Intraoperative Hemorrhage in Ventriculoscopic Surgery: Experience of a Single Chinese Neurosurgery Center

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BACKGROUND: **The ventriculoscopic approach has been considered to be more safe and effective in the treatment of hydrocephalus, arachnoid cysts and intraventricular lesions in neurosurgery. We found that intraoperative bleeding-related complications have the greatest impact on ventriculoscopic surgery. Until now, few studies fully discussed this complication.**

METHODS: **Patients who underwent ventriculoscopic surgery between May 2011 and December 2012 at Beijing Tiantan Hospital were analyzed.**

RESULTS: **A total of 126 patients were enrolled in the study. Intraoperative hemorrhage was observed in 75 cases (59.5%). Intraoperative hemorrhage classification of patients was as follows: stage I (n = 62); stage II (n = 11); stage III (n = 2). We found that there was no significant difference in complication rate and rate of symptom improvement between the patients who had hemorrhage and the patients who did not ($P < 0.05$).**

CONCLUSIONS: **Intraoperative hemorrhage in ventriculoscopic surgery should be paid more attention. Generally, a skilled neurosurgeon can address hemorrhage with a low complication rate. Consequently, the ventriculoscopic approach is safe and effective in the treatment of specified brain ventricular disease.**

INTRODUCTION

The ventriculoscopic approach is considered to be safer and more effective in the treatment of hydrocephalus, arachnoid cysts, and intraventricular lesions in neurosurgery.[1-6] Because the whole process of ventriculoscopic surgery is carried out via an endoscopic sheath less than 7 mm in diameter, the surgical trauma is mild, and treatment-related complications are rarer than with other surgical procedures. We found that intraoperative bleeding-related complications have the greatest impact on ventriculoscopic surgery. Until now, however, few studies fully discussed this complication. Consequently, we retrospectively reviewed patients who underwent ventriculoscopy in Beijing Tiantan Hospital in an attempt to present our experience in the management of intraoperative bleeding.

MATERIALS AND METHODS

Patients

Patients who underwent ventriculoscopic surgery between May 2011 and December 2012 at Beijing Tiantan Hospital were analyzed. The diagnosis of patients was confirmed according to clinical manifestations and magnetic resonance imaging (MRI). All patients were followed up until March 2015. Follow-up evaluations included the recording of clinical symptoms and physical signs, in addition to MRI of the brain. The study protocol was approved by the Ethics Committee of Beijing Tiantan Hospital, and informed consent was obtained from all patients.

Instruments

The HD neuroendoscopy system, pneumatic support arm, and rigid endoscopes (0° and 6°) were obtained from Karl Storz GmbH & Co. (Tuttlingen, Germany). The flexible endoscope was obtained from Fujinon Corp (Saitama, Japan). The irrigation pump was obtained from Clarus Medical LLC (Minneapolis, Minnesota, USA). Bipolar coagulation instruments were obtained from ERBE Elektromedizin GmbH (Tübingen, Germany). A Cavitron ultrasonic surgical aspirator was obtained from Söring GmbH (Quickborn, Germany).

Key words
- Hemorrhage
- Neurosurgery
- Ventriculoscopy

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
ETV: Endoscopic third ventriculostomy
MRI: Magnetic resonance imaging

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Surgical Procedure

A skin incision was made, and a burr hole was placed according to the best trajectory obtained from MRI. After trepanation, a small opening of the dura was performed. After we entered the ventricle or cyst, the endoscope was held by the operator or fixed to the endoscope holder, and then the trocar was removed and the cerebrospinal fluid (CSF) space was inspected with the rigid endoscopes. A flexible endoscope was sometimes used as a supplementary measure.

Endoscopic third ventriculostomy (ETV) was carried out in patients with hydrocephalus and in whom the diameter of the ventriculostomy stoma was greater than 6 mm. For patients with an arachnoid cyst, endoscopic partial resection of the cyst wall plus cystoventriculostomy or cystocisternostomy was performed and the fistula orifice was expanded as much as possible to ensure an unobstructed circulation of the CSF. For patients with intraventricular tumors, the Cavitron ultrasonic surgical aspirator was used for tumor resection. If the endoscopic resection was difficult, conversion to open microscopic surgery was required. In the end, the encephalopuncture tract should be packed with absorbable gelatin sponge to prevent minor bleeding. Generally, computed tomography of the brain was performed within 4 hours after surgery and MRI of the brain was performed in 7 days after surgery. Follow-up evaluations included recording of clinical symptoms and physical signs and brain MRI.

Types of Intraoperative Hemorrhage

We divided the intraoperative hemorrhage into 3 types (Figure 1). Type I: The view of the surgical field was clear or only slightly blurred and the observation range of the endoscope was unaffected. Endoscopic hemostasis can be carried out directly, or the view of the surgical field became clear again within a short time after irrigation. Type II: The view of the surgical field

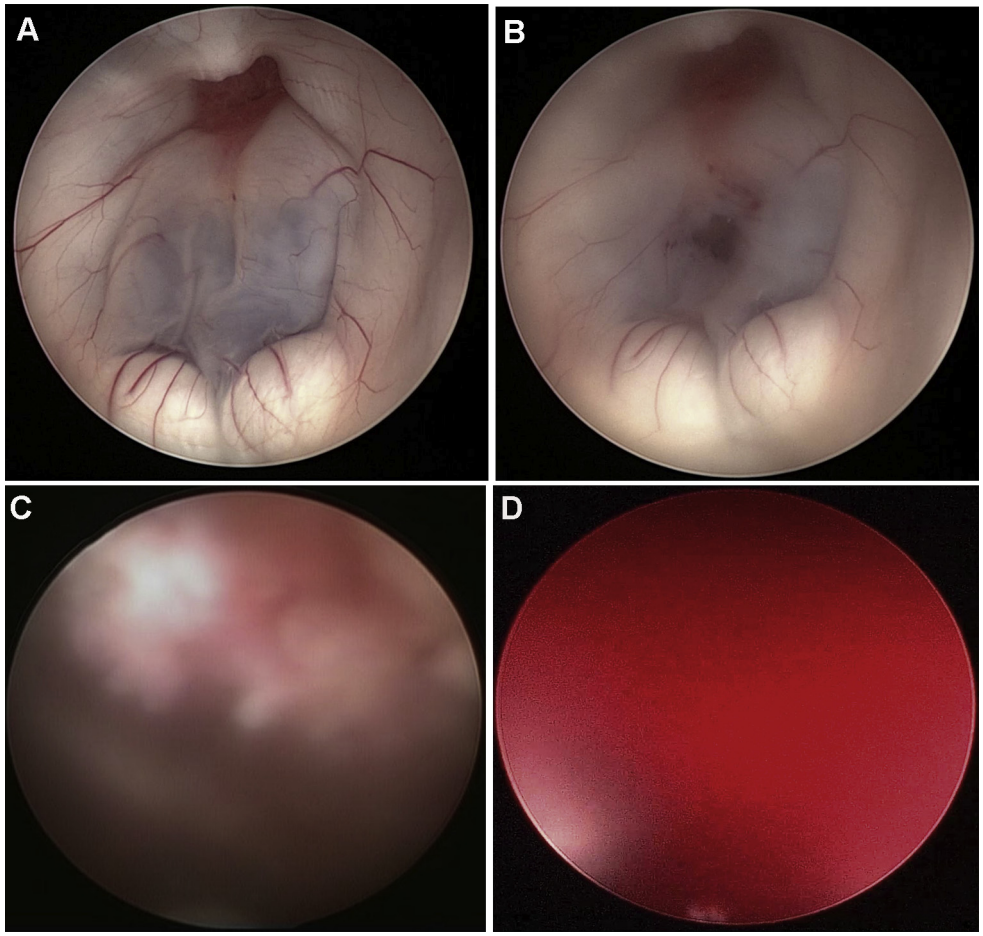

Figure 1. (**A**) Normal view of endoscopy. (**B**) Type I hemorrhage. After endoscopic third ventriculostomy (ETV), bleeding sites of the bottom of third ventricle can be stopped within a short time with irrigation. (**C**) Type II hemorrhage. The shunt tube was blocked and the patient underwent ETV + shunt tube removal. Bleeding from small blood vessels can be seen in the site of adhesion, and the view of the surgical field is blurred. (**D**) Type III hemorrhage. Because the hemostasis is difficult, conversion to microscopic surgery was required to stop the bleeding in a case of central neurocytoma.

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