

The Clinical Application of the Gamma Camera to the Study of the Intrarenal Distribution of Blood Flow

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Evidence that intrarenal distribution plays an important role in sodium regulation in man has led to increasing interest in the use of ^{133}Xe for assessing this function. The gamma camera has been used to evaluate the anatomical representation of components identified by compartmental analysis in xenon washout from the human kidney. In addition, the disappearance of xenon from portions of the normal and diseased kidney has been measured to assess the regional renal perfusion.

(Method)

Thirty-seven subjects including twelve normal kidney donors have been studied at the time of selective renal arteriography. ^{133}Xe solution (10-20 mc) was injected into the renal artery as a bolus and washout curves recorded simultaneously by a conventional scintillation probe and a gamma camera with data-store and regional analyzers.

(Results)

The kidney area determined from the image on the persistence scope decreased within 20 seconds after uniform distribution of blood flow within kidney to much greater extent than the area of the kidney phantom whose area was constant; this finding is compatible with a non-uniform distribution of blood flow within kidney, the cortex having a much faster flow-rate than the remainder. Patients with acute renal failure who had a markedly reduced rapid flow component of xenon washout have not shown an equivalent early reduction in renal size supporting the hypothesis of a preferential reduction in cortical perfusion in

this setting. In most cases, four components could be identified on compartmental analysis of both the probe and the scintillation camera digital data. The first and second components were identical for the two methods. The camera image revealed increasing non-renal background activity with time, mainly due to lung counts and reflux of isotope. The compartmental analysis showed a significantly larger fourth component in probe data, in keeping with this observation.

The differences in the disappearance rate of isotope from superior and inferior portions of the kidney were sufficiently small in normal men that it was possible to assess regional segmental perfusion in patients with renal disease.

Five of fourteen patients with hypertension have shown an abnormal segmental renal perfusion (The difference in the disappearance rate is larger than 1.9 sec).

All patients with renal cyst were found to have a normal segmental perfusion; on the contrary, all patients with renal cancer disclosed markedly abnormal segmental perfusion with reduced blood flow in the region of renal cancer.

(Conclusion)

We conclude that the early rapid flow component of xenon disappearance from the normal human kidney corresponds to cortical perfusion. The very slow components are altered significantly by recirculation and lung activity. The camera will be useful for assessing regional differences in cortical perfusion or small areas of non-cortical elements within the kidney.