Diagnosis of intraventricular and cisternal cysticercosis by computerized tomography with positive intraventricular contrast medium

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Computerized tomography (CT) has replaced pneumoencephalography and ventriculography in the diagnosis of intraventricular cysticercosis. The authors present a refinement in the use of CT by introducing a positive contrast medium into the ventricles to increase the definition of plain and contrast-enhanced scans in the diagnosis of intraventricular cysticercosis. Eleven cases of Cysticercus cyst are presented, 10 of which were precisely delineated by CT-iodoventriculography. In the remaining case, lack of definition was due to obstruction of the cerebral aqueduct. Surgical confirmation was obtained in all cases.

KEY WORDS • computerized tomography • intraventricular contrast medium • intraventricular cysticercosis • cisternal cysticercosis

Cysticercosis is a serious public health problem in Mexico. Its great prevalence among Mexicans is well documented in clinical reports and autopsy studies. Costero has said that it is found in 3% to 3.6% of postmortem examinations, and Gomez Mendez reports that it involves 9% of all neurological patients. Flisser, et al., and Woodhouse estimate the prevalence of cysticercosis as 1% of the Mexican population.

Cysticercosis may be localized in different structures of the central nervous system (CNS): 1) the convexity of the brain; 2) the cisterns; 3) the parenchyma; 4) the ventricles; and 5) the spine. It can occur in a single or in multiple locations. Its prevalence in the various ventricular cavities is not clear; however, the following seems to be the most accepted order of preference: 1) fourth ventricle; 2) lateral ventricles; 3) foramen of Monro; 4) third ventricle; and 5) cerebral aqueduct. Traditionally, the diagnosis of cysticercosis has been made possible by the use of pneumoencephalography (PEG), ventriculography, and iodoventriculography. Computerized tomography (CT) has proved of great assistance in detecting the cysts.

The purpose of this report is to demonstrate the additional value of performing CT scanning after injection of low-toxicity positive contrast medium into the lateral ventricles. We are presenting our experience with patients studied with CT and intraventricular iodized material (Conray or metrizamide) in the diagnosis of ventricular cysticercosis.

Summary of Cases

Clinical Material

Eleven patients, four females and five males, whose average age was 35.5 years, were studied at our institution over a period of 16 months. All had a clinical diagnosis of intracranial hypertension and hydrocephalus. The diagnosis of hydrocephalus in all the patients was corroborated by simple CT and CT with intravenous contrast enhancement. Three patients also underwent PEG and eight had iodoventriculography. After a shunting procedure was carried out, if an intraventricular cyst was suspected, we introduced positive contrast medium into the right lateral ventricle by a transvalvular percutaneous route. This technique has resulted in exact localization of the intraventricular and/or cisternal cyst.

Technique

The patient was placed in a seated position, and local anesthesia was initiated. In four patients without
<table>
<thead>
<tr>
<th>Case No.</th>
<th>Sex, Age (yrs)</th>
<th>Duration of Course</th>
<th>Clinical Diagnosis</th>
<th>Radiological Diagnosis (CT)</th>
<th>Location of Cyst with CT Iodoventriculography</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F, 32</td>
<td>6 mos</td>
<td>intracranial hypertension</td>
<td>hydrocephalus; multiple parenchymatous cysts</td>
<td>single cyst in rt lat vent</td>
</tr>
<tr>
<td>2</td>
<td>F, 41</td>
<td>12 mos</td>
<td>intracranial hypertension</td>
<td>hydrocephalus; 3rd vent cyst</td>
<td>single cysticercus cyst in retrochiasmatic cistern</td>
</tr>
<tr>
<td>3</td>
<td>F, 31</td>
<td>2 mos</td>
<td>intracranial hypertension</td>
<td>hydrocephalus</td>
<td>single 4th vent cysticercus cyst</td>
</tr>
<tr>
<td>4</td>
<td>M, 42</td>
<td>4 mos</td>
<td>intracranial hypertension; partial seizures (rt side)</td>
<td>hydrocephalus; cyst in rt lat vent &amp; probably in 4th vent; multiple parenchymatous lesions</td>
<td>cyst in rt &amp; lt lat, &amp; 4th vents</td>
</tr>
<tr>
<td>5</td>
<td>M, 28</td>
<td>20 days</td>
<td>intracranial hypertension; post fossa syndrome</td>
<td>slight hydrocephalus; cyst in 3rd &amp; 4th vent</td>
<td>single cyst in 4th vent</td>
</tr>
<tr>
<td>6</td>
<td>M, 32</td>
<td>5 yrs</td>
<td>intracranial hypertension; post fossa syndrome</td>
<td>hydrocephalus; single cyst in 4th vent</td>
<td>single cyst in 4th vent</td>
</tr>
<tr>
<td>7</td>
<td>F, 33</td>
<td>5 yrs</td>
<td>intracranial hypertension</td>
<td>asymmetrical hydrocephalus, rt lat vent; cyst in lt lat vent (ventriculography) &amp; right lat vent (CT)</td>
<td>single cyst in rt lat vent</td>
</tr>
<tr>
<td>8</td>
<td>M, 25</td>
<td>4 mos</td>
<td>intracranial hypertension</td>
<td>single cyst in 4th vent</td>
<td>single cyst in 4th vent</td>
</tr>
<tr>
<td>9</td>
<td>M, 41</td>
<td>3 mos</td>
<td>intracranial hypertension; rt hemiparesis</td>
<td>single cystic lesion in lt temporal horn</td>
<td>multiple cysts (temporal horn, temporal parenchyma &amp; 4th vent)</td>
</tr>
<tr>
<td>10</td>
<td>M, 28</td>
<td>2 mos</td>
<td>closed head trauma; rt hemiparesis</td>
<td>hydrocephalus; no visualization of 4th vent</td>
<td>hydrocephalus; no visualization of 4th vent</td>
</tr>
<tr>
<td>11</td>
<td>M, 62</td>
<td>1 mo</td>
<td>intracranial hypertension; post fossa syndrome; lt hemiparesis</td>
<td>hydrocephalus; hypodense image in post fossa; delimitation of 4th vent not possible</td>
<td>single cyst in cisterna magna</td>
</tr>
<tr>
<td>11</td>
<td>M, 62</td>
<td>1 mo</td>
<td>intracranial hypertension; post fossa syndrome; lt hemiparesis</td>
<td>hydrocephalus; hypodense image in post fossa; delimitation of 4th vent not possible</td>
<td>single cyst in cisterna magna</td>
</tr>
</tbody>
</table>

* There were no complications associated with computerized tomography (CT) iodoventriculography, which was diagnostic as confirmed at surgery in all cases but two (Case 9, treated only with a shunt, and Case 10; see text). Post = posterior; lat = lateral; vent = ventricle.

A shunting system, a right frontal opening was made and 3 to 5 ml of metrizamide (in a concentration of 200 to 250 mg/ml) or 10 ml of Conray was injected into the lateral ventricles. In seven patients with a shunt in place, the contrast material was introduced through the antechamber of the Hakim shunt system. Proper distribution of the contrast medium in the ventricular system was confirmed under fluoroscopic control. The CT procedure was carried out immediately afterward using the customary technique.

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*Fig. 1. Case 1. Left: Plain computerized tomography (CT) scan showing bilateral dilatation of the lateral ventricles, and a cystic lesion in the left temporal lobe. Right: On CT iodoventriculography, a cystic lesion became visible in the right lateral ventricle, which was not seen in the previous study.*

*Fig. 2. Case 2. Left: Computerized tomography (CT) with intravenous contrast material showing what seems to be a space-occupying contrast material showing what seems to be a space-occupying lesion of the third ventricle. Right: On CT iodoventriculography, the lesion is seen to lie outside the ventricular system, in the perichiasmatic cisterna.*
CT with intraventricular contrast medium

**Results**

The CT iodoventriculography precisely showed the location, form, and size of the cysticercosis cyst (Table 1). In only one case (Case 10) was it not possible to demonstrate the presence of the cyst in the fourth ventricle because the cerebral aqueduct was obstructed and the contrast medium failed to reach the fourth ventricle. In five of the eight patients so studied, conventional iodoventriculography localized the lesion with sufficient accuracy, but failed to detect the cyst in three cases.

Two cystic parenchymatous lesions were observed in the left temporal and right lateral lobes in Case 1, using plain CT and CT with intravenous contrast enhancement (Fig. 1 left). On CT iodoventriculography, the intraventricular situation of the cysts was clearly visible (Fig. 1 right), and their location was confirmed at surgery.

In cases where there is doubt, this method clarifies whether the cyst is located inside or outside the ventricle. An example of this is Case 2, in which a cystic lesion was observed in the anterior portion of the third ventricle by means of Conray ventriculography, plain CT, and CT with intravenous contrast enhancement (Fig. 2 left). On CT iodoventriculography, however, the cyst was shown to lie in the retrochiasmatic cistern, outside the third ventricle (Fig. 2 right). This was confirmed on surgical intervention.

This procedure allows clear observation and high resolution in the fourth ventricle, as in Case 3. In that case, only supratentorial hydrocephalus was observed on plain CT, and the fourth ventricle cyst was not visualized. On CT iodoventriculography, a circular filling defect was revealed, suggesting that the cysticercosis was located in the lower portion of the fourth ventricle.

In Case 4, CT showed dilatation of the fourth ventricle, and possible intraventricular lesions; however, CT iodoventriculography clearly demonstrated two supratentorial intraventricular cysts and one fourth ventricle cysticercus cyst (Fig. 3). Conray ventriculography suggested a cyst in the third and fourth ventricles in Case 5. On CT iodoventriculography, however, a third ventricle lesion was not visible, but a cyst was seen in the fourth ventricle. Suboccipital craniectomy revealed a calcified cyst and arachnoiditis of the fourth ventricle. Case 7 was an example of a solitary hypodense cystic lesion. Plain CT suggested an intraventricular location, but it was clearly delineated with Conray CT (Fig. 4). Figure 5 shows a typical diagnostic CT iodoventriculography appearance of a fourth ventricular cyst, and Fig. 6 illustrates the surgical removal of such a cyst. Conray ventriculography, plain CT, and CT with intravenous contrast enhancement showed a cysticercus cyst in the fourth ventricle of Case 11. On CT iodoventriculography, the cyst was shown to be in the cisterna magna, and this was confirmed at surgery.

**Fig. 3.** Case 4. Left: Plain computerized tomography (CT) scan showing dilatation of the fourth ventricle, associated with hydrocephalus. The scan is suggestive of an intraventricular lesion. Center Left: A CT iodoventriculogram clearly demonstrating the intraventricular Cysticercus cyst. Center Right: Supratentorial plain CT scan of the ventricular system showing possible intraventricular lesions. Right: Conray CT scan perfectly delineating the two supratentorial intraventricular cysts.

**Fig. 4.** Case 7. Left: Plain computerized tomography (CT) scan suggesting a hypodense cystic lesion in an intraventricular location. Right: Precise localization of the intraventricular lesion is possible with Conray CT.
Discussion

In view of the high incidence of CNS cysticercosis in Mexico and of the possibility for curing the infection when it is located intraventricularly,14 we have adopted CT iodoventriculography as the most exact method for discovering the location of these lesions. Other forms of neurocysticercosis have been successfully treated with chemotherapy.12

This procedure was not invasive in the majority of our patients, who had already had ventriculoperito-

nal or ventriculointeratrial shunting systems placed for the treatment of their hydrocephalus. The contrast medium was administered by percutaneous puncture of the antechamber of the shunting system.

In the patients examined with the CT iodoventriculography procedure, excellent definition of the ventricular structures was obtained. The exact site of the obstruction was established, as well as the location of the cyst, its size, shape, and relation to adjacent structures, and whether it was solitary or multiple. Other authors2,13 have commented upon the traditional radiological diagnostic protocol for cysticercosis and have cited CT as the most useful tool. We are proposing, in the case of intraventricular cysticercosis, the addition of positive intraventricular contrast medium to the procedure to increase the accuracy of diagnosis.

References

13. Rodriguez Carbajal J, Palacios E, Behroos AK, et al: Radiology of cysticercosis of the central nervous sys-

Fig. 5. Case 8. Computerized tomography showing a typical fourth ventricle Cysticercus cyst delineated by the positive contrast-medium technique.

Fig. 6. Case 10. Operative photograph showing removal of the Cysticercus cellulosae cyst from the fourth ventricle.
CT with intraventricular contrast medium


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