Case Report

Acute epidural hematoma following restoration of ventriculoperitoneal shunt patency

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ABSTRACT

Acute bilateral frontal epidural hematoma developed in a child with long standing hydrocephalus following restoration of ventriculoperitoneal shunt patency. A CT brain scan revealed acute bifrontal epidural hematoma. The epidural hematoma developed as a result of rapid decompression of the hydrocephalus. An emergency neurosurgical evacuation of the hematoma saved the patient from this rather rare and potentially fatal complication that can occur in patients with hydrocephalus.

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Hydrocephalus is one of the most common congenital malformations involving the central nervous system. Previously, hydrocephalus in untreated patients led to death or severe and permanent brain damage. Cerebrospinal fluid (CSF) diversion using a variety of shunt systems has improved the outcome of patients with hydrocephalus, and ventriculoperitoneal (VP) shunt is overwhelmingly the most used.[1,2] The development of acute hematoma in the juxta-dural areas of the brain is an unusual complication that may arise following the drainage of a hydrocephalus. In this patient, the restoration of VP shunt patency triggered the acute epidural hematoma. It is the rapid detachment of the dura mater from the skull that results in the tearing of dural blood vessels and subsequent bleeding. This complication though rare, is potentially fatal and must be promptly investigated and treated.

Case Report. A 6-year-old male Saudi child who had a VP shunt inserted in the first year of life was brought to the hospital, one week earlier with a request that the shunt be removed as the child was doing well and did not need the shunt again. The shunt was revised twice before, the last of which was 3 years earlier. The shunt tube was clamped in the neck under general anesthesia in the operating room and soon after the patient was discharged home. Five days later the child started complaining of headache, vomiting, poor appetite and drowsiness. No convulsions were reported. Physical examination revealed a drowsy child with a temperature of 37^{0}C; respiratory rate 30/min; pulse rate 85/min; blood pressure 130/80 mm Hg. Cranial nerve function was intact; tone, coordination and reflexes were normal. Chest examination showed good air entry bilaterally and no added sounds. Heart sounds were normal with no murmurs. The abdomen was soft, there was no organomegaly and bowel sounds were normal. Complete blood count, electrolytes, blood glucose, serum calcium and renal function were normal. Radiological examination confirmed that the shunt was in continuity and had

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not detached. A CT brain showed moderately dilated lateral ventricles with the right frontal catheter in place **(Figure 1)**. An emergency release of the clamped VP shunt was carried out under general anesthesia in the operating room on the same night. The patient improved in the immediate post operative period, but the severe headache returned 3 hours later, and the patient became unconscious. An emergency CT scan of the brain showed acute bilateral frontal hyperdense epidural hematoma **(Figure 2)**. An emergency surgical evacuation of the hematoma was successfully carried out in the operating room under general anesthesia. The patient became fully conscious afterwards, had stable vital signs and had no more headache post operatively. He was subsequently discharged home on the fifth day in very good condition. A postoperative CT brain scan showed resolution of the hematoma and full expansion of the frontal lobes to normal **(Figure 3)**.

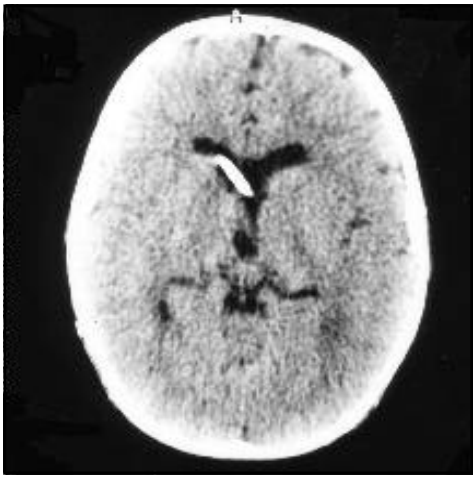

Figure 1 - Initial CT brain showing a right frontal ventricular catheter in situ and no area of abnormal signal intensity within both cerebral hemispheres.

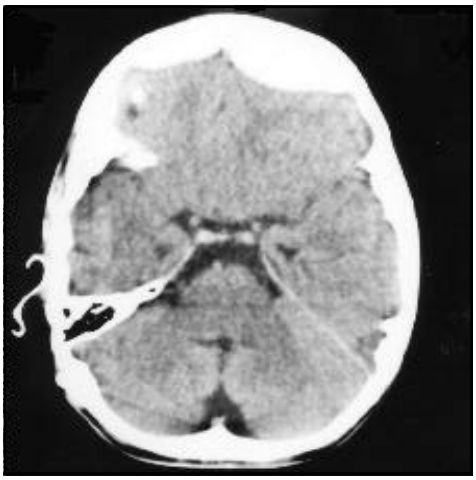

Figure 2 - A CT brain showing an extra-axial bifrontal biconvex hyper intense signal - the left signal is bigger than the right. A smaller hyper density is also seen near a hypo dense one in the right frontal lobe along the catheter track.

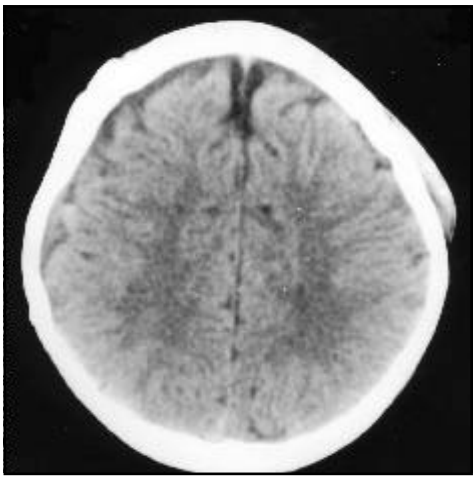

Figure 3 - Post operative CT brain showing normal frontal lobes and no epidural hematoma.

Discussion. The acute bilateral frontal epidural hematoma in this patient developed following the rapid decompression of the hydrocephalus following restoration of VP shunt patency. The amount of fluid drained in a patient with a CSF shunt system is not directly related to the opening valve pressure in the device but to the pressure gradient between the ventricle and the body cavity into which the CSF flows. This pressure gradient is mainly influenced by ventricular and peritoneal factors in VP shunt systems and can cause CSF over drainage. The true incidence of CSF over drainage is underreported, as many patients are asymptomatic despite low intraventricular pressures. This is because compensatory mechanisms, the exact nature of which are not fully understood, come into play. Over drainage complications can be divided into acute and chronic. Acute over drainage complications include acute epidural hematoma and acute subdural hematoma. Chronic over drainage complications include, chronic subdural hematoma, chronic subdural hygroma, slit ventricles syndrome, post shunting craniosynostosis pneumocephalus, epilepsy and ventricular compartmentalization.

Epidural hematoma, an uncommon complication of VP shunt is not as common as subdural collections.[3-5] Chronic hydrocephalus, young age and discrepancy between the cranial and brain volumes are contributing factors.[5,6] The separation of the dura mater from the skull as well as tearing of small dural vessels results from the rapid reduction in intracranial pressure following shunt placement especially in children and young adults and may cause acute epidural hematoma. It is well known that the dura mater is less adherent to the skull in children and young adults compared with older patients.[4,5] Previous trauma, surgery or infection can cause arachnoidal scarring with adherence to the

brain and facilitate the production of acute epidural hematoma.[4]

Surgical evacuation of the hematoma is the treatment of choice and replacement of the shunt valve with a medium/high-pressure opening valve system. Shunt systems with antisiphon devices and programmable valves have also been reported to reduce the incidence of subdural collections.[7] Shunt dependence has been reported in as high as 75% of all cases of treated hydrocephalus and in 50% of children with communicating hydrocephalus.[8] Arrested hydrocephalus is stabilization of a known ventriculomegaly secondary to a compensatory mechanism. Caution should therefore be exercised in deciding to intervene or remove a long-standing VP shunt that has had no problems for a long time. Long implanted shunts acquire a fibrous tissue along the entire length and may be functioning despite appearing not to do so.[9,10] Regular follow up in the outpatient clinic and at least one CT brain scan during the first year is essential. Good parental and physician involvement in the care of the patient, continuous health education, cooperation as well as awareness in hydrocephalus will ensure early presentation and a prompt clinical diagnosis and successful management.

In conclusion, the occurrence of acute bilateral frontal epidural hematoma following restoration of VP shunt patency in this patient serves to remind us all of this rare and potentially fatal complication. Caution must therefore be exercised in the care of patients with hydrocephalus.

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