Study of Intrarenal Dynamic Process by Scintillation Camera

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For the regional study of intrarenal dynamic process in man, a scintillation camera combined with a storage system and with digital computer has been used. The intrarenal dynamic consists of two aspects, namely, blood flow aspect and urinal flow aspect. The blood flow aspect can be delineated by observing a desaturation process of ^{133}Xe solution after an instantaneous saturation which is attained by a bolus injection via a catheter into a renal artery. The delineation of the urinal flow aspect can be achieved by introducing a bolus of a radioactive GFR or RPF substance such as ^{131}I hippuran or ^{99m}Tc Inulin, successively done following the ^{133}Xe study via the catheter. Both procedures are to be an impulse response of the two aspect of renal function. These processes were recorded by serial scanning of the camera in a form of numerical matrices of 40×40, and stored onto a magnetic tape to be analyzed by the computer.

After recording the intrarenal washout rate constant representing mean blood flow per each matrix, according to the height over area method proposed by Zieler. This combined visualization of a static distribution and a dynamic change was appeared to be useful in evaluating the focal ischemia of the kidney.

Intrarenal urinal flow through nephrons down to pelvis was labelled with radioactive hippuran or inulin to be analyzed by a battery of time radioactivity curves which were obtained from a region of interest such as total, cortical and pelvic part of kidney. Transit tmies of these tracers through various part of urinal pathway were essentially considered to be the same, although an initial decrease after inulin administration at the total curve was prominent because of its lower extraction ratio from blood stream than that of hippuran. To be interesting enough, the radioactivity of the cortical curve increased again after a minimum of 2 minutes of the initial decrease, which might correspond with the appearance of the tracer through proximal tubules up to Henle loop. Thereafter, definite decline occurred, while the radioactivity of the pelvic curve increased reciprocally followed by continuous decline. Obviously combination of these curves would provide a new tool for evaluation of functional status of hydration relating to segmental part of nephron, and differentiating between parenchymal and pelvic renal disorders.

While the renal function study relating to the static distribution using scintillation camera would certainly offer many new possibilities, the present report has mainly been concerned with comfirming some fundamental aspects of the intrarenal dynamics by the approach of the impulse response of the two aspects of kidney function.