RENAL SCAN PRIOR TO RENAL BIOPSY— A METHOD OF RENAL LOCALIZATION

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Palpation, percussion, and auscultation are the classical methods of determining organ localization by external nontraumatic means. With the need for more specific information about smaller organs, especially for needle biopsy or aspiration techniques, more definitive localization of these organs has become necessary. The anatomic landmarks used in most biopsy techniques are simply not specific enough to cover individual variation. This has led to the development of many radiographic procedures and more recently to the use of radionuclide distribution or ultrasonography for localization. The latter procedures are desirable because they deliver a generally lower radiation dose to the patient than the radiographic procedures. One such technique—renal localization prior to renal biopsy—has become routine at our institution in the last 6 years.

METHODS

In our method (*1*) the patient is given an injection of 1.0 mCi of Tc-Fe-ascorbic acid complex and about 1 hr later is positioned under the gamma cam-

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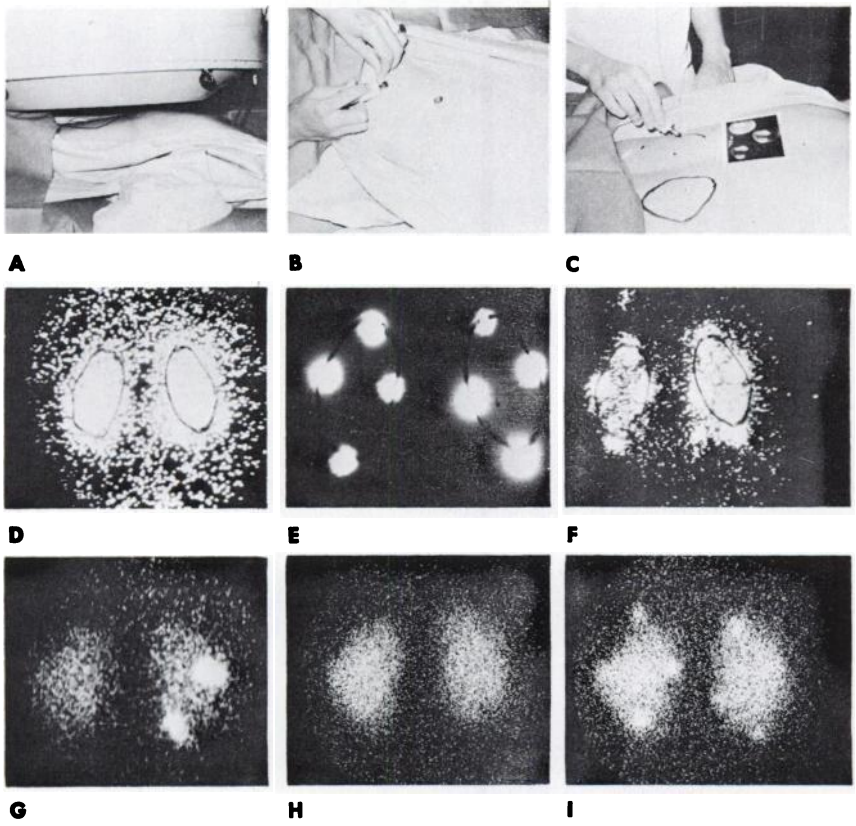

FIG. 1. A shows patient positioned under camera 1 hr after injection of 0.1 mCi Tc-Fe-ascorbic acid complex in "biopsy position". B shows small point sources (^{57}Co) positioned on patient's back until they coincide with scan image of renal outline by trial and error method or with use of persistence oscilloscope. C shows renal outline drawn with indelible ink on back of patient between four points marked for each kidney. D shows persistence oscilloscope with renal image "stored" and renal outline drawn in on face of oscilloscope with wax pencil. E shows persistence oscilloscope with eight point sources defining two kidneys positioned on "wax pencil" outline of renal scan previously collected. F shows persistence oscilloscope with composite of points and renal scan to recheck accuracy of renal localization. G shows renal scintiphotograph and two points positioned by trial and error. H shows final renal scintiphotograph without markers to detect gross renal abnormalities. This becomes part of patient's record. I shows final renal scintiphotograph with markers to document renal localization. This too becomes part of patient's record. Patient then returns to his room where biopsy is performed at convenience of referring physician.

TABLE 1. ACCURACY OF RENAL LOCALIZATION PROCEDURES

Author	Accuracy*	Technique
Kark, Muehrcke (1954)	47 of 50 (94%)	Pyelogram
Kark, et al (1958)	401 of 500 (80%)	Pyelogram
Brun, Raaschou (1958)	162 of 243 (67%)	Not stated
Lindhom, Hagstam, Kjellstrand (1967)	114 of 150 (76%)	Pyelogram or plain abdominal film
Lusted, Mortimore, Hopper (1958)	9 of 10 (90%)	Image amplifier and pyelography—direct vision of needle progress
Ginsburg, Durant, Mendex (1962)	30 of 37 (81%)	Image amplifier and pyelography
Kark, Buenger (1966)	All work (87%) 1,500 biopsies	TV image intensifier and infusion IVP—done in normal room illumination—specificity of cortex vs hilum
Haddad, Mani (1967)	22 of 23 (96%)	TV image intensifier and infusion IVP
Junghagen, et al. (1968)	57 of 68 (84%)	TV image intensifier and arteriography—not limited by uremia
Kark (1968)—appendix by Welt	Survey (89.9%)	TV image intensifier and infusion IVP—21 nephrology centers—data representing 8,081 biopsies—1,398 done under fluoroscopic control
Fajers, Holm, Lindqvist (1970)	54 of 66 (82%)	TV image intensifier and arteriography—not limited by uremia
Kaplan, et al (1970)	31 of 32 (97%)	TV image intensifier and pyelography—use of a disposable needle
Telfer, Achroyd, Stock (1964)	9 of 11 (82%)	10 μCi of ^{203}Hg-chlormerodrin with *portable* scintillation counter
Baum, Rabinowitz, Malloy (1966)	6 of 7 (86%)	200 μCi of ^{197}Hg-chlormerodrin with rectilinear scanner
Forland, et al (1967)	16 of 17 (94%)	1 mCi ^{99m}Tc-Fe-ascorbate with rectilinear scanner—applicable to children
Reese, Joshi (1968)	30 of 30 (100%)	100 μCi of ^{203}Hg-chlormerodrin with rectilinear scanner
Zimacek, et al (1970)	37 of 40 (92%)	3.5 Ci/kg ^{197}Hg-chlormerodrin with rectilinear scanner or gamma camera
Berlyne (1961)	18 of 20 (90%)	Ultrasound flaw detector

* Accuracy defined as recovery of tissue of diagnostic value as defined previously.

era, prone with a small pillow under the midabdomen, i.e., in biopsy position. Following the localization procedure the patient returns to his room where the biopsy is performed at the convenience of the referring physician. The low-energy parallel-hole collimator is used, and two techniques are used to localize the kidneys (Fig. 1A).

Trial and error. Scintiphotographs are accumulated for 20–30 sec with ^{57}Co microsources placed on the skin of the back and moved after each scintiphotograph until they coincide with the margin of the underlying kidney. At least four marker positions are used to define the two poles and width of each kidney. A composite picture of the entire kidney is then drawn around these points on the skin of the back (Fig. 1B–F).

Persistence oscilloscopy. With the oscilloscope in the "store" mode, counts are accumulated until the kidneys are clearly delineated. The outline of the kidneys is then drawn on the oscilloscope face in wax pencil and the image "erased" electronically. Marker microsources (^{57}Co) are placed on the patient's back and moved until they coincide with the outline of the kidneys on the oscilloscope face. This approach decreases the time required for the procedure from approximately 30 min by trial and error to 5–10 min with the persistence oscilloscope. This is particularly advantageous in small children (Fig. 1G–I).

Rectilinear scanner. An additional procedure using a rectilinear scanner has been previously described (*1*).

RESULTS

The ability to localize the kidney outlines in this manner was compared with the histologic findings over the 6-year period of our experience with this procedure.

Of 478 patients referred for prebiopsy scan, biopsies were not attempted on 101 for a variety of reasons. These reasons included (A) poor kidney function with no renal localization of nuclide (36 patients), (B) biopsy either relatively or absolutely contraindicated by subsequent clinical course or diagnostic evaluation (42 patients), and (C) patient refusal and other miscellaneous reasons (23 patients). The clinical contraindications (relative or absolute) included anemia, dyspnea in biopsy position, hypertension, single kidney, infection (renal or systemic), age and recent myocardial infarction, severe agitation, technical difficulty in reaching the kidney with the needle, and moribund patient.

Of the 377 patients on whom percutaneous renal biopsy was attempted, renal tissue was obtained in

343 (91%) and tissue of diagnostic value* in 310 (82%). In the last 100 patients biopsied, renal tissue was obtained in 99 (99%) and tissue of diagnostic value* in 94 (94%). These latter figures are of significance in demonstrating the need for some familiarity with the techniques of scanning and biopsy, but are also a tribute to the various individual residents, internists, and pediatricians who actually performed the biopsies with such consistency.

In addition, the renal scan gave some information on relative renal size and areas of nonuniform uptake which might suggest renal mass or hydronephrosis. The most common abnormal finding was uniformly decreased or absent renal uptake suggesting poor renal function; this finding did not seem to be correlated with the ultimate success or failure of the biopsy attempt if the kidneys could be localized at all.

DOSE

The absorbed radiation dose for this technique is 0.336 rads to the kidneys, <10 mrads to the gonads, and <10 mrads to the total body (*2–4*). This is small compared with the pyelogram dose which seems to be obtained in all patients with renal disease, although not necessarily before each biopsy. The dose from a pyelogram is 0.468 rads/film or 4.4 rads/examination at our institution (*5*). The fluoroscopic dose with image intensifier is less than 3 rads for 90 sec of fluoroscopy time (*6*). All the above doses are proportionately less for children, including the administered radionuclide dose.

DISCUSSION

As percutaneous renal biopsy becomes even more commonplace, the most accurate, most innocuous, and most convenient procedure will be sought to localize the kidneys and minimize technical failures. The method of translating the position of the kidneys from a plain abdominal film or pyelogram to the patient has been found by most to be too cumbersome to make adequate corrections (*7*) and of only borderline accuracy (*8–11*). Radionuclide localization of the kidneys has been used extensively in small series (*1,12–18*), but only with the advent of ^{99m}Tc compounds has the radiation dose of 5–10 rads for ^{203}Hg compounds been reduced to acceptable levels as calculated above. Television image intensifier fluoroscopy with infusion pyelography is a popular (*6,12,19–27*) and competitive procedure because of the direct vision of needle position as it is advanced for biopsy. The method, however, has the disadvantages of requiring a fluoroscopic suite, the involvement of multiple physicians, a relatively high dose of patient irradiation with large dose of pyelographic contrast material, and cumbersome technical operation around the intensifier-television chain. In contrast, the radionuclide procedure outlined above requires a lower patient irradiation, is easily performed by technicians, and has competitive if not better accuracy (Table 1). In the future ultrasonography may be as good or better since no dose of ionizing radiation is given. Ultrasonography shows promise for renal localization (*28*), but the ultimate role of this method remains to be evaluated.

* The pathologic interpretation of "tissue of diagnostic value" signified that enough glomeruli (usually at least ten per section) were obtained to be representative of all renal glomeruli or that a glomerular lesion was seen that was so pathognomonic of a disease process as to be diagnostic of it.

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