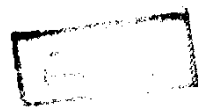
ROLE OF DIAGNOSTIC IMAGING IN RENAL CELL CARCINOMA

Thesis

Submitted in Partial Fulfilment for

The Master Degree in Radio-Diagnosis



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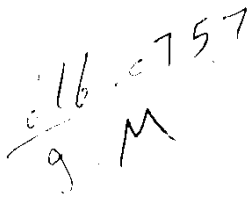

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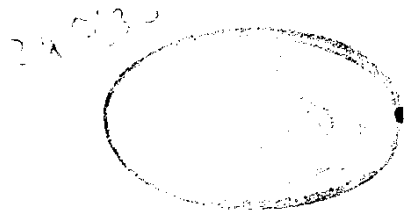

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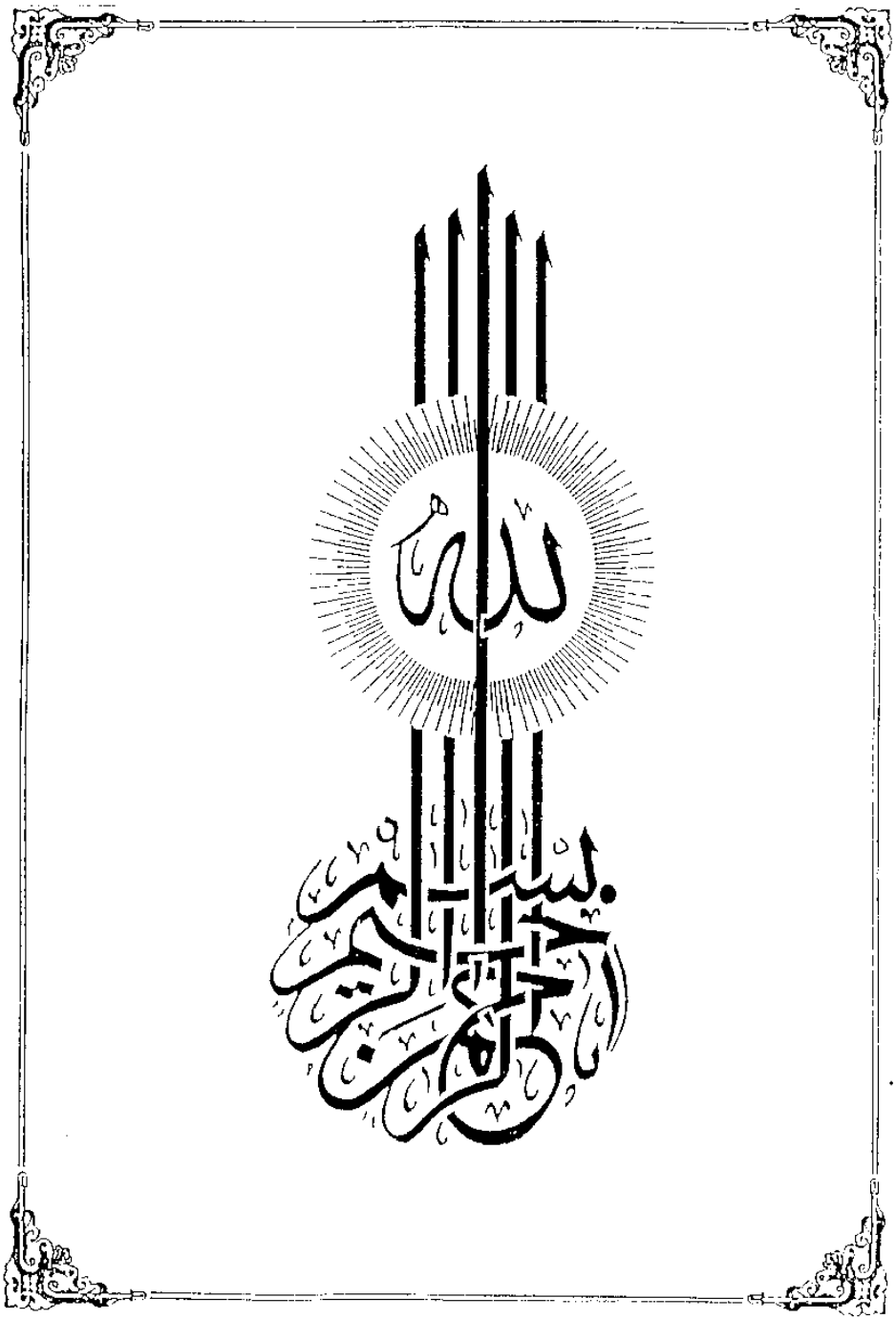

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INTRODUCTION & AIM OF WORK

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Adenocarcinoma of the kidney constitutes 85%-90% of the malignant tumours of the kidney.

It occur primarily in the later decades of life and is more common in males than in females.

About one third of patients who have renal cell carcinoma will have no complaint directly related to the primary tumour when it is first detected.

It is the most common solid mass of the kidney. Although some solid masses such as angiomyolipoma can be diagnosed as benign tumours, a solid mass should be considered malignant until proved otherwise.

Evidence of tumour spread such as invasion of the I.V.C., hepatic or lymph node metastases further supports the malignant nature of the renal lesion.

Nephrectomy is usually performed when renal carcinoma is clinically and radiographically suspected, but per-cutaneous fine needle aspiration can be used to confirm the diagnosis in selected cases.

The aim of this work is to review the different radiological and imaging modalities used in the diagnosis of renal cell carcinoma with their merits and limitations in order to arrive at an early proper diagnosis.

ANATOMY OF THE KIDNEY

RADIOLOGICAL ANATOMY OF THE KIDNEY

The kidneys are retroperitoneal bean shaped organ lying on either side of the vertebral column.

The kidneys correspond in position with the last thoracic and upper three lumbar vertebrae, in the recumbent position (Fig. 1, Diag. 1). A maximum excursion of 5 cm. occur in the change from the recumbent to the erect position (Meschan, 1978).

The upper pole lies more medially than the lower pole, the long axis making an angle of about 20 degrees with the mid-line, and follows the line of the psoas muscle. The kidney lies obliquely at an angle of about 45^{o} with the pelvis lying antero-medially and the calyces postero-laterally (Hamilton et al., 1978).

The average kidney is about 10 to 12 cm in length, 5 to 6 cm in width and about 3 cm in thickness (Meschan, 1978).

The kidneys are approximately oval in shape. The medial border of the kidney show a concavity in the centre and is convex towards each pole.

At the central part of the concavity there is an opening termed the hilus which leads into the renal sinus. Within the sinus of the kidney the renal pelvis divides most commonly into three large division called the major calyces (Fig. 1, Diag. 1), less commonly, there are two branches, namely, the

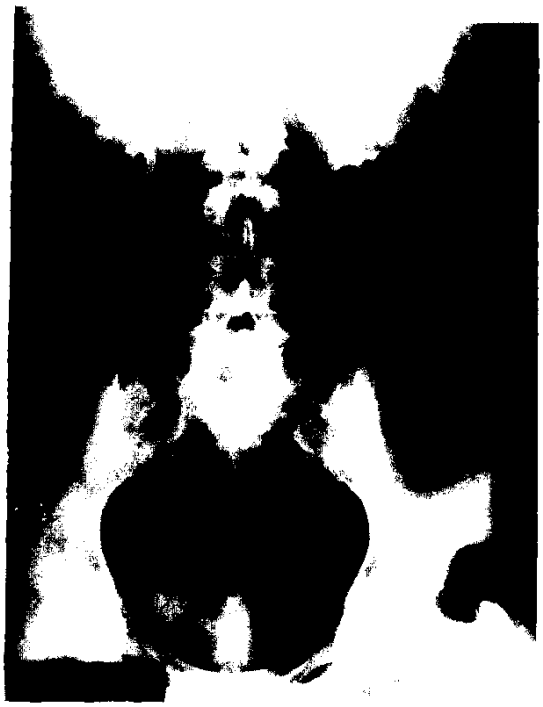
minor calyces. The number of minor calyces in a kidney varies from 4 to 18 within an average 8, they lie in two rows just anterior to and posterior to the mid-plane of the kidneys.

The renal pelvis is funnel-shaped, narrowing towards its medial inferior angle where it joins the ureter at an obtuse angle. The upper border is somewhat convex and the inferior border presents a semicircular concavity (Hamilton et al., 1978).

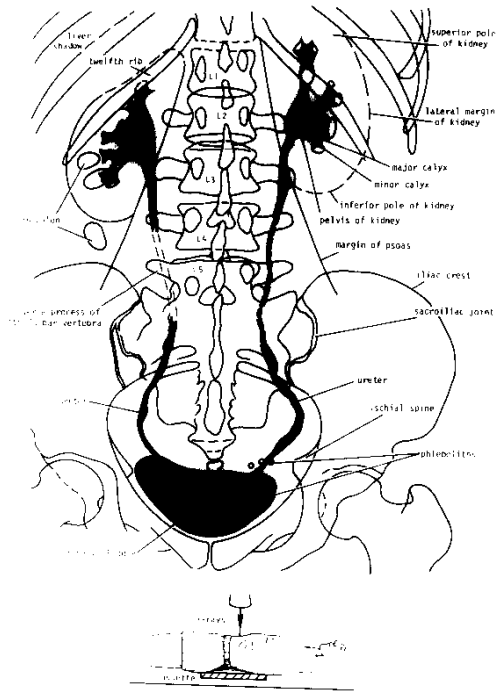
The surface of the kidney is invested by a thin but strong fibrous capsule, and external to this capsule is a considerable quantity of fat tissue known as, the adipose capsule.

The kidneys are related to other retroperitoneal structures as follows (Diag. 2):

The medial border of the right kidney is in contact with the descending portion of the duodenum, and most of the lower half of the right kidney is in contact with the ascending colon and hepatic flexure of the colon. The middle one third of the anterior part of the left kidney is in contact with the pancreas, the splenic artery is situated along the upper border of this pancreatic area, and the splenic vein is interposed between the pancreas and the left kidney. A small portion of the lower pole of the left kidney is contact with the colon, but the rest of the anterior surface of the left kidney is peritonized (Meschan, 1978).

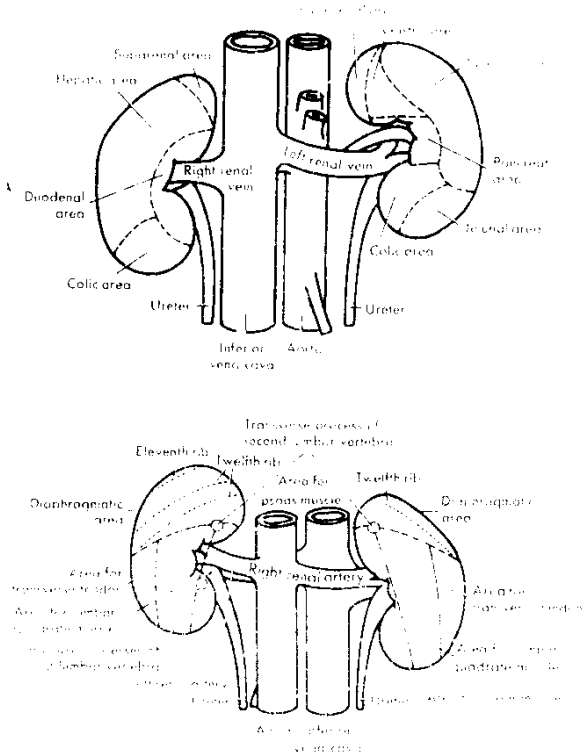


(Fig.1)



(Diag.1)

(Fig.1, Diag.1): A normal intravenous pylogram and its diagramatic illustration which shows the kidney, ureter and urinary bladder. (After, Snell & Wyman, 1976)



(Diag.2): Relationships of the kidney to other retroperitoneal structures (Ventral surface and dorsal surface).
(After, Haaga & Altidi, 1983).

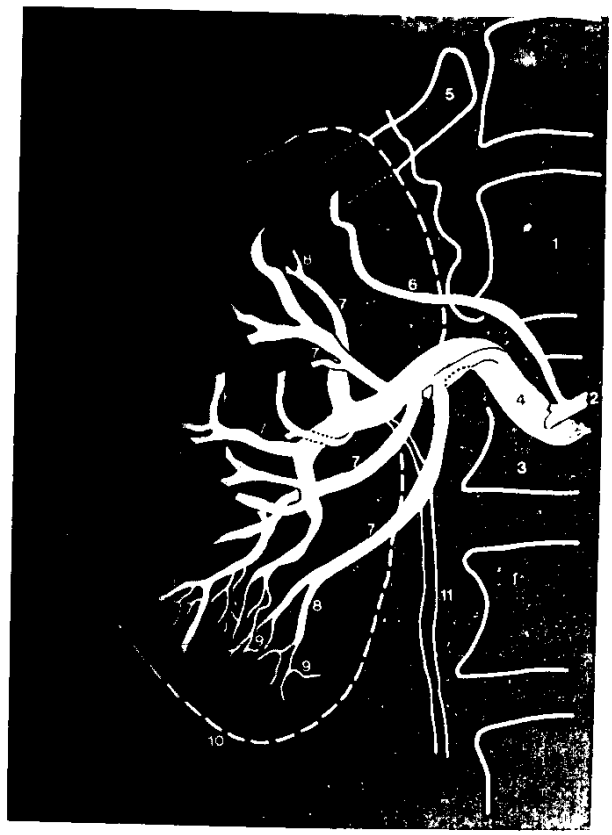
Renal Blood Supply

Renal Arteries

Each kidney usually receives its blood from a single branch of the aorta arising laterally between the level of the upper border of the 1st and 2nd lumbar vertebrae (Diag. 3).

The right artery arises just below the coeliac trunk, the left at a slightly lower level. Multiple renal arteries are common.

The renal arteries pass at a variable angle-usually a right angle-to the hilum of the kidney where each divides into a dorsal and ventral branch. These pass respectively behind and infront the pelvis of the ureter. Each branch divides into lobar, one for each renal papilla -these and all subsequent branches are end arteries. Each lobar artery divides into two or three interlobar arteries which run towards the cortex of each side of the pyramid. At the corticomedullary junction, the interlobar arteries divide into arcuate arteries, each branch running perpendicular to the parent stem giving off a large number of interlobular arteries running into the cortex at angle to the surface of the kidney. The glomerular arteries- branches of the interlobular arteries- are too small to be seen at selective renal arteriography using conventional technique.



Renal Arteries

(Diag.3): 1- Body of L1 vertebra.
2- Catheter tip in right renal artery.
3- Body of L2 vertebra.
4- Principal renal artery.
5- Twelfth rib.
6- Inferior suprarenal artery.
7- Lobar arteries.
8- Interlobular arteries.
9- Arcuate artteries.
10- Renal outline.
11- Ureter overlying transverse process of L3.
(After, Weir & Abrahams, 1978).

The renal artery has the following branches:

1. The inferior adrenal artery : this arises proximally from its superior border to run obliquely towards the adrenal gland.

2. The ureteric artery : this arises from the renal artery shortly before its bifurcation into dorsal and ventral branches.

3. Capsular arteries : to the capsule of the kidney and the perinephric fat.

The Renal Veins

The interlobar, arcuate and lobar veins are similar in distribution to their arterial counterparts.

The tributaries that form the renal vein are variable with no defined pattern. Unlike the arteries, they anastomose free with one another.

The right renal vein : This is shorter than the left, passing from the hilum of the kidney to the lateral border of the inferior vena cava just above the L1-2 disc level. Occasionally the right gonadal vein drain into the right renal vein.

The left renal vein : This is usually 3 times as long as the right, it passes anterior to the left renal artery and aorta in its course from the hilum of the kidney to the lateral border of the inferior cava at the level of the disc

between the 1st and 2nd lumbar vertebrae. It receives tributaries from the left adrenal vein, left gonadal vein and the lumbar vein (Hamilton et al., 1978)