



# Simple Removal of Ventriculoatrial Shunt and Simultaneous Ventriculoperitoneal Shunt Revision: Short Communication

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## Abstract

**Background** Ventriculoatrial shunt (VAS) is a common alternative treatment option for hydrocephalus in patients with ventriculoperitoneal shunt (VPS) failure. Most previous reports on VAS discuss the atrial-related complications and none focus on simple removal (i.e., without specialized equipment). We report a case of simple VAS removal and simultaneous VPS revision, with no obvious shunt-related cardiac complications.

**Case presentation** The patient was an 87-year-old female who had received a VAS for idiopathic normal pressure hydrocephalus 6 years prior. She developed a right thalamic hemorrhage with intraventricular hemorrhage and was admitted to our hospital. She had a recurrence of the hydrocephalus and was diagnosed with shunt malfunction, due to simple obstruction without obvious shunt-related cardiac complications. The VAS was simply and safely removed, and a VPS was simultaneously placed, as per the usual procedure in our institution. She remains well with no evidence of complications on postoperative day 10.

**Discussion** Since VAS is mostly used in pediatric cases that are difficult to treat with VPS, the duration of time elapsed allows VAS catheters to form strong adhesions with the surrounding cardiac tissue. Therefore, the simple removal of VAS is usually not straightforward.

**Conclusion** If the follow-up period is short and there are no specific cardiac complications at the time of replacement, VAS can be safely removed and VPS can be spontaneously placed, without any specialized surgical techniques or equipment.

## Keywords

- Ventriculoatrial shunt
- ventriculoperitoneal shunt
- hydrocephalus

## Introduction

The ventriculoatrial shunt (VAS) was first introduced by Nulsen and Spitz in 1952. With the contribution of Pudenz in the evolution of the shunt valve, the VAS became popular for the treatment of hydrocephalus until the 1970s. However, long-term severe cardiac and renal complications have been reported, such as complications associated with tricuspid

lesions, endocarditis, thrombosis, the catheter traversing the foramen ovale, and pulmonary hypertension.<sup>1,2</sup> In previous reports, shunt removal by sternotomy was recommended for the treatment of these complications, while an endovascular approach is common for the removal of a broken VAS catheter.<sup>1,3,4</sup> Thus, the VAS was established as an alternative treatment when the other options were not feasible. In recent years, however, some have reported that the VAS

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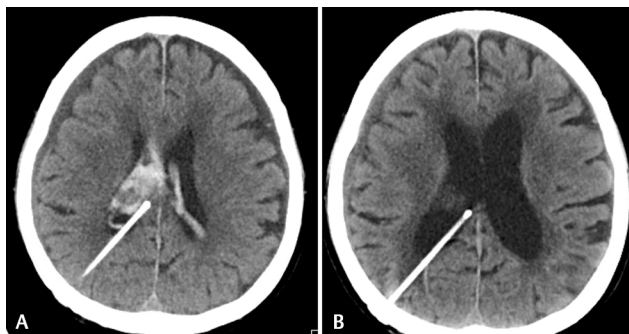
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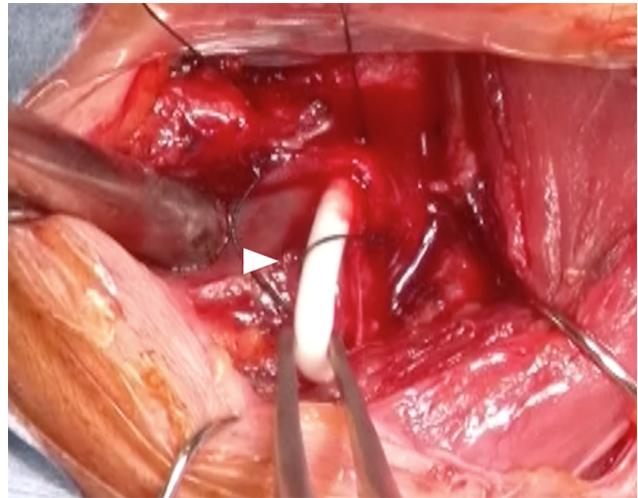
should be considered the treatment of choice for hydrocephalus in older patients, because in their studies, patients with VAS were less likely to experience shunt obstruction than those with VPS.<sup>5</sup> Accordingly, we are more likely to encounter older patients with VAS. There are no previous reports of the simple removal of VAS without any specialized techniques or equipment with simultaneous shunt revision using VPS. In the present case, we report a patient who underwent simple removal of the VAS and simultaneous VPS revision without any shunt-related cardiac complications.

## Case Presentation

An 87-year-old, otherwise healthy female, had undergone implantation of a VPS for the treatment of idiopathic normal pressure hydrocephalus 6 years prior. She developed mild chronic subdural hematoma through overdrainage, but neither revision nor evacuation of hematoma was performed. She presented with left hemiparesis and was transferred to our hospital, and right thalamic hemorrhage with intraventricular hemorrhage was diagnosed. One month after admission, head CT scan revealed the hematoma had resolved with ventriculomegaly (►Figs. 1 A, B). Transthoracic echocardiography (TTE) demonstrated no obvious cardiac complications. The reservoir of the VAS would not pump up after it was pushed in, suggesting malfunction of the shunt system, especially on the cranial side. She underwent VAS removal by patching of the internal jugular vein with fascia, and a VPS was performed simultaneously as per the usual procedure in our institution (►Fig. 2). She remains well with no evidence of complications on postoperative day 10. The patient has provided informed consent for publication of the case.



**Fig. 1** Preoperative axial CT scan (A) on admission; (B) 1 month after admission, indicating a recurrence of hydrocephalus.



**Fig. 2** Intraoperative photographs of the internal jugular vein at the insertion site of the shunt catheter (white arrowhead).

## Discussion

The removal of a long-term implanted VAS is not recommended, because of the possibility of severe adhesion to the right atrium or formation of an intracardiac thrombus.<sup>6,7</sup> Our review of the literature identified only three cases of simultaneous VAS removal and VPS revision in adulthood (►Table 1).<sup>2,4,7</sup> The articles were identified via a PubMed search using the keywords “ventriculoatrial shunt,” “complications,” and “shunt revision,” alone and in combination. In two of the three cases, the VAS removal was achieved through sternotomy, and the revision was performed several days later.<sup>2,7</sup> The third case underwent endovascular treatment, wherein the distal catheter was removed intravenously, and then the remaining shunt system was connected to a new peritoneal catheter; this does not constitute simple removal.<sup>4</sup> Natarajan et al recommend follow-up using TTE for patients who had undergone VAS implantation more than 10 years ago.<sup>8</sup> Paradini-Santos et al reviewed reports of VAS complications and suggested that, if the catheter has only recently been inserted, simple traction on the distal catheter may be sufficient for removal.<sup>1</sup> These reports suggest that if there are no obvious VAS-related complications identified on TTE, safe removal of the VAS is possible.

According to Alvi et al, VAS accounted for 0.95% ( $n = 130$ ) of all shunting procedures in patients over 60 years of age

**Table 1** Summary of previous case reports on surgery for complication of VAS

Author (year)	Age	Sex	Complication	Treatment	Revision
Cowan and Allen <sup>2</sup>	52	M	Retrograde cardiac migration	Ligation of IJV	VAS on the contralateral side
Tonn et al <sup>4</sup>	26	F	Pulmonary embolism	Endovascular	VPS
Gopal and Peethambaran <sup>7</sup>	41	M	Endocarditis	Sternotomy	VAS

Abbreviations: F, female; M, male; IJV, internal jugular vein; VAS, ventriculoatrial shunt; VPS, ventriculoperitoneal shunt.

from 2007 to 2017.<sup>9</sup> In recent years, however, there have been more reports that there is no difference in long-term complications between VPS and VAS in older patients. Rymarczuk et al reported that the most common etiology of shunt malfunction is proximal catheter failure,<sup>10</sup> and Paradini-Santos et al reported that the most common complications of shunt malfunction were shunt obstruction or disconnection.<sup>1</sup> In other words, the number of cases in which removal and replacement are necessary without VAS-related complications is expected to increase. The present study, based on these reports, demonstrated the safe removal of VAS with only basic hemostasis via pressure on the fascia of the internal jugular vein at the distal catheter insertion site and the usual revision of the VPS.

## Conclusion

We reported that VAS removal in patients without VAS-related cardiac complications could be performed without specialized techniques and that simultaneous VPS was possible.

### Funding

None.

### Conflict of Interest

None declared.

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