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REDISTRIBUTION OF THALLIUM-201 IN THE LOWER EXTREMITIES ---I CLINICAL STUDY---.
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In order to investigate significance of the redistribution of muscle perfusion in the lower extremities,early and delayed scintigrams were performed in 35 normal subjects at rest(n=18) and during exercise using ergometer(n=10) and treadmill(n=7). E(ratio of early count for thigh and calf to whole body) and D(that of delayed count for them to whole body) were calculated in all subjects and we obtained the relation between D/E(the redistribution ratio) and E. The relation between D/E and E was found to be the hyperbola;Y(D/E)=0.75+3.4/X(E) in the thigh,Y(D/E)=0.70+1.8/X(E) in the calf. The curves of D/E vs E in normal subjects were expected to be one of the indices for prognosis of the patients with peripheral vascular disease.

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REDISTRIBUTION OF Tl-201 IN THE LOWER EXTREMITIES----II ANALYSIS BY COMPARTMENT MODEL.
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Kinetics of Tl-201 was analysed using a compartment model in order to explain the clinical result of early and delayed Tl-201 scintigrams in the lower extremities based on the following assumptions: 1. The early distribution of Tl-201 is proportional to the perfusion. 2. Concentration of Tl-201 in serum $q_b(t)$ decreases exponentially except in initial stage, as $q_b(t)=q_b(0)\exp(-\mu_b t)$ 3. Tl-201 can migrate from blood to muscle and vice versa. Then the concentration of thallium in muscle can be expressed by the equation: $q_m(t)=\lambda_1 q_b(0)/(\lambda_2-\mu_b)\cdot(\exp(-\mu_b t)-\exp(-\lambda_2 t))+q_m(0)\exp(-\lambda_2 t)$, where λ_1 and λ_2 are the uptake and release rate constants for muscle. The equation states that if initial uptake $q_m(0)$ is lower than the equilibrium concentration, $q_m(t)$ increases with time and that if the initial uptake is sufficient for making equilibrium with blood it decreases corresponding to the decrease of thallium in blood. The relation between the redistribution ratio $Y(=q_m(t)/q_m(o))$ and initial uptake $X(=q_m(0))$ is described as Y=A/X+B (A and B are constants) from the above equation. The relation is in accordance with the clinical results of Tl-201 redistribution in the normal thigh and calf.

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DEVELOPMENT OF A NEW Xe-133 SINGLE DOSE MULTI-STEP METHOD (SDMM) FOR MUSCLE BLOOD FLOW MEASUREMENT USING GAMMA CAMERA: METHODOLOGY AND BASIC EVALUATION.
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In order to measure the muscle blood flow(MBF)during exercise(Ex), a new Xe-133 single dose multi-step method(SDMM)for leg MBF measurement before, during and after exercise using gamma camera was developped. Theoretically, if the activity of Xe-133 in the muscle immediately before and after Ex are known, then the mean MBF during Ex can be calculated. In SDMM, these activities are corrected through correction formula using time delays between end of data aquisition(DA)at rest(R1)and beginning of the Ex (TAB)and between end of Ex and beginning of the DA after Ex(R2)(TDA). Validation of the SDMM and MBF response on mild and heavy Ex were evaluated in 11 normal volunteers.

Ex MBF calculated from 5 and 2.5 min. DA (5 sec/frame)both at R1 and R2 were highly correlated(r=.996). Ex MBF by SDMM and direct measurement by fixed leg exercise were also highly correlated(r=.999). Reproducibility of the R1 and Ex MBF were excellent (r=.999). The highest MBF was seen in GCM on miled walking Ex and in VLM on heavy squatting Ex. After miled Ex, MBF returned to normal. After heavy Ex, MBF remained high in VLM. SDMM is simple and accurate method for evaluation of dynamic MBF response.

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DEVELOPMENT OF A NEW Xe-133 SINGLE DOSE MULTI-STEP METHOD (SDMM) FOR MUSCLE BLOOD FLOW MEASUREMENT USING GAMMA CAMERA: EVALUATION OF MILED EXERCISE STRESS.
H. Bunko,M.Seto,J.Taki,I.Nambu,Y.Shiire,N. Tonami,K.Hisada,T.Iida,M.Yamada,M. Matsudaira. Kanazawa University, Kanazawa

Dynamic response of leg muscle blood flow(MBF) during miled exercise(Ex) was evaluated by newly developed single dose multi-step method(SDMM) using Xe-133 in order to evaluate its diagnostic significance. MBF of bilateral gastrocunemius(GC) and adductor magnus(AM) were evaluated in 8 normal volunteers(NV) and 9 patients with ASO or TAO(PTS) at rest(R1), during walking Ex and after Ex(R2). Data were aquired at 5 sec/frame for 2.5 min at R1 and R2 after single dose of Xe-133(1mCi) in each muscles.

There was no difference of MBF at R1 between GC and AM in NV(mean=2.31±1.35ml/min/100g) and normal leg of PTS(NL). During Ex, MBF increased significantly in NV and NL, however affected leg(AL) failed to increase (mean MBF: >11.2 and <3.7ml/min/100g, respectively). Criteria for the normal MBF during Ex was as follows: AM>4.0 and GC>8.0, or ΔMBF in AM>2.0 and GC>4.0ml/min/100g). Diagnostic efficiency for detection of AL was greatly improved by application of mild Ex compared to rest study(accuracy of SDMM with Ex=94% and R1=56%). Evaluation of dynamic response of MBF during miled Ex by SDMM was useful for detection of ischemic legs and evaluation of MBF reserve in the AL.