Differential Analysis of Intra and Extra-Cranial Blood Volume by New External RI Counting Technique on Cerebral Vascular Diseases

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We have previously reported the measurement of extra and intra-cranial cerebral blood volume under utilization of the external counting technique of RISA with the special detector having two foci.

In this report, we re-presentended this new dual focused detector head and discussed a new theory about the measurement of intra and extra cranical blood volume.

The new dual focused detector head was placed on temporal regions of human head and RISA was injected into cubital vein and external counts were measured with the use of each focused scientillation counter, especially at the state of uniformly distributed of RISA following its injection.

The concentration of RISA in equribrilium was measured on the blood which drown out from the cubital vein by well-type santillation counter.

An each count-rate of double cristal having two focus distances, interactions each other obviously, although when the one focus situated at extra cranial and the other one at cerebri.

Therefore we could not decide with only observed count rates of each scientillation counter on the short forcused callimator (S-channel) and long forcused one (L-channel).

The true counting rate (X_S, X_L) of each channel's expressed as follows.

$$C_S = X_S + kL_S X_L \tag{1}$$

$$C_L = kS_L X_S + X_L \tag{2}$$

$$X_S = \frac{1}{1-kL_S\ kS_L} C_S - \frac{kS_L}{1-kL_S\ kS_L} C_L \tag{3}$$

$$X_L = \frac{1}{1-kL_S\ kS_L} C_S + \frac{1}{1-kL_S\ kS_L} C_L \tag{4}$$

Where

C_S(cpm): observed counting rate of S-channel.

C_L(cpm): observed counting rate of L-channel.

X_S(cpm): true counting rate of S-channel.

X_L(cpm): true counting rate of L-channel.

kS_L : Contribution factor to L-channel from S-channel.

kL_S : Contribution factor to S-channel from L-channel.

Hence, we could calculate X_S and X_L in the equation (3) and (4). And in these equations each contribution factors (kL_S. kS_L) were able to calculate from the count rate on phantom which was separated extra and intra cavities modified to human cranium.

The extra cranial blood volume (V_E) and intra cranial blood volume (V_I) are expressed by following equations, as already reported.

$$V_E = \frac{X_S}{B} \times n_E \tag{5}$$

$$V_I = \frac{X_L}{B} \times n_I \tag{6}$$

Here, the B indicates a contribution of RISA in 1 ml of blood which obtained from cubital vein.

Constants n_I, n_E, were calculated from the above phantom.

However, when the long focus situated at the centor of cerebri and the short one situated in extra cavity, the former count rate involve almost no counts from the extra cranial cavity, making a limited narrow efficiency field by specific collimations.

Then V_I could be expressed as following equation.

$$V_I = \frac{C_L}{B} \times n_I \tag{7}$$