

Computerized Method for the RI-Angiographic Left Ventricular Volume Measurement

M. KUWAHARA, K. HACHIMURA and H. TANENO

Automation Research Lab, Kyoto University

M. KINOSHITA and R. KUSUKAWA

Tenri Hospital

An automated technique for left ventricular boundary extraction and volume computation in RI-angiography has been developed. RI-angiography by peripheral venous injection is performed using a scintillation camera. The image data together with an ECG signal are simultaneously recorded on a magnetic tape for several cardiac cycles. During replay, delay and gating circuits are activated by the ECG signal so that only the scintillation images at a certain time after every R-wave are displayed. These intermittently displayed images are photographed so that they are summed up on a film to form a left ventricular image of the corresponding phase.

The film thus obtained is scanned and digitized by a flying spot scanner controlled by a mini-computer. The centre in the left ventricular region is first determined by integrating the film density at each sampling point along the horizontal and vertical axes, density values are then sampled along radial scanning lines from this centre to detect the left ventricular boundary.

The density curve obtained on each scanning

line is fitted on an idealized density curve (higher valued in the interior of the left ventricle, lower in the exterior and changes linearly between them) by applying the method of least squares. The density value which separates the left ventricle and the background is then determined by a statistical method. The position which corresponds to this density is decided on the idealized curve and is taken as a boundary point. The boundary is depicted by performing the above procedure on every scanning line taken at a certain angular interval.

After removing the unevenness of the boundary curve, the apex and the aorta are located by observing the curvature of the boundary. Finally, the volume is computed by applying the Simpson's method.

The feasibility of the method is examined on a phantom model and several experimental results are presented. Though the method has not been evaluated on a large data base, the initial results have proven to be very satisfactory.