

Case Report

Giant acute epidural hematoma after ventriculoperitoneal shunt: a case report and literature review

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Abstract: Cerebrospinal fluid over-drainage is a common complication of ventriculoperitoneal devices. In terms of haemorrhage, subdural haematomas are usually more frequent lesions than epidural hematomas, which, more rarely, may also be seen after ventricular shunt procedures and may lead to rapid neurological decline and even death unless a surgical procedure can be promptly performed. This study reports the case of a 47 years-old Dandy Walker man, with clinical condition compatible with the diagnosis of normal pressure hydrocephalus submitted to a ventriculoperitoneal shunt with a high fixed pressure valve. After discharge, on the second day after the procedure, he presented with headache and impaired level of consciousness. At hospital admission he was in a coma and anisochoric. Underwent endotracheal intubation and a head CT, showed epidural hematoma. We performed emergency craniotomy to drain the hematoma, the patient died in the operating room despite resuscitation attempts. In conclusion, prompt diagnosis and emergency craniotomy is recommended in these cases. We must be aware of this possible evolution and maintain high suspicion besides a longer in-hospital observation after these procedures.

Keywords: Hydrocephalus, epidural hematoma, ventriculoperitoneal shunt

Introduction

Ventriculoperitoneal shunt (VPS) is the most common technique used to long-term management of hydrocephalus [1]. Intracranial haemorrhage related to ventriculostomy is relevant and sometimes life-threatening complications of this procedure, related mainly to over-drainage [1]. Subdural bleeding after cerebrospinal fluid excessive drainage is seen frequently.

Epidural hematoma is common disease and represents a risk for death and sequel [2, 3]. This hematoma following ventricular shunting and drainage procedures is rare (0.4%) [4] and has seldom been reported however, it can present significant mortality rate [5] justify excessive suspicion of this entity. In this paper we present a case report of a fatal contralateral epidural hematoma after a VPS.

Case report

47 years-old male, with past medical history of Dandy-Walker malformation and surgery for meningomyelocele at first year of life. He had a one year history of progressive difficult to walk and a three-month with urinary incontinence and severe impairment of deambulation. He denied cognitive decline. On physical examination, he was alert, oriented and presented with gait apraxia. No focal sensory or cranial nerve deficits were found. Preoperative workup included Magnetic Resonance Imaging (MRI) with cerebrospinal fluid (CSF) flow study (**Figure 1**) which showed a large left frontotemporoparietal porencephalic cyst, corpus callosum dysgenesis, and retrocerebellar cyst, with diagnosis of Dandy-Walker syndrome. It also showed marked dilatation of the ventricular system and free passage of fluid through the foramen of Monro, Luscha, Magendie, and cerebral aque-

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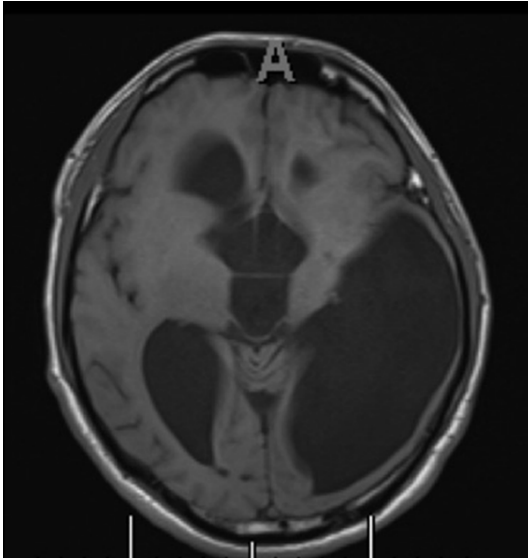


Figure 1. Preoperative magnetic resonance imaging showing hydrocephalus with a large left frontotemporo-parietal porencephalic cyst.



Figure 2. Head computed tomography scan performed 8 hours after the procedure showed good results without hematoma.

duct. Lumbar tap test (Miller Fisher test) demonstrated positive results (clinical improvement after removal of 40 mL of CSF). Coagulation profile (Thrombin time, prothrombin time, activated partial thromboplastin time) and platelet counting were within normal range.

A right frontal ventriculoperitoneal shunt (VPS) was performed with a high-pressure valve.

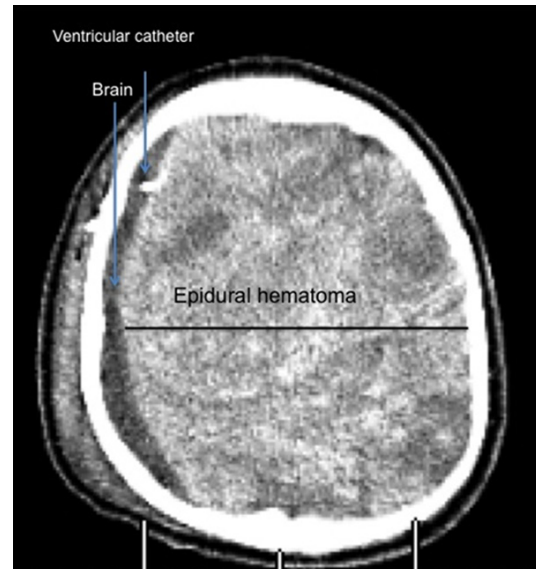


Figure 3. Head CT scan performed 2 days after the surgery, showing a giant left epidural hematoma involving the frontal, temporal, parietal, and occipital lobes with left to right midline structures shift and ventricle collapse.

During surgery, we avoided excessive CSF loss. The patient developed uneventfully on immediate and first post-operative days. Head computed tomography (CT) scan performed 8 hours after the procedure showed good results without hematoma (**Figure 2**).

The patient was discharged at the post-operative day 1 asymptomatic. Thirty-six hours after the procedure (about 12 hours after hospital discharge) the patient was brought to the emergency department with a history of rapid neurological impairment and loss of consciousness. Neurological examination revealed deep coma and anisocoria (left > right). The patient was underwent orotracheal intubation and performed head CT scan (**Figure 3**) showed a giant left epidural hematoma involving the frontal, temporal, parietal, and occipital lobes with left to right midline structures shift and ventricle collapse. Left frontoparietal craniotomy for hematoma evacuation was performed and didn't find any arterial lesions or vascular malformations; active superior sagittal sinus (SSS) bleeding was noted although no injuries have been viewed. The patient developed cardiovascular collapse during the operation and cardiopulmonary resuscitation was performed, but the patient died after thirty minutes following cardiovascular collapse.

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Table 1. Results of published studies, reporting cases of EDH after ventriculoperitoneal shunt

| Author/year | Age | Gender | Diagnosis | Location of burrhole | Type of shunt/valve | Side of EDH | Delta T VPS to EDH diagnosis | Hematoma evacuation | Outcome |
|----------------|-----------------|--------|--|----------------------|--|-----------------------|------------------------------|---------------------|-------------------------|
| Present Paper | 47 y | Male | Dandy-Walker malformation+porencephalic cyst | Frontal | High pressure valve | Contralateral | 36 hours | Yes | Intraoperative death |
| Pereira, 1998 | 33 y | Female | Intraventricular cystic lesion | Parietal | Medium pressure valve | Ipsilateral | 4 months | No | Good |
| Pereira, 1998 | 39 y | Male | Meningitis (inflammatory process) | - | - | Ipsilateral | 0 | Yes | Died shortly thereafter |
| Power, 1999 | 20 y | Male | Congenital aqueduct stenosis | Frontal | Programmable valve set at 100 mmH ₂ O | Contralateral | 3 hours | Yes | Good |
| Fujimoto, 1999 | 11 weeks of age | Male | Intraventricular hemorrhage and congenital factor X deficiency | Parietal | Low pressure valve | Contralateral | A few hours later | Yes | Good |
| Chauvet, 2009 | 26 y | Male | Triventricular hydrocephalus due to quadrigeminal plate tumor | - | Defective valve (opening threshold close to 0 mmHg) | Bilateral (Bifrontal) | 3 hours | Yes | Good |
| Yue, 1985 | 16 y | Male | Tumor at the foramen of monro | Parietal | Medium pressure Holter valve (60 to 90 mmH ₂ O) | Ipsilateral | 11 days | Yes | Good |

Note: all the cases submitted to ventriculography or other intracranial interventions in the same surgical time were excluded.

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Discussion

Ventricular shunting to treat hydrocephalus is a very common neurosurgical procedure worldwide. Complications such as obstruction of the device and infection (up to 60%) are more frequent than bleeding [4, 6-10].

Since 1941, when the first case of epidural hematoma after ventricular drainage was reported, some cases have been described in literature [6, 9, 11-15] (**Table 1** shows results of the published studies).

Sengupta and Hankinson [7] described 3 EDHs following cerebrospinal fluid (CSF) drainage and reported the details of a further 22 patients. They tended to have long-standing lesions with previous hydrocephalus and the bleeding accompanied surgical procedures with some form of CSF drainage.

However, in such cases, the technique of ventricular drainage was different, with a sudden and significant drainage of cerebrospinal fluid, different from the VPS. Additionally the patients reported tended to be younger (mean age 28, 3 years old). Theoretically, in these cases, the dura mater can be easily detached from the inner cranium [7, 8].

On pre CT scan era, when ventriculography was frequently performed, massive EDH after ventricular shunt was not such a rare complication, as reported by Higazi [8] and most of them died shortly thereafter. Marked degree of hydrocephalus, atrophy of the cortex, and the long history of the disease seems to be risk factors [8].

One must regard collapse of the cortex as the cause of hematomas, because it may lead to the occurrence of traction forces over the middle meningeal artery and its branches (slightly adhered to the skull) following the collapse of the brain tissue. Seyithanoglu et al [16] suggested that, in some patients, the skull-dura adhesions are less significant than the dura-arachnoid adhesions and, in cases of overdrainage, this would lead to the formation of a hematoma in the epidural space rather than the subdural one.

The most common location of EDH is on frontoparietal lobes. This may be due to loose fixation of the dura to the cranial vault at this region [8]. EDH tends to develop within the first few hours

after the operation [9]. Besides causing neurological signs EDH can be life-threatening if not promptly suspected and treated.

The largest cases series of epidural hematoma after ventricular decompression, from Otake and Matsumoto [5], includes not only ventriculoperitoneal shunt but also other procedures for draining cerebrospinal fluid: ventricular puncture, ventriculography, ventriculoatrial shunts and so forth.

According to them, epidural hematomas are more common in individuals of middle age (10-40 years). However Kalia et al reported the occurrence of multiple epidural hematomas in a child after VPS [15].

The hematoma is usually distant to the site of burr-hole with predilection for the anterior half of the cranial vault. Presentation varied from the first hour [7] to three weeks even four months [16] to three years [17] after the insertion of the shunt.

Even having taken steps to avoid excessive CSF loss and using a high pressure valve, we suppose that in our case, the mechanism appears to be caused by a combination of some factors: a likely over-functioning of the device was responsible for the hyper drainage with a sudden decompression of the dilated ventricles, stripping the dura from the bone and leading to the contralateral acute epidural hematoma. Furthermore, the long hydrocephalus associated with lower thickness of the left brain parenchyma, have contributed to the event.

Our case draws attention because it is a patient with advanced age, thus presenting the dura mater adhered to the skull besides that he underwent placement of a high-pressure valve, which limits further CSF drainage. Another alternative would be the use of adjustable pressure valves, not available in our service.

This patient had a favorable CT scan in the immediate post operative and was discharged the next day, having been brought to the emergency department after some hours in an unfavorable condition. Perhaps doing the CT control in the first post operative day or delaying the discharge may be effective mechanisms for the early diagnosis of EDH post VPS.

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In conclusion, EDH as a complication of ventriculoperitoneal shunt is a rare but rapidly evolving and often catastrophic entity. Maybe the use of programmable shunts and a longer hospital stay could change the evolution and outcome of these cases.

Disclosure of conflict of interest

None.

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References

- [1] Naradzay JF, Browne BJ, Rolnick MA, Doherty RJ. Cerebral ventricular shunts. *J Emerg Med* 1999; 2: 311-322.
- [2] De Andrade AF, Figueiredo EG, Caldas JG, Paiva WS, De Amorim RL, Puglia P, Frudit M, Teixeira MJ. Intracranial vascular lesions associated with small epidural hematomas. *Neurosurgery* 2008; 62: 416-20.
- [3] Paiva WS, Andrade AF, Mathias Júnior L, Guirado VM, Amorim RL, Magrini NN, et al. Management of supratentorial epidural hematoma in children: report on 49 patients. *Arq Neuropsiquiatr* 2010; 68: 888-92.
- [4] Louzada PR, Requejo PR, Barroso MV, Vaitsman RP, Machado AL, Paiva MS, Salame JM. Bilateral extradural haematoma after acute ventricular over-drainage. *Brain Injury* 2012; 26: 95-100.
- [5] Otake G, Matsumoto S. Supratentorial epidural hematoma as a complication of internal decompression-one personal and 42 reported cases. *Neurol Med Chir (Tokyo)* 1981; 21:897-905.
- [6] Hamlat A, Heckly A, Doumbouya N, Seigneuret E, Brassier G. Epidural Hematoma as a complication of endoscopic biopsy and shunt placement in a patient harboring a third ventricle tumor. *Pediatr Neurosurg* 2004; 40: 245-248.
- [7] Sengupta RP, Hankinson J. Extradural haemorrhage-a hazard of ventricular drainage. *J Neurol Neurosurg Psych* 1972; 35: 297-303.
- [8] Higazi I. Epidural hematoma as complication of ventricular drainage: Report of a case and review of literature. *J Neurosurg* 1963; 20: 527-528.
- [9] Driesen W, Elies W. Epidural and Subdural Haematomas as a Complication of Internal Drainage of Cerebrospinal Fluid in Hydrocephalus. *Acta Neurochir (Wien)* 1974; 30: 85-93.
- [10] Chen GM, Cai T. Clinical analyses of complications after ventriculoperitoneal shunt in 125 cases. *Di Yi Jun Yi Da Xue Xue Bao* 2004; 24: 1078-1079.
- [11] Gulliksen G, Hasse J. Epidural haematoma as a complication of a ventricular drainage. *Acta Neurochir* 1977; 36: 107-109.
- [12] Olivecrona H. Chirurgische Behandlung der Geschwulsten. In *Die spezielle Chirurgie der Gehirnkrankheiten* 1991; 3: 465-468.
- [13] Fukamachi A, Koizumi H, Nagaseki Y, Nukui H. Postoperative extradural hematomas: Computed tomographic survey of 1105 intracranial operations. *Neurosurgery* 1986; 19: 589-593.
- [14] Fujimoto Y, Aguiar PH, Carneiro JD, Martins RS, Ciquini O Jr, De Andrade AF, Manreza LA. Spontaneous epidural hematoma following a shunt in an infant with congenital factor X deficiency. Case report and literature review. *Neurosurg Rev* 1999; 22: 226-9.
- [15] Kalia KK, Swift DM, Pang D. Multiple epidural hematomas following ventriculoperitoneal shunt. *Pediatr Neurosurg* 1993; 19: 78-80.
- [16] Seyithanoglu H, Guzey FK, Emel E, Ozkan N, Aycan A. Chronic ossified epidural hematoma after ventriculoperitoneal shunt insertion: A case report. *Turkish Neurosurg* 2010; 20: 519-523.
- [17] Pereira CU, Porto MW, de Holanda RR, de Andrade WT. Epidural hematoma after ventriculoperitoneal shunt surgery. Report of two cases. *Arq Neuropsiquiatr* 1998; 56: 629-32.