Stereotactic Insertion of an Ommaya Reservoir: Technical Note

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ABSTRACT: ***Background:*** Stereotactic insertion of catherters into deep-seated tumors or developmental cysts is easily accomplished, but connecting the catheter to an Ommaya reservoir while maintaining catheter position can be difficult. We describe a technique for easy placement of a catheter-Ommaya reservoir construct with one pass. ***Methods:*** Standard stereotactic imaging is performed. The distance from the outer table of the skull to the target point is measured. A catheter-Ommaya reservoir construct is assembled to this length and directed to the target position with a standard Cosman-Robert-Wells (CRW) stereotactic frame. ***Results:*** Use of this technique placed catheters into tumor or developmental cysts accurately and with no surgical complications in 12 patients. ***Conclusions:*** This technique is simple, safe, reliable, and requires no special equipment. It avoids the risk of dislodging the catheter when it is being connected to the Ommaya reservoir, reducing the chances of cyst leakage and collapse.

RÉSUMÉ: Mise en place d'un réservoir Ommaya par stéréotaxie: note technique. ***Introduction:*** Il est facile de mettre en place sous guidage stéréotaxique un cathéter dans une tumeur profonde ou dans un kyste embryologique, mais il peut être difficile de brancher le cathéter à un réservoir Ommaya tout en maintenant le cathéter en place. Nous décrivons une technique pour mettre en place facilement, en une seule manoeuvre, le dispositif préassemblé constitué du cathéter et du réservoir Ommaya. ***Méthodes:*** La distance de la table externe du crâne au point cible est mesurée par imagerie stéréotaxique standard. Le dispositif est préassemblé selon cette mesure et guidé vers la position cible au moyen d'un cadrage stéréotaxique Cosman-Robert-Wells (CRW). ***Résultats:*** Nous avons placé un cathéter dans une tumeur ou un kyste embryologique avec précision et sans complication chirurgicale chez 12 patients en utilisant cette technique. ***Conclusions:*** Cette technique est simple, sûre, fiable et ne requiert par d'équipement spécial. On évite ainsi le risque de déplacer le cathéter au moment où il est connecté au réservoir Ommaya, ce qui diminue les risques de fuite et d'affaissement au niveau d'une lésion kystique.

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The Ommaya reservoir system has been used widely for the delivery of chemotherapeutic agents into the ventricular system.[1-4] It has also been used for the intermittent drainage of glial tumor and craniopharyngioma cysts, and to permit the delivery of drugs and radionuclides into these same cysts.[3,5,6] A variety of stereotactic and non-stereotactic methods have been described for catheter placement and confirmation of catheter location before connection to these reservoirs.[2,4,7-9] Accuracy is a problem when placing a catheter into a deep-seated tumor cyst that is either not intimately related to the ventricular system or is adjacent to critical structures. If the catheter is placed using stereotactic methods, then the second difficulty is maintaining the catheter position within the cyst at the determined length while connecting it to the Ommaya reservoir. Frank et al.[7] have described the use of a custom device that attaches to the Brown-Roberts-Wells stereotactic system for the implantation of ventricular access reservoirs. We have used the Cosman-Robert-Wells (CRW) target-centered system, without modification, for the insertion of a catheter-Ommaya reservoir construct into tumor cysts. The details of this procedure are as follows.

Methods

The CRW base ring or the magnetic resonance (MR)-compatible base ring is attached to the skull in the usual manner under local anesthesia. A stereotactic computerized tomography (CT) scan or MR image is then obtained and a target position is selected for the tip of the catheter within the tumor cyst. For CT-based stereotactic methods, the anterior-posterior, lateral, and vertical coordinates are derived directly from the CT scan console using the CRW localizer system. For MR imaging stereotactic methods, the positions of the localizing rods are entered into the Radionics (Burlington, MA) SCS1 computer "TMRI" program and the appropriate (X,Y) coordinates entered, depend-

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ing on whether an axial, sagittal or coronal image is selected for target localization.

A trajectory to the target cyst is then determined using knowledge of neuroanatomy and information provided from coronal MR imaging. A slice is taken through the largest diameter of the cyst and then the distance (A) between the outer table of the skull and the center of the tumor cyst measured directly from the stereotactic coronal MR images, or from preoperative hard copies of MR image films (Figure 1). This distance determines the depth from the base flange of the 22-mm diameter Ommaya reservoir to the tip of the catheter. Since the distance from the base of the reservoir to the connection point with a catheter is 15 mm (Figure 2A), this distance is subtracted from the distance measured above (A) to determine the length of catheter needed, remembering that the first perforations on the catheter are 2 to 3 mm back from its tip.

In the operating room, the catheter-Ommaya reservoir construct is assembled to the measured distance (A) before touching the skin and is soaked in Bacitracin solution (50,000 units/50 cc saline) for 20 minutes. A 25-gauge stainless steel wire, or a 0.038" K-wire, is inserted through the center of the dome of the Ommaya reservoir down to the tip of the silastic catheter just before use. This assembly is then placed aside on the operating room table. The site for the proposed burr hole is prepped and draped in the usual manner. The anterior-posterior, lateral, and vertical coordinates for the target (catheter tip) are entered into both the phantom base and the arc-ring system and the phantom base is used to confirm the trajectory to the target position. The arc-ring system is then moved to the patient base and the arc ring positioned to allow for the preoperatively planned trajectory that avoids critical neuroanatomic structures, passes lateral to a ventricle, and is in a plane that is perpendicular to the outer table of skull. A burr hole is made, the dura is opened, and a small cerebrotomy is made. The CRW arc-ring system is then adjusted using the 2 degrees of rotational freedom allowed by this target-centered system, so that the trajectory for the catheter-Ommaya reservoir construct will pass through the small cerebrotomy. Once this has been confirmed by placing a blunt stylette down to the surface of the brain and cerebrotomy opening, the drill-guide block is removed.

The proximal end of the wire exiting from the top of the Ommaya reservoir dome is inserted back through a needle-guide in the drill-guide block (Figure 3). This unit (catheter-Ommaya reservoir construct, wire, drill-guide block) is then delivered through the drill-guide block collar on the CRW arc-ring system (Figure 4). This entire unit is then advanced until the catheter tip enters the small cerebrotomy. The entire unit is moved downward until the drill-guide block abuts the collar. At this point, the catheter-Ommaya construct is passed to the final target posi-

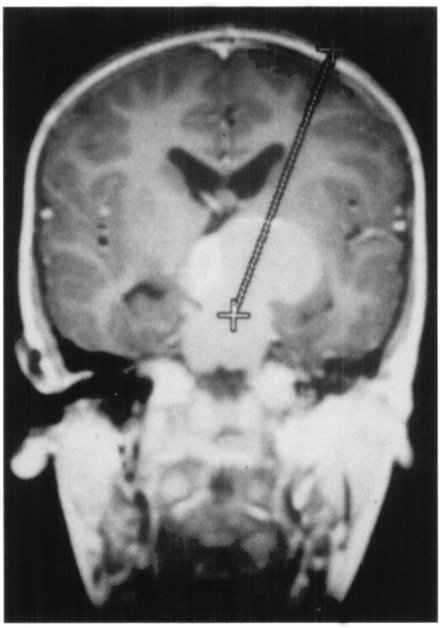

Figure 1: *Coronal T1-weighted MR image with gadolinium enhancement of a huge craniopharyngioma cyst. In this coronal preoperative image, a trajectory lateral to the ventricular system towards the center of the cyst was selected and the distance between the outer table of the skull (linear line of signal void consistent with cortical bone) to the center of the cyst was measured directly on the MR image (90 mm).*

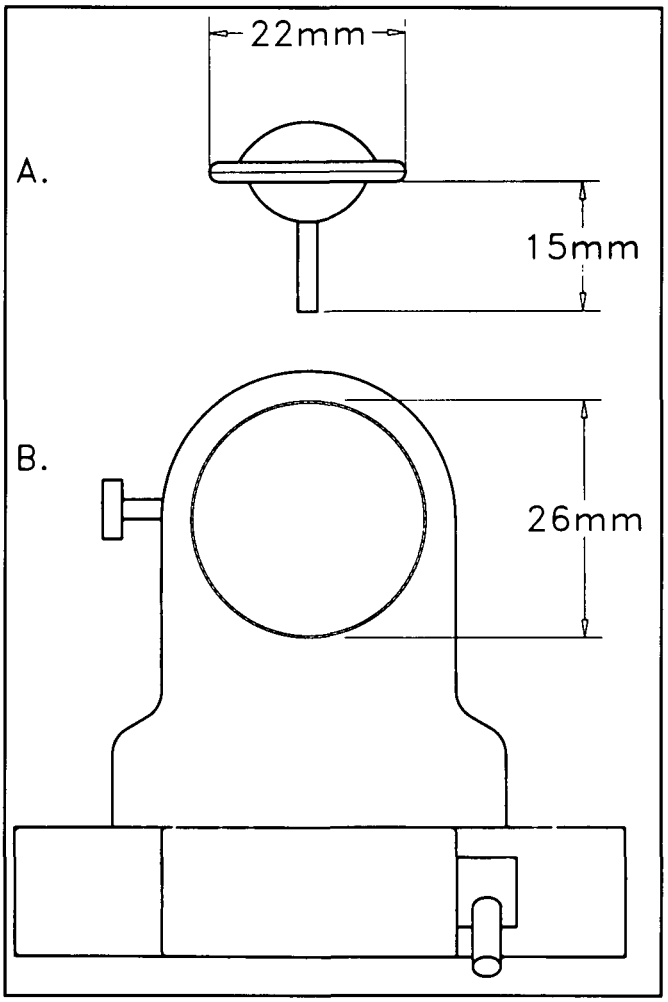

Figure 2A: *Profile view of burr hole style Ommaya reservoir. Distance from base to connection point to be included in calculation of length of construct (length of catheter equals distance from outer table to target, minus 15 mm).*

Figure 2B: *Drill-guide block collar on CRW stereotactic frame viewed from above easily admits Ommaya reservoir.*

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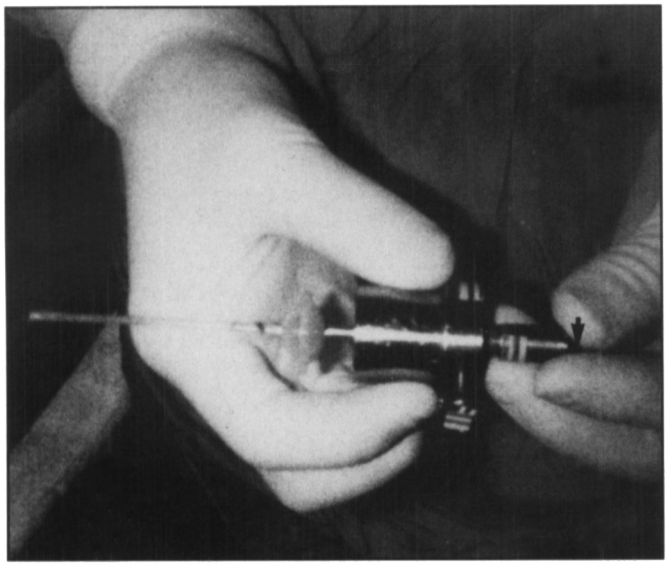

Figure 3: *The catheter-Ommaya reservoir construct and drill-guide block assembled and ready to be inserted through the CRW drill-guide block collar. Arrows indicate proximal portion of 25-gauge wire.*

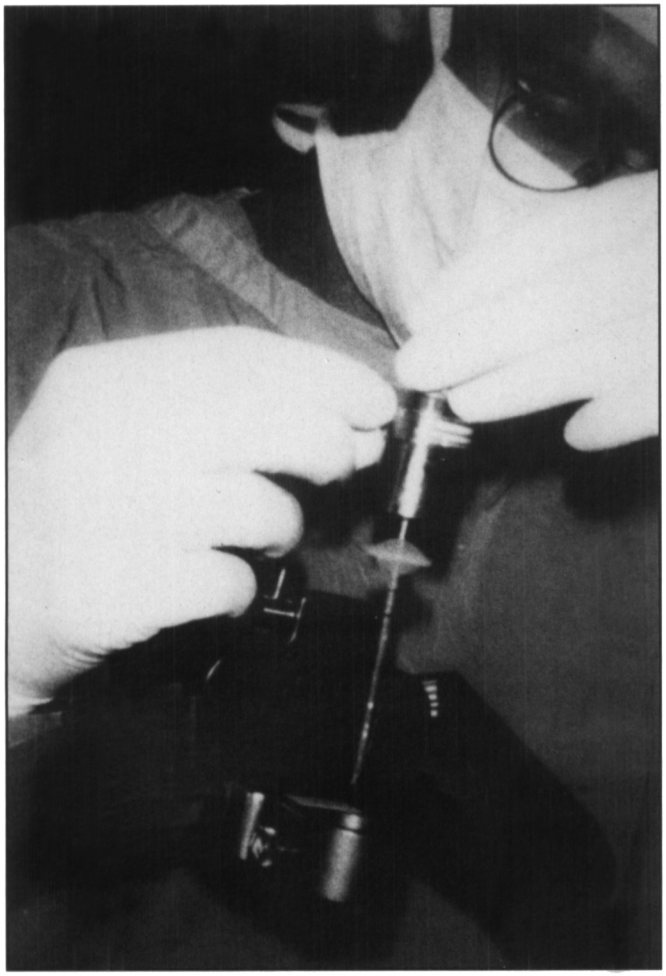

Figure 4: *Insertion of this assembly and Ommaya reservoir catheter construct through the CRW drill-guide block collar.*

tion using the 25-gauge wire, until the flange on the Ommaya reservoir stops at the outer table of the skull; the wire is then removed and the Ommaya sutured in place (Figure 5). Confirmation of placement is obtained first by aspirating cyst fluid intraoperatively and then by obtaining a postoperative CT or MR image to confirm location within the tumor cyst and reduction in cyst volume (Figure 6).

Discussion

Several methods have been described that assist with the correct placement of Ommaya reservoir systems into the lateral ventricles, glial tumors, and craniopharyngioma cysts. Both stereotactic and non-stereotactic methods have been used, some

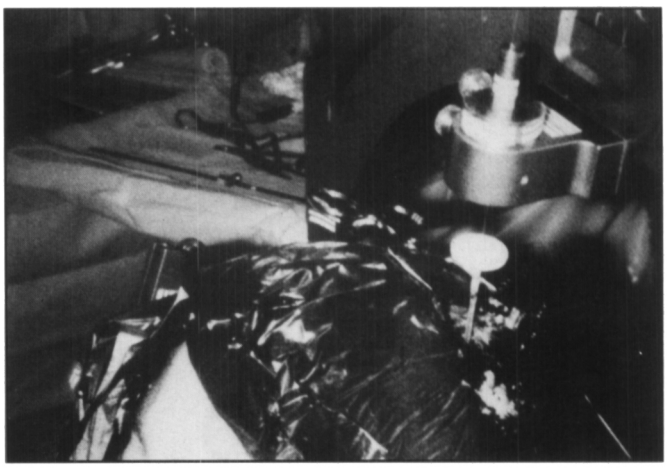

Figure 5: *Once the drill-guide block is seated on the collar, the catheter Ommaya reservoir construct is advanced to the final position using the 25-gauge wire or 0.03" K wire.*

Figure 6: *Postoperative coronal MR image demonstrating Ommaya reservoir catheter construct placed in the above fashion into a retrochiasmatic recurrent craniopharyngioma cyst.*

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requiring placement of the catheter while the patient is in the imaging suite, and others requiring special devices for the use of a particular stereotactic apparatus.[2,4,7-9]

Our procedure does not require any modifications of the existing CRW target-centered stereotactic frame and takes advantage of the fact that the inner diameter of the drill-guide block collar is 26 mm, larger than the outer diameter of the base flange for the Ommaya reservoir, which is 22 mm (Figure 2). This enables passage of the catheter-Ommaya construct through the collar without any difficulty. We have used this technique without complications in 12 patients, most commonly to place catheters into low- and high-grade glioma cysts and craniopharyngioma cysts to administer chemotherapeutic agents and aspirate cyst fluid. We have also used it to place a convertible Ommaya reservoir into a perimesencephalic arachnoid cyst, which required using the side connector on the reservoir to connect to the peritoneal catheter to complete the shunting procedure.

The advantage of our technique includes the fact that the catheter-Ommaya reservoir construct can be assembled before passage into the brain tissue and cyst, avoiding the difficulty that arises when attempting to connect an Ommaya reservoir to a stereotactically-placed catheter that is already at its appropriate target depth. Particularly for small cysts, movement of the catheter out of the brain in order to accomplish this connection runs the risk of dislodging the catheter from its intended position. The act of connecting the catheter to the reservoir with a single straight connector requiring two sutures is often cumbersome and at times difficult. We think our method offers a simple, safe and reliable alternative.

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