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The Computed Tomography in Differentiation of Renal Angiomyolipoma from Renal Cell Carcinoma

Dr.Zahraa Qahtan Ali
Al muthanna health department, Alrumaitha general hospital

Dr.Entesar Abdul Ameer Haraj Alhusseini
Department of health of Al Diwaniyah ,Afak general hospital

Dr . Hanan Qassem samawy
Department of health of Dhi qar, Suq Alshuyukh general hospital

Abstract:

Background: The most common Imaging modality used now a day to diagnose and to differentiate between renal angiomyolipoma and renal cell carcinoma are the Ultrasonography , Computerized Tomography scanning and Magnetic Resonance Imaging . Ultrasound is commonly employed as an initial imaging exam due to its relative low cost, relative ease of performance, and lack of need for ionizing radiation.

Objective: To evaluate the Role of Ultrasound (gray scale and color Doppler) in differentiating renal angiomyolipoma from Renal Cell Carcinoma in comparison to Computerized Tomography scanning finding.

Patients and Methods: This study was conducted in the Radiology department / Alsader teaching hospital / Basrah / Iraq during the period from (January 2016) to (January 2017) , (48) patients with suspicion of renal angiomyolipoma were referred for CT scan examination for definite diagnosis , all these patients were re-examined by Gray Scale and Color Doppler Utrasound to confirm the presence of renal mass and to determine its benign or malignant features. The data was analyzed using SPSS version 20.

Results: Of the 47 hyperechoic renal masses; 44(93.61%) were diagnosed as Renal angiomyolipoma on CT scan and 3(6.38%) were diagnosed as Renal Cell Carcinoma . Of the 3 isoechoic renal masses; 1(33.33%) were diagnosed as Renal angiomyolipoma and 2 (66.66%) as Renal Cell Carcinoma. all the 20 renal masses that contain shadowing on Ultrasound examination were hyperechoic and were diagnosed as renal angiomyolipoma on CT scan. All 3 renal masses that contain hypoechoic rim on Ultrasound examination were hyperechoic and were diagnosed as Renal Cell Carcinoma on CT scan examination. The 2 masses that contain intramural cyst; one of them was hyperechoic and the other was isoechoic and both of them diagnosed as Renal Cell Carcinoma. Of the 14 renal masses that contain exophytic sign; 10 of them were diagnosed as Renal angiomyolipoma (9 of them hyperechoic) and 4 were diagnosed as Renal Cell

Carcinoma (2 of them were Isoechoic). all the 6 renal masses with peripheral pattern of vascularity were diagnosed as renal angiomyolipoma on CT scan (5 of them were hyperechoic on ultrasound), on other hand all the 5 renal masses with diffuse pattern of vascularity were diagnosed as Renal Cell Carcinoma on CT scan (3 of them were hyperechoic on ultrasound)

Key words: renal angiomyolipoma, ultrasound, cell carcinoma

Introduction

Whilst renal tumors can be broadly divided into primary and secondary (metastatic), benign and malignant or adult and pediatric tumors, they are more formally and comprehensively classified according to the International Society of Urological Pathology Vancouver Classification of Renal Neoplasia (2013), an updated version of the World Health Organization Classification of Renal Tumours (2004).[(1)]

Renal tumors may be discovered incidentally on medical imaging (i.e. an incidentaloma), or may be present in patients as an abdominal mass, hematuria, abdominal pain, or manifest first as a paraneoplastic syndrome that seems unrelated to the kidney.[(2)]

The most common malignant and benign tumors of the kidney are renal cell carcinoma (RCC) and renal angiomyolipoma (AML) respectively. They are the frequently encountered solid renal tumors. The treatment strategies and prognosis for the two entities are quite different; thus, it is crucial to concentrate on the diagnostic characteristics to make differential diagnosis between them more clear.[(3)]

It's a mesenchymal tumour, it's the most common benign renal tumour, with an incidence of about 0.3-3%. Composed of fat, vascular, and smooth muscle elements, two types are described; isolated angiomyolipoma (sporadic) and angiomyolipoma associated with syndromes (syndromic).
(4),(5)

Isolated AML occurs sporadically, often solitary and constitutes 80% of angiomyolipomas. The mean age at presentation is 43 years; it is about 4 times more common in women than in men, Interestingly it has preponderance toward the right kidney in 80% of the cases. **(6)**

Syndromic AML accounts for 20% of AML, It is unlike the isolated one because the lesions are typically larger, often bilateral and multiple, occurs in 80% of patients with tuberous sclerosis, the male-to-female sex distribution in those patients are nearly equal, but the prevalence is higher in women, this type of renal AML occurs in young female with lymphangiomyomatosis without other features of tuberous sclerosis and it is also associated with VHL syndrome and Neurofibromatosis. **(7)**

Approximately 77% of AML smaller than 4 cm are asymptomatic, while 82% of the tumors which are larger than 4 cm produce symptoms. The presenting symptoms primarily include; pain, fever, nausea, vomiting, hematuria, hypertension, palpable mass, , anemia, and shock. Retroperitoneal hemorrhage (Wunderlich syndrome) occurs in up to 50% of patients with tumors larger than 4 cm, and renal failure is observed in nearly 15% of those patients with tuberous sclerosis and numerous confluent renal AMLs**.** Urinary tract infection has been observed in up to 4% of patients with tumors larger than 4 cm . [(8)],[(9)] the aim of study is the role Color Doppler Ultrasound In Differentiation Of Renal Angiomyolipoma From Renal Cell Carcinoma.

Patients and Methods

A total of 48 patients with suspicion of renal angiomyolipomas or indeterminate renal masses on previous ultrasound study were referred from the urologists and clinicians to our radiology department for CT scan examination seeking for a more definite diagnosis.

Patients referred by Urologist with solid renal masses on preliminary ultrasound.

Data collected using a pre constructed data collection form in which

Patients' demographic and clinical data, results of U/S examination and CT

Scan findings were recorded. All these patients were re-examined by Gray Scale and Colour Doppler Ultrasound to confirm the presence of renal mass and to determine its benign or malignant features depending on specific characters (echogenicity, shadowing, hypoechoic rim, cystic components, exophytic or not, and the presence of calcification and vascularity on Doppler) and other characters like site, size and multiplicity of renal masses and then renal CT scan was done further charecterization, first by noncontrast study searching for presence of significant amount of intra lesional fatty component, depending on the Hounsfield unit ranging from -15 to 150 which in turn considered diagnostic for renal angiomyolipoma and then with iodinated contrast CT for further characterization of renal masses.

The echogenicity of the lesion was graded as hyperechoic if more than that of renal parenchyma, isoechoic if equal to renal parenchyma and hypoechoic if less than that of renal parenchyma. The data was analyzed using SPSS version 20. Descriptive statistics were used to calculate the mean age of patients, frequencies were calculated for the renal mass character.

Depending upon the CT scan diagnostic findings, the sensitivity, specificity, positive and negative predictive values, accuracy (total agreement value) and misclassification of each ultrasonic character were calculated to determine the ability for differentiating renal angiomyolipoma from malignant tumor.

Results

Forty-eight patients referred from the urologists and clinicians with suspicion of renal angiomyolipoma and indeterminate masses; Two patients were excluded from the study; one because of his history of allergy to contrast media. Non-contrast CT examination was inconclusive therefore sent for MRI study for further characterazation, and another one was excluded because of the confirmative CT scan findings of proteinaceous cyst rather than solid renal mass.

After exclusion; 46 patients were included in this study. The age distribution is shown in (table 1.). The patient's ages ranged from 17 to 76 years. The gender of the patients participating in this study was; 34 (73.91%) females and 12 (26.08%) males.

Table 1. Age Distribution of the Study Population.

Age (year)	No.	%
< 20	1	2.17%
21 – 30	6	13.04%
31 – 40	11	23.91%
41 – 50	13	28.26%
51 – 60	9	19.56%
61 - 70	4	8.69%

>70	2	4.34%
Total	46	**100**

Of 46 patients; 43 (93.47%) patients have solitary renal masses and 3 (6.53%) patients have multiple renal masses; one of them has three masses; two in the right kidney and one in the left and the other two patients showed one in each kidney.

The overall number of renal masses examined were 50; 38 (76%) of them were found in the right kidney and12 (24%) in the left kidney.

All renal masses were small in size, ranging from 0.8 cm to 3.5 cm, and relatively well defined and rounded, located totally or partially within the renal parenchyma and within the renal capsule.

The ultrasound characters of renal masses shown in (table .2.), (figures 1. and 2.) , No mass was reported to be hypoechoic or has calcification on U/S examination.

Table 2. Ultrasound Characters of Renal Masses.

Characters		**Positive test**	**Negative test**	**Total**
Echogenicity	Hyper-echoic	47(94%)	3 (6%)	50(100%)
	Iso-echoic	3 (6%)	47 (94%)	50(100%)
Shadowing		20(40%)	30 (60%)	50(100%)
Hypoechoic rim		3(6%)	47(94%)	50(100%)
Intramural cyst		2(4%)	48(96%)	50(100%)
Exophytic		14(28%)	36(72%)	50(100%)

Regarding vascularity of renal masses on Doppler U/S examination; 39(78%) were avascular and 11(22%) were vascular, (Table3.3.), (figures 3 &4).

Table 3. Characters of Renal Masses on Doppler Ultrasound.

Vascularity of renal masses on Doppler U/S	**Total No.**

Vascular		Non Vascular	
Peripheral Pattern	Diffuse Pattern		
6 (12%)	5 (10%)	39(78%)	50(100%)

Regarding the results of CT scan examinations for renal masses suggestive diagnosis, and the Sensitivity, Specificity, PPV and NPV of each ultrasonic characters for differentiating renal AML from suspected RCC; Of the 47 hyperechoic renal masses; 44(93.61%) were diagnosed as AML on CT scan and 3(6.38%) were diagnosed as suspected RCC, table3.4.

Table 4: Sensitivity, Specificity, PPV and NPV of Hyperechoic Character.

Ultrasound Character	**No.(%)**	**Final CT diagnosis No.(%)**		**Sensitivity**	**Specificity**	**PPV**	**NPV**
Hyperechoic	47 (94%)	AML	44(93.61%)	97.77%	40%	93.61%	66.66%
		RCC	3(6.38%)	60%	2.22%	6.38%	33.33%

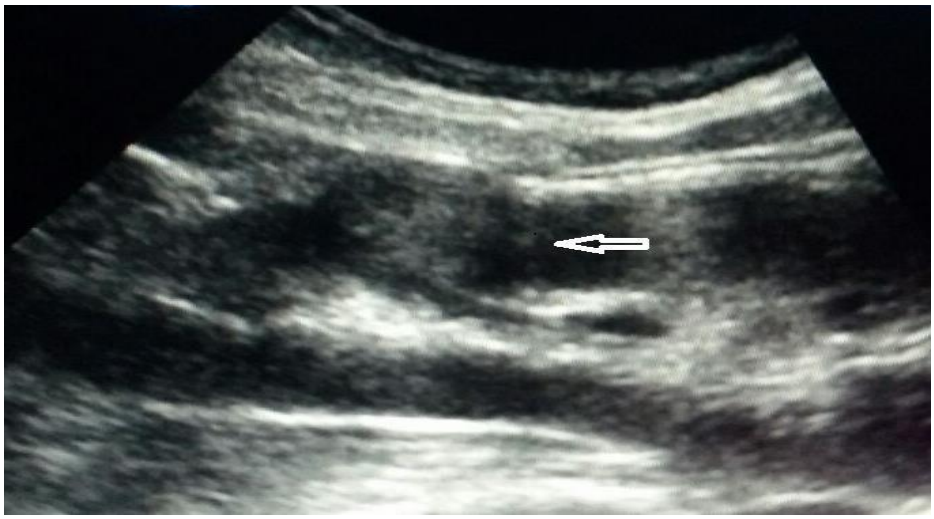

Figure 1. : 42yr male, Right kidney shows 2.3cm hyperechoic mass With hypoechoic rim & internal cystic component (white arrow).

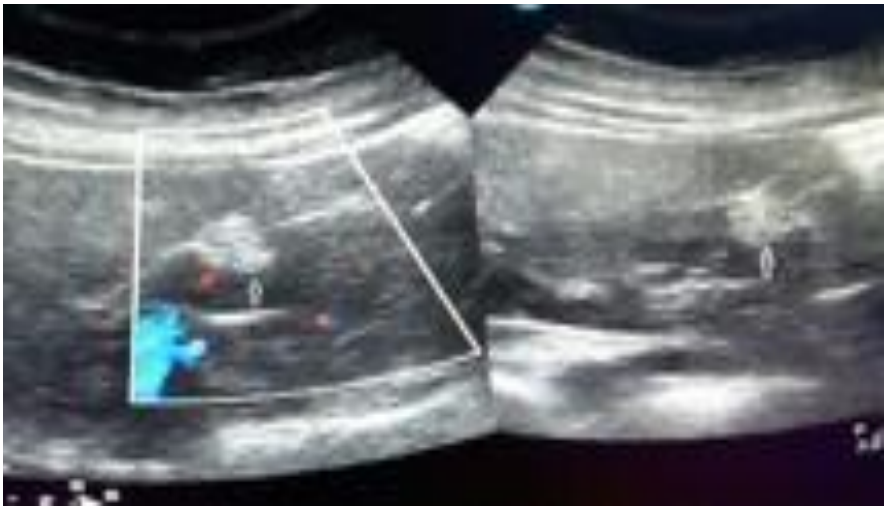

Figure 2.: 50years old female; right kidney shows small avascular hyperechoic mass with acoustic Shadowing (white arrow).

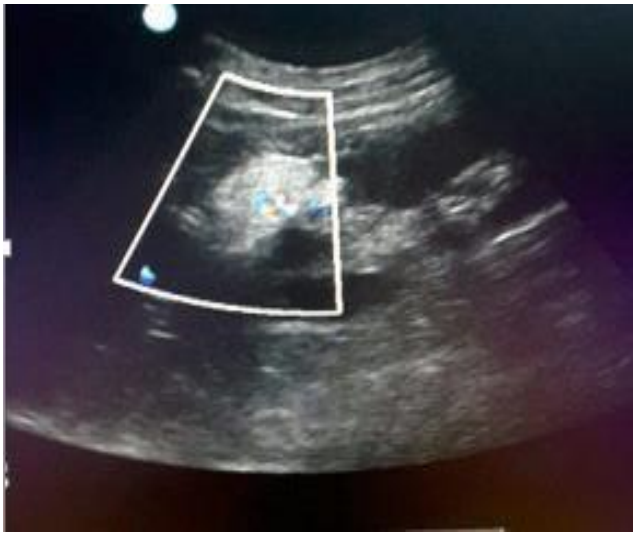

Figure 3.: 72 year old male; left kidney shows 3.2cm hyperechoic mass with acoustic shadowing

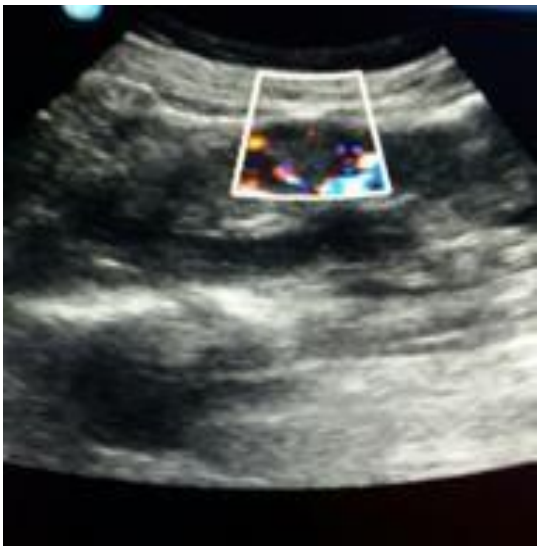

Figure 4: 38 year old female; Rt kidney shows hyperechoic mass with diffuse vascularity.

Discussion

Regarding the correlation between the patients' demography and the final diagnosis of renal masses; our results reported no significant difference in mean age for two groups (43 ± 6.32 SD)for suspected RCC and (42 ± 7.56 SD) for renal AML , female predominance for renal AML and male predominance for suspected RCC , larger size for suspected RCC masses (2.8cm ± 0.74 SD) in comparison to (1.9 cm ± 0.56 SD) for AML and both renal AML and suspected RCC masses were more predominant on the right side (77.77%) and (60%) respectively , these results were similar to the published results by ***Campbell SC et al***.[10]

Regarding the ultrasound echogenicity of renal masses; Although most of hyperechoic renal masses were diagnosed on CT scan as AML, with high sensitivity (97.77%) and accuracy (92%) , the presence of this sign

in three cases of suspected RCC that diagnosed by CT scan leading to low specificity of this character (40%). On other hand, one third of isoechoic masses were diagnosed as AML on CT scan leading to low sensitivity of this sign (40%) for RCC. These results are consistent with the results of recent studies which demonstrate that RCCs display a broad range of echogenicity, although most often they are hypoechoic or isoechoic, a large percentage of RCCs are hyperechoic relative to renal parenchyma and that up to 12% simulate AML, therefore; this character is no longer be considered adequate to exclude the diagnosis of malignancy. (11)

Regarding the acoustic shadowing sign on U/S examination; this was reported in 20 (40%) of renal masses and on CT examination all these masses were diagnosed as renal AML. Although a low NPV was reported (16.66%), a high specificity of (100%) was found, this is similar to the finding obtained by ***Farrelly et al***.(12)

Three out of 47 hyperechoic renal masses had shown hypoechoic rim on ultrasound examination and all of them were diagnosed as suspected RCC masses on CT examination, with (100%) specificity and a sensitivity of (60%), compared with ***Yamashita Y et al.*** that identified a hypoechoic rim in 32 of 38 (84%) hyperechoic RCCs. (13),(14)

Regarding ultrasonic intramural cyst sign; it was reported only in RCC and not in AML. This sign was found in two out of five cases of suspected RCC (40%) which were diagnosed by CT scan with a sensitivity of (40%) and a high specificity of (100%), published studies reported discrete cystic regions in 26% of all RCC cases, the difference of our results from the results of published studies may be due to small number of RCC masses in this study. (13),(14)

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