the instilled joint, local heat and mild reddening were observed between Days 4 through 6 after treatment, and relief of pain was noted about 3 days after that with improved movement of the involved knee in the wheel chair and the possibility of walking. The patient's knee scan made a few days after the instillation showed the anatomy of the synovial structures (Fig. 1) (*7*).

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RADIATION DOSE TO THE BRAIN FROM ^{169}Yb-DTPA IN CISTERNOGRAPHY

The radiation dose to the brain from ^{169}Yb-DTPA administered intrathecally has recently come into question. J. Barbizet, et al (*1*) have suggested the radiation dose to the brain can be as high as 1,500 rads/mCi administered. The high radiation dose is due to apparent persistence of activity in the meningoencephalitic structures and can be detected over a period of 3 months' time.

In their recent letter to the editor, R. Morris and F. DeLand (*2*) studied five patients from 9 to 87 days to detect any long-term retention of ^{169}Yb and found only a few percent of the administered activity to have long-term retention in the brain.

We also have made quantitative measurements on six patients to assess the retention of ^{169}Yb in the head region. Three of the patients were studied out to 4 days postadministration and three out to 9 days. One patient returned at 3 months with no detectable radioactivity. Of these six patients four showed abnormal flow patterns and two were normal.

All measurements were made with the gamma camera coupled to a PDP-11 computer. The brain region excluding the brain stem was flagged to determine background counts. The net brain counts were obtained for anterior, posterior, and right and left lateral views. The geometric mean of the anterior and posterior counts was determined and similarly for the right and left lateral views. A calibration factor relating microcuries of ^{169}Yb to imaged counts was obtained from a standard 50-ml volume source in a water phantom. Corrections were made for varying head dimensions and skull attenuation (*3*).

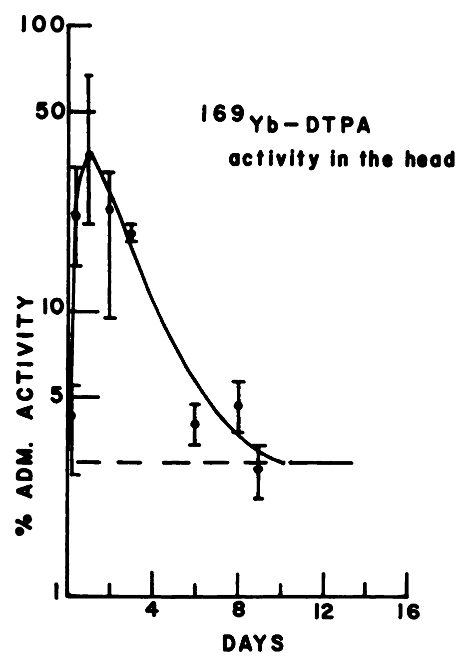

FIG. 1. Percent of administered activity in head region following intrathecal injection of 1.0 mCi of ^{169}Yb-DTPA. Error bars indicate range of measured values.

The fraction of administered activity in the head is shown in Fig. 1 as a function of time. The initial flow of activity into the head follows a half-time of about 8 hr, the disappearance half-time is on the order of 24 hr, and 3% of the activity is assumed to be retained with an effective half-life of 32 days.

The activity in the head at t hours after administration of the activity can be described by the following equation:

$$A(t) = 970\, e^{-0.0294t} + 30\, e^{-0.0009t} - 1000\, e^{-0.0875t}\ \mu Ci$$

The total cumulated activity ($\tilde{A}$) in the brain is calculated to be 54,880 μCi-hr. The volume of CSF in the head region is assumed to be 130 ml, the absorbed fraction, ϕ, to the surface of the surrounding tissues from particulate radiations is assumed to be 0.5 and $\Sigma_i \Delta_i \phi_i$ is 0.1426. For the penetrating radiation it is assumed that the radioactivity is uniformly distributed in the brain tissues and $\Sigma_i \Delta_i \phi_i = 0.127$.

Based upon these assumptions and parameters, the total radiation dose to the surface of the brain tissues in contact with CSF in the ventricles and posterior fossae is calculated to be 65 rad/mCi administered activity. The average dose to the brain from penetrating radiation only is calculated to be 5 rad/mCi. The uncertainty in biologic data based upon small numbers of patients is large but the values agree with the data presented by Morris and DeLand and the radiation dose is an order of magnitude less than reported by Barbizet, et al (*1*).

Although it does not appear that prolonged retention in the meninges takes place under usual circumstances, it is possible the observations of Barbizet, et al may be related to some pathologic or anatomic variant yet unrecognized. We therefore suggest further evaluation and corroboration of the safety of this agent for cisternography.

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EFFECTS OF SCATTER SUBTRACTION ON IMAGE CONTRAST

It appears that some confusion exists regarding the improvement in image contrast described by Bloch, et al (*1*) as evidenced by Inia's Letter to the Editor (*2*) and by the author's response.

Bloch and Sanders used a subtraction technique intended to compensate for the contrast reduction due to Compton-scattered photons which produce pulses that occur within the photopeak window of a NaI(Tl) detector system. Even with an "optimum" baseline setting of 126 keV for a large uniform volume distribution of ^{99m}Tc, the window set on the photopeak will contain a significant scatter fraction (*3*). The scattered photons give rise to the characteristically long tails of the line-source response functions (LSRF) measured in a scattering medium. The effect of these tails is a reduction in image contrast.

If a second window could be set somewhere on the scatter spectrum so as to produce a LSRF having the same magnitude and shape as the scatter component within the photopeak, then subtraction of the former LSRF from the latter would eliminate contrast degradation due to scatter pulses in the photopeak window. The principal concern in the original article, however, was only with the magnitude of the scatter response; that is, the shape of the scatter response was not treated explicitly. To compensate for this magnitude, Bloch and Sanders set a second window with the baseline at 91 keV near the backscatter energy. The width of this window was adjusted to yield approximately the same number of scattered photons as were contained within the photopeak window. This setting was based on the assumption that the Klein-Nishina equation adequately describes the observed pulse-amplitude spectrum due to scattered photons. The events occurring in the scatter window were then subtracted from those in the photopeak at each position in the scan. Although this approach may compensate accurately for the magnitude of the scatter component in the photopeak, image contrast is improved only because the shapes of the line-source response functions due to scatter were approximately the same for the two windows; therefore, this procedure produced a net line-source response function with reduced tails compared with the photopeak window alone. The reduction in the tails results in an increase in the system MTF(ν)* at all spatial frequencies, ν (cycles per unit

* The MTF(ν) is the magnitude of the detector transfer function which is the Fourier transform of the line-spread function (*4*).