

Comparative Investigation about Qualitative and Quantitative Findings of the Dilution Curves on RI Angiocardiology in Various Diseases

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RI dilution curves of several "area-of-interest (AOI)" of central circulatory system were obtained using a high resolution gammacamera with a video system and Tc-99 m-albumin. and the curves were investigated qualitatively through circulation times and curve patterns, while quantitatively through cardiac output, regurgitant fraction and shunt rate. As the subject of the study, 16 adult controls, 5 child controls, 55 cases of various heart diseases and 29 cases of the others were chosen.

Comparison of the curve patterns in various diseases were performed about the ratio of the first-circulation peak high corrected by its dilution equilibrium of each AOI curve to of right ventricle, the shape of each first-circulation wave and the existence of abnormal wave indicating intracardiac shunt.

Central circulation times by means of "peak to peak" prolonged in valvular heart disease, and

shortened in hyperthyroidism compared with control. And in the former, left atrium to ventricle time prolonged in MS but shortened in MIS or MI. Correlation between right to left ventricle and first- to re-circulation time was reliably estimated for the most part of various diseases although the relationship in stenotic or insufficient valvular heart disease was obscure.

The cardiac output of right ventricle rose in the cases of intracardiac shunt, hyperthyroidism and hypertensive heart disease, reduced in valvular and coronary heart disease compared with in adult control estimated to be 6.75 ± 0.58 l/min. The ratio of the cardiac output of left ventricle to of right was 0.98 ± 0.04 in control, but fairly lower in valvular heart disease.

Regurgitant fraction evaluated by a formula and shunt rate were calculated respectively in valvular heart disease and in the cases of intracardiac shunt.

Simple TV Analyzing System for Radioisotope Angiocardiology: Analyzing of Cardiac and Pulmonary Dilution Curves

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A simple system in use in our laboratory for two years, TV monitorphotomultiplier analyzing

system (TPAS), has been developed for analyzing dynamic blood flow studies performed on the

scintillation camera. When the TPAS is compared with a direct store videotape data-processing system, there are the advantages of simplicity and low cost. The system is as follows: The dynamic blood flow study is recorded through ITV camera onto videotape and is replayed a TV monitor. One area of interest obtained on the monitor screen is shown as a light window. This window is made by use of a photomultiplier tube which is held against the screen of CRT putting together in the same loop. Simultaneously, pulse output of the PM tube according to variation of the light density in area of interest is transmitted through a ratemeter to a pen-recorder. In this way dilution curves (activity-time histograms) are obtained.

We had an experience of detection of left to right cardiac shunts with the TPAS. Dilution curves were obtained in 9 patients with left to right shunts and in 12 patients without shunts. The C_2/C_1 /percentage according to the manner

employed by FOLSE and BRAUNWARD for the pulmonary dilution curves was determined. It was also determined for the right atrium and right ventricle. The results of analysis of the pulmonary dilution curves were as follows: C_2/C_1 /ranged from 47.7% to 72.9% and averaged 58.8% in the 9 patients with shunts. On the other hand, in the 12 patients without shunts C_2/C_1 /ranged from 17.5% to 51.5% and averaged 40.4%. Thus, there were distinctly different values between two groups, so it was useful to detection of left to right cardiac shunts. If the pulmonary dilution curve indicated the presence of a shunt, the right atrium and right ventricle curves were useful to localizing its site of entry into the heart. In this way it was possible to make a differential diagnosis between ASD, VSD and PDA.

We believe that the simple and low cost method with the TPAS will become a routine examination of congenital heart diseases.

Simulation Study on the Effect of Heart Motion on Radiocardiogram by Digital Computer

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The present study was undertaken (1) to simulate regional RI angiocardigram, considering non-linear action of heart valves and heart motion, and (2) to develop a method to estimate hemodynamic parameters with an aid of a digital computer.

Modeling

In a simple model, cardiac chamber could be simulated as a first delay function principally, however, in our cardiovascular model, the change of the volume of the cardiac chamber was added to the simple model through giving apriori curve of time sequential ventricular and atrial volumes.

The motion of the heart valve was composed as switching functions which acted when the differentiation of the time-volume function of the ventricle was equal to zero.

The segment of lung was composed by three parallel compartments each with different delay time constant and dead time constant. The same assumption was adopted in the case of simulation of systemic circulation.

The digital simulation program used in this work had been developed in our laboratory for solving biological systems, especially including non-linear phenomena. It was written in Fortran