

Radioactivity in Gastric Juice—A Simple Adjunct to the Yb-169 DTPA Cisternographic Diagnosis of CSF Rhinorrhea: Concise Communication

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A new method is offered as an adjunct to radionuclide cisternography and the measuring of radioactivity in nasal pledgets. The activity in gastric juice following the intrathecal injection of Yb-169-DTPA is measured and the ratio of gastric juice to blood is calculated. In patients suffering from CSF rhinorrhea the ratios significantly exceed the normal range. This method can be used to detect CSF leakage at the back of the nasopharynx, and in patients with head injuries too severe to permit the use of nasal pledgets.

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Cisternography has become an important diagnostic means for the detection and the localization of CSF rhinorrhea and CSF fistulas (1–3). The use of nasal pledgets may assist the cisternogram in patients who might have occult CSF rhinorrhea (4). This method is unsuccessful, however, if a patient's head injury precludes the proper placement of a pledget, or if the CSF leak drains fluid into the nasopharynx, in which case the tracer goes into the stomach rather than into the nose.

This study was done to estimate the radioactivity in gastric juice and in that way served to develop a simple method for the detection of CSF rhinorrhea.

METHODS AND MATERIALS

Patients should be fasted for at least 12 hr before the beginning of the cisternographic studies. Our examinations were carried out following suboccipital injection of 1 mCi Yb-169 DTPA into the cisterna magna.

The patient was placed in the supine position usually. The stomach was evacuated by gastric tube and the blood samples were obtained 4 and 6 hr after the intrathecal injection. The radioactivity was measured in a 2-ml specimen of gastric juice, 2 ml of blood, and 2 ml of plasma. The results were expressed as the ratio of gastric activity (in cpm) to blood and plasma activity (in cpm), respectively.

Pledgets were placed in each nostril 6 hr after intrathecal injection, and the patient was turned into the prone position. The pledgets were removed 18 hr later, at which time blood was also withdrawn. The activities were counted for each pledget and specimen of plasma. The results are given as the ratio of the activities of pledgets to the average of the 6-hr and the 24-hr plasma samples.

Rectilinear scans were made at 4 and 24 hr after injection.

The investigations were performed in 30 subjects referred for evaluation of diseases involving the spinal cord (considered as normal subjects), and in 46 patients referred for suspicion of CSF rhinorrhea.

RESULTS

Tables 1 and 2 show the ratios of the radioactivity of gastric juice to blood and to plasma, respectively, in the normal subjects. The maximum ratio amounted to 0.23 for gastric juice to blood, 4 hr after injection.

Figure 1 shows the individual values for normal subjects and for patients. In 33 of 46 patients referred for suspicion of CSF rhinorrhea, the scinti-

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TABLE 1. RATIOS OF RADIOACTIVITY OF GASTRIC JUICE TO BLOOD IN NORMAL SUBJECTS

Time (hr)	\bar{x}	s.d.	$\bar{x} + 2 \text{ s.d.}$	n
4	0.050	0.044	0.14	30
6	0.051	0.055	0.16	20

TABLE 2. RATIOS OF RADIOACTIVITY OF GASTRIC JUICE TO PLASMA IN NORMAL SUBJECTS

Time (hr)	\bar{x}	s.d.	$\bar{x} + 2 \text{ s.d.}$	n
4	0.036	0.032	0.10	15
6	0.045	0.050	0.15	11

graphic patterns and the examinations of the gastric juice, as well as the pledgets, gave normal results, but in seven patients it was impossible to insert pledgets.

In only one case was the ratio of gastric juice to blood (0.4, at 4 hr after injection) above our assigned upper limit of normal, although there was no indication of CSF leakage in the 6-hr gastric/blood ratio, the pledget/plasma ratio, or the scintiscans.

In 11 of 12 patients with proved CSF fistulas the ratios significantly exceeded 0.25. There was a good correspondence with the pledget/plasma ratios. However, in a 34-year-old man injured in an automobile collision the radioactivity was found in gastric juice but not in the pledgets. The following ratios were obtained: left pledget 0.5, right pledget 0.5, gastric juice/blood 125. The scans showed an abnormal accumulation of radioactivity at the back of nasopharynx.

DISCUSSION

The ratios of the radioactivity of gastric juice to blood for normal subjects as given in Table 1 show that there is no significant difference between the values obtained 4 hr and 6 hr after injection. The ratios of gastric juice to plasma (Table 2) offer no more information. For these reasons we use the value gastric juice/blood obtained 4 hr after injection. From the individual data we calculated the upper level of normal to be 0.14 ($\bar{x} + 2 \text{ s.d.}$). Since the highest normal value was 0.23, we take 0.15–0.25 as the range of suspicion.

In 11 of 12 patients with proved CSF fistulas, the ratios significantly exceeded 0.25. One patient, however, gave a rather low ratio of 0.3. The explanation may be that, because his CSF leak was from the anterior part of the cribriform plate, and because he lay

in the prone position, the fluid may have escaped largely from the nose instead of being swallowed.

The determination of the ratio of gastric juice to blood has been found helpful in the diagnosis of CSF leaks located at the back of the nasopharynx, because the pledget technique can fail in such cases. This is demonstrated by a patient in whom we obtained a high ratio gastric juice/blood associated with normal activity in the pledgets.

Diagnosis by means of gastric juice is still feasible in patients with severe head injuries and in those unable to lie prone. It does not, however, permit lateral localization of a CSF fistula.

$\frac{\text{cpm gastric juice}}{\text{cpm blood}}$

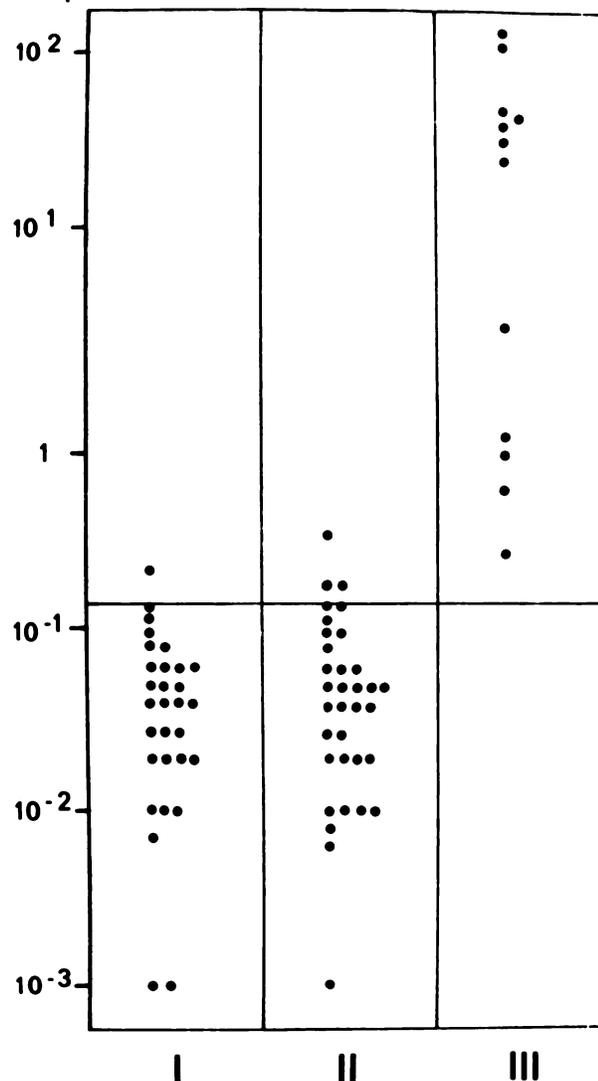


FIG. 1. Ratios of radioactivity of gastric juice to blood 4 hr after intrathecal injection. Upper limit of normal indicated. (I) normal subjects ($n = 30$); (II) patients without scintigraphic detection of CSF leak ($n = 34$); (III) patients with CSF rhinorrhea detected scintigraphically ($n = 12$).

These studies indicate that it would be advantageous to use not only scanning and plectet counting but also the estimation of the ratio of radioactivity of gastric juice to blood.

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**NORTHERN CALIFORNIA CHAPTER
SOCIETY OF NUCLEAR MEDICINE
ANNUAL MIDWINTER MEETING**

February 15, 1978

Wednesday, 3:00 p.m.

Lawrence Hall of Science

Berkeley, California

The Scientific Program will consist entirely of invited papers on topics of current interest. Confirmed presentations are as follows: Getting the Most out of the Image (Controllable Parameters) — Dr. Dennis Patton, Tucson, Arizona; Biliary Tract Imaging with Tc-99m Compounds — Dr. Robert Stadalnik, Sacramento, California; Radiation-Induced Thyroid Disease — Dr. Michael Okerlund, San Francisco, California; Management of Differentiated Thyroid Cancer — I. Ross MacDougal, Stanford, California.

A talk by a prominent speaker on a nuclear medicine related topic is also being arranged. A Chapter business meeting and supper will follow.

The Technologist Section is planning an early afternoon program in conjunction with this meeting.

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