A PRACTICAL COMPROMISE IN BONE SCANNING

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At this time ^{85}Sr remains of necessity the most widely used bone scanning agent. Its gamma emission energy (513 keV) is of a magnitude that makes gamma camera imaging inefficient. The clinically permissible dose gives such low bone activity levels that prolonged rectilinear scanning time is required. This usually makes total-body bone scanning impracticable because the scanner speed has to be slow to gain sufficient information.

The speed of the detector head is limited by the information density per unit area scanned that is required for accurate interpretation. The present consensus (*1*) regarding the information density desired for interpretation of bone scans is that it should be in the range of 100–200 counts/cm² of the scanned area.

A commercially available rectilinear scanner (Ohio-Nuclear) electronically reduces the display area five fold in both the vertical and horizontal directions. This increases the information per unit area of display by a factor of 25; further, because of the smaller angle subtended at the retina by a reduced image, it is more easily resolved by the eye (*2*). The purpose of this minification is to allow a faster rate of scanning. Although the limiting factor must be the information density per unit area scanned, the above compensations afforded by minification make it clinically feasible to do whole-body bone scanning with ^{85}Sr in a reasonable time.

Since the rectilinear scanners in most nuclear medicine laboratories are not equipped with electronic minification, we felt that similar advantages could be achieved by photographic minification of a 14 × 17-in. scan recorded at about four times the speed normally used for bone scanning.

METHODS AND MATERIAL

In this hospital we routinely do whole-body ^{85}Sr bone scans with a ten-crystal rectilinear scanner (Dynapix) at an information density of approximately 150 counts/cm². Following this procedure, on 21 consecutive patients referred for bone scanning, we scanned the lumbosacral spines and pelvic area with our 3 or 5-in. rectilinear scanners at an

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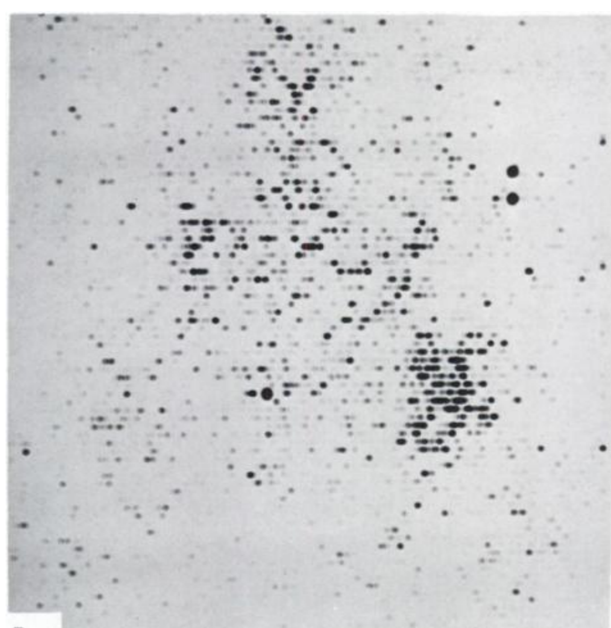
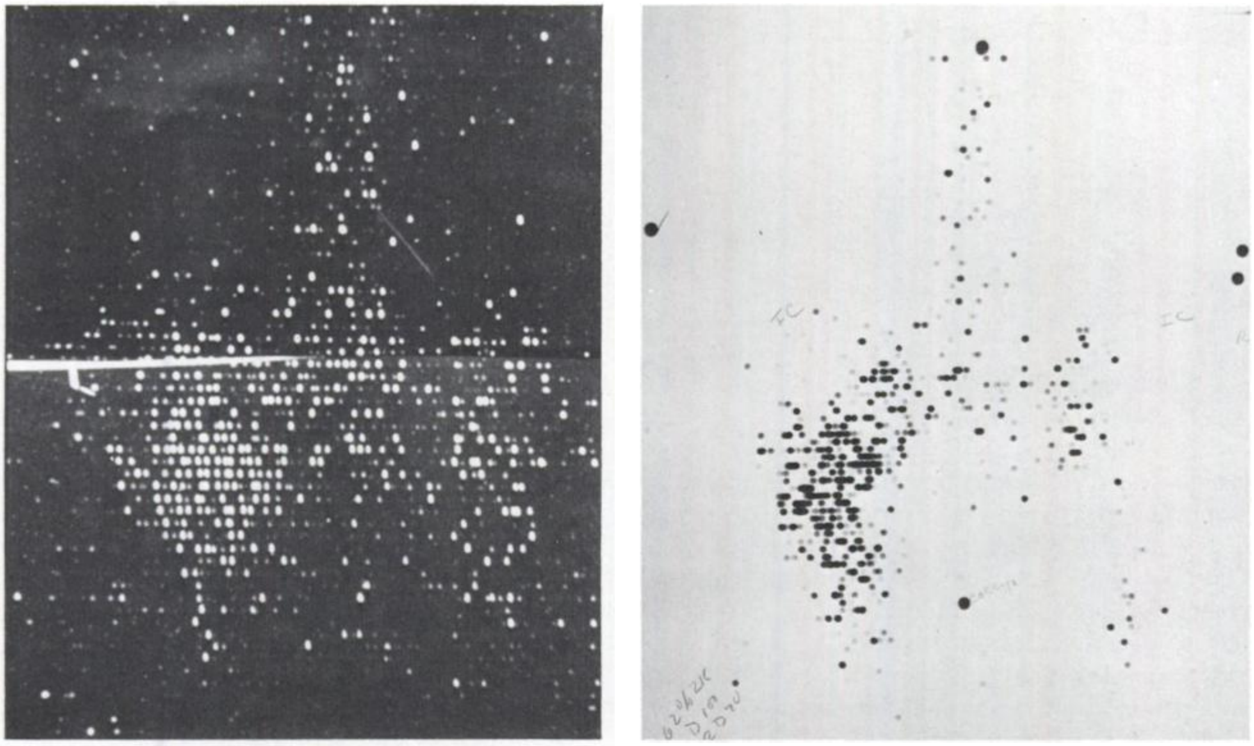
A



B

FIG. 1. Sixty-eight-year-old woman postresection for carcinoma of lung. Lesion on left side of pelvis shown in x-ray (A) stands out from normal sacroiliac joints and lower spine on modified scan (B).



A B

FIG. 2. Eighteen-year-old man with proven Hodgkin's disease and pain referable to positive area. "Dynapix" scan (A) shows positive area on right side of pelvis. Area is well demonstrated on modified rectilinear scan (B).

information density of 30–40 counts/cm² which allowed us to scan about four times faster than normal. We used a normal sacroiliac joint as the "hot spot" and made this approximately 70% of the gray scale so as to demonstrate pathologic areas, if any, on a normal skeletal outline (Fig. 1B). No contrast enhancement was used (*3*). With this technique it is not necessary to manually search for pathological areas of activity. The resultant 14 × 17-in. film was photographed onto a Polaroid and/or 35-mm transparency.

RESULTS AND DISCUSSION

Twenty-one consecutive patients referred for bone scanning were scanned on the Dynapix as well as on a 3 or 5-in. rectilinear scanner with our modified technique. Out of these 21 patients, 18 had positive findings in the areas scanned by both methods. In all, 28 positive areas were detected. All of the abnormal areas found on the Dynapix scans were also present on our photographically minified scans (Fig. 2).

Although all the information present on the minified scan was also present on the original 14 × 17-in. film, the shapes and localization of relative densities were much enhanced and sometimes only appreciated on the miniaturized photograph due to the small solid angle subtended at the retina and the smoothing effects on statistical variations.

Questionable regions at this low information density may be rescanned with a higher information density if desired. The anatomic landmarks on the large scans are preserved on the photographic image. By photographing a localizing roentgenogram at the same distance as the scan, the degree of miniaturization is identical.

CONCLUSION

We feel that miniaturization may to some degree compensate for decreased detected information density, and this allows a scan speed fast enough to make large-area or whole-body bone screening with ^{85}Sr feasible. Simple photographic miniaturization appears to be an adequate way to achieve this and thus to bring the capabilities for this type of examination to any department with a simple rectilinear scanner and facilities for making 35-mm or Polaroid transparencies.

REFERENCES

1. Timpe GM: Rectilinear scanners in clinical medicine. In *Mallinckrodt/Nuclear,* 3 ed, p 16

2. Tuddenham WJ: Visual physiology of roentgen diagnosis; basic concepts. *Amer J Roentgen,* 78: 116–123, 1957

3. Charkes DN: Bone scanning: principles, techniques and interpretation. *Radiol Clin N Amer,* 8: 259–270, 1970