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SIGNIFICANCE OF RENEWAL ASYMMETRY IN BONE SCANS: EXPERIENCE IN 795 CASES

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A retrospective study of 795 consecutive bone scans employing either ^{18}F or ^{99m}Tc-pyrophosphate to evaluate the diagnostic value of renal asymmetry in such scans has been carried out. It is concluded that asymmetric renal images in bone scans convey relatively specific information regarding renal pathology, especially in the ^{99m}Tc-pyrophosphate studies.

Sharma and Quinn and Park and his colleagues have pointed out the diagnostic value of the renal images obtained incidental to skeletal scintigraphy (*1,2*). The skeleton and the kidneys compete for both ^{18}F and the ^{99m}Tc-polyphosphate analog bone-seekers with the distribution being approximately equal (*3,4*). The physiologic quality of these radiopharmaceuticals results in fortuitous renal and bladder images in bone scans which may be subjected to diagnostic analysis. Because the major indication for skeletal scintigraphy is to assess the possibility of bony metastases, the patient group undergoing bone scanning is more likely to have renal abnormality resulting from primary and secondary retroperitoneal and pelvic lesions than the general population. These abnormalities are often clinically silent and are important both to the staging of the neoplasm and to radiation field planning. Because of the potential clinical utility of detecting renal abnormalities in bone scans, we have undertaken to assess the value of information related to the urinary system obtained from bone scans.

METHODS AND MATERIALS

Experimental design. A retrospective survey of 795 consecutive whole-body rectilinear bone scans spanning our experience of the past 2 years was made. The studies were analyzed without reference to patient data and those showing definite renal asymmetry were selected for further analysis. This evaluation included thorough review of the patient's medical record and reference to the patient's excretory urogram if performed within 4 weeks of the bone scan. The patients were then categorized as follows.

Unclassifiable. No information documenting the presence or absence of renal abnormality was available.

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TABLE 1. RESULTS OF 795 CONSECUTIVE WHOLE-BODY RECTILINEAR BONE SCANS

Scan agent	Total	Asymmetry	Confirmed renal status	Concordance with clinicopathologic findings			Discordance with clinicopathologic findings	
				Definite	Probable	%	No.	%
^{18}F	536	17	12	5	3	67	4	33
Tc-pyrophosphate	259	20	18	15	3	100	0	0

Renal allograft recipients excluded.

TABLE 2. CLASSIFICATION OF RENAL ABNORMALITIES

Scan agent	Confirmed cases	Obstructive uropathy	Nephrectomy	Unilateral nonfunction	Ectopic location
^{18}F	8	5	3	1	0
Tc-pyrophosphate	26	9	5	6	8

One ^{18}F patient and two ^{99m}Tc-pyrophosphate patients appear in two categories.

Concordant with clinicopathologic findings. Definite findings included unequivocal evidence of renal abnormality (IVP, autopsy, or history of nephrectomy). Probable findings were presumptive evidence of renal abnormality (known paraspinal or pelvic pathology without IVP or IVP showing relative ureteropelvic junction obstruction).

Discordant with clinicopathologic findings. Renal asymmetry on scan with normal IVP was discordant with clinicopathologic findings.

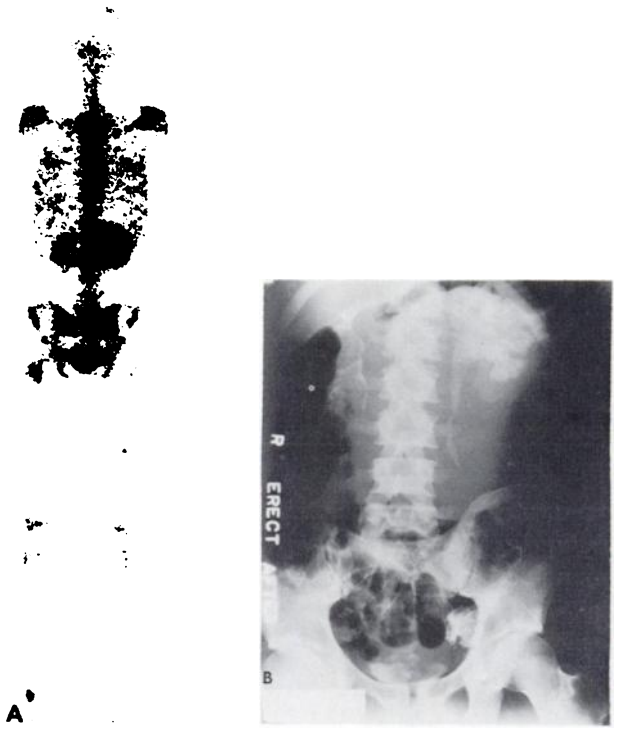

FIG. 2. Twenty-four-year-old man with melanocarcinoma. (A) Note renal asymmetry. (B) Excretory urogram showing left ureteral obstruction.

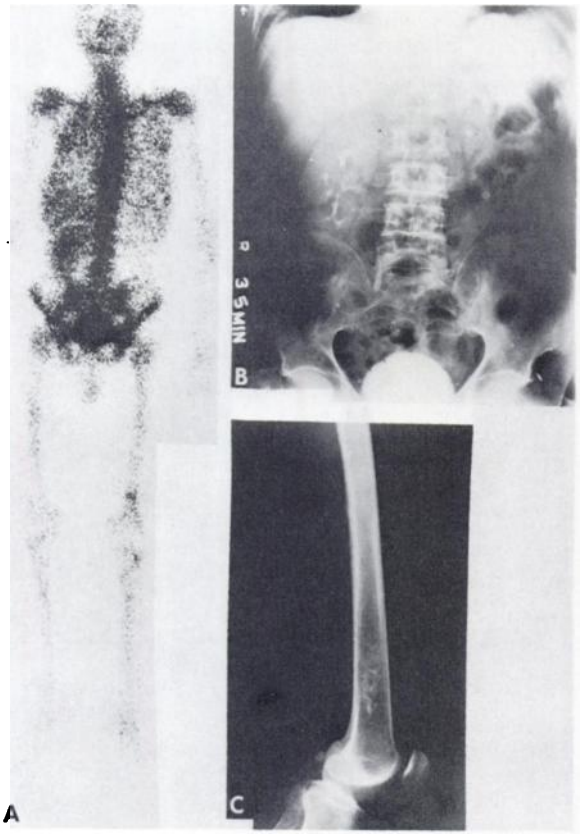

FIG. 1. Fifty-nine-year-old man with bronchogenic carcinoma. (A) Note renal asymmetry. (B) Excretory urogram showing nonfunctioning left kidney. (C) Radiograph showing left distal femoral scan abnormality to be bone infarct.

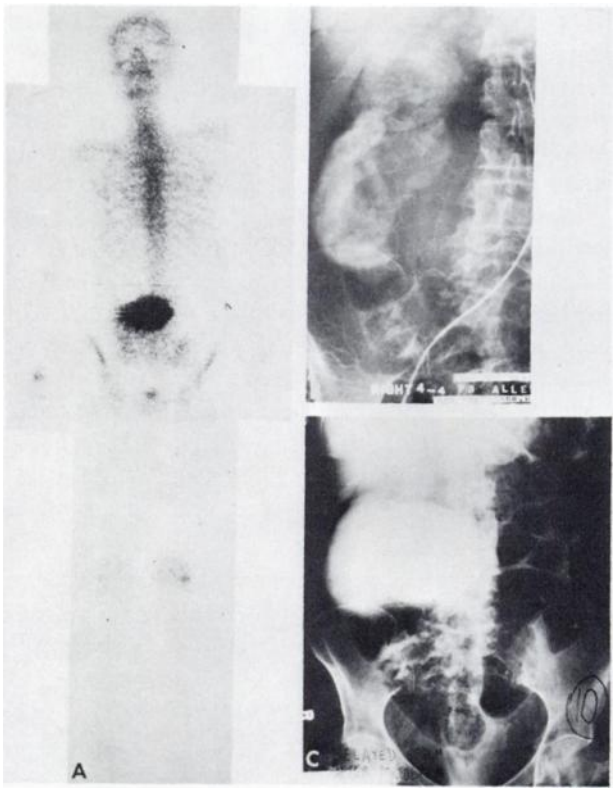

FIG. 3. Sixty-eight-year-old woman with hypernephroma. (A) Note absence of normal renal images, midabdominal activity, and minimal bladder excretion. (B) Angiogram showing renal cell carcinoma of right kidney. (C) Delayed film showing obstructed renal pelvis. Patient's left kidney had been removed 30 years previously for another primary hypernephroma.

Scan technique. Fluorine-18 (536 scans): 2–4 hr after intravenous injection of 2–4 mCi ^{18}F (Medi-Physics) whole-body rectilinear scans were obtained with a dual 5-in. scanner (Ohio-Nuclear) using 5-in. focal depth high-energy collimators (38H) to a data density of approximately 300 events cm^{-2} using a 20% window and appropriate calibration. Technetium-99m-pyrophosphate (259 scans): same technique as used for ^{18}F except 10–15 mCi ^{99m}Tc-pyrophosphate (*5*) and 3-in. focal depth collimators (17L) were used.

RESULTS

The findings are tabulated in Table 1. A classification of the renal abnormalities is shown in Table 2. A noteworthy observation was the fact that renal images were always present in the ^{99m}Tc-pyrophosphate scans. This finding was unusual in the ^{18}F studies. Three typical examples of renal abnormalities detected are shown in Figs. 1–3.

DISCUSSION

Renal asymmetry in ^{18}F scans was a helpful but unreliable sign (33% discordant). By comparison the finding proved highly specific for renal abnormality in the ^{99m}Tc-pyrophosphate scans (no discordant). The overall sensitivity of renal asymmetry in bone scans as a diagnostic test cannot be assessed with the analysis employed, but ^{99m}Tc-pyrophosphate scans were two and one-half times as sensitive as ^{18}F scans for detecting renal asymmetry, and the total incidence of renal asymmetry of 10% in the ^{99m}Tc-pyrophosphate studies suggests that bone scans using polyphosphate analogs are a sensitive index of renal abnormality. Routine evaluation of the bone scan for renal asymmetry will add to the diagnostic information obtained from the procedure, improving patient care by providing greater accuracy in clinical staging, permitting more rational radiation treatment field planning, and diagnosing unsuspected abnormalities threatening renal function.

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