Intracranial hypertrophic calcification complicating neuroendoscopy

Report of three cases

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Three cases are presented in which progressive hypertrophic calcification formed following ventricular endoscopy. After a ventricular endoscopy has been performed, it has been the authors’ practice to seal the burr hole with bone dust. They believe that the calcifications formed from bone dust that fell into the track left by the endoscope. This is the first time this complication has been described.

Key Words • hypertrophic calcification • third ventriculostomy • endoscopy

Surgical Technique

The surgical technique performed at Leeds General Infirmary is not markedly different from that used at other institutions. A right frontal burr hole is made on the coronal suture in the midpupillary line by using a standard cranial perforator. The bone dust is collected, the dura mater is opened, a Dandy cannula is used to form a track to the lateral ventricle, and the endoscope is introduced. A rigid endoscope is usually used because this simplifies orientation and instrumentation.

An unconnected, blunt-tipped bipolar wire is used to create the stoma, which is then dilated using a figure eight balloon (Neumedtronics, Forth Medical, Ltd., Berkshire, UK). An external ventricular drain is sometimes left in the ventricle, but is not connected. The endoscope is removed and the leak of cerebrospinal fluid is rapidly stopped by packing the residual defect with a large piece of surgical cellulose and bone dust. The galea and skin are closed.

A total of 122 cases have been treated using this technique over the last 5 years. Postoperatively, most patients have been discharged rapidly within 1 to 2 days.

Case Reports

Case 1

Examination. This 23-year-old man was admitted on an emergency basis with a 3-month history of headache and nausea. He exhibited bilateral papilledema, and an MR image (Fig. 1 upper left) obtained at the time demonstrated extensive dilation of the left lateral ventricle. There was no structural lesion to explain this hydrocephalus.

Operation. The patient was taken to the operating room and an endoscopic fenestration of the septum pellucidum was performed from the left side. The foramen of Monro was not visible and was, therefore, thought to show atresia. An external ventricular drain was left in situ, but not connected. A routine CT scan was performed (Fig. 1 upper right) and the patient was discharged home 3 days later.

The man was readmitted twice during the next 2 months with headaches. On the second occasion he underwent CT scanning (Fig. 1 lower left) and pressure monitoring. The patient had a normal intracranial pressure. He has since been seen at our clinic and his headaches have largely resolved.

The most recent CT scan (Fig. 1 lower right) in this case was obtained 1 year after surgery. A recent MR image did not demonstrate any structural lesion to explain the patient’s hydrocephalus. The unilateral hydrocephalus has resolved.

The CT scans demonstrated the development of radiopaque lesions in the left frontal and occipital horns of the lateral ventricle. These lesions were not visible on the immediate postoperative scan. On later scans they appeared and gradually enlarged, becoming more clearly defined on each subsequent scan.

Case 2

Examination. This 64-year-old woman was admitted on an emergency basis with a 2-month history of headaches, repeated falls, and both fecal and urinary incontinence. A
FIG. 1. Axial unenhanced MR image obtained preoperatively (upper left) revealing hydrocephalus, and unenhanced CT scans obtained 1 day postoperatively (upper right), 2 months postoperatively (lower left), and 1 year postoperatively (lower right) demonstrating resolution of the initial hydrocephalus and progressive development of intraventricular calcifications.
CT scan demonstrated triventricular hydrocephalus due to aqueductal stenosis.

**Operation and Immediate Postoperative Course.** An uncomplicated third ventriculostomy was performed from the right side. An external ventricular drain was not used. Following surgery the patient made an excellent recovery, underwent routine CT scanning (Fig. 2 left) 2 days later, and was discharged back to her referral hospital.

**Later Postoperative Course.** The patient was seen twice in clinic, 3 and 9 months postoperatively. She still has some residual headache, but her gait and incontinence have resolved. A CT scan (Fig. 2 right) obtained 3 months following surgery revealed the development of radiopaque lesions in the right frontal horn, right occipital horn, and endoscope track. These lesions were not present on the immediate postoperative scan.

**Case 3**

**Examination and Operation.** This 11-year-old boy was admitted to our institution with a 3-week history of headaches. A CT scan (Fig. 3 upper left) obtained at the time demonstrated hydrocephalus and a pineal tumor. The patient's tumor markers were normal and we, therefore, elected to perform an endoscopic biopsy and third ventriculostomy.

**Postoperative Course.** The patient underwent CT scanning 3 days postoperatively (Fig. 3 upper right); the scan demonstrated a small calcified focus in the floor of the third ventricle. The patient was readmitted 5 weeks later with headaches and papilledema. A CT scan (Fig. 3 lower left) revealed progression of the calcified focus and recurrence of hydrocephalus. A repeated endoscopy was performed and the ventriculostomy stoma was found to be blocked by hypertrophic calcification (Fig. 3 lower right). Histological analysis demonstrated viable fat cells; the bone cells had been destroyed in the process of making the histological slides.

**Discussion**

We performed a Medline search using the key words postoperative, osteoma, neurosurgery, third ventriculostomy, and complication, but were unable to find any previous reports of postoperative hypertrophic calcifications.

Bone dust contains viable osteoblasts that when implanted into vascular tissues are capable of dividing and laying down bone. This is used, for example, to seal burr holes and encourage fusion in the cervical or lumbar spine. In the first two cases that are presented, we have shown that the areas of calcification were not present immediately postoperatively, but developed during a period of a few weeks to months. In the third case some calcification was present immediately postoperatively, but this was observed to progress on subsequent scans. The histological confirmation that there are viable fat cells also suggests that these are growing masses. These cases demonstrate that should the bone dust get into the highly vascularized cerebral cortex or the choroid plexus, it can form viable, progressive hypertrophic calcifying masses.

Currently, our treatment of these calcifications consists of serial scans and observation. Surgical removal will be difficult if it becomes necessary. Clearly, it is important to prevent the occurrence of these hypertrophic calcifications in future cases and we have, therefore, modified our technique so that bone dust is no longer replaced. Surgicel alone followed by a watertight galeal closure is now used. No fur-
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Conclusions
Sealing third ventriculostomy burr holes with bone dust can result in the development of viable, growing intraventricular hypertrophic calcifications. We propose that other methods should be used to seal a burr hole after the surgeon performs a third ventriculostomy.

Reference

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