

Dacryocystoscintigraphy: Diagnosis of Lacrimal Duct Obstruction Using Pinhole Collimator

Margaret Goodyear, Kattadiyil P. Poulouse, Hanmant Rajguru, and Richard C. Reba

Department of Nuclear Medicine, Washington Hospital Center, and Department of Radiology, George Washington University, Washington, DC

The technical details of a dacryocystoscintigraphic procedure, using a standard pinhole collimator, are presented. Fourteen patients were studied and there were no incorrect interpretations of the results. Standard pinhole collimator seems to be satisfactory for scintigraphic studies of the lacrimal system.

Radiologic studies of the nasolacrimal system following instillation of various opaque media have been found to be of value in patients with epiphora. However, there are certain disadvantages with these methods. Extravasation of the oily opaque media into the surrounding tissues may subsequently result in the development of pseudopolycystic sacs. The use of too highly concentrated solutions of aqueous contrast substances occasionally results in local irritation. Although improved contrast preparations are now available for studies of the nasolacrimal system, injection directly into the duct is necessary. A local anesthetic is required before the introduction of the contrast material through a dilator or cannula.

Recently, scintigraphic study of the nasolacrimal system has been described using a micro pinhole collimator (0.04-in. or 1-mm diameter) (1). This method was found to be convenient and valuable to evaluate the patency of the nasolacrimal duct. Since the micro pinhole collimator is not readily available, we have used a standard pinhole collimator (5 mm). In this report we describe our technique of performing a dacryocystoscintigram with the standard pinhole collimator in 16 patients referred to our department with complaints of epiphora. The results are discussed briefly, for the clinical and scintigraphic details are to be published elsewhere.

Materials and Methods

The patient is placed in a supine position with the neck and head stabilized. The neck should not be hyperextended. A tuberculin syringe with a 25-gage needle is employed to dispense one drop—which is approximately equal to 100–150 μCi (1 drop = 15 λ)—of $^{99\text{m}}\text{Tc}$ -pertechnetate laterally into each eye. Care should be taken not to contaminate the external surface of the eye,

check, or the area around the orbit. The patient is then placed under the scintillation camera. The distance from the entrance of the pinhole septum of the collimator to the patient is adjusted to 17 cm. This is done so that there is no image magnification on our 35-mm film display. An image is obtained at 2–3 min post instillation to insure that both eyes are in the field of view. Fifty thousand counts are recorded. The time interval necessary to collect the 50,000 counts is noted (t1). The pinhole collimator is then advanced to approximately a 3-cm distance (for image magnification) so that only one eye with its nasolacrimal region is in the field. Slight tilting of the head to the opposite side to avoid the other eye in the view is necessary. A second exposure is taken collecting 50,000 counts. The time interval necessary to collect the 50,000 counts is noted (t2). Thereafter, the opposite eye is imaged at the same distance (3 cm) after tilting the head to the opposite side with the preset time t2. Serial images of the individual eye at a 3-cm distance with preset time t2 and composite images of both eyes at a 17-cm distance with preset time t1 are then taken at 10, 20, and—if necessary—at 30 min. Since true life images are not a requirement for this study, we are currently evaluating a modification of the original technique using

For reprints contact: Margaret Goodyear, 5671 Rayburn Ave., Alexandria, VA 22311.

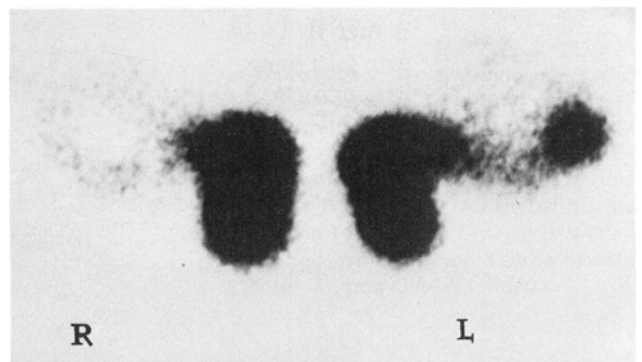


FIG. 1. Normal study—magnified composite image at distance of 17 cm from patient, 10 min post instillation.

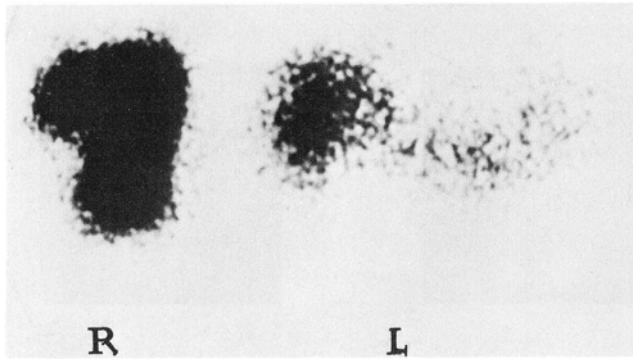


FIG. 2. Composite image 10 min post instillation (17-cm distance) showing complete obstruction distal to left lacrimal sac.

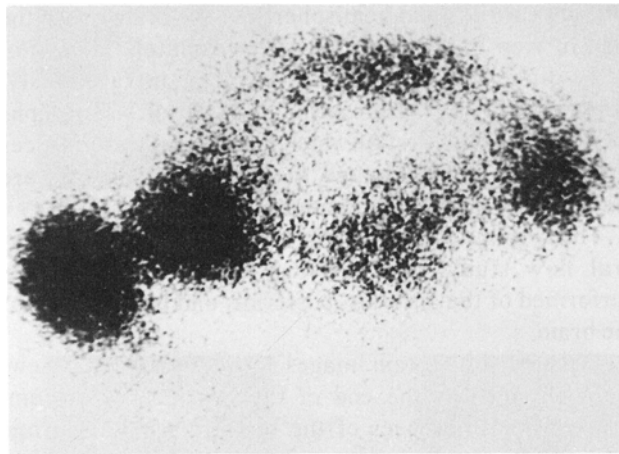


FIG. 3. Individual eye imaging with 3-cm distance from patient. Imaging of left eye 20 min post instillation reveals obstruction distal to lacrimal sac.

a multiimager magnification system. This simply involves serial images at the closest distance that allows both orbits to be viewed simultaneously without distortion on a single exposure. It appears that this modification will be the preferred technique.

Results

A study is interpreted as normal when the tracer distribution is seen symmetrically in the nasolacrimal ducts (Fig. 1). This usually occurs within 5 to 10 min after administration. If there is delay or evidence of obstruction of flow of the tracer, the study is considered abnormal (Figs. 2 and 3).

Although 16 patients were studied, followup could be obtained in only 14 patients. Out of these 14, 13 studies were abnormal and suggestive of complete or partial obstruction. One was normal. The scintigraphic studies were interpreted without knowledge of the contrast or clinical studies. Subsequent confirmation by contrast studies, probing, or by surgery was obtained in all 13 patients with abnormal scintigrams. However, in two patients in whom the scintigram showed bilateral obstruction, x-ray studies were done only on one side.

There were no false interpretations of the abnormal conditions. The clinical and scintigraphic details of these 14 patients will be published separately.

Discussion

Tears secreted by the lacrimal glands located behind the superolateral margin of the orbit move across the globe to the medial angle of the eye. The outflow portion of the lacrimal system is composed of a superior and inferior canaliculus which opens into the eye through the superior and inferior lacrimal puncta. The superior canaliculus usually joins the inferior canaliculus to form a common sinus which drains the tears into the lacrimal sac. Tears enter the nasal cavity from the lacrimal sac through the nasolacrimal duct. The volume of tears secreted in a 24-hr period has been estimated to be 1.0 ml or less (2). One-half of the secreted volume of tears is evaporated. The remainder drains through the lacrimal sac inferiorly into the nose. Normal lacrimal drainage is dependent upon a pumping effect produced by blinking.

Epiphora or weeping eye was the most common complaint of patients referred for these studies. Epiphora results primarily from two causes: (A) increased lacrimation due to excessive secretion and (B) obstructive epiphora, an inadequacy or obstruction of the drainage mechanism so that the tears spill over the cheek. A dacryocystoscintigram usually can differentiate obstructive causes from nonobstructive ones.

Chaudhuri et al. recently described good correlation between the contrast dacryocystogram and nuclear dacryocystogram (dacryocystoscintigraphy) (3). There was no discrepancy in their results between the two comparable procedures. However, they used a micro pinhole insert with a diameter of 0.04 in., which no doubt increases the resolution. The radionuclide procedure is simple and convenient. The test can be utilized as a screening procedure in patients with epiphora. No patient preparation is necessary and the procedure requires only 30 min. The critical organ is the lens, and the estimated radiation dose to the lens is only 4-6 mR as compared to 200-300 mR by an ordinary AP skull x-ray (1).

Acknowledgment

Our thanks are due to Meredith Brock for her expert secretarial assistance in the preparation of this manuscript.

References

1. Carlton WH, Trueblood JH, Rossomondo RM: Clinical evaluation of microscintigraphy of the lacrimal drainage apparatus. *J Nucl Med* 14:89-92, 1973
2. Hartmann E, Gilles E: Lacrimal passage. In *Roentgenologic Diagnosis in Ophthalmology*, Berens C, ed, JB Lippincott Co, Philadelphia, 1959, pp 166-187
3. Chaudhuri TK, Sparoff GR, Dolan KD: A comparative study of contrast dacryocystogram and nuclear dacryocystogram. *J Nucl Med* 16:605-608, 1975