≪特別講演≫

IAEA Co-Ordinated Research Programme on The Intercomparison of Computer-Assisted Scintigraphic Techniques*

Teruo NAGAI

National Institute of Radiological Sciences, Chiba

The IAEA initiated the Programme in 1970. The studies at present being carried out under the Programme are intercomparisons of data-processing techniques for image enhancement, particularly as regards their relative merits in improving the detectability of small lesions.

For an initial intercomparison, simulated scans were generated by computer from a mathematical simulation of a simple phantom in the form of a paraboloid of rotation.

The resulting data were recorded and reproduced on magnetic tape and sent to 18 participating institutions. Twenty-four variants of the phantom, each with a different pattern of lesions, were generated. The phantom was divided into four quadrants, each of which contain either one lesion, either hot or cold, being of random chi-square significance (0~30 s. d.) and randomly located, or none. Institutions were requested to process and display the data by their usual techniques, evaluate the displays as regards the presence or absence of lesion, and estimate the position and the diameter of each lesion detected in each of the 96 quadrants. A total of 30 sets

of results were returned to the IAEA by the 17 institutions.

Each set of results was compared by computer with the true results, binary decisions as to presence or absence of lesions in quadrants being recorded as true positives, true negatives, false positives or false negatives. Various rejection criteria were applied, such as that if the polar co-ordinates of an observed lesion differed by more than 3 cm or 30° from those of the true lesion, the observed lesion would be regarded as a false one.

A plot of percentage true positive against percentage false positive is described as Receiver Operating Characteristic (ROC) plot in the theory of signal detection. The ROC plots were used for comparing each set of results. In addition, a simple method of scoring was devised, and the scores for each set of results were calculated. The sets of results with the highest scores were those for which the corresponding points on the ROC plot lay furthest from the diagonal line representing a random performance; the converse was also true. Overall lesion detectability in the 30 sets of results was plotted as a function of lesion chi-square significance. The thresholds in lesion detectability observed

in the significance region between 5 and 10 s. d. appeared to be independent of lesion size within the limits chosen (0.5～2.5 cm in diameter).

The following interim conclusions could be drawn: When digital techniques are used for evaluation, the results obtained with processed data are superior to those obtained with unprocessed data. The results obtained with Wiener and Wienerlike filters are in general superior to those obtained by 9-point or other simple smoothing techniques. If display are examined without statistical criteria, the results obtained by a given processing technique may depend greatly on the choice of display technique. Whilst there may still be considerable dispersion in the results obtained by different observers evaluating data obtained by the same techniques, the dispersion in the results obtained with different techniques is considerable greater.

Further intercomparisons based on the initial findings are now being planned under the Programme.