Measurement of Pancreatic Blood Flow with ^{133}Xe Clearance Method in Dogs

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A new technique to measure the pancreatic blood flow with ^{133}Xe clearance method was reported. Using the adult dogs, a thin catheter was inserted to the branch of the pancreaticoduodenal artery, into which 300 μCi of ^{133}Xe solution was delivered. The wash-out curve obtained from the uncinate portion of the pancreas consisted of two components, $T\frac{1}{2}$ of which was 22 ± 3.3 seconds and 237 ± 106 seconds, respectively. Partition coefficient between blood and pancrease tissue (λ) measured by our Conn's modified method was 0.62 ± 0.05. Consequently, the pancreas blood flow estimated by the first component of the clearance curve was 117.2 ml/100 tissue•min. In order to evaluate these results, radioactive microsphere method using ^{85}Sr microspheres was applied. By means of the latter technique, estimated blood flow in the same portion of the pancreas was 96.2 ml/100 tissue min., which appeared to be fairly correspondent to the results determined by ^{133}Xe clearance method.

As is well known, exogenously administered secretin gives rise to increase in the pancreatic blood flow. Both 0.5 and 3.0 units per killogram of body weight of secretin was respectively administered in the dogs with normal pancrease and 60% pancreatectomy. In the latter, the pancreatic blood flow after secretin stimulation showed remarkable increase in comparison with that in the untreated pancreas. Secretory rate of the pancreatic juice following administration of each dose of secretin was also much enhanced in the 60% pancreatectomized dogs. These data suggest the facts that there is the close relationship between exocrine function and blood flow not only in the normal pancreas but in the remnant pancrease after pancreatectomy.

Determinations of Peripheral Blood Flow of Legs in Patients with Diabetes Mellitus by ^{133}Xe Clearance.

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^{133}Xe saline solution was injected rapidly into femoral artery in normal subjects and in patients with diabetes mellitus. ^{133}Xe clearance curves were recorded by scintillation counter placed on toes of these subjects. The curves were plotted semilogarithmically and were resolved by the peeling procedure into three components. The mean blood flow (MBF, ml/100g/min.) in toes was calculated as follows: $MBF=100\times\lambda\times Km$, where λ is the tissue blood partition coefficient and Km is the mean fractional disappearance rate of ^{133}Xe. Furthermore, in some subjects studied in

the present paper ^{99m}Tc labeled albumin was injected rapidly into femoral artery. The changes of ^{99m}Tc activity in the foot were recorded by scintillation counter. The mean transit time (MMT, sec.) of the dilution curve through the capillary bed of toes was obtained by mean of curve fitting with the analog computer.

Significant inverse relation was found between MBF and MTT ($r=-0.79$, $p<0.01$), suggesting the adequacy of MBF determined by the present study.

MBF in toes average 11.0 ± 7.9 ml/100g/min. in all diabetic patients and were significantly lower than those of normal subjects, averaging 22.1 ± 5.4 ml/100g/min. ($p<0.05$). Moreover, all the patients with complication had diminished MBF in toes, and MBF was reduced in about half of the patients without complication. Thus, MBF in toes was useful indicator of the disturbance of peripheral blood flow of legs in patients with diabetes mellitus.

Application of Random Walk Equation for Flow Model

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An attempt to applicate the Ramdom Walk Equation for radioisotope dilution process through the system composing vascular net has been made. This equation is characterized by two parameters, mean transit time (MTT) and randomizing constant (K). The latter is thought to represent the anatomical arrangement of vascular space. Upon examining the input output curves monitored over heart and head, the K of cerebral vascular bed was appeared to be irrespective with the changes of cardiac output (CO), while MTT was liable to increase with the increase of CO. The recorded curve was fitted to shoose the optimal parameters iteratively using learst square method.

An attempt to fit monitored curve without the information of imput curve was done by using so colled simplex method where arbitary combination of four parameters should have been shoosed if a boundary condition was set. This method might merit to analyze usual external monitoring curve over various organs in future.