

POSTERIOR/ANTERIOR DISTRIBUTION OF RADIOLABEL ON LATERAL RENAL IMAGES: POSSIBLE USE IN STUDYING THE RETROPERITONEUM

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SUMMARY

At 30 minutes after intravenous administration of the glomerular renal agent TC-99m-DTPA, both right and left lateral views were obtained. We analyzed the ratio of optical densities (behind the ureter/in front of the ureter). In patients without gross renal failure or retroperitoneal disease, the ratio was always less than 1 (range 0.38 to 0.95, mean 0.68). This represents greater perfusion of the intestine and anterior organs as compared with the retroperitoneum. Since the posterior/anterior ratio can be readily determined by computer processing or by measurement of optical density of the film, it was suggested that this might be an approach for detecting increased retroperitoneal permeability in diseases of that area or possibly in cases of renal disorders.

INTRODUCTION

The diagnostic studies in Nuclear Medicine have paid little attention to the appearance of the retroperitoneum. However that region is potentially accessible to study by lateral views, such as during renal imaging. Breuel and coworkers, 20 years ago, remarked on diagnostic uses of the lateral view (1). We have therefore analyzed lateral renal images to obtain data on the posterior/anterior distribution of radiotracer and the appearance of the retroperitoneum.

MATERIALS AND METHODS

We retrospectively reviewed 124 consecutive adult renal studies, performed on

gamma cameras, after intravenous administration of the glomerular agent TC-99m-DTPA. Both right and left lateral views were obtained at 30 minutes after the tracer was administered. On the lateral view, the linear distance from the lower renal pole to the bladder was noted. At one - third of this distance, just anterior and posterior to the ureter, the optical film density was measured by a Sakura PDA-85 densitometer (which was "zeroed" against a nearby blank area of the film). Prior study of the response of the NMC-1 film utilized for the studies indicated that it was suitably linear in the optical density range of interest.

From the 124 studies, we eliminated 21 because of malpositioning under the gamma

camera, recent ureteral surgery, or frank renal failure with poor extraction of the radiotracer. This left 103 cases for analysis; none of these had known retroperitoneal disease. The optical density for the region just anterior to the ureter was obtained for the right and left lateral views and averaged. Similarly, the values for the region just posterior to the ureter were averaged between right and left sides. From these a posterior/anterior ratio was calculated.

RESULTS

The range of values for the posterior/anterior ratio was from 0.38 to 0.95 (mean of 0.68). The calculated values approximated a normal distribution (Figure 1). In each instance, the posterior region had less uptake than the anterior; i.e, the retroperitoneum had a lower concentration of radioactivity than the anterior region (the anterior activity represented that in the intestine and other intraperitoneal structures).

DISCUSSION

The finding of a posterior/anterior ratio of less than 1, in the absence of known retroperitoneal disease, suggests that lateral view might be of interest in exploring retroperitoneal uptake of radiotracer in cases of lesions of that region, or the extension of renal disorders posteriorly. In several cases with known elevated blood urea nitrogen values, the posterior/anterior ratio approached a value of 1. This raises the possibility of increased permeability in some cases of renal failure.

The lateral renal scan corresponds to a superimposition of multiple sagittal slices. There are relatively few reports in the Nuclear Medicine literature that relate to this view of the renal area (1). Cook and associates

discussed transaxial, coronal and sagittal kidney images, but did not comment on the retroperitoneum (2). The retroperitoneal accumulation of bone imaging agents has been noted, as well as the displacement of organs by retroperitoneal disease, but only on planar images of anterior and posterior projections (3, 4, 5). Radiogallium accumulation has been reported in a case of retroperitoneal fibrosis, with resolution after steroid therapy (6); again this was by only anterior and posterior planar views. Another report of retroperitoneal fibrosis, showing that anterior and posterior images was negative for radiogallium uptake and concluded that the fibrosis was "mature" with few inflammatory elements present (7). There is a potential problem with examining the posterior/anterior ratio when peritoneal fluid is present; the fluid can absorb photons, reducing the number presenting to the gamma camera. Alazraki and her coworkers noted this effect when 2 liters of the fluid were present and the inferior cardiac wall was imaged (8).

We have noted that the commonest images on CT reconstruction represent views which are transaxial. The sagittal images, which would correspond to our lateral view of the ureters, are seldom presented. However, we have begun reconstructing CT images in the sagittal plane, for comparison with lateral renal views. This appears to be an area that deserves further investigation. The Nuclear Medicine studies could of course be carried out by computer processing of the posterior/anterior ratio. However, since this was a retrospective study, we utilized the film record of the examinations.

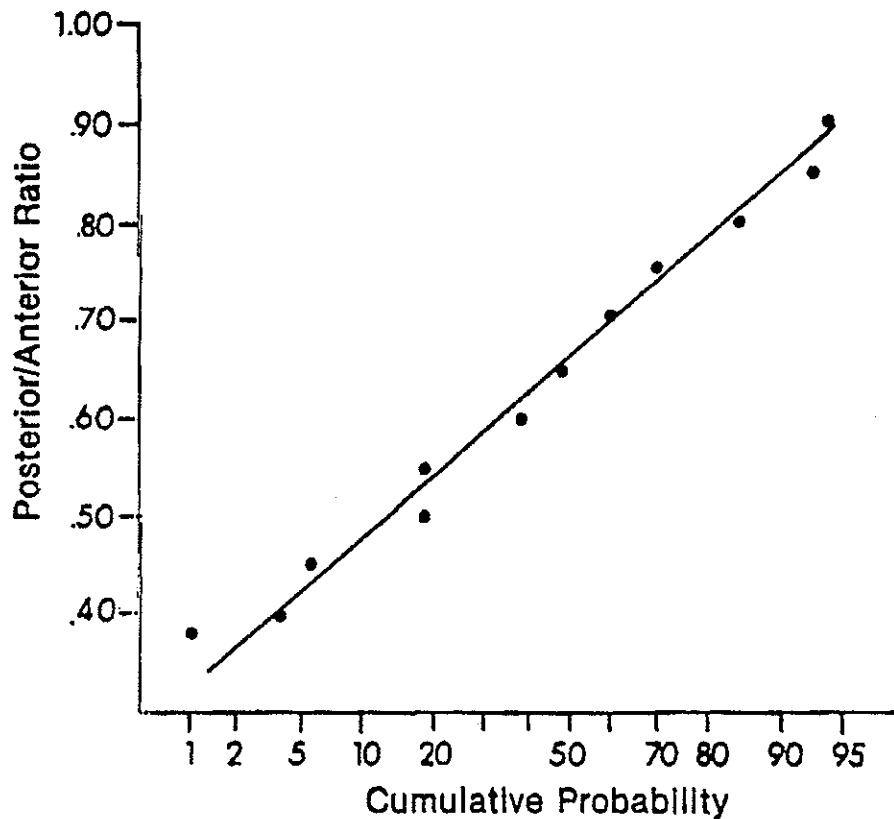


Figure 1. This is a probability plot of the values of the posterior/anterior ratio. The values are close to normally distributed.

REFERENCES

- 1) Breuel HP, Kraft W, Behre M, Emrich D. Lateral renal scans. *Fortschr. Geb. Roentgenstr. Nuclearmed.* 1976; 125: 84-50.
- 2) Cook GJR, Lewis MK, Clarke SEM. An evaluation of TC-99m-DMSA SPET with three-dimensional reconstruction in 68 patients with varied renal pathology. *Nucl Med Comm.* 1995; 16: 958-967.
- 3) Wilkinson MJS, Howell A, Harris M, Adam NM, Lupton E, Johnson RJ, Sellwood RA. Retroperitoneal tumor infiltration detected by bone scanning in patients with infiltrating lobular carcinoma of the breast. *Br J Surg.* 1985; 72: 626-628.
- 4) Boykin MW, Heartshorne MF, Bauman JM, Cawthon MA. Massive retroperitoneal chondrosarcoma. *Clin Nucl Med.* 1985; 10: 899-900.
- 5) Sty JR, Carmody TJ, Ruiz M.E. Accumulation of TC-99m-MDP in diaphragm and retroperitoneum of a battered child. *Clin Nucl Med.* 1995; 20: 931.
- 6) Talati SJ, Abghari R, Kochkodan JJ, Helmer SR. Use of Ga-67 imaging in diagnosis and follow-up after steroid treatment of retroperitoneal fibrosis. *Clin Nucl Med.* 1995; 20: 995-997.
- 7) Jacobson AF. Gallium-67 imaging in retroperitoneal fibrosis: significance of a negative result. *J Nucl Med.* 1991; 32: 521-523.
- 8) Alazraki N, Rab ST, Krawczynska E. Peritoneal fluid causing inferior attenuation on SPECT thallium myocardial images in women. *J Nucl Med.* 1988; 29: 941.