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Case Report

External ventricular drain migration into the cisterna magna: A case report

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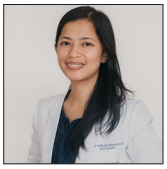

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ABSTRACT

Background: External ventricular drain (EVD) insertion is a common neurosurgical procedure used to treat acute hydrocephalus. In this report, we present a rare case of an EVD that was initially correctly placed within the frontal horn but subsequently migrated to the cisterna magna, the first to be reported in the literature.

Case Description: A 46-year-old man with postoperative meningitis and hydrocephalus underwent EVD insertion using an improvised EVD system. The EVD was also used as a route for the administration of intraventricular antibiotics. The patient was restless and agitated during his treatment, causing him to move his head frequently. Serial computed tomography scans showed that the EVD was initially correctly placed within the frontal horn and then migrated to the cisterna magna.

Conclusion: Inward catheter migration is a rare complication of EVD insertion and is an important concern since it may cause neurologic deficits and potentially harmful sequelae. We have also highlighted measures that can be taken to prevent a similar event in the future.

Keywords: Cisterna magna, External ventricular drain (EVD) migration, External ventricular drain

INTRODUCTION

External ventricular drain (EVD) insertion is one of the life-saving procedures for acute hydrocephalus; thus, it is considered a vital skill in the neurosurgical armamentarium. The surgical technique is relatively simple, but its complications, such as malposition, may be devastating. In this report, we present a rare case of an EVD that was initially correctly placed within the frontal horn but subsequently migrated to the cisterna magna, the first to be reported in the literature.

CASE REPORT

A 46-year-old man presented with fever, headache, and suboccipital pseudo meningocele formation at the emergency department. He had a recent history of a ruptured right vertebral artery aneurysm, which was managed with suboccipital craniotomy, C1 laminectomy, and Hunterian ligation of the right vertebral artery. On examination, he was drowsy, confused, and able to follow simple commands. He was febrile, with nuchal rigidity and a positive Brudzinski's

sign, and had a tense pseudo meningocele in the suboccipital area. Cranial computed tomography (CT) [Figure 1a] showed hydrocephalus and suboccipital extracalvarial fluid collection. Cerebrospinal fluid (CSF) cultures were positive for *Staphylococcus aureus.* Antibiotics were started, and a lumbar drain was inserted, with improvement in the patient's sensorium and regression of the pseudo meningocele. However, repeat CSF culture showed growth of *Klebsiella* sp., so the lumbar drain was removed, and a left frontal EVD was inserted to facilitate intraventricular antibiotic treatment. The correct placement in the left frontal horn was confirmed with a postoperative CT scan [Figure 1b].

The patient received a 3-week regimen of intraventricular antibiotic treatment in addition to intravenous antibiotics. The patient also developed hospital-acquired pneumonia and nosocomial sepsis. During this time, he had episodes of agitation, causing him to move his head frequently. In the interim, the EVD fulcrum was raised progressively to determine if the patient could be weaned off the EVD. However, the CSF output decreased markedly, prompting a repeat cranial CT scan that showed that the ventricular size had decreased and that the tip of the EVD was in the cisterna magna [Figures 1 c-f]. The patient did not develop any new neurologic deficits but was still agitated and restless. While the neurosurgical team was deciding on the best course of action, the EVD was accidentally pulled out. Again, the patient did not exhibit any new neurologic deficits, and a post-EVD removal scan showed no increase in ventricular size and no hematoma along the intracranial tract of the EVD [Figures 1g and h]. The patient was closely monitored and was eventually discharged after completing antibiotic treatment. On follow-up at the outpatient clinic, he was awake, oriented, following commands consistently, and ambulating with assistance. Written consent was obtained from the patient himself.

DISCUSSION

EVD insertion is a life-saving procedure that decreases intracranial pressure by draining CSF. Complications include infection, intracerebral hemorrhage, CSF leak, disconnection within the drainage system, accidental EVD pull-out, and EVD catheter migration.[1] Saladino *et al.* reported that malpositioned ventriculostomy catheters were the most commonly identified complication.[12]

EVD migration after an initial correct placement is a rarely reported complication.[10] Migration of the catheter may

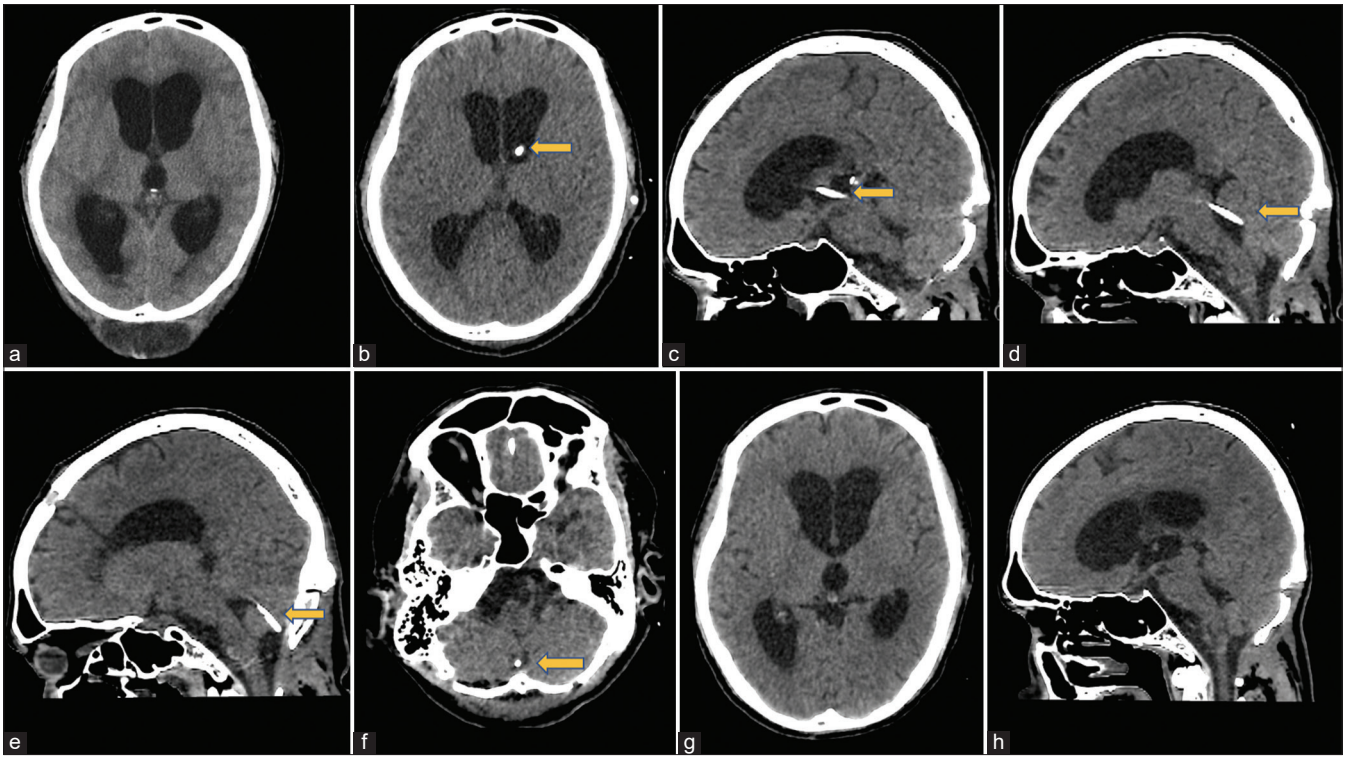

Figure 1: (a) Initial cranial CT, axial image, showing hydrocephalus and suboccipital extracalvarial fluid collection. (b) Post-EVD insertion cranial CT, axial image, showing the EVD tip within the left frontal horn. (c and d) Repeat cranial CT, sagittal images, showing the course of the EVD catheter through the third and fourth ventricles. (e and f) Cranial CT, sagittal and axial images, showing the EVD tip in the cisterna magna. (g and h) Post-EVD removal CT, axial and sagittal images, showing stable ventricular size and absence of hematoma along the EVD tract. CT: Computed tomography, EVD: External ventricular drain. (b-f): Yellow arrow pointed at the ventricular catheter.

result in neurologic deficits secondary to the manipulation of nearby neurovascular structures, with potentially devastating consequences.[8] To the authors' knowledge, there has been no previous report of EVD migration along the ventricular system down to the cisterna magna. There has only been one published report of EVD migration to the dorsal midbrain, resulting in Parinaud syndrome.[8]

Several factors were hypothesized to have contributed to the EVD migration in our case. The first was the EVD system that was used. In our institution, commercial EVD systems were not always available, so we often had to use an improvised EVD system that consisted of a sterile Fr 8 nasogastric tube connected to a blood transfer bag [Figure 2]. The nasogastric tube served as the ventricular catheter, while the transfer bag served as the drainage system. The lack of gradations or markers in the nasogastric tube may have contributed to the late detection of EVD migration. If external markers were present, they may have provided a sign that the catheter was not in the correct depth early on, precluding further migration. The second factor was the lack of a standard technique for securing the EVD in our institution. The techniques used were based on the individual neurosurgeon's preference and experience. The third factor was the additional manipulation during intraventricular antibiotic administration, which may have contributed to EVD migration. The fourth factor was the patient's agitation, which caused his head to move from side to side. The frequent head movement over time may have allowed the ventricular catheter to migrate inferiorly, following the ventricular system.

Based on this experience, we have made some recommendations to prevent EVD migration. The first is the use of a commercial EVD system if it is available. There have been published reports on the use of improvised EVD systems in low-resource settings for economic reasons,[6] but commercial EVD systems have been found to be superior in terms of lower infection and malfunction rates compared to improvised ones.[7,9] The increase in EVD-related infections is attributed to the lack of antibiotic impregnation in improvised EVDs.[7]

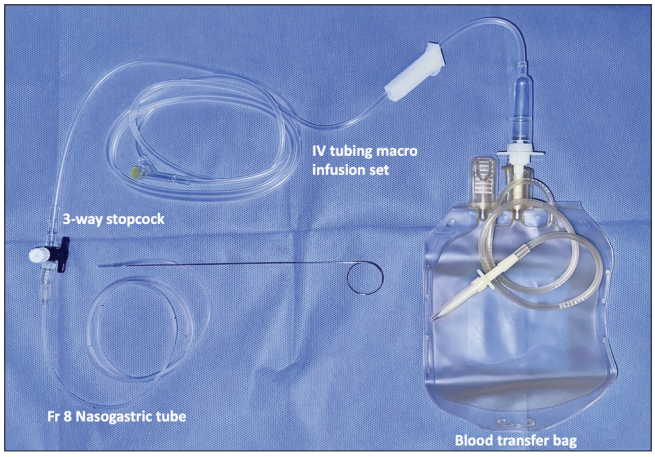

Figure 2: Improvised external ventricular drain system consisting of a sterile Fr 8 nasogastric tube connected to a blood transfer bag; the nasogastric tube served as the ventricular catheter while the blood transfer bag served as the drainage system.

The second recommendation is to ensure that the EVD is secured properly since it is maintained for several days. The tunneled-EVD (T-EVD) has been the standard practice in EVD placement for years. Friedman and Vries described it in 1980, wherein the EVD catheter was tunneled subcutaneously, made to exit the skin 5–6 cm away from the incision, and secured with sutures.[2-5,13] Another option is the bolt-connected EVD (BC-EVD), wherein the catheter is mounted and secured onto a fixed bolt that is placed in the burr hole.[5] There were fewer complications seen with the BC-EVD compared to the T-EVD, such as decreased risk of unintended EVD pull-out or removal, EVD malfunction and obstruction, and CSF leak.[5] An EVD catheter-locking device has also been developed to maintain the EVD in place, with promising initial results.[13] A standard institutional protocol for EVD insertion and post-operative care is also recommended so that all the members of the team will be familiar with the correct surgical technique and postoperative surveillance.[9] After administration of intraventricular antibiotics, extra care should be taken to determine that the EVD remained in the correct position. Finally, agitated patients with an EVD must be restrained properly to avoid both internal migration and accidental pullout. They can also be lightly sedated if necessary.[11,14]

We presented this case to demonstrate that it is possible for the EVD catheter to migrate from the frontal horn to the cisterna magna. EVD migration is an important concern since it may cause neurologic deficits and potentially harmful sequelae. Our patient is very fortunate that he did not develop any new deficits from the EVD migration; nevertheless, this is something that should never have happened. We have also highlighted measures that can be taken to prevent a similar event in the future.

CONCLUSION

This case demonstrated a rare complication of EVD insertion, which is an important concern since it may cause neurologic deficits and potentially harmful sequelae. Recommended measures were proposed to prevent a similar event in the future.

Statement of authorship

MUH: Conceptualization; resource; data curation; writing - original draft preparation; writing – review and

editing, KPC: Conceptualization; resource; data curation, KOK: Conceptualization; writing - original draft preparation; writing – review and editing; supervision; and project administration.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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