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Case Report

Traumatic Migration of a Shunt Valve Into the Cyst

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Conflict of Interest
The author has no financial conflicts of interest.

ABSTRACT

Hardware migration is an unavoidable complication of intracranial shunt surgeries. Traumatic dislodgement of a valve into the skull occurred in a young boy with a cystoperitoneal shunt following a head injury. Shortly before admission, he fell off his wheelchair and hit his head on the floor. Medical treatment was initiated to manage the patient for traumatic intracranial hemorrhage, and he was subsequently discharged home. However, 2 weeks after discharge, computed tomography (CT) showed a migrating valve and associated meningitis. The CT scan showed that the shunt valve was deep in the temporal cyst. The dislodged shunt valve was left in situ because the parents did not want surgical intervention. The author demonstrates how this complication develops and suggests preventive measures through reviews on the migration of the shunt into the cranium.

Keywords: Arachnoid cysts; Head trauma; Meningitis

INTRODUCTION

Cystoperitoneal (CP) shunting is a valid method of achieving obliteration of the intracranial cysts and clinical improvement. This option for fluid diversion seems to feature low operative risks and few complications.[4] However, it should be noted that some patients might experience the short- and long-term adverse effects after CP shunt insertion.[20]

Upward or downward migration of the system has been presented as a well-known cause of shunt malfunctions.[15] However, the literature contains only a few descriptions on the traumatic intracranial displacement of a valve in pediatric groups.[14,19] No report on such a complication in an adult with intracranial shunts exists. Herein, a very rare case of traumatically dislocated valve in an adult who received a CP shunt in childhood is illustrated. The author also proposes the operative techniques to resist the mechanical failure associated with proximal migration of the shunt component.

CASE REPORT

A 20-year-old male came to emergency department after a blow to the head. Originally, this patient had a porencephalic cyst in the temporal lobe, which was diagnosed by means of fetal sonogram. At the first year after birth, a CP shunting procedure was performed to release the mass effect and limit its expansion into the pericerebral space. The child grew up with seizures and delayed milestones. But, clinical follow-up with a pediatric clinician was not sought out by the parents.

Upon arriving, the patient was somnolent and his vital signs were stable. There was an extensive soft-tissue contusion over the left-sided head. Traumatic subdural hemorrhage with epidural clot was evident in computed tomography (CT) images. A small amount of intracranial air secondary to the temporal bone fracture was also delineated (**FIGURE 1A**). Neck X-ray disclosed a calcification and disconnection of the distal shunt tubing (**FIGURE 1B**). On examination, an old implant in the temporal bone was palpated easily, but the reservoir resulted in no refilling. The flat-based reservoir was smaller than the diameter of the burr hole (**FIGURE 1C**). The patient responded well to a week of conservative therapy, and then his presenting symptoms resolved completely.

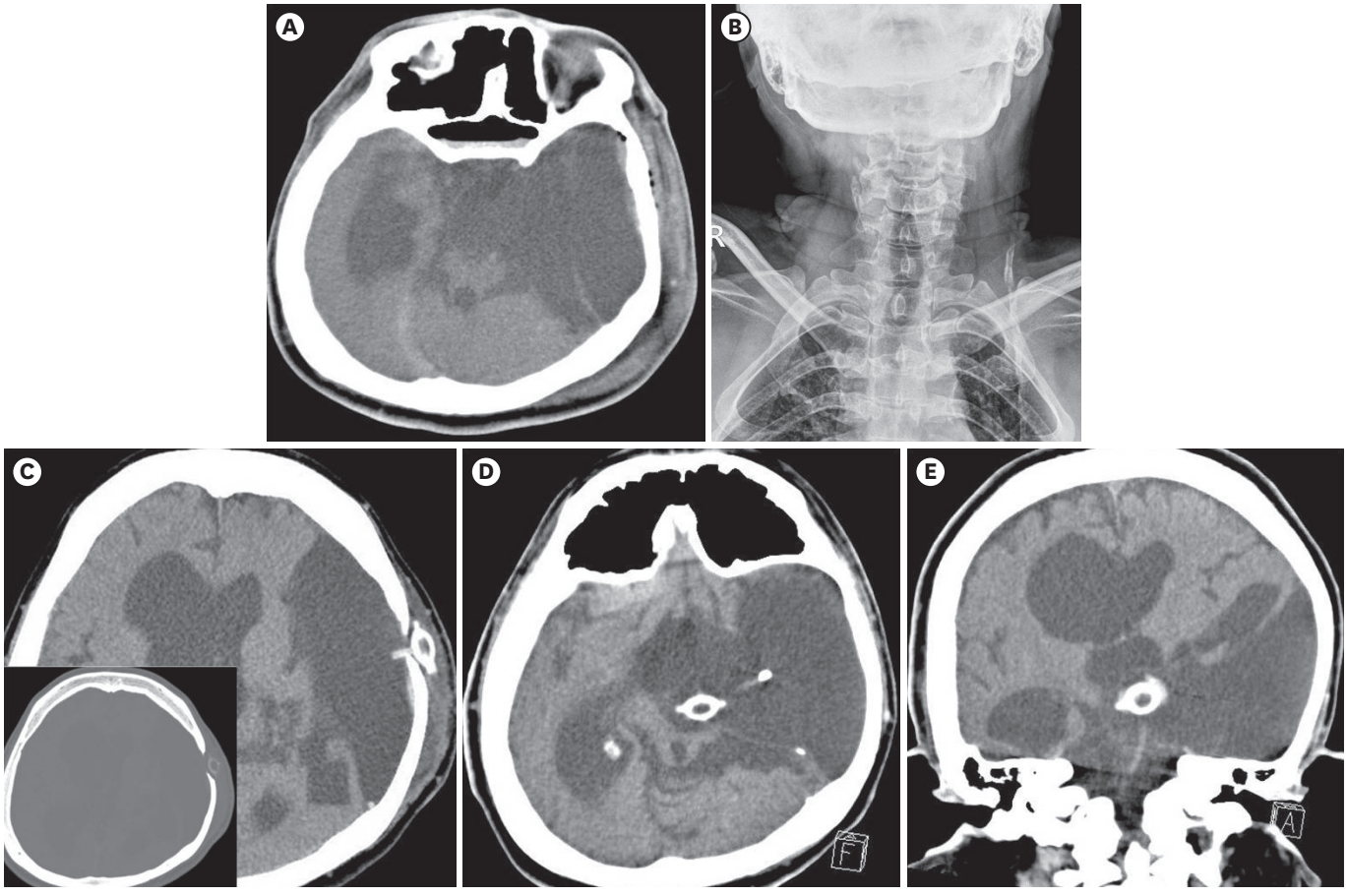

FIGURE 1. Traumatic migration of a shunt valve into the cranium. (A) Head scan shows acute hemorrhages in the epidural and subdural space with minimal pneumocephalus. There is a scalp contusion over the left side of the head. (B) Neck X-ray reveals a calcification and fragmentation in the disconnected distal shunt tubing. (C) This section depicts the burr hole-type reservoir to be in the correct position. (D & E) The size of the perforation is larger than the base of the device in the inset. Note the valve migrating into the deep portion of the cyst at the second admission.

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Two weeks later after discharge, he was readmitted with worsening headache and vomiting. The patient's body temperature was 36.7°C, and his blood pressure, pulse rate, and respiratory rate were normal. On examination, there was no palpable reservoir in the trephination. CT showed the shunt valve which deeply situated into the cerebral cyst (**FIGURE 1D & E**). Prior to the current hospitalization, medical history supplied by the parents focused on the scalp swelling and the use of compression bandage. While the subgaleal hematoma fluctuated during its resolution stage, his mother applied an elastic band on the patient's head. Laboratory analysis of the cerebrospinal fluid was consistent with aseptic meningitis. The examination revealed an increase in cell count (63/μL; mostly lymphocytes) and total protein (97 mg/dL), but normal glucose concentration (64 mg/dL). After 2 weeks of steroid therapy, we planned to retrieve the displaced valve with aid of an endoscopy. However, this treatment option was refused by the parents for economic reasons, and the patient was discharged.

DISCUSSION

A CP shunting was an effective treatment option for the management of symptomatic intracranial cysts.[20] Displacement of its element can also occur in either direction, rostrally or caudally, as in the cases with ventriculoperitoneal shunt.[2,4] Theoretically, their migrations are mainly afforded by a combination of negative suction pressure created by fluid drainage, positive pushing pressure from the abdomen exerted by physiological processes, a tortuous subcutaneous track of the tubing, and an incorrect fixation of the both ends of the system.[1,3,5,14]

Upward migration of the hardware to the cyst or ventricle, the subcutaneous spaces of the head, neck and chest, often with coiling of the catheter in areas of loose skin, has been described in several reports,[2,16] although this remains an unusual cause of shunt failure. A number of causative factors are responsible for such complication of the intracranial shunt. These were small infants, pumping test, uni-component system, thin cortical mantle, a long proximal tube, giant cyst, valveless shunt, impacts on the hole in seizures, occipital entry, and wide endoscopic channel.[6-9,12]

Clinical manifestations of the reported cases complicated with the proximal migration usually were due to shunt malfunctions.[3,10] Occasionally, in the process of migration, the valve might damage the ventricular and intracystic structures en route to its final destination, and could be a source of infection and inflammation.[9,14,15] An extremely rare case presenting with constricted visual field due to a shunt valve which spontaneously embedded in the occipital lobe has been also introduced.[18]

Traumatic origin for the valve migrated into the cranium is seldom reported as a cause of mechanical shunt dysfunction. Until now, there is only 2 pediatric cases who had an apparent history of direct injury related to the shunt chamber.[19] Their CT scans depicted intracranial dislocations of the valve beneath the frontal bone with no interruption of the shunt system. Interestingly, regarding to our case, traumatic internalization of a chamber is an unreported occurrence for the adults with a valve-containing shunt system. In addition, this is the first case with complication of a wandering valve within intracavitary circulation in the cyst, causing a foreign substance reaction and eventually presenting with chemical meningitis.

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We assume that 4 types of physical stress might have caused a slippage of the valve into the cranial cavity. At first, the size discrepancy between the perforation and the chamber was clearly delineated. This was a surgical factor which facilitated the passive herniation of a valve through the enlarged hole with osteolytic change.[17] Second, the granulation which tacks the device into the primary position became weakened due to scalp contusion, whereby reduced resistance to its movement potentiated a risk of intracranial migration of the valve. Third, head compression exerted a strong force on the dome of the valve, augmenting its deformation and collapse, and consequently the implant was driven into the skull. Fourth, as shown in radiography, the shunt valve has been disconnected from the distal catheter, thus it could penetrate the larger burr hole more easily following head trauma.

A number of operative tactics are available to obviate the vulnerability of the valve to upward migration. Preferentially, care is taken to make sure that the trephination should be as small as possible for the shunting procedures. Another recommendation is a firm anchorage for the proximal component of the shunt on the cranium. As a more robust technology, the microscrew was recently used to rigidly secure the reservoir to the skull for avoiding its untoward migration.[13] Suturing the valve to the periosteum is also used, but it seems that this method does not give it stability in the acute phase following placement of the shunt. Furthermore, the selection of the shunt type has been implicated in the system migrations. A right-angle type of reservoir could be used, and a larger device may be preferable, and thereby tend to resist the migration into the skull at the entry site.[11] Finally, considering the causative factors of the shunt migration, it is essential to instruct that persons without relevant skills do not apply the bandage to the underlying valve when the patients present with scalp hematomas.

Shunt migrations could be surgically treated by repositioning the erroneous ventricular catheter, the valve, the reservoir or the distal tubing. Early operative intervention is required to remove the components that not functioning, hence preventing any shunt-related complications in the future.

CONCLUSION

The shunt valve was found to have passed through the trephine following head trauma in the current case. We suggest that the placement of a small craniostomy and the use of anchor screws to fasten reservoir are efficient steps for avoiding this unusual complication of the shunt.

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