Letters to the Editor

Superscan Prediction—Another Benefit of Early Renal Views in Bone Scans

TO THE EDITOR: "Superscans" are bone scans with uniformly increased bone-to-soft-tissue ratio generally associated with faint or absent renal visualization (*1-3*). Diffuse metastasis and systemic diseases affecting bone metabolism have been associated with superscans (*1,2,4,5*). The uniformity of bone concentration as well as variations in renal visualization have led to false-negative readings of some superscans (*2,6*) and to efforts to attain confirmation by computer analysis of soft-tissue-to-bone ratios (*7*).

Our bone scan protocol includes an early Phase II (3-8 min postinjection) posterior renal view in an effort to maximize renal status information as a "fringe benefit" to patients undergoing bone scans (*8*). In some of these renal views unexpected sporadic vertebral concentration of bone agent was noted. Association of this early finding with emergence of superscans in the delayed, Phase III (3-4 hr postinjection) bone views prompted this investigation.

In a consecutive series of 320 routinely obtained bone scans with technetium-99m methylene diphosphonate ([^{99m}Tc] MDP) on a typical Veterans Hospital population, Phase II renolumbar tissue views were compared to Phase III bone views. Early vertebral visualization was graded "marked," "mild," and "absent" (Fig. 1). Full consensus on this classification was reached by two uninvolved nuclear medicine specialists who independently evaluated a sample of 50 cases comprising of four "marked" 24 "mild" and 22 "absent" findings.

In eight recognized superscans all six findings of "marked" vertebral visualization correctly predicted superscans (6/6) whereas only two (of 40) "mild" visualization cases were followed by superscans. No false negatives were recorded in the 274 patients with no vertebral visualization (Table 1).

Unusually early bone uptake resulting in "marked" vertebral visualization proved to be remarkably predictive of superscans. The utility of this test might be questioned, since, after all, once a patient has been injected nobody will forego the regular bone scan, irrespective of the accurate prediction. Yet, at the very least, the finding would alert the observer to the likelihood of a superscan which otherwise would occasionally be missed. The underlying mechanisms of this phenomenon remains unexplained. Increased bone avidity for MDP with or without associated hyperemia is postulated but requires further investigation (*9*). In this context the early renolumbar view may prove useful in prospectively identifying patients requiring such investigation. The cost effectiveness of adding a single postinjection view to the bone scan routine is debatable but in our hands the mere gain in renal information justifies the effort. The described serendipitous finding is regarded as a thought provoking bonus.

TABLE 1
Correlation of Early Vertebral Visualization with Presence of Super Scan

Vertebral visualization	No. of patients	No. of superscans
Marked	6	6
Mild	40	2
Negative	274	0

Conclusion

Marked vertebral MDP uptake in Phase II renolumbar views preceding routine bone scans proved to be an accurate

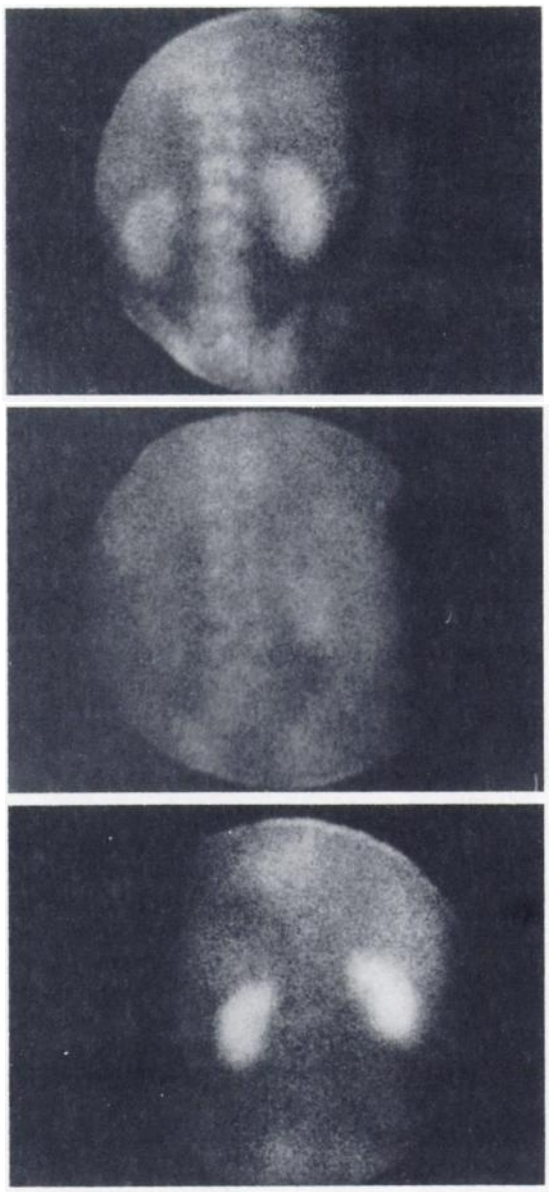

FIGURE 1
Top: "Marked"—Individual vertebrae with interspersed disk spaces are clearly distinguished. Middle: "Mild"—Vertebral bodies and disk spaces are indistinctly visualized. Bottom: "Absent"—No distinguishable vertebral bodies or disk spaces

predictor of superscans without requiring computer analysis. By the same token early detection of abnormal bone uptake may facilitate the prospective selection of cases where more extensive workup is warranted. The finding can be regarded as an added incentive to the inclusion of an early renal view in the bone scan procedure.

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Computer Analysis of Radionuclide Esophageal Transit Studies

TO THE EDITOR: We read with interest the paper "Computer Analysis of Radionuclide Esophageal Transit Studies" by Klein and Wald (*1*), and there are some methodological aspects described in the paper that we would like to comment on.

The calculation of mean transit time (MTT) using area to height ratio implies the calculation of the area from the beginning of the swallowing until all the activity is cleared from the region of interest (*2*). By calculating the MTT from only the rapid component, the authors assumed that the residual component was an artifact and they have given the possible causes of this artifact.

This assumption is not valid in patients with esophageal transit abnormalities. As a matter of fact, in patient with a slightly or moderately prolonged esophageal transit time, the swallowed dose is often separated in two parts, one part passes through the esophagus rapidly (the rapid component) and the other remains often in the esophagus for a longer period (the slow component). In patient with a severe transit delay such as in achalasia, the whole dose may remain in the esophagus for quite a long time and there is no more rapid component. The "residual" activity observed in these cases is not artifactual but rather represents the impairment of the esophageal transit. By removing this activity, the MTT becomes artificially normal.

Our second comment concerns the centroid analysis which is indeed a very interesting technique. We would like to add, however, that the application of this principle on the temporal distribution of the radioactivity instead of its spatial distribution will give a better idea on regional esophageal transit. Indeed, the calculation of the ratio of first and zeroth moments of the pixel to pixel time activity curves allows to obtain the distribution of the mean time (*3*).

On one point, we are in total agreement with Klein and Wald. It concerns the condensed image which in our experience also constitutes the best display for the qualitative assessment of esophageal transit study (*4*).

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REPLY: We thank Ham and Piepsz for their comments concerning our methodology for the analysis of esophageal transit studies (*1*,*2*).

When studying the fate of a swallow of radioactive liquid, one acquires a record of the distribution of particles in space and time. A logical approach to quantitation is one which leads to computation of a transit time which is specifically the mean for the many heterogeneously behaving particles. The record upon which the computation is based must therefore be one which specifically accounts for all the individual transit times contributing to the desired mean. The problem, as exemplified by the first-swallow, whole-esophagus, time-activity curves that we have used, is that the curves may not descend to zero during the time interval under study. One may deal with the remaining particles by a curve stripping procedure, as we have done, or by extrapolation. To compute mean transit time (MTT) without such a treatment is to assume that the curve drops to zero in a sudden final step, and the result will obviously be invalid.

We have observed that our curves descend to a late plateau value which remains nearly constant before a second swallow ensues. Extrapolation to infinity would preserve the constant plateau value and lead to an infinite MTT, which would not