

counting rate of extra or intra cranial tissues of human head, the  $V_E$  and  $V_I$  should calculate.

Therefore, the equation (3) was offered for the calculations under use of a flat field collimator, and the equation (4) was presented for use of some different type of collimators, having different size of efficiency fields, for instance the tapered cone or honey cone collimator etc.

$$V = V_E + V_I = \frac{R'_E}{B} \times n'_E + \frac{R'_I}{B} \times n'_I \dots (4)$$

In these equations  $n_E, n'_E, n_I$  and  $n'_I$  were able to calculate from the phantom which is separated extra and intra cavities modified to human cranium.

The external counts on this phantom above mentioned  $P_E, P'_E$  or  $P_I, P'_I$  which are indicating the counting of extra phantom cavity or intra phantom cavity.

When was poured each cavity by RISA, are measured (5) (6) (7) and (8) are obtained as follows,

$$\frac{R_E}{R'_E} = \frac{P_E}{P'_E} = \sigma_E \dots \dots \dots (5)$$

$$\frac{R_I}{R'_I} = \frac{P_I}{P'_I} = \sigma_I \dots \dots \dots (6)$$

$$R = R_E + R_I \dots \dots \dots (7)$$

$$R' = R'_E + R'_I \dots \dots \dots (8)$$

With these equations (3) and (4) are converted to (9).

$$\frac{1}{B} \{ (R - R_I) n_E + R_I n_I \} \\ = \frac{1}{B} \left\{ \left( R' - \frac{R_I}{\sigma_I} \right) n'_E + \frac{R_I}{\sigma_I} n'_I \right\} \dots \dots \dots (9)$$

Then

$$R_E = \frac{R' n'_I - R n_I}{\left( \frac{n'}{\sigma_E} - \frac{n'_E}{\sigma_E} \right) - (n_I - n_E)}$$

$$R_I = \frac{R' n'_E - R n_E}{\left( \frac{n'_E}{\sigma_I} - \frac{n'_I}{\sigma_I} \right) - (n_E - n_I)}$$

The method of the measurement was as follows.

A double focuses scintillation detector or two scintillation detectorheads were placed on bilateral temporal regions, the one is a flat field collimator.

RISA was injected into cubital vein and the external tracing counts were recorded with above scintillation counters after being uniformly distributed RISA, approximately 5 minutes following injection of one.

And thus concentration of RISA after uniformly distributed was measured on the blood drawn from the cubital vein using with well-type scintillation counter.

By this method we resulted and in 2 cases as follows.

- (A) 43 yrs. male. T.I.A.  
Extracranial blood volume  $V_E$  : 27.6cc  
Intracranial blood volume  $V_I$  : 73.5cc
- (B) 52 yrs. male. Cerebral artery sclerosis  
Extracranial blood volume  $V_E$  : 22.4cc  
Intracranial blood volume  $V_I$  : 56.2cc

**Considerations of Factors Influencing on Circulating Blood Volume Measurement Especially in Post-Operative State**

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Usefulness of circulating blood volume measurement as care of post-operative circulating condition were stressed.

A method measuring circulating blood volume should be rapid and simple, for clinical purpose. Volemetrone satisfies these requirements.

Circulating blood volume (C.B.V.) measurement should be carried out when the patient's circulatory condition is stable. But clinically, especially in postoperative state, the condition is unstable. For purpose of investigating the factors influencing upon the measurement of C.B.V. in these unstable con-

ditions, circulatory disturbances were made in dogs.

As the results, following factors should be considered in C.B.V. measurement.

(1) Infusion tube or monitoring tube should not be used for blood sampling or injection of RISA. It may induces erroneous estimation of C.B.V.

(2) Usual mixing time were 10 minutes. It should not be exceeded 15 minutes.

(3) For the first measurement distilled water was used for premix blood instead. It is advantageous especially in the case of infants.

(4) In infants and children C.B.V. showed correlation to body weight rather than body surface area. In the cases having left to right shunt C.B.V. prone to be measured larger.

(5) Since, in dogs, repeated measurement of hematocrit in one animal under same condition showed some variation, inevitable errors may be induced in calculating the corpuscular-volume and plasma volume.

(6) Relatively correct value of lost or overinfused blood could be available, but some variation from the estimated values were observed,

which may be resulted from concentration or dilution of blood.

(7) As the most reliable index for transfusion, corpuscular volume should be used, it is almost independent of concentration or dilution of blood.

(8) Hemorrhage during measurement of C.B.V. may cause inevitable loss of RISA, which resulted in erroneous estimation of the blood loss.

(9) In case of the disturbance of venous return, which was brought about by right sided hemothorax or half ligation of inferior vena cava, measured C.B.V. was greater than otherwise.

(10) In cardiac tamponade, erroneous overestimation of C.B.V. tend to be occurred.

(11) When there was difference between peripheral hematocrit and body Ht measured C.B.V. were greater than otherwise. But it has little significance clinically.

When C.B.V. is estimated considering above mentioned factors together with another hemodynamic data and clinical findings, proper care of postoperative circulatory disturbance can be done.

## Studies on Measurement and Clinical Application of Functional ECF Its Measurement by $^{24}\text{NaCl}$ and $\text{Na}_2^{35}\text{SO}_4$

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Since the introduction of an idea on 'Functional Extracellular Fluid' by Prof. Shires in Texas based on his bleed-animal experiments, clinical meaning of E.C.F. has been changed from its 'Stational' status of body fluid to its 'Functioning' one of which amount is available on an emergency to fill intravascular beds. He utilized plasma taken 20 minutes after injection of  $\text{Na}_2^{35}\text{SO}_4$  to evaluate functional ECF, however, authors speculated on plasma radiogram of  $^{24}\text{Na}$  that multiple sampling method of 20, 40 and 80 minutes after  $^{24}\text{NaCl}$

given, in order to extrapolate 'zero time' has been more reliable and highly reproducible, even though time-consuming they were. Authors believe these ECF on authors' method means 'Functional one'.

*Experiment I*  $50\mu\text{Ci}$  of  $^{24}\text{NaCl}$  is injected intravenously to 60 preoperative surgical candidates. Sampling blood is drawn from large cubital vein and/or femoral artery each 20, 40 and 80 minutes thereafter. Radioactivities of sera were measured by well-type NaI scintillation counter. By means of extra-