

# Acute Deafness: A Rare Complication of Shunting

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#### Key words

- Deafness
- Hearing loss
- Hydrocephalus
- Overshunting
- VP shunt

#### Abbreviations and Acronyms

CSF: Cerebrospinal fluid MRI: Magnetic resonance imaging VP: Ventriculoperitoneal

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## **INTRODUCTION**

Ventriculoperitoneal (VP) overshunting<sup>1</sup> is a very rare condition produced by the siphoning effect caused by the column of the cerebrospinal fluid (CSF) tube when the patient is erect.<sup>2</sup> Auditory symptoms and mild hearing loss are uncommon complications associated with VP shunt insertion that have been rarely reported in the literature; however, acute deafness after a prolonged time of normal function of the VP shunt is not considered to be a clinical manifestation of overshunting in patients with hydrocephalus. We report a case of documented acute severe hearing loss associated with VP overdrainage and resolution of the symptoms after shunt replacement. Diagnostic and treatment options for this unusual condition are presented and discussed.

### **CASE DESCRIPTION**

A 27-year-old man presented to the emergency department with a headache,

BACKGROUND: Mild hearing loss following shunting has been described; however, severe auditory impairment associated with ventriculoperitoneal (VP) shunt is an uncommon, rarely reported phenomenon. Treatment options and pathophysiologic considerations are discussed in this case report.

CASE DESCRIPTION: A 27-year-old man who was treated for an eighth cranial nerve schwannoma with complete resection and a VP shunt 10 years previously presented to the emergency department with acute severe hearing loss and headache. Imaging showed diminished size of the ventricles and dural contrast enhancement. The previous shunt was replaced with a programmable antisiphoning VP shunt. The patient's hearing and headache improved 48 hours later, as demonstrated in serial audiograms.

CONCLUSIONS: Hearing loss is an underestimated complication of shunting that in some cases may progress to severe impairment and deafness. Patients with a VP shunt who experience hearing loss should undergo further evaluation and possibly adjustment of shunt settings.

tinnitus, and progressive severe hearing loss within the 72 hours before admission. He had undergone retrosigmoid craniotomy and internal acoustic meatus drilling 10 years previously for complete resection of a left KOOS grade IVB acoustic schwannoma and VP shunt placement (**Figure 1**). After the procedure the patient developed left facial palsy (House-Brackmann grade IV) and left ear deafness. During the follow-up period, the patient remained without changes in his neurologic condition and without any evidence of shunt dysfunction (**Figure 2**).

The headaches were bifrontal and remitted when the patient was in the recumbent position. They were occasionally so disabling that the patient could not attend school; however, the patient was more concerned about the right ear hearing loss and tinnitus. Results of limb examination were normal, and cranial nerve examination revealed left facial palsy and bilateral hearing impairment. Formal audiologic evaluation demonstrated severe right-sided sensorineural hearing loss (Figure 3).

Magnetic resonance imaging (MRI) suggested overshunting, with significantly smaller ventricles than on previous MRI and dural contrast enhancement (Figure 4). There was no evidence of tumor recurrence or any other lesion at the right internal acoustic meatus (**Figure 4**C). There was no meningocele, fluid in the middle ear, or any sign of CSF leak on cranial or spinal MRI. Computed tomography scan with contrast medium failed to demonstrate any CSF leak or bone defect along the anterior or middle fossa.

The patient underwent replacement of the VP shunt with a programmable VP shunt with antisiphoning effect. The opening pressure at the time of surgery measured through the proximal ventricular catheter was I cm H<sub>2</sub>O. The VP shunt was tested following the removal and demonstrated anterograde flow through the device at small increases in positive pressure. Postoperatively, the patient immediately reported improvement of hearing and headaches. On day 2, formal audiologic evaluation demonstrated great improvement of hearing function, and computed tomography scan showed mild enlargement of the lateral ventricles. At the 3-month followup, the patient remained stable with no headaches or hearing loss. Follow-up MRI showed clearance of dural contrast enhancement.



Figure 1. Preoperative (A) and immediate postoperative magnetic resonance imaging (MRI) (B) performed 10 years before the most recent admission. Preoperative MRI showed a sphenopetrous meningioma with complete occlusion of the fourth ventricle and mass effect over the brainstem.

Postoperative MRI showed subtotal resection with adequate decompression of the brainstem and no other significant findings. Current MRI performed at admission (**C**) did not show evidence of meningocele or any other signs of fistula, although it was remarkable for diffuse dural contrast enhancement.

#### DISCUSSION

Although shunting or hydrocephalus is not traditionally considered in the differential diagnosis of hearing loss, some recent evidence indicates that CSF circulation abnormalities and changes in pressure can produce auditory dysfunction.<sup>3-6</sup> In I study, 10 of 12 patients treated with VP shunt for hydrocephalus experienced a highfrequency cochlear hearing loss.<sup>6</sup> Lim et al.<sup>4</sup> observed that 40% of ears of patients treated with VP shunt experienced a threshold elevation of at least 15 dB in  $\geq$ 1 frequencies, and other studies have shown similar results.<sup>3,5</sup> Recent articles have suggested that this complication is more commonly associated with pediatric age<sup>5:7</sup> and that the hearing loss is more dramatic on the side where the VP shunt was deployed.<sup>6</sup> The presumed explanation for

this phenomenon is that the decrease in intracranial pressure produced by shunting is transduced into the endolymph causing a small pressure difference between endolymph and perilymph. These pressure differentials may cause displacement of the Reissner membrane, affecting hearing.<sup>7,8</sup>

According to Lee et al.,<sup>9</sup> auditory impairment is an underestimated complication, rather than a rare event in



Figure 2. Head computed tomography scans performed over the follow-up period show changes in ventricle sizes. (A) Baseline computed tomography scan performed 5 years before present admission showed optimized position of the ventricular catheter and normal ventricle sizes without signs of shunt dysfunction. (B) Computed tomography scan at admission showed the typical

images of slit ventricles, consisting in reduced size of lateral ventricles. (C) Postoperative computed tomography scan performed after ventriculoperitoneal shunt replacement demonstrated significant change in diameter of lateral ventricles with size comparable to the baseline computed tomography scan.

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