Symptomatic Intracerebral Hemorrhage Secondary to Ventriculoperitoneal Shunt in Adults without Bleeding Tendency

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BACKGROUND: **Ventriculoperitoneal shunt (VPS) is a common procedure in daily neurosurgical practice. According to some reports, the rate of intracerebral hemorrhage secondary to VPS in patients with no bleeding tendency can be 43.1%; however, symptomatic intracerebral hemorrhage (SICH) secondary to VPS is rare with only sporadic cases reported in adults. To further elucidate the characteristics, mechanism, management, and prognosis of SICH secondary to VPS, we performed a retrospective study in our institution and a systematic review of the literature.**

METHODS: **A retrospective review of the medical records of patients admitted for VPS was performed. We also performed a systematic PubMed search of published studies.**

RESULTS: **Of 5 patients identified at our institution, 3 experienced a favorable recovery. Including our case series, there were 16 (8 female) patients. The time interval from the termination of VPS procedure to SICH was 4 hours to 15 days. All but 1 patient experienced intracerebral hemorrhage adjacent to cannulation. Of 11 patients in whom a Glasgow Outcome Scale score could be obtained, the score was 5 in 4 patients, 4 in 1 patient, 3 in 1 patient, and 1 in 5 patients.**

CONCLUSIONS: **SICH is a rare complication after VPS in adults without bleeding tendency. The mechanism is obscure, management is challenging, and prognosis is dismal. Future prospective study is anticipated.**

INTRODUCTION

Ventriculoperitoneal shunt (VPS) is a common procedure in daily neurosurgical practice. Postoperative complications associated with VPS include catheter obstruction, infection, intracranial hemorrhage, and shunt malfunction. According to some reports, the rate of intracerebral hemorrhage secondary to VPS in patients with no bleeding tendency can be 43.1%; however, symptomatic intracerebral hemorrhage (SICH) secondary to VPS is rare with only sporadic cases reported in adults.[1-3] To our knowledge, no comprehensive systematic review of SICH secondary to VPS in adults has been conducted. To further elucidate the characteristics, mechanism, management, and prognosis of SICH secondary to VPS, we performed a retrospective study in our institution and a systematic review of the literature.

MATERIALS AND METHODS

Definition

Our definition of SICH secondary to VPS in adults without bleeding tendency included the following: new onset of symptoms (e.g., seizure, mental state decline, headache) after a certain period of well-being following VPS; no intracerebral hemorrhage revealed by postoperative imaging modalities before occurrence of new-onset symptoms; evident (not trace amount) intracerebral hemorrhage with or without ventricular extension verified by computed tomography (CT) or magnetic resonance imaging after new-onset symptoms; no clear history or evidence of coagulation disorder, platelet deficiency, or antiplatelet and anticoagulation medication; no vascular malformation verified by imaging; and patient age >16 years.

Key words
- Adult
- Symptomatic intracerebral hemorrhage
- Ventricular hemorrhage
- Ventriculoperitoneal shunt

Abbreviations and Acronyms
CT: Computed tomography
EVD: External ventricular drain
GOS: Glasgow Outcome Scale
SICH: Symptomatic intracerebral hemorrhage
VPS: Ventriculoperitoneal shunt

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Retrospective Study

After receiving institutional ethical approval, a retrospective study of the medical records from January 2008 to March 31, 2017, of patients admitted for hydrocephalus was conducted at the neurosurgical department of our hospital. Clinical data including demographics, laboratory and radiologic investigations, accompanying chronic diseases such as diabetes and/or hypertension, management, outcome, and follow-up were collected for final interpretation.

Systematic Literature Review

A systematic PubMed search of published studies written in English of patients developing SICH secondary to VPS was performed on April 13, 2017. "Ventriculoperitoneal shunt" and "hemorrhage" were used as the key words. Articles for which full text could be obtained were included in this study. The reference lists of the identified articles were also manually searched for additional studies. Studies without clear descriptions of the demographic, clinical, and radiologic data of patients with SICH secondary to VPS were excluded from the final analysis (Figure 1).

RESULTS

Current Series

From January 2008 to March 31, 2017, 263 consecutive adult patients were admitted to our institution for hydrocephalus. Of these patients, 215 underwent VPS. CT scans of the head were performed within 72 hours postoperatively. All types of postoperative intracranial bleeding were identified in 39 patients (18.1%). According to our inclusion criteria, 5 patients (2.3%) developed SICH (Table 1). A medium pressure valve was selected for all 5 patients. The time interval from the termination of VPS cannulation to SICH was 1–9 days. Intraoperatively, the catheter was safely placed at the first attempt for all patients who developed SICH. All patients had SICH ipsilateral to the side of cannulation. A history of hypertension was reported in 2 patients. Three patients received conservative treatment and experienced a favorable recovery, and 2 patients died, even though an external ventricular drain (EVD) had been placed for aggressive drainage in 1 of these patients.

Illustrative Case

A 54-year-old man was admitted for sudden onset of headache. On examination, he had a Glasgow Coma Scale score of 13. He had a history of hypertension and diabetes for 4 years and had been taking no drugs other than antihypertension medication and insulin. CT scan of the head performed on admission showed subarachnoid hemorrhage centered at the interhemispheric cistern and mild ventricular enlargement (Figure 2A), which was demonstrated on subsequent CT angiography to be secondary to a ruptured anterior communicating artery aneurysm. Emergency surgery was performed to clip the intracranial aneurysm via a left pterion approach. An EVD was also placed through the left frontal horn during surgery (Figure 2B). The intraoperative course was unremarkable. The EVD was left in place for 10 days and withdrawn without intracranial infection.

The patient developed shunt-dependent hydrocephalus 5 days after EVD withdrawal (Figure 2C). Preoperative blood cell count and coagulation test were within normal limit. A VPS was performed via the right frontal horn 20 days after his admission. The catheter was safely placed at the first attempt, and the cerebrospinal fluid was

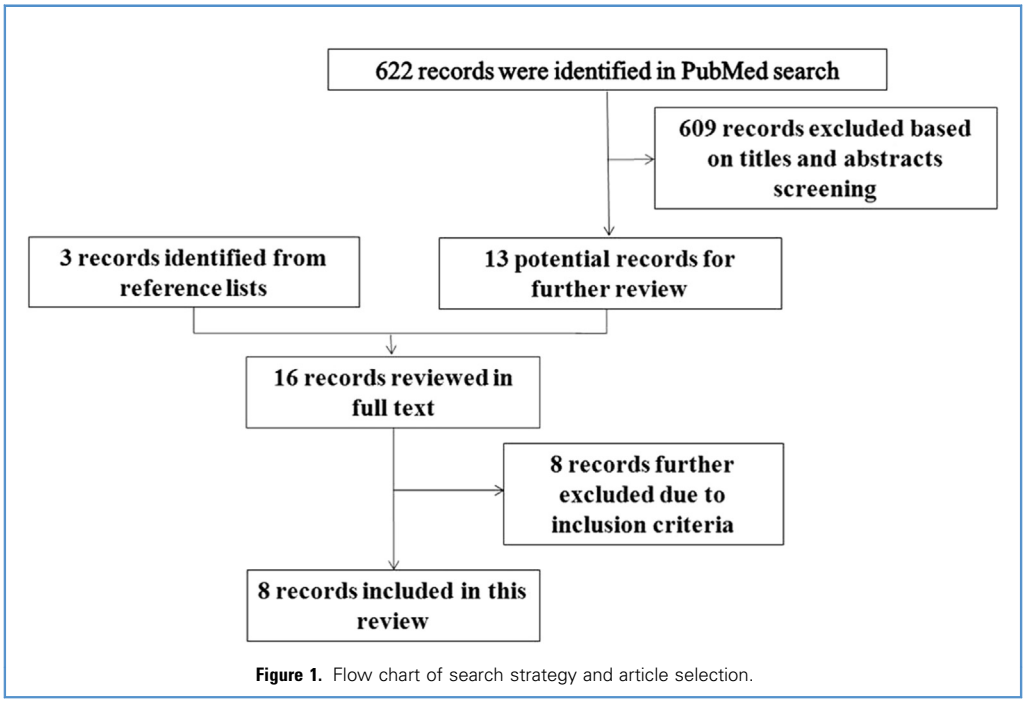

Figure 1. Flow chart of search strategy and article selection.