

pulation to zero time on their specific radioactivities, functional ECF is obtained.

Experiment II In order to compare sodium space and sulphur one, 100 μ Ci of Na₂³⁵SO₄ is given to some 20 preoperative surgical candidates either with or without simultaneous administration of ²⁴NaCl. Sampling sera were divided into three parts; one for counting of γ -emission of ²⁴Na, one for β -emission of ³⁵S by 2 π -gas flow counter and the rest for the same by S. N. Albert's method utilizing anthracene cell scintillation counter for β -emission after treated by 20% TCA. (The cell was kindly offered us by Dr. Albert).

Results

Experiment I Mean value of ECF on 50 cases denotes to 194.5 ± 4.3 ml/kg of body weight, which is smaller than ordinary 'stational' values of ECF measured by ²²Na or ²⁴Na, and is closer to ordinary mean values of ECF by many reporters. Its reproducibility was $\pm 6.1\%$ in successive measurements in

three cases.

Clinical importance of those ECF was reassured by authors that, there was linear relationship between the amounts of surgical candidates' ECF and their degree of hypotension after they were introduced general anesthesia. Their correlation ratio was $\gamma = +0.642 \pm 0.093$ ($p < 0.001$). Anyhow, all those cases were estimated as good risk and their hematocrits ranged between 35 to 45%.

Experiment II In order to apply ECF as a routine work, ²⁴Na is inconvenient as its half-life is too short. Radioactivities of ³⁵S in sera measured according to Albert's method had reliable merit compared to ones by 2 π -gas flow method. The latter has inferior reproducibilities. Though it is not conclusive yet, authors obtained almost the same value between sodium space and sulphur one. These investigations are still on progress by authors.

Quantitative Evaluation of the External Monitoring Method Using Radioisotopes in the Studies of Congenital Heart Disease with Left-to-Right Circulatory Shunts

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Since 1965 the external monitoring method using radioisotopes has been one of the routine examinations in our clinic. The purposes of the examination are (1) screening of patients with heart murmur of uncertain etiology on the outpatient basis, (2) postoperative evaluation of the cardiac patients, and (3) cardiac evaluation of the poor-risk patients for whom cardiac catheterization is not recommended.

Following intravenous injection of RIHSA or ¹³¹I Hippuran, dilution curves were recorded by placing the probes on the precordium, the peripheral lung field, and the peripheral arteries (frontal). The precordial curve is characterized by the two primary peak waves followed by systemic recirculation waves, whereas the pulmonary curve shows a single primary peak wave, which lies between the two primary peaks of the precordial curve.

and followed by recirculation waves as well.

In congenital heart diseases with shunts alterations of the curves are observed according to the type of the shunts; prolongation of the descending limbs in cases of left-to-right shunts, and a short appearance time and a reduced peak concentration of the peripheral arterial curves in cases of right-to-left shunts.

In this report curves obtained in 79 patients (V.S.D., A.S.D. P.D.A., and normals) were analysed. The concentration values of the descending limb of a dilution curve indicate a straight line, when plotted on a semi-log paper, and half-time ($T_{1/2}$) was determined on the line. The left-to-right shunt group was clearly differentiated from normal by using $T_{1/2}$ of the pulmonary curves. A good correlation was observed between $T_{1/2}$ and left-to-right shunt expressed as per cent (obtained

by the Fick method) in the pulmonary curves with a coefficient of correlation $+0.85$. In order to eliminate the influence of the original flow in which the shunt flow does not partake half-time was divided by build-up time ($T_{1/2}/BT$). $T_{1/2}/BT$ was better correlated with left-to-right shunt ratio than $T_{1/2}$ in both precordial and pulmonary curves. Especially in the latter a remarkably high correlation was observed with a coefficient of correlation $+0.92$, giving a regression equation:

$$X = 29.88(Y - 1.61) + 47.66$$

where X represents shunt %, and Y $T_{1/2}/BT$. The standard deviation of the differences between the values of the shunts determined by the Fick method and by this $T_{1/2}/BT$ method was 7.79 per cent. In the pulmonary curves $C(p+2BT)/Cp$ was better correlated with

shunt % than $C(p+BT)/Cp$.

Since Prinzmetal described radiocardiograms, many attempts have been made to analyse the externally recorded dilution curves; Shapiro et al. employed DT/BT , Cornell et al. $DT \times BT$, and Braunwold et al. $C(p+BT)/Cp$. However, no attempt has been made to quatitate the studies as yet. We have shown in this report that $T_{1/2}/BT$ of the pulmonary curves can be used not only for the screening of the patients with heart murmur but also for the approximation of the left-to-right shunt ratio. We also feel that this method is highly valuable in the detection of a postoperative residual shunt and in the cardiac evaluation of infants in whom cardiac catheterization is too hazadous to perform.

Clinical and Experimental Studies on Comparison of Pulmonary Blood Flow in Various Respiratory Diseases with Radiocardiogram

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The pulmonary circulation of various respiratory diseases were studied from the standpoint of the pulmonary blood flow on measuring R-L time, HB-HS time, total circulating blood volume, pulmonary blood volume and cardiac output clinically and experimentally with radiocardiogram.

The following resuts were obtained.

1. 20 normal clinical cases showed on an average 5.0 seconds in R-L time, 23.5 seconds in HB-HS time, 4700 ml in total circulating blood volume, 410 ml in pulmonary blood volume and 4.9 l/min. in cardiac output; and 37 normal experimental cases showed 2.7 seconds in R-L time, 16.8 seconds in HB-HS time, 1300 ml in total circulating blood volume, 181 ml in pulmonary blood volume and 36 l/min. in cardiac output on an average.

2. The values in these normal cases were little influenced by the variety of ages, but the weight in these cases influenced on total circulating blood volume and pulmonary blood volume, and the increase of weight was relative to them directly. The pulse was rela-

tive to R-L time and HB-HS time inversely. The increase of pulse shortened R-L time, but it showed the tendency of increased total circulating blood volume, pulmonary blood volume and cardiac output.

3. Pulmonary tuberculosis in pulmonary diseases and the worse of focus in pulmonary abscess and lung cancer caused to prolong R-L time and HB-HS time but to decrease pulmonary blood volume and cardiac output.

4. In bronchiectasis, R-L time and HB-HS time did not show marked differences, and pulmonary blood volume and cardiac output volume showed the tendency of decrease. In bronchial asthma, in attack-free interval, they showed little difference to them in normal cases, but during attack, R-L time tended to be prolonged and pulmonary blood volume and cardiac output to be increased.

5. In pleurisy, compared with the normals, pulmonary blood volume showed the decrease, but cardiac output showed the increased tendency when pleural effusion raised high. Experimental pleurisy and pneumothorax