COMPUTED TOMOGRAPHY AS AN AID TO DIAGNOSIS IN RENAL DISEASE AND TRANSPLANTATION

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Computed Tomography (C.T.) is a method of producing high resolution transverse section body images. Data for producing the image is acquired by measuring the attenuation of finely collimated beams of X-rays traversing the patient. Computation of data acquired from various angles around the patient produces a digital image in which variations of radio-density of one part in one thousand can be detected.

The technique allows demonstration of morphological and density changes in the diseased kidney together with variations in density in response to intravenous iodinated contrast media. It has proved of value in the assessment of renal disease.

The normal kidneys are best demonstrated in the obese subject where the peri-renal fat acts as a natural surrounding low density contrast. The radio-density of the kidneys is lower than that of surrounding organs (e.g., liver, pancreas, muscle etc), but the density of renal parenchyma increases following intravenous injection of a bolus of urographic contrast medium. In a normal patient the fat filled renal sinuses are readily visualised and renal vessels can be seen communicating with the Aorta and Inferior Vena Cava. The pelvocalyceal systems are demonstrated most clearly by excreted urinary contrast, but the averaging effect produced by the thickness of section limits the resolution of calyceal detail.

The ability of C.T. to image an unenhanced kidney where conventional or high dose urography has failed to produce satisfactory visualisation, renders this technique valuable in the investigation of patients with non- or poorly functioning kidneys.

In the presence of bilateral poorly functioning kidneys, an urgent clinical problem is the exclusion of remediable obstruction of the lower urinary tract. The renal parenchyma may be of normal thickness as in acute renal failure or bilaterally shrunken and scarred as in chronic pyelonephritis. In polycystic disease however, the cysts expanding the kidney are demonstrated as well defined rounded low density areas, which are accentuated when the surrounding residual parenchyma is enhanced by iodine.
The unilateral non-visualised kidney may be congenitally absent or when small, vestigial, or scarred and poorly functioning due to chronic pyelonephritis. Where the unilateral non-functioning kidney appears normal in size or enlarged, obstruction may be present. Even in the later stages of obstruction where there is only a thin rim of renal parenchyma, the sensitivity of C.T. enables the residual parenchyma to be displayed and an assessment of function, by response to contrast, to be made. Primary neoplasms distorting renal architecture present as isodense areas which may have lower density components due to necrosis or cyst formation. The degree of tumour contrast enhancement is less than normal parenchyma and may indeed be absent. Where secondary infiltration has occurred, e.g., lymphoma, both the abnormal kidney and the systemic involvement including para-aortic lymph enlargement may be demonstrated.

Measurement of renal function has also been carried out with the EMI Whole Body scanner. Rapid sequential scans after a bolus injection of intravenous contrast, demonstrate renal cortical blood flow and contrast excretion. The pattern of excretion by the normal, diseased or transplanted kidney, has then been assessed. In the normal ‘C.T. angiogram’ the early scans show marked enhancement of the renal cortex and columns of Bertin. In acute tubular necrosis, cortical perfusion is maintained, whereas in cortical necrosis, such perfusion is not demonstrated. It is thus possible by C.T. to augment the urographic investigation of a transplanted kidney. The examination may demonstrate not only function, but also the morphological changes related to rejection.