Epidural Hematoma as a Complication of Endoscopic Third Ventriculostomy in a Patient with Aqueductal Stenosis

Omar Zalatimo* and Mark Iantosca
Department of Neurosurgery, Penn State Hershey Medical Center, USA

Abstract

Objective: The use of endoscopic third ventriculostomy (ETV) for the treatment of hydrocephalus in the setting of aqueductal stenosis has been well established. There have been many demonstrated complications of this procedure, but epidural hematomas have rarely been reported in the literature.

Case description: The authors report a case of a 16-year-old female with aqueductal stenosis, who underwent an endoscopic third ventriculostomy which was initially without incident but she was later found to have an epidural hematoma.

Conclusion: The authors conclude that though this is a rarely reported entity, epidural hematoma following ETV is a possible, serious complication of the procedure.

ABBREVIATIONS

CSF: Cerebrospinal Fluid; VPS: Ventriculoperitoneal Shunt; ETV: Endoscopic Third Ventriculostomy; EDH: Epidural Hematomas; MRI: Magnetic Resonance Imaging; CT: Computed Tomography; ICP: Intracranial Pressure; EVD: External Ventricular Drain

INTRODUCTION

The most widely accepted method for the treatment of hydrocephalus is cerebrospinal fluid (CSF) diversion by techniques such as ventriculoperitoneal (VP) shunt placement. However, CSF shunts are associated with variety of complications. In the pediatric series of de Ribaupierre et al. [8] less revisions and larger revision-free time were observed in patients treated with ETV. At 5 years of follow-up, the failure rate of ETV was 26% and that of VP shunt was 42%. For several decades ETV has been an alternative to shunting procedures. ETV is an accepted option for treatment of patients with noncommunicating hydrocephalus, especially those due to aqueductal stenosis [5,7,14,16,17]. In this select patient population the success rate of this procedure is found to be between 60 to 85% in most reported series [1,18,19]. The ease of the procedure, its low infection rate, and high success rate in selected patients with hydrocephalus make this treatment modality a good option in the properly selected patient with hydrocephalus.

The permanent morbidity of the procedure is reported to be lower than 5% in a recent series [2]. The two main categories of complications are neurologic and hormonal. This rate is comparable to the morbidity rates reported for shunt placement [8,9], and thus it is justifiable to characterize ETV as an alternate to shunt placement in terms of safety. Overall, complication rate of ETV is higher in previously shunted patients than in patients treated for newly diagnosed hydrocephalus [12]. Regarding intraoperative incidents, there are three main categories reported: hemorrhagic (subarachnoid, epidural and subdural), neurotraumatic, and anesthetic. Among these, the hemorrhagic complications are the most common accounting for up to 4% of the complications reported [2,4]. In the current literature there are only a few cases of epidural hematomas (EDH) complicating endoscopic surgery that have been reported [3,6,13], though it is a well-known complication that arise following ventricular shunting [10,15,20].

In this article, we describe the complication of acute EDH in a young girl who underwent ETV for treatment of hydrocephalus due to aqueductal stenosis.
CASE PRESENTATION

A 16-year-old female presented to the clinic with an existing ventriculoperitoneal shunt placed for congenital aqueductal stenosis at 6 months of age. In the interim, she has had multiple shunt revisions including distal revisions for pseudocyst formation. The patient reported that she had been having progressively worsening headaches over the preceding two weeks. On fundoscopic exam exam, papilledema was seen. On physical examination, the shunt tract had fluid collections along the shunt tubing in the neck and abdomen, suggesting malfunction. She was admitted to the hospital for further treatment.

Laboratory tests were normal and CSF culture sent from a shunt tap was negative for infection. Brain magnetic resonance imaging (MRI) (Figure 1) showed that the patient had aqueductal stenosis with dramatically enlarged ventricles as compared to prior studies, and was confirmed with Cine phase-contrast study. Abdominal computed tomography scan (CT scan) showed a pseudocyst around the distal tubing.

Given the history of hydrocephalus secondary to aqueductal stenosis and recurrent pseudocysts, endoscopic third ventriculostomy was discussed with the patient and her family as a potential option. With their consent, the patient was taken to the operating room for an ETV. The procedure was performed without incident. First the old shunt was removed through her previous right parietal incision, and this incision was closed. Next, a precoronal burr hole was made on the right side using the large (14/11mm) perforator (Stryker Instruments, Kalamazoo, MI). Through the burr hole, a wide dural opening was made in a cruciate fashion with a number 11 blade, followed by bipolar electrocautery to coagulate the dural leaflets. Next, a cortisectomy was performed using bipolar electrocautery. Next, a trocar was passed to the ventricle with brisk flow of CSF. A MINOP rigid neuroendoscope (Aesculap Inc, Center Valley, PA) was inserted and the ETV was performed without incident. Intraoperatively there were no complications. An external ventricular drain was left in the right lateral ventricle as is our standard practice with ETV surgery. The external ventricular drain (EVD) remained clamped for ICP monitoring.

Postoperatively, according to our standard protocol, the patient was taken to the Pediatric Intensive Care Unit. Within the first four hours the patient developed diabetes insipidus (DI) and became lethargic. During this time her intracranial pressure (ICP) remained low (<10), with the device having a normal waveform. The patient then became progressively more confused and developed a slight left hemiparesis. At this time the ICPs increased to the mid 20’s. She was taken for an emergent CT scan of the brain which revealed a large right frontal epidural hematoma (Figure 2). Patient and the family were notified and consented for an emergent EDH evacuation.

The hematoma was evacuated without intraoperative complications. The hematoma was not directly connected to the burrhole (Figure 3). No primary source of bleeding was found. Following completion of the surgery, the patient was taken back to the ICU. The ICPs were down to <10 following surgery.

Postoperatively, the patient progressed well. She did not have any more episodes of DI and the ICP’s remained low. The EVD was removed on postoperative day 2 and at the time of discharge only a mild hemiparesis remained. By her 3-month follow-up, the patient reported that her headaches had resolved.
and there remained no signs of weakness. She continued to be asymptomatic at 1 year.

**DISCUSSION**

ETV is an alternative procedure to ventriculoperitoneal shunt placement. Unfortunately, there are rare but serious complications associated with this procedure [24]. Epidural hematomas are a rare complication of this procedure. Complications of neuroendoscopy may be revealed intraoperatively or postoperatively [21]. Intraoperatively, if hemorrhagic control is an issue it may require stopping of the procedure. If the complications are revealed postoperatively, it will require re-evaluation with a CT scan to ensure that a rare complication such as EDH has not taken place.

EDHs are a rare complication of ventricular drainage [10,15,20]. The incidence of EDH associated with ventricular shunting on drainage is as about 0.4% [11]. The largest report to date addressing EDHs complicating cerebrospinal fluid (CSF) drainage is by Sengupta et al. [20] where he reported on 3 cases of EDH and reviewed 22 patients. There were several factors that were possible factors in creasing the susceptibility for developing EDH: young age, long standing hydrocephalus, postoperative CSF drainage (lumbar or ventricular).

The leading hypothesis for cause of EDH following ETV is that a sudden drop in ICP may cause the dura to strip away from the inner surface of the skull [15,20], encouraging the accumulation of epidural blood. This corresponds to the finding that the complication rates of ETV is higher in previously shunted patients than in patients treated for newly diagnosed hydrocephalus [12]. We believe that in this patient with longstanding hydrocephalus, as we pulled out the old shunt there was CSF under high pressure that leaked out. By draining out CSF intraoperatively, the epidural space was created, leading to the formation of the EDH. Another issue that may have contributed to this process was that intraoperatively, as per our standard protocol, we had the ports on the scope open so that pressure does not build up in the ventricles. In this case, the open ports may have allowed too much CSF to drain out of the ventricles adding to the abrupt change in intracranial pressure.

We believe that to avoid an abrupt drop in intracranial pressure, in patients with longstanding hydrocephalus, the utmost care should be taken to maintain a high ventricular pressure during the procedure. Despite our efforts of making a large dural opening, a cortisectomy, and using a trocar, these are still potential sources for strain on the brain that deserve attention to limit any stripping of the dura from the skull. However, we do not believe these were factors in this case as these details were closely monitored and the EDH is not contiguous with the burr hole site as would be the case if these were the factors in its production. In addressing similar patients, the shunt should be removed after performing the ETV if possible, as this will limit the loss of CSF initially. The other point that deserves attention is the drainage of CSF through the scope. We recommend closing one of the ports and ensuring that not too much CSF is draining too quickly.

**REFERENCES**


