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Case Report

A Unique Case of Intraparenchymal Chemotherapy due to Ventricular Access Device Misuse: A Cautionary Tale

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Abstract

Background: Ommaya reservoirs are ventricular access devices used for chemotherapeutic treatment of hematological malignancies with CNS involvement. We report a case describing inadvertent intra-parenchymal spread of chemotherapy resulting from unrecognized failed access of the device.

Presentation: A 56 year old male had an Ommaya reservoir placed for relapsed monoclonal acute myeloid leukemia with CNS involvement. Routine post-operative CT was unremarkable and demonstrated satisfactory device placement. After the device was accessed and utilized, subsequent CT disclosed new moderate sized intra-parenchymal hemorrhage centered on the Ommaya catheter with significant scalp hematoma. Fluoroscopic ventriculogram demonstrated faulty access with contrast filling around the reservoir and tracking through the burr holes into brain parenchyma. Reaccessing the device correctly showed a patent system without extravasations and normal drainage into ventricular CSF pathways.

Conclusions: Adequate training and supervision is necessary for accessing ventricular reservoirs to prevent local extravasation. This case illustrates that extravasation may extend through the burr hole to affect adjacent brain parenchyma, falsely simulating a detached catheter. Fluoroscopic ventriculograms are useful in diagnosing problems with intraventricular catheters and in this case the patency of the Ommaya reservoir system was demonstrated, allowing its ongoing use after correct cannulation.

Keywords: Ommaya réservoirs; Complications; Hemorrhage; Case report

Abbreviations

CT: Computed Tomography ; CSF: Cerebrospinal Fluid

Case Presentation

A 56 year old man with central nervous system involvement from relapsed monoclonal acute myeloid leukemia had an Ommaya reservoir placed for intraventricular chemotherapy.

Routine day one post-operative computed tomography (CT) confirmed adequate ventricular catheter placement with no catheter kink, disconnection or intra-cranial hemorrhage (Figure 1).

One day after surgery, after the first access of the reservoir for chemotherapy, he developed sudden worsening of his headache with vomiting. This progressed over 12 hours however non-contrast CT did not show any acute intra-cranial pathology. The following day, Hematology attempted to access the reservoir but only blood could be aspirated. Chemotherapy was instead given via lumbar puncture.

There was ongoing headache, nausea, vomiting, as well as pain at the reservoir site by post-operative day four. A palpable fluctuant scalp collection was evident. Repeat CT showed new moderate sized right frontal lobe intra-parenchymal hemorrhage adjacent to the Ommaya catheter, as well as significant subgaleal hematoma surrounding the Ommaya reservoir (Figure 2). Two further unsuccessful attempts were made to access the reservoir over subsequent days with only blood stained fluid aspirated. Chemotherapy administration was therefore not attempted.

In view of suspicion of catheter disconnection or fracture, fluoroscopic ventriculogram through the Ommaya reservoir was

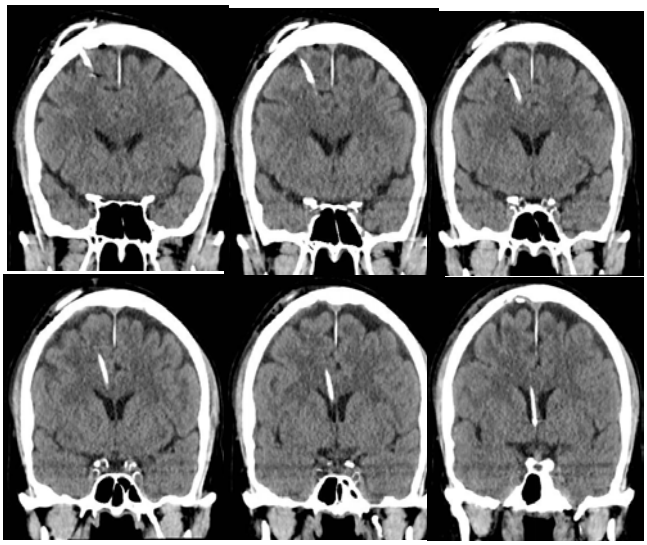

Figure 1: Coronal CT images on post-operative day one demonstrating the entire course of the ventricular catheter with its tip within the lateral ventricle at the level of the Foramen of Monro. The catheter sits 17mm within the lateral ventricle.

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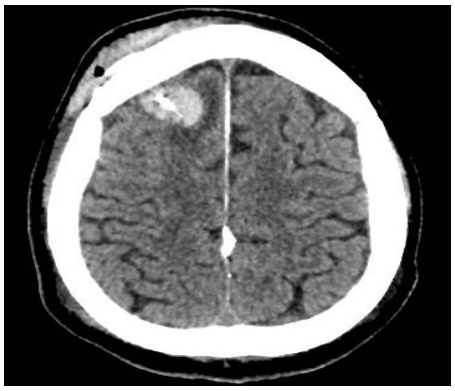

Figure 2: Transaxial CT on postoperative day four demonstrates 32x22x17mm (transverse x craniocaudal x anteroposterior) intraparenchymal hemorrhage in the right frontal lobe with surrounding edema and a subgaleal hematoma.

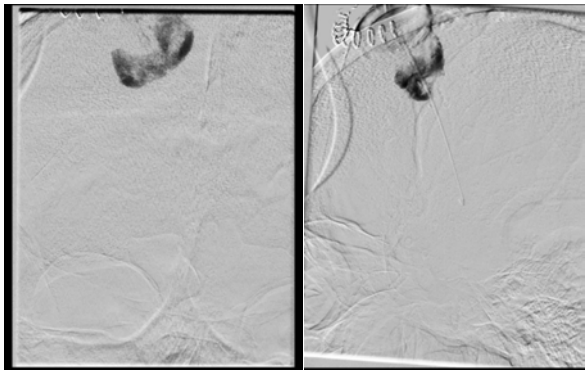

Figure 3: Coronal and sagittal fluoroscopic portogram demonstrates absent filling of the Ommaya reservoir lumen and its ventricular tubing. Contrast extravasation is seen around the device, extending through the burr hole into superficial brain parenchyma.

arranged. With initial access of the reservoir, 3ml 50% dilute non-ionic contrast (Omnipaque 300) was injected under fluoroscopic screening. Contrast was seen to extend around the outside of the reservoir, into the subgaleal space and then track through the burr hole, along the tubing into the brain parenchyma (Figure 3). This was confirmed on rotational angiography/cone beam CT. Subsequently the reservoir was reaccessed by an experienced doctor and fluoroscopic imaging confirming needle tip position within the center of the reservoir. Injection of 5 ml 50% dilute non-ionic contrast (Omnipaque 300) demonstrated central filling of the reservoir without extravasation and with free flow within the catheter tubing into the ventricular system without extravasation into brain parenchyma (Figure 4).

The patient's hemorrhage was conservatively managed. He had progressive improvement in both his symptoms and CT imaging. After the acute phase, he received further chemotherapy through the Ommaya reservoir without complication.

Discussion

Chemotherapy via an intraventricular catheteris an important option for localized drug delivery. It allows for more reliable CSF concentration and distribution compared to lumbar puncture [1,2]. An Ommaya reservoir is a ventricular access device which facilitates such therapy. A burr hole is created and the reservoir placed in the

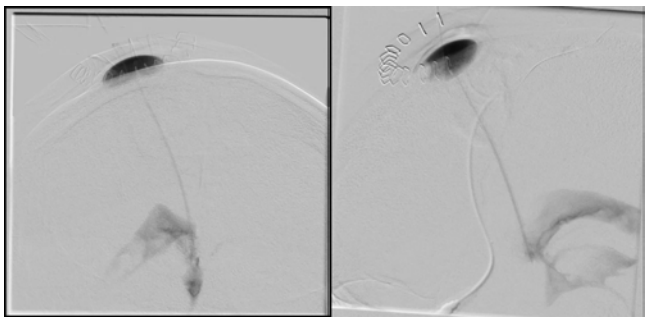

Figure 4: Coronal and sagittal fluoroscopy after correct cannulation of the device shows central filling of the Ommaya reservoir without extravasation. The contrast extends within the tubing to opacify the lateral and third ventricles. There is no extravasation into brain or subgaleal space.

subgaleal space with an intraventricular catheter extending from the reservoir into the lateral ventricle.

The incidence of severe adverse events complicating Ommaya reservoirs has decreased over time. Recent publications report 5-6% complication rate which includes infection, hemorrhage, catheter mal position and/or disconnection [3,4].

Intra-parenchymal delivery of methotrexate causing tissue necrosis has been reported as a consequence of Ommaya device disconnection [5], but cases of chemotherapy extravasation into brain parenchyma from faulty cannulation have not been reported.

In this case an inexperienced doctor unaware of the design of the Ommaya reservoir repeatedly failed to appropriately access the device. Access requires central placement of a 25-gauge or smaller needle within the reservoir dome. Firm pressure is required; timid insertion may place the needle bevel within the silicone elastomer capsule which facilitates leakage. The accessing needle bevel should be within the entire port lumen. Standard Integra Reservoir dome sizes are of 6 mm and 7.2 mm maximum depth, with smaller variations also available [6]. Needle guards are fitted in the base of all Integra reservoirs, except the Mini models, and the side inlet- flat bottom - 1.5 cm (NL850-1214) model, which resist inadvertent puncture through the base [6].

Additional factors that could be considered to reduce the risk of leakage around ventricular reservoirs include minimizing opening of leptomeninges and delaying introduction of chemotherapy injections. In this case chemotherapy was instituted on post-operative day one because of the severity of the underlying condition. Delaying chemotherapy also allows some healing of tissue around the implant which could reduce the risk of leakage spread in the case of incorrect injected solutions.

Blood aspirated during early attempts to access the device was likely from adjacent scalp hematoma. There was no evidence the reservoir was blocked or outside the lateral ventricle. Fluoroscopy confirmed that subgaleal injections can track through the burr hole into brain parenchyma explaining the hemorrhagic necrosis seen on CT.

This case serves to highlight the potential risk to brain tissue from inappropriate cannulation of ventricular access devices and the role of

fluoroscopy in such cases. It is important that medical staff accessing ventricular reservoirs have adequate training and supervision.

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