus (SSS). There were either small punctate openings in the SSS, which could be easily controlled with pressure using gelatin sponges or larger tears, which required suturing with 4-0 nonabsorbable sutures. The need for massive blood transfusion due to sudden large volume blood loss from SSS injury has to be kept in mind. The possibility of air embolism also has to be guarded against.

One patient had active bleeding from the skull because of increased vascularity due to Paget's disease. Another patient with indications for surgery refused the same and was lost to follow-up. All 28 patients recovered completely. The follow-up period was up to 6 months. There were no major residual neurological or higher function deficits in these patients.

Discussion

Vertex epidural hematoma is a relatively uncommon condition and is recognized as a separate entity because of certain distinct features. The majority of the cases reported so far have been either isolated case reports or small series. Columella *et al.* reported the first series in an Italian language journal.^[1] Alexander reported the first major series in English language

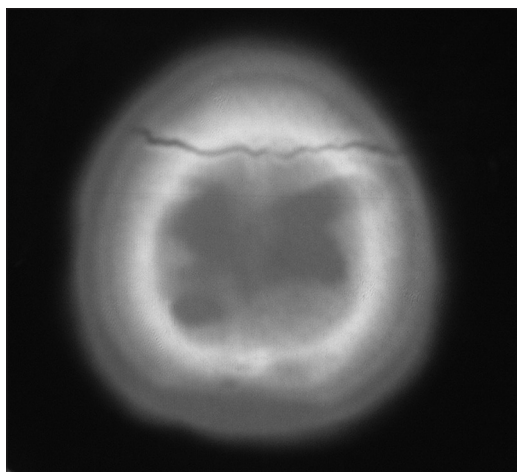


Figure 1: Axial computerized tomography (bone window) showing coronal suture diastasis

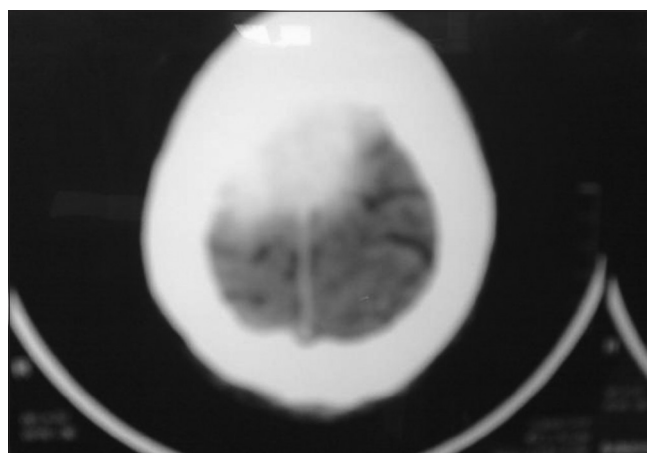


Figure 2: Axial computerized tomography showing vertex epidural hematoma as a vague hyperdensity



Figure 3: Direct coronal computerized tomography showing vertex epidural hematoma

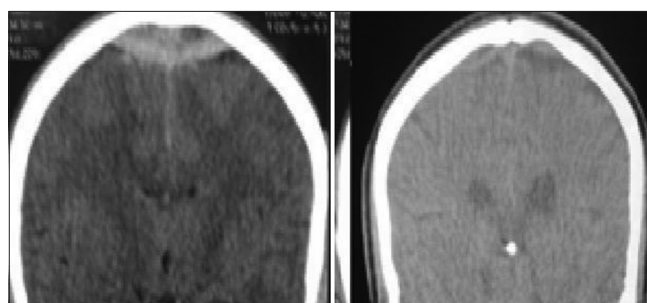


Figure 4: Direct coronal computerized tomography showing resolution of vertex epidural hematoma with conservative management

literature.^[2] The details of the major series reported so far are shown in Table 2.

The incidence of VEDH in the present series is 0.024% of head injuries and 0.47% of all EDH. Wylen and Nanda reported that VEDH account for 1.3-8.2% of all traumatic intracranial hematomas.^[6]

Vertex epidural hematomas are EDH occurring in the quadrangular area of the skull, bounded anteriorly by bregma and coronal sutures, posteriorly by lambda and lambdoid suture, laterally by the parietal eminence. The source of these EDH are any of the following: (1) A tear in the sagittal sinus, which is the commonest source.^[7] (2) Bleeding from the fracture line itself.^[8] (3) Dural stripping from the inner table of the skull.^[8] (4) Bleeding from the diseased vascular skull bone, as in Paget's disease.^[9] (5) An arterio-venous fistula of meningeal artery created by a laceration of dura underlying a linear skull fracture.^[10] (6) Re-bleeding in chronic cases,^[11] and (7) Spontaneous VEDH also have been reported.^[12] Some cases of VEDH in our series extended beyond the anatomical confines of the vertex. These "extended VEDH," were either anterior (in four cases) or posterior (in three cases).

The clinical presentation of VEDH is variable. They might present either in the immediate posttraumatic period or later. In the series of Borzone *et al.*, 9 out of 14 patients presented in the acute phase.^[4] In the present series, 22 out of 29 patients presented within the first 24 h with severe headache. Severe headache is considered to be a major symptom of VEDH. This has been emphasized by Columella *et al.* and by Miller *et al.*^[8,13] The pathogenesis of the headache in these cases could be either due to direct dural irritation around the SSS, which is rich in pain sensitive fibers or raised intracranial pressure (ICP) due to obstruction of SSS. Some patients may present with other features of increased ICP (visual impairment and papilledema).^[8,13] Lower limb weakness, either unilateral or bilateral, is also a presenting feature of VEDH. This is because of the direct pressure of VEDH on the motor cortex representing the leg area. Paraparesis may mislead the attending physician into suspecting a spinal cord injury.^[2,6,14] The presence of pure motor weakness without sensory involvement should alert one to the possibility of

the intracranial cause of the weakness. Though this could be due to underlying small brain contusion, such a lesion could not be demonstrated in the imaging in any of our patients with lower limb weakness. Some patients also have upper-limb weakness or hemiparesis.^[2,3] Cranial nerve involvement is unusual in VEDH. Alexander has reported a case of VEDH presenting with unilateral third-nerve palsy.^[2] In our series headache was the presenting symptom in all the cases. Papilledema was present in five patients and lower limb weakness in five patients. None of the patients had any cranial nerve involvement.

Demonstration of VEDH in the pre-CT era had been by venous phase of angiography, which showed an avascular area separating SSS from the inner table of the skull and narrowing of the SSS.^[2,8] With the advent of multi-planar imaging modalities like CT and MRI, the diagnosis of VEDH has become much easier. In routine axial CT scan, done in cases of head trauma, VEDH is missed many of a time. In the axial CT scan, VEDH may be seen as: (1) Vague hyper-dense lesion in highest slices, which might be dismissed as an artifact.^[14,15] (2) Fracture line is running across the vault of the skull on either side. (3) Diastasis of coronal or sagittal suture. In these cases, the diagnosis can be confirmed with direct coronal CT.

Ramesh and Sivakumar reported the first case of VEDH diagnosed with MRI.^[7] MRI scans are very useful in diagnosing VEDH, due to multi-planar capability and lack of bone artifacts.^[13-15] However, the MRI is not used routinely because of the longer time taken and higher cost. Direct coronal CT is the preferred radiological investigation in suspected cases of VEDH.

The management of VEDH is better considered on a case to case basis.^[8,13] The factors which determine the management of VEDH are the size of the VEDH, the rapidity of evolution of VEDH, location of the hematoma and clinical presentation of the patient.^[2,8,13] Smaller hematomas are likely to resolve spontaneously. However, rapidly evolving hematomas likely to be fatal, have to be evacuated surgically. VEDH located posteriorly are likely to present with more severe symptoms and usually require surgical evacuation. Broadly the indications for surgery in the case of VEDH are: deteriorating consciousness, features of severely increased ICP, features of focal neurological deficit and hematoma measuring more than 30 ml in volume. The threshold volume of 30 ml is as per the Brain Trauma Foundation guidelines for surgical management of EDH.^[16] In the present series of 29 cases, 24 of them improved with conservative treatment and 4 were managed surgically. Patients who were managed conservatively were followed-up with serial imaging.

Surgical management consists of wide craniotomy extending across midline to include the margins of the hematoma,

Table 2: The major series of VEDH

Author	Number of cases	Diagnostic investigation
Columella <i>et al.</i> , 1959 ^[1]	5	CA/PEG
Alexander, 1961 ^[2]	4	CA
Da Pian <i>et al.</i> , 1963 ^[3]	4	CA
Borzone <i>et al.</i> , 1979 ^[4]	14	CT
Kunz <i>et al.</i> , 1996 ^[5]	8	CT
Present, 2013	29	CT/MRI

VEDH – Vertex epidural hematoma; CA – Carotid angiograph; PEG – Pneumoencephalography; CT – Computerized tomography; MRI – Magnetic resonance imaging

hematoma evacuation and the control of the source of bleed. Tears in SSS may be controlled by either direct suturing or using hemostats like gelatin sponge.

High index of suspicion, prompt diagnosis, close monitoring and surgical intervention when required lead to a good outcome in VEDH.^[8] The following should make one suspect the presence of VEDH: (1) Direct impact on the vertex, (2) fracture line running across the vertex, (3) coronal or sagittal suture diastasis, (4) the patient presenting with features of increased ICP and or limb weakness. The radiological investigation of choice for these patients is either direct coronal CT or MRI. Majority of VEDH may be managed conservatively. Surgery, when indicated has to be performed promptly. Crash helmets go a long way in preventing direct injury to the vertex and development of VEDH. Hence the incidence of VEDH is very rare in places where the wearing of helmets by two-wheeler riders is compulsory.

The present series of 29 cases of VEDH is the largest to be reported so far. The diagnosis of VEDH requires a high index of suspicion and carries a good prognosis when diagnosed and managed appropriately.

Acknowledgment

The authors would like to thank Dr. Chandramouli Balasubramanian, MS, MRCS, Senior Resident in Neurosurgery, Chettinad Superspeciality Hospital, Chennai, Tamil Nadu, India, for his help in the preparation and editing of the manuscript.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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