Modified stereotactic insertion of the Ommaya reservoir

Technical note

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Insertion of an Ommaya reservoir must result in perfect intraventricular placement of the catheter on the first pass to ensure that it will function as intended for as long as needed. Proper insertion minimizes the risks of missing the ventricle and/or requiring several passes and the risks of infection. The stereotactic technique is a superb way of ensuring perfect placement; however, the presence of the requisite arc system, irrespective of which frame is used, frequently obstructs the surgical field and may cause potential breaks in sterile technique as the arc is brought into the sterile field. We present a simple modification that obviates these problems.

Stereotactic Technique

After a local anesthetic has been applied, the CRW stereotactic head ring (Radionics, Inc., Burlington, MA) is fixed to the patient’s head. A nonenhanced computerized tomography scan is obtained and the target is selected in the posterior half of the right frontal horn, above the foramen of Munro and just medial to the midsagittal plane of the ventricle. Data for the scan points and the target are entered into the computer and the x, y, and z coordinates (that is, the anteroposterior, lateral, and vertical coordinates, respectively) of the target are obtained. In the operating room the patient’s head is affixed to the operating table, the target point is set on the phantom base, and the arc ring is adjusted empirically to produce the correct trajectory to this point passing through a point on the scalp approximately 3 cm from midline and anterior to or just on the coronal suture. The right frontal region is shaved and an inverted U-shaped flap is drawn with its base facing posteriorly such that its apex extends 1 cm anterior to the point of entry of the catheter, as previously marked. The flap is large enough to accommodate a large flat-bottomed Ommaya reservoir. The marked flap area is infiltrated with a local anesthetic agent and the entire area is prepared by applying povidone iodine solution. The arc is then removed, after which the area is washed again with povidone iodine solution and draped with transparent sticky surgical drapes, which are supported anteriorly by a Mayo stand so that they do not fall onto the patient’s face. The flap is opened in the standard fashion preserving the perosteum. The arc system is left sterile in case cannulation of the ventricle, as described later, fails.

The ventricular catheter, which has an outer diameter of 2.5 mm, is marked for the appropriate depth, by using a piece of bone wax that is gently stuck to the catheter. In the operating room the target point is set on the phantom base, and the arc ring is adjusted empirically to produce the correct trajectory to this point passing through a point on the scalp approximately 3 cm from midline and anterior to or just on the coronal suture. The right frontal region is shaved and an inverted U-shaped flap is drawn with its base facing posteriorly such that its apex extends 1 cm anterior to the point of entry of the catheter, as previously marked. The flap is large enough to accommodate a large flat-bottomed Ommaya reservoir. The marked flap area is infiltrated with a local anesthetic agent and the entire area is prepared by applying povidone iodine solution. The arc is then removed, after which the area is washed again with povidone iodine solution and draped with transparent sticky surgical drapes, which are supported anteriorly by a Mayo stand so that they do not fall onto the patient’s face. The flap is opened in the standard fashion preserving the perosteum. The arc system is left sterile in case cannulation of the ventricle, as described later, fails.

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Abbreviation used in this paper: CSF = cerebrospinal fluid.
catheter is then simply guided down the bone hole that was made by the drill (Fig. 1). At the appropriate depth the wax and the metal internal guide are removed. If CSF does not flow spontaneously (as is often the case in these patients) confirmation of ventricular entry is made using gentle aspiration. The catheter is cut at the correct length to connect the Ommaya reservoir, and the junction is secured using a silk suture (Fig. 2). The catheter–reservoir junction is secured to the periosteum by using a silk suture and, similarly, the reservoir is secured to the periosteum with at least six stitches. Proper functioning of the reservoir is established by applying finger pressure to empty the bulb and by observation of prompt refilling. The wound is irrigated, closed in two layers, and covered with sterilized strips, leaving the reservoir accessible for immediate use by the medical oncologists. Patients are observed for a few hours and then discharged; all patients undergo outpatient procedures after a local anesthetic is administered.

Results

A small series of nine patients was treated between December 1996 and April 1999 by using the modified technique. During the same period, other procedures were performed using standard stereotactic guidance and some procedures using our new intraoperative magnetic resonance imaging system. Excellent intraventricular catheter location was achieved on the first pass in all nine cases, and no delayed system failures have been observed. There was only one complication: a symptomatic intraventricular hemorrhage in a patient with systemic lymphoma and difficult coagulopathy. Removal of the reservoir and temporary ventricular drainage were required in that case, and full neurological recovery was achieved.

Discussion

The use of Ommaya reservoirs was first documented in 1963 by Ommaya, et al. Since then they have been used for a variety of indications including: instillation of intrathecal drugs, usually to treat leptomeningeal involvement from a systemic malignancy; monitoring drug levels in the CSF; aspiration of CSF or tumor cyst contents; instillation of radioactive material; instillation of biological therapies such as anticancer genes, and others. Ommaya reservoirs are associated with a number of complications including: acute hemorrhage with or without neurological deficit; early malfunction due to poor catheter placement; late malfunction due to catheter migration or obstruction by cellular debris; and infection. Insertion of an Ommaya reservoir into an enlarged nondisplaced ventricle is not a difficult procedure. The difficulty occurs when the ventricle is small and/or displaced, which increases the complication rate. To overcome this difficul-
different techniques have been developed, starting with a change in the approach from the right posterior parietal area to the right frontal horn and dilation of the ventricle by instillation of air via lumbar puncture. In 1981 Levy and Hahn reported using computerized tomography scan guidance to aid in the insertion of Ommaya reservoirs. More contemporarily, stereotactic guidance has been used with reliable results.

Recently Frank and colleagues and McDermott and associates reported their use of stereotactic techniques with some modification that may facilitate the surgical procedure and lessen complications. However, in their methods the stereotactic arc needs to be fixed and maintained on the patient’s head, which makes the surgical field somewhat restricted and may have negative effects on the sterility and the draping of the surgical site. In our technique, the stereotactic frame is used mainly to determine the target point and the trajectory to this point, but then a twist-drill hole coaxial with the desired trajectory replaces the stereotactic needle to serve as an external, as opposed to internal, guide for the catheter. The hole is just adequate in diameter to accommodate the ventricular catheter without significant angular deviation. Using simple trigonometric calculations and assuming a skull thickness of 1 cm and a catheter depth of 5 cm, one can calculate that the maximum possible deviation of the catheter tip from the “true stereotactic” target is 1.1 mm (Fig. 3). Removal of the arc at this stage allows one to prepare and drape the surgical site in the ideal manner and to work in an unencumbered field with fewer potential breaks in sterile technique because the feet of the base of the arc do not penetrate a sterile barrier. This procedure has worked well in our small series; however, to prove the superiority or equivalence of our technique compared with standard techniques, which may or may not include standard stereotactic guidance, would require a large randomized study in which catheter location and infection rate were outcome measures.

References


Fig. 3. Line drawing showing the maximum possible deviation of the catheter tip from the optimum desired or “true stereotactic” position. The twist-drill hole is 2.7 mm; the catheter’s outer diameter is 2.5 mm; the skull thickness is 10 mm (1 cm); and the catheter depth is 5 cm (50 mm). Sin angle a = (2.7 – 2.5 mm)/10 mm = 0.02, which must also = X mm/(10 + 50 mm); therefore, X = 1.2 mm; therefore, maximum catheter deviation = 1.2 mm – (2.7 – 2.5 mm)/2 = 1.1 mm.