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USE OF COMPUTERS IN RADIONUCLIDE IMAGING

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One of the advantages of radioisotope scanning is that the data obtained from the patient is in a form that is readily amenable to quantification. Thus, it is possible to obtain quantitative answers to questions suggested to the observer by the appearance of the scan. In evaluation of a patient with suspected pulmonary embolism, the following questions must be answered: (1) Is there any abnormality in the fractional distribution of the blood flow to the lungs ? (2) How much impairment of the pulmonary circulation is involved ? and (3) What changes in perfusion have occured during the course of the illness.

To obtain answers to these questions, we have designed and constructed an image display and analysis system (IDA) that has been found to be useful in the evaluation of serial lung scans in looking quantitatively at the basic data on which the lung scan is based. The value of the procedure is greatly enhanced by combining the image of the distribution of activity with the ability to obtain quantitative data in the analysis of single and serail images. The image of the distribution of pulmonary arterial blood flow is useful for selecting area of interest prior to quantification. Since the scan image is an interface between the detection system and the observer, his performance depends on the optical characteristics of the display system. Thus, brightness, contrast, image size, and color all contribute to the subjective effect of the display on the observer.

It is helpful if the observer can vary and optimize the characteristics of the display while viewing the image, and can then get quentitative answers to questions suggested by the image. Our system has the following performance characteristics: all orginal date are stored, and the system can be used both with moving detector scanners as well as staionary imaging devices. In the case of moving detector scanners, after energy filtering, counts are accumulated for successive increments of detector travel and recorded on tape in digital form together with identification of the ends of scan lines. The 10,000 image cells that make up the image can be displayed without flicker. Counts are integrated over 0.3cm of detector travel with line spacing 0.3cm. This provides a field size 30×30cm. For a smaller field size integration can be done over smaller distances and the 10,000 image cells can be used to portray multiple images from serial scans.

Data tapes representing the radionuclide concentrations seen by the detector are read into the computer memory sequentially, starting from a specified starting address. The image data in the memory can then be subjected to different program routines initiated by single letter commands from the teletype keyboard. Since the system includes a general purpose computer, almost any type of data processing can be carried out.

As part of the nationwide trial of the thrombolytic agent urokinase, we have had the opportunity to evaluate three methode of lung scan analysis and quantification. In addition, we have been able to assess the reliability of five experts in interpreting independently serial lung scans. The three methods are: (1) the subjective method: the series of lung scans are evaluated by five expert observers and the extent of the perfusion defect estimated directly from the lung scan and expressed as a percentage: (2) semi-objective: the presence of a perfusion defect is

again detected visually, as in the subjective method, but the photoscan with a densitometer and planimeter: (3) computer assisted system of image display and analysis (IDA): the scan is evaluated from an optimized image from the computer display, and the extent of the lesion is measured from the image using a light pen with the aid of the computer.