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# A reverse brain herniation (RBH) after ventriculoperitoneal shunt (VP) in posterior fossa tumour with obstructive hydrocephalus. A rare and fatal complication

**Lamkordor Tyngkan, Avatar Singh, Abdul Rashid Bhat**

## Abstract

The risk of hydrocephalus in posterior fossa tumour is quite high (71- 90%), cerebrospinal fluid (CSF) diversion procedures like ventriculoperitoneal (VP) shunt, Endoscopic third ventriculostomy (ETV) and external ventricular drainage (EVD) are emergency procedures and may improve symptoms like headache and vomiting. However, post-operative deterioration after CSF diversion should alert the clinician to the possibility of RBH which is rare (3%) and has a high mortality. We report a case of a 12-year female child with a left cerebellar lesion with hydrocephalus. VP shunt was done and her pupils revert back to normal size, two hours post-surgery her pupils become dilated and not reacting to light, an urgent CT was done which showed reverse brain herniation. Reverse brain herniation is a very rare complication after the CSF diversion procedure with a poor prognosis.

Keywords
posterior fossa tumour, hydrocephalus, reverse brain herniation, ventriculoperitoneal shunt

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## Introduction

Obstructive hydrocephalus secondary to posterior fossa tumour is quite common, occurring in 71–90% of children with posterior fossa tumors.1The optimal management of hydrocephalus in a child with a posterior fossa tumor is a topic of debate.2 The question of whether to place an external ventricular drain (EVD), insert a ventriculoperitoneal shunt (VPS), perform an endoscopic third ventriculostomy (ETV), or defer CSF diversion procedures before resective surgery depends on the clinical presentation and individual surgeon practice; there exists no class I evidence to guide management.3Cerebrospinal fluid (CSF) diversion procedure carry the risk of reverse brain herniation (RBH) which is rare and associated with significant mortality. RBH may aggravate hydrocephalus and cause hemorrhagic infarction of the brainstem and cardiorespiratory disturbance. 4, 5 we report case of left cerebellar lesion with obstructive hydrocephalus that developed fatal reverse brain herniation after ventriculoperitoneal (VP) shunt.



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## Case report

A 12-year female child presented to surgical emergency department with complaints of headache since 2 months and altered sensorium since 2 hours. On examination Glasgow Coma Scale (GCS) was E1V1M2 (4/15), pupils bilaterally dilated not reacting to light, Magnetic resonance imaging (MRI) showed left cerebellar heterogenous enhancing lesion with hydrocephalus. Urgent intubation and right ventriculoperitoneal shunting was done, CSF came out under high pressure. Post surgery patient pupils revert back to normal size and reacting to light and patient was shifted to Neuro ICU as she was not extubated. However after 2 hour of surgery her pupils become dilated and not reacting to light again, urgent NCCT (non contrast computed tomography) was done which showed decompressed ventricles with shunt tip in situ and revesre brain herniation. Surgical decompression of posterior fossa tumours was planned but patient relatives didn't give consent for surgery and unfortunately patient died after 3 days.

## Discussion

To the best of our knowledge only three cases of revesre brain herniation (RBH) after CSF diversion procedure in posterior fossa tumour with hydrocephalus has been reported in the literature.

Obstructive hydrocephalus secondary to posterior fossa tumors is quite common, occurring in 71–90% of children with posterior fossa tumors.1 CSF diversion procedures are emergency procedure in these cases; however, post-operative deterioration in the condition of the patient after CSF diversion should alert the clinician to the possibility of RBH of the brain. RBH is the least understood of the brain herniation syndromes and is a rare complication of VP shunt with an incidence of 3%.6 Cuneo et al. reported that cerebellar mass (65%) is the commonest lesion associated with RBH, followed by lesions of CP angle (13%), the pons (11%), and the fourth ventricle. It usually occurs when the mass originates near the incisura, when drainage of the lateral ventricles relieves obstructive hydrocephalus, or when the opening in the tentorium is large.4 Galen's vein lies immediately above the posterior tentorial incisura. Herniation of the vermis through the notch displaces Galen's vein upward against the splenium and the unyield¬ing free edge of the falx. Acute compression of Galen's vein may produce hemorrhagic infarction in the diencephalon and the adjacent white matter if venous collateral channels fail.4

Direct compression of the brainstem and downward tonsillar herniation may be present. The clinical picture includes signs of pontine compression (obtundation, hyperventilation, decerebrate rigidity, and small fixed pupils), midbrain compression (loss of upward gaze and pupils which may be fixed and dilated). Compression of the brainstem nuclei causes severe bradycardia and asystole.4, 5 In our case as tumour was large possible cause of reverse brain herniation (RBH) into the supratentorial compartment, was a sudden decrease in the supratentorial pressure due to the shunt.

Gurajala I et al. showed that Interruption of VP shunt and prompt institution of mechanical ventilation immediately after clinical diagnosis of RBH may have reduced the extent of herniation. Even though RBH has significant mortality, surgical decompression should be undertaken as soon as possible even in cases of severe RBH.8 Our patient was only mechanically ventilated because patient relatives denied for any surgical intervention.

The mortality associated with RBH is significant. In the series by Cuneo et al, only seven cases out of a total of 52 reviewed were diagnosed antemortem and the mortality was 100%. Cases reported later in the literature had a better outcome. In about 25% of the patients, ventricular drainage is directly responsible for precipitation of the herniation.5, 6, 8, 9 Hence, patients who undergo CSF diversion should be observed closely for reverse brain herniation (RBH) postoperatively.

**Table 1.** Reported cases of reverse brain herniation (RBH) after CSF diversion in obstructive hydrocephalus secondary to posterior fossa tumour

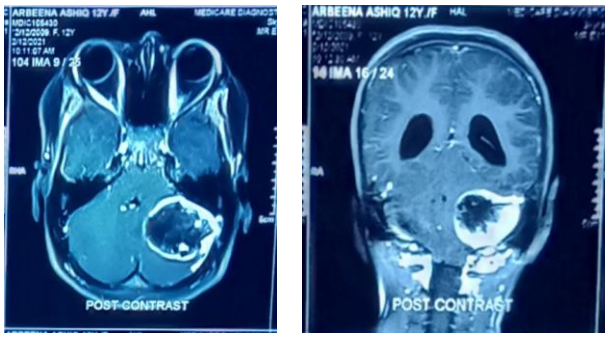
| Case | Author | Year | Age / Sex | Location of tumour | Treatment | Out-come |
|---|---|---|---|---|---|---|
| 1 | Singha SK et al[9] | 2009 | 57/M | Midline posterior fossa (Involving vermis and both cerebellum) hemangioblatoma with hydrocephalus | ETV + suboccipital craniectomy and tumor decompression. | Uneventful |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | Gurajal l et al[8] | 2012 | 45/M | Right cerebellopontine (CP) angle tumours with hydrocephalus | VP shunt + Tumour decompression | Discharged with nasogastric tube |
| 3 | Marappan K et al[10] | 2018 | 3.5/F | 4th intraventricular tumour | VP shunt | Not avail-able |
| 4 | Present case | 2021 | 12/F | Left cerebellar lesion | VP shunt | Expired |

ETV- Endoscopic third ventriculostomy; VP- Ventriculoperitoneal

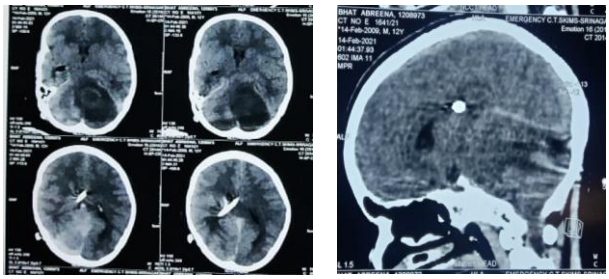
## Conclusions

Ventriculoperitoneal shunt for obstructive hydrocephalus with posterior fossa tumour can be complicated by reverse brain herniation which is a rare complication and can be fatal if prompt diagnosis and intervention is not done. Surgical decompression should always be done even in a case of severe RBH.




**A.** **B.**

**Figure 1.** (**A**) axial CEMRI image showing left cerebellar lesion with heterogeneously enhancing lesion; (**B**) Coronal MRI image showing left cerebellar lesion with hydrocephalus.



**A.** **B.**

**Figure 2.** NCCT (**A**) axial image showing decompressed ventricles with reverse brain herniation; (**B**) saggittal image showing raised tentorium with revesrse brain herniation.

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