Isotope Cisternography — RISA®

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Isotope Cisternography — RISA®


Several cases are presented which illustrate the indications and results of a relatively new procedure of intrathecal injection of radioiodinated human serum albumin I 131 to demonstrate cerebrospinal fluid dynamics. This procedure has been used in conjunction with pneumoencephalography in the diagnosis of communicating hydrocephalus. A proper dose as well as adequate volume are necessary to obtain diagnostic scans.

Evaluation of cerebro-spinal fluid dynamics by the use of intrathecal radio-iodinated (I 131) human serum albumin has been described recently.2, 4, 9, 11, 12 Within only a few years' time the technique has been widely adopted as another diagnostic study for a variety of cerebral disorders, particularly complementing pneumoencephalography.

This type of isotope study has been particularly helpful in the evaluation of ventriculo-subarachnoid block and cerebrospinal fluid leak. Current interest has also been focused on the diagnosis of incisural block resulting in occult communicating hydrocephalus.1

This report presents some cases illustrating the various uses of this procedure.

Method

RISA† [Radio-iodinated (I 131) human serum albumin] is recommended since there have been no reports of complications using this high specific activity (250-500 µc/ml) material for isotope cisternography.7 Two recent reports5, 10 described aseptic meningitis following the use of a material with a higher protein content and lower specific activity.

A dose of 100 µc is necessary for a diagnostic scan. Scans done with lumbar injection of a lower dose are generally not satisfactory. The tissue dose from 100 µc is reported8 to be 100 millirads to the total body and about 1 rad to the central nervous system.

The patient's own cerebrospinal fluid, obtained by routine sterile lumbar puncture, is used to dilute 100 µc of RISA to a total volume of 10 ml. It is reinjected for isotope cisternography. The position of the patient following intrathecal injection is not considered to be a factor in the distribution of the RISA.5, 8 However, initial volumes less than 10 ml generally result in an inadequate count rate over the head, indicating that volume is important. Elliott's "B" solution, 10-20 ml, has been used by some investigators
in place of the patient's own cerebrospinal fluid. Anterior and lateral scans are obtained routinely at 6 to 10 hours and at 24 hours. Additional scans may be necessary at 36 and 48 hours. Our department uses the standard rectilinear scanning device for isotope scanning.

Case Reports

1. D.V. Four months prior to admission an 18-year-old male sustained a left temporal skull fracture. Isotope cisternography was performed for suspected cerebrospinal fluid leak. The normal early (10 hour) scan as shown in figure 1 demonstrates that predominant RISA activity is in the area of the basilar cisterns. On the 24-hour scan (Fig. 2) the RISA is shown to have moved over the cerebral hemispheres into the subarachnoid space in the area of the sylvian sinus and Pacchionian granulations. These standard scans, obtained in all cases as a minimum study, are normal and show no evidence of cerebrospinal fluid block or leak.

2. J.B. Six months prior to admission a 43-year-old male sustained trauma to the left parietal region of the skull, necessitating surgical drainage of a subdural hematoma. The chief complaint was unexplained convulsive seizures. A pneumoencephalogram showed generalized enlargement of all ventricles, but no air passing over the cerebral convexities; a preliminary diagnosis of incisural block was made. This was confirmed by isotope cisternography as demonstrated in figures 3A and 3B on 6-hour and 24-hour scans. Note is made of persistence of isotope activity in the basilar cisterns and absence of RISA activity over the hemispheres. Figure 3C demonstrates the dilated ventricles and absence of air over the cerebral convexities on the pneumoencephalogram. The most anterior isotope activity shown in the lateral scan at 24 hours is confirmed by the pneumoencephalogram to be in the left lateral ventricle. A ventriculo-atrial shunt was done and the patient was discharged home, having had no recurrence of seizures.

3. M.C. This 41-year-old female had a ventriculo-atrial shunt for communicating hydrocephalus three years prior to the

Figure 1
Case 21, D.V. Normal Early Scan. The anterior and lateral scans obtained 10 hours after lumbar injection of RISA demonstrate isotope activity to be predominantly in the basilar cisterns. There is some activity in the sylvian fissures and between the hemispheres. Unless otherwise noted, the landmarks on the anterior scans indicate each external auditory meatus and the midline. Landmarks on the lateral scan indicate the nasion, the lateral orbital rim, and the external auditory meatus.
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Case 21, D.V. Normal 24 Hour Scans. The lateral and anterior scans obtained at 24 hours demonstrate progress of the RISA over the cerebral hemispheres to the area of the sagittal sinus and the Pacchionian granulations. On the lateral scan, the landmark over the external auditory meatus was moved to the occiput.

Case 22, J.B. The 6-hour scan shows RISA in the area of the basilar cisterns. Also noted is increased isotope activity anteriorly on the lateral scan. The vertex landmark in the anterior scan has been placed on the nasion.

Present admission. At this time she complained of increasingly severe headaches.

A pneumoencephalogram demonstrated no air over the cerebral convexities, and isotope cisternography confirmed the incisural block as shown in figures 4A and B: 6-hour and 24-hour scans. Isotope activity was concentrated in the area of the basilar cisterns, with no RISA activity over the vertex.

A revision of the ventriculo-atrial shunt was done, after which the patient's headaches decreased in severity.

4. D.C. A 51-year-old male showed radiographic evidence of a depressed left parietal

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On the 24-hour scan there is persistence of isotope activity in the basilar cisterns, also, increased activity anteriorly and over the area of the lateral ventricles. There is no isotope activity over the vertex. A diagnosis of subarachnoid block was made.

Figure 3B

PA and left lateral views of the pneumoencephalogram demonstrate the dilated ventricles and confirm the location of RISA in the lateral ventricles.

Figure 3C

skull fracture after injury. The fracture was elevated surgically but an anterior cerebrospinal fluid leak was suspected. This leak was demonstrated by isotope cisternography as shown in figure 5A. The abnormal isotope activity was shown over the area of the nasal passages on the 7-hour lateral scan. The cerebrospinal fluid leak stopped after conservative management and a progress RISA scan, Figure 5B, was normal. The patient was discharged home well.

5. M. D. Five months prior to admission, a 50-year-old female had had right temporoparietal craniotomy for drainage of a subdural hematoma. Three months later, the right craniotomy was reopened for recurrent subdural hematoma. At this time a RISA study was done because the patient was thought to have a communicating hydrocephalus with block. Figure 6 shows no evidence of subarachnoid block but does demonstrate an area of increased isotope
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Figure 4A
Case我当时. M.C. Anterior and lateral scans at six hours demonstrate isotope activity in the basilar cisterns. The nasion landmark has been omitted in the lateral view.

Figure 4B
Anterior and lateral scans at 24 hours show essentially no change, with persistence of isotope activity in the basilar cisterns and absence of activity over the region of the hemispheres and vertex. The scans thus show subarachnoid block.
Case 2 4, D.C. Cerebrospinal Fluid Leak. The lateral scan at seven hours demonstrates activity over the region of the nose as well as in the basilar cisterns and over the convexities of the hemispheres. The abnormal isotope activity over the nose was reported as demonstrating cerebrospinal fluid leak.

A progress scan was obtained several days later showing no evidence of isotope activity in the nasal area.
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Figure 6

Case 5, M.D. Postoperative Changes. Anterior and right lateral scans obtained at 24 hours demonstrate normal isotope activity over the hemispheres. There is also an area of increased isotope activity over the right lateral margin which corresponds to the site of the previous craniotomy as demonstrated in the AP and right lateral skull films below. The scan shows no evidence of block. Landmarks have been omitted from the right lateral scan. The RISA activity demonstrates an abnormal postoperative dilation of the subarachnoid space at the craniotomy site.
activity in the dilated subarachnoid space adjacent to the surgical site.

Discussion

The cerebral subarachnoid fluid dynamics can be evaluated by scanning the head at intervals following lumbar injection of radio-iodinated human serum albumin tagged with I 131. Prior to administration, a dose of 100 µc of high specific activity RISA is diluted with at least 10 ml of the patient’s own cerebrospinal fluid. Anterior and lateral scans are done at both 6 hours and 24 hours, with the standard rectilinear device, as a minimum procedure.

Isotope cisternography using radio-iodinated human serum albumin (I 131) has proved to be a useful diagnostic procedure in suspected cases of communicating hydrocephalus with subarachnoid block, cerebrospinal fluid leak, suspected encephaloceles, and evaluation of postoperative meningeal deformities. Recently its most important use has been in the diagnosis of suspected occult hydrocephalus, and it has been used in conjunction with pneumoencephalography.

REFERENCES