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RADIONUCLIDE CISTERNOGRAPHY: NORMAL VALUES FOR NASAL SECRETION OF INTRATHECALLY INJECTED ^{111}In-DTPA

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Radioactive tracers are frequently used in the detection and localization of CSF leaks in patients with rhinorrhea. However, little data are available concerning normal levels of nasal secretion of intrathecally injected ^{111}In-DTPA. We propose a technique which compares the activity in nasal pledgets to plasma activity in 16 patients without any known abnormalities. The ratio of pledget activity to plasma activity per 0.5 ml did not exceed 1.3. In a proven case of occult CSF rhinorrhea the ratio was 6.2. The combined technique of visualization by cisternography and localization by quantitative study of pledgets may offer an improved method for the detection and localization of occult CSF leaks in patients with either CSF rhinorrhea or recurrent meningitis even in the absence of CSF rhinorrhea.

The diagnosis of cerebral spinal fluid (CSF) rhinorrhea is usually based either on the presence of radioactivity on nasal cotton pledgets after intrathecal injection of a radioisotope or by visualization of the leak on images obtained with the patient positioned to augment the flow of CSF into the nose (*1,2*). The localization of CSF fistulae by the measurement of radioactivity on intranasal pledgets was first reported in 1956 by Crow, et al. His group injected ^{24}Na into the cisterna magna (*3*). Others have measured the radioactivity on nasal pledgets after lumbar intrathecal injection of radiopharmaceuticals, particularly ^{131}I-human serum albumin (*4,5*). The values for normal radioactivity in nasal secretion following intrathecal administration of radiopharmaceuticals have not been reported. Because ^{111}In-DTPA enters the extracellular fluid after absorption from the CSF, it is expected that some radioactivity may be detected in normal nasal secretion. The purpose of this study was to determine the normal levels for radioactive nasal secretion in patients undergoing cisternography with ^{111}In-DTPA.

METHODS

Sixteen consecutive patients (age 30–74 years) who had been referred for radiocisternographic evaluation for possible communicating hydrocephalus were studied. None of the patients had rhinorrhea or was suspected of having a CSF fistula. Following pontacaine anesthesia of the nasal mucosa, two pledgets were placed anteriorly and posteriorly in each nostril with minimal discomfort to the patient. Each pledget measured approximately 1 cm^2, was attached to a string, and had an absorptive capacity of 0.5 ml water. The pledgets were inserted 2 hr after intrathecal injection of 0.5 mCi ^{111}In-DTPA and remained in place for 4 hr. Five milliliters of venous blood was withdrawn both at the time of placement and removal of the pledgets. Saliva was collected concurrently with the blood withdrawal in five of these patients. The activity in each pledget and each 0.5-ml aliquot of plasma and sputum was measured in a well scintillation counter using a 150–250-keV window. The results were expressed as the ratio of the pledget activity (cpm) to the average of the two plasma samples (in cpm).

RESULTS

Summarized in Table 1 are the cisternographic diagnoses and the ratios of pledget activity to plasma activity. This ratio (Fig. 1) did not exceed 1.3 in any subject (mean 0.45 s.d. ± 0.34). Generally, the highest pledget activity was obtained in those subjects with the highest levels of plasma activity; in any one subject the activity on each of the four pledgets did not vary greatly. The saliva activity was comparable to nasal activity in each of the five studied subjects.

In addition to the 16 normal subjects studied, a 6-year-old girl was referred to us for evaluation of

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TABLE 1. SUMMARY OF RESULTS

			Ratio of pledget counts/ plasma counts			
			Right		Left	
Age	Sex	Diagnosis	Ant	Post	Ant	Post
46	M	Normal	0.06	0.09	0.15	0.18
30	M	Normal	1.33	1.21	1.29	1.20
50	M	Normal	0.60	0.54	0.83	0.66
56	M	Hydroceph. without stasis	0.40	0.39	0.53	0.35
62	F	Normal	0.46	0.84	0.22	0.43
62	F	Normal	0.27	0.15	—	0.21
37	M	Hydroceph. with stasis	0.41	0.24	0.32	0.18
72	M	Normal	0.55	0.22	0.38	0.39
68	F	Normal	0.39	0.43	0.53	0.46
57	F	Hydroceph. with stasis	0.16	0.29	0.21	0.13
49	M	Hydroceph. with stasis	0.22	0.15	0.20	0.07
31	M	Normal	0.30	0.19	0.21	0.26
68	F	Hydroceph. with stasis	0.12	0.10	0.40	0.81
59	M	Normal	0.33	0.45	—	0.49
75	M	Hydroceph. with stasis	0.43	0.35	0.43	0.29
50	M	Normal	1.30	0.96	1.18	1.08

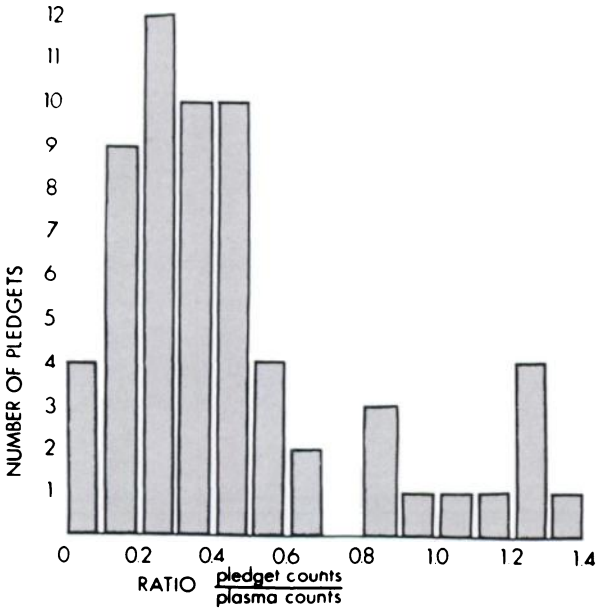

FIG. 1. Pledget/plasma ratios obtained in 16 patients.

occult CSF rhinorrhea. The patient had a history of recurrent pneumococcal meningitis following a skull fracture at the age of 2½ years. Using the method described here, the following ratio counts were obtained: left posterior pledget, 6.2; left anterior, 0.40; right posterior, 0.26; right anterior, 0.15. A cisternogram demonstrated nasal radioactivity when the patient was tilted downward. At surgery, a hole in the left cribiform plate was identified and repaired. A repeat cisternogram 6 weeks later demonstrated no residual leak and normal nasal radioactivity.

DISCUSSION

Indium-111-DTPA is a chelate which is incorporated into the extracellular fluid after entering the systemic circulation upon absorption from the subarachnoid space. It is then rapidly cleared as a glomerular agent. When administered intrathecally, ^{111}In-DTPA can reach the nasal mucus either directly, as in the case of CSF fistulae, or indirectly by absorption into the systemic circulation with eventual nasal secretion in mucus or serous fluid. In the case of a CSF leak, the activity per milliliter of nasal secretion is expected to be greater than the activity per milliliter of plasma since CSF activity is greater than plasma activity following intrathecal injection. In the absence of a CSF fistula, the activity per nasal pledget was found to be less than that of plasma in 55 of 62 samples from 16 patients. On a small number of pledgets, the ratio was greater than 1. This may have been due to more than 0.5 ml of nasal mucus being absorbed on the pledgets or secondary to evaporation of the secretions with accumulation of ^{111}In-DTPA during the time the pledgets remained in place. Normal values should be established in any individual clinic using the procedure if pledgets other than the type* used in this study are used. The finding of a ratio of pledget to plasma activity which is far greater than 1 indicates the presence of a CSF fistula. The case report illustrates this point.

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* Surgical Absorbent Patties, single string nonradiopaque, ½ × ½ in., Edward Weck Co.