Original Article

The Role Of Ct In Differentiating The Non-Pediatric Renal And Adrenal Region Fatty Masses

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Abstract

Background: Due to its excellent morphological resolution and capacity to image a variety of structures, including bones, lungs, abdominal viscera, and pelvic organs, CT is recommended in many abdominal disorders.

Aim of the work: The aim of this study is to highlight the accuracy of multi-detector computed tomography scan in diagnosing the different fatty lesions of the renal and adrenal regions by comparing the CT study of the benign lesions with their follow up CT scan and comparing the CT study of the malignant cases with their histo-pathological results.

Patients and Methods: The current study included 34 patients referred to Radiology department, Theodor Bilharz Research Institute. Their age ranged from 20 years to 81 years old with average (56.35 years±13.61). Most of the patients were males 21cases while female were 13 cases. The patients were referred from general surgery and urology departments of Theodor Bilharz Research Institute hospital as well as the outpatient clinics to perform MDCT in the period from November 2021 to June 2022.

Results: MDCT examinations were done for 34 patients and concluded that MDCT should be used in the first place in the course of diagnostic procedures of patients with renal and adrenal region fatty lesions and this was justified by an overall diagnostic accuracy of 100% for benign lesions and 82% for malignant lesions, where MDCT could correctly diagnose (33/34) cases and only 1 case was misdiagnosed, confirming the ability of MDCT to show up the accurate diagnosis, the exact location, extent of tumor, along with involvement of adjacent organs and vessels. Conclusion: It also has a high accuracy in differentiation of malignant from benign lesions and detection of lymph node involvement & metastasis. There by improving the prognosis.

Keywords: CT, Non-Pediatric Renal, Adrenal Region Fatty Masses.

INTRODUCTION

The abdomen and pelvis are home to a variety of both common and uncommon macroscopic fat-containing tumours. These include malignant masses, such as liposarcoma and malignant transformation of benign entities, as well as benign masses such as lipomas. (1)

Due to its excellent morphological resolution and capacity to image a variety of structures, including bones, lungs, abdominal viscera, and pelvic organs, CT is recommended in many abdominal disorders. (2)

The exact separation of the major body compartments, including adipose tissue, skeletal muscle, bones, and organs, at the tissue and organ level is made possible by CT imaging. In clinical trials, the additional capability of the imaging modalities to discriminate cortical from trabecular bone and visceral from subcutaneous fat is quite valuable. (3)

Making the distinction between benign and malignant lesions is crucial when evaluating adrenal incidentalomas. The proper surgical removal of malignancies is aided by accurate classification of adrenal masses as adenomas or non-adenomas, preventing the needless removal of benign lesions. (4) The most popular technique for identifying and characterizing renal masses, as well as for pre-surgical planning and post-therapy monitoring, is computed tomography (CT). (5)

The retroperitoneal can be imaged most effectively using CT. The attenuation differences between organs and fat in the retroperitoneum boost the diagnostic precision of CT in detecting illnesses of the retroperitoneum. (6).

AIM OF WORK

This study objective is to highlight the accuracy of multi-detector computed tomography scan in diagnosing the different fatty lesions of the renal and adrenal regions by comparing the CT study of the benign lesions with their follow up CT scan

and comparing the CT study of the malignant cases with their histo-pathological results.

METHODOLOGY

Type of the study: Retrospective study.
All patients were subjected to the following:
1) Detailed history taking.
2) Revision of previous investigations.
3) Renal function tests.
4) Imaging: MDCT examination of the abdomen and pelvis with and without IV contrast. Patients with poor renal function (creatinine level >1.5 mg/dl) and/or a history of contrast media hypersensitivity underwent non-contrast CT scans. All studies were performed using CT scan machine Toshiba Alexion 16 slice.
5) Histo-pathological correlation by surgical excisional biopsy for suspected malignant cases.

TECHNIQUE OF MDCT EXAMINATION

1) Patient preparation:

The findings of the renal function tests were of particular interest when patient laboratory data were initially amended. Prior to their examinations, all patients were told to abstain from solid food for four to six hours. To ensure appropriate hydration, they were instructed to continue consuming enough simple fluids up to three hours before the assessment.

2) Contrast administration:

- 18-20 gauge catheter was placed into RT ante-cubital fossa.
- Intravascular non-ionic contrast agent (Ultravist 370) is used.
- The dose of contrast material injected is weight based: 1-2 ml/kg.
- Power injector administer of IV contrast material is used.

3) Scan protocol and parameter: CT scanning
Toshiba Alexion 16 CT scanner was used for all analyses. The following parameters were used to perform a CT of the abdomen and pelvis with IV contrast; (350 mA, 120 KV, 0.5 second tube rotation time, slice thickness 5 mm, 8 mm table feed & 3 mm incremental reconstruction, scan area extend from Diaphragm to pubic symphysis, patient lying supine). In order to keep the radiation dose provided to children as low as possible, scanning settings were adjusted for peak kilovoltage and tube correct setup milliampere seconds (MAS); (Kvp: low dose protocol 80-110 KV tube voltage, MAS: weight adapted setting for tube current. Patients with poor renal function (creatinine level >1.5 mg/dl) and/or a history of contrast media hypersensitivity underwent non-contrast CT scans.

Post procedure assessment: the patient is maintained under observation for 15 minutes after the peripheral venous line is withdrawn.

4) Volumetric data analysis:

To perform post-processing, all photos were sent to the workstation. MPR, two- and three-dimensional reformation with volume rendering, were the main methods utilised for volumetric imaging analysis.

5) Statistical analysis:

Microsoft Excel software was used to code, enter, and analyse historical data, basic clinical examinations, laboratory investigations, and outcome measurements. The Statistical Package for the Social Sciences then imported the data (SPSS version 20.0) Software for analysis is (Statistical Package for the Social Sciences). The following tests were performed to determine whether differences were significant; difference and association of qualitative variable by Chi square test; quantitative continues group represent by mean SD; and according to the type of data qualitative represent as number and percentage (X2). P values were established at 0.05 for significant results and 0.001 for highly significant results when comparing differences across quantitative independent groups using the t test or Mann Whitney. Data were gathered and statistical analysis was performed. These statistical evaluations and parameters were applied.

RESULT

Table 1: Age and sex distribution among studied group (N=34)

		Age	
Mean± SD		56.35±13.61	
Median		57.5 (20-81)	
		N	%
Sex	Female	13	38.2
	Male	21	61.8
	Total	34	100.0

Age was distributed as **56.35±13.61** with minimum 20 and maximum 81 years and male were majority with 61.8% and female 38.2%.

Table 2: Follow up distribution among benign (N=28)

			Tumor		Total	X^2	P
			Adrenal	Renal			
6 Months change	Same	N	11	12	23	3.24	0.18
		%	73.3%	92.3%	82.8%		
	Decreased	N	1	0	1		
		%	6.7%	0.0%	3.8%		
	Increased	N	3	1	4		
		%	20.0%	8.3%	14.2%		
Total		N	15	13	28		
		%	100.0%	100.0%	100.0%		

Total 82.8% didn't change and 1 case decreased. 14.2% (4 cases) increased (3 cases adrenal (adenoma and myelolipoma), and 1 case renal angiomyolipoma) and 1 case adrenal adenoma decreased with no significant difference between groups.

Table 3: Comparison between malignant and benign lesions of the studied group (N=34)

			Malignant	Benign	t/X^2	P
Age			60.16±21.75	55.53±11.61	0.751	0.45
HU			-32.83±22.63	-44.26±28.52	0.707	0.484
Sex	Female	N	3	10		
		%	50.0%	35.7%		
	Male	N	3	18	0.42	0.51
		%	50.0%	64.3%		
Finding	Bilateral renal angiomyolipomas	N	0	1		
		%	0.0%	3.6%		
	Left adrenal adenoma	N	0	8		
		%	0.0%	28.6%		
	Right adrenal adenoma	N	0	5		
		%	0.0%	17.9%		
	Left adrenal myelolipoma	N	0	2	34.0	0.00**
		%	0.0%	7.1%		
	Left renal angiomyolipoma	N	0	5		
		%	0.0%	17.9%		
	Right renal angiomyolipoma	N	0	4		
		%	0.0%	14.3%		
	Left renal exophytic angiomyolipoma	N	0	3		
		%	0.0%	10.7%		
	Retroperitoneal liposarcoma	N	6	0		
		%	100.0%	0.0%		
Complaint	Abdominal swelling	N	5	0		
		%	83.4%	0.0%		
	Bilateral flank swelling	N	0	1		
		%	0.0%	3.6%		
	Incidental	N	0	24	34.0	0.003*
		%	0.0%	85.7%		
	left loin pain	N	0	2		
		%	0.0%	7.1%		
	left renal dull aching pain	N	0	1		
		%	0.0%	3.6%		
	sudden loss of weight	N	1	0		
		%	16.7%	0.0%		
Metastasis	No	N	3	28		
		%	50.0%	100.0%		
	Yes	N	3	0	15.35	0.00**
		%	50.0%	0.0%		
Total		N	6	28		
		%	100.0%	100.0%		

Swelling and metastasis are strongly correlated with cancer. t test or Mann Whitney differences between quantitative

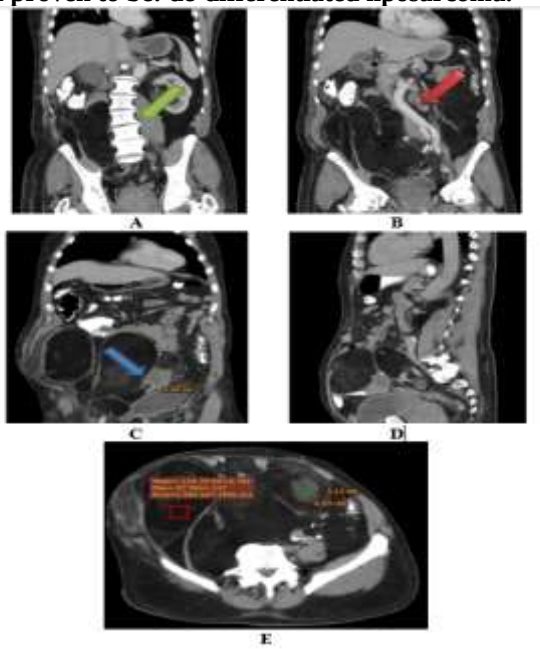
independent groups P value was chosen at 0.001 for very significant results and 0.05 for outcomes that were significant.

Case 1: Patient history:
Male patient 73 years old complaining of multiple recurrence of retroperitoneal liposarcomas and repeated resections with history of surgical removal of the right kidney right psoas muscle and right tests during the previous operations.

MDCT:
Contrast enhanced CT coronal (A,B&C) & sagittal (D) axial (E), reformatted images of the abdomen and pelvis show
A huge well defined retroperitoneal pelvi-abdominal solid mass lesion measuring about 24 x 23 x 18 cm, the mass is seen occupying the whole middle and right aspects of the abdominal & pelvic cavities, and extending down to the right iliac fossa region. The mass is predominantly fatty attenuation with CT attenuation value about (-124 HU), foci of calcifications, and multiple soft tissue components are noted, the largest one is seen measuring about 4.6 x 5.6 x 3 cm (green measuring lines), with no necrosis. The lesion is hypo-vascular, showing faint intervening thick and thin septal enhancement.

It is seen displacing the related small bowel loops and colon, the descending abdominal aorta and its bifurcation (red arrow) and the urinary bladder (blue arrow) to the left side. It is also seen slightly displacing the lumbar spine vertebra to the left side (green arrow).

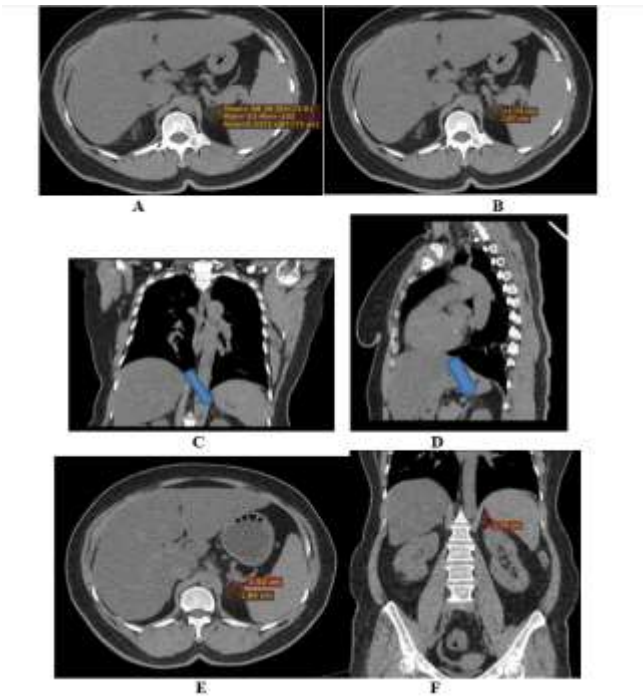
**** The lesion is histopathological proven to be: de-differentiated liposarcoma.**



Case 2
Personal history:
Female patient 40 years complaining from cough and fever and came for CT chest.

MDCT:
NON-Contrast CT axial (A & B), coronal (C) & sagittal (D) reformatted images of the chest showing:
A left adrenal gland hypo-dense nodule is noted measuring about 1.7 x 1.9 x 1.7 in maximum cranio-caudal, transverse and AP diameter. Its mean attenuation values on non-contrast images measured -68 HU (fatty). An adrenal lesion is seen in the left suprarenal space which contains macroscopic fat, compatible with an incidental adrenal myelolipoma. (blue arrows)

** Six months follow up non-contrast CT scan of the abdomen and pelvis showed mild increase in size by about 11%. (E (axial) & F (coronal))



DISCUSSION

Numerous neoplastic and non-neoplastic diseases can develop in the retro-peritoneum and manifest as soft tissue masses. Fat within a retroperitoneal lesion aids in narrowing the differential diagnosis. [7]

MDCT is the preferred method for the diagnosis of retroperitoneal tumors, because of its availability, reduced cost, high resolution and short time required for the scan. Contrast enhanced MDCT scan has the ability to detect the exact tumor location, nature and components of the mass, along with the extension to the adjacent organs and relation to the blood vessels. It can also detect if there is lymph node involvement or distant metastasis in cases of the malignant tumors, & thus staging of the malignant disease. [8]

The distinctive imaging appearance of fat makes it simple to identify. Typically, computed CT shows little attenuation.(−10 to −100 HU). [7]

The "beak indication," the "embedded organ sign," the "phantom (invisible) organ sign," and the "prominent feeding artery sign" are just a few of the imaging indicators that can assist identify the organ of origin. The most frequent adrenal mass that contains microscopic fat is an adrenal adenoma, whereas the most frequent adrenal mass that contains macroscopic fat is a myelolipoma. The most typical renal mass that contains fat is called a renal angiomyolipoma. Liposarcoma is the most prevalent primary retroperitoneal fat-containing malignant lesion. [7]

This study included 34 patients who had renal and adrenal region fatty masses. Their age were ranging between 20 years to 81 years with mean **56.35±13.61** and median **57.5** which is keeping with **Audenet** (2013) [9] who said that adrenal incidelenomas (AI) incidence increases with the patients' age, being 0.2 % in young subjects compared with 6.9 % in patients older than 70 years of age. And **Bülow** (2006) who said that the mean incidence age for adrenal incidelenomas was 64 years. And **Swärd** (2020)[10] who said that angiomyolipomas mean age incidence is 56 years. And **Bhatt** (2016) [11] who said that median age incidence of renal angiomyolipomas is 58 years. And **Lu** (2014) [12] who said that retroperitoneal liposarcomas mean age incidence is 54 years old.

In our study we found that adrenal adenomas and myelolipomas were more common at males than females with incidence 80% & 20% respectively, this was not in agreement with **Yilmaz** (2020) who said that in his study the females represented (65.8 %) and the males (34.2 %). We also found that the incidence of retroperitoneal liposarcoma was equal in both sexes this was relatively in agreement with **Lee** (2011) [13] who found in his study that 57% of his patient were males and 43% were females; and relatively in agreement with **Bock** (2020) [14] who found in his study that the incidence of retroperitoneal liposarcoma in males was 60.95% compared to females 39.05 %. We also found that the incidence of renal angiomyolipoma was more in males than females with 53% and 46% incidence respectively which was not in agreement with **Jesper (2020)** [15] who found in his study that the incidence of renal angiomyolipoma was 82.7 % in females compared to 17.2 % in males.

In our study, the most common adrenal lesion was adenoma followed by myelolipoma, each one constituted 46% & 7% of benign lesions respectively; this was in agreement with **Yilmaz** (2020) [16] who said that the incidence of adenoma is 78.5 % and myelolipoma is 4.4 %. And **Bittner** (2012) [17] who said that among all AI the most common pathology is nonfunctioning benign lesion presenting as adenoma (61%), myelolipoma (10%). [17]

In our study we found out that 66.7% of the adrenal adenomas and myelolipomas were found at left adrenal gland compared to 33.3% at right adrenal gland this was relatively in agreement with **Yilmaz** (2020) [16] who found out in his study that of all cases with adrenal adenomas 49.7% were at left adrenal gland and 36.3% were at right adrenal gland. We also found that 61.5% of the diagnosed renal angiomyolipomas were at left kidney compared to 38.46% at right kidney. This was not in agreement with **Jesper** (2020) [15] who found out in his study that 48 % of his patients had angiomyolipoma at right kidney and 45 % at left kidney; and also with **Fittschen** (2014) [18] who found out in his study 45.5% renal angiomyolipomas at right kidney and 43.1 % at left kidney.

In our study we found that the number of well differentiated retroperitoneal liposarcoma (WDL) was the most common among all the malignant cases where we found 3 (50%) cases WDL and 2 cases de differentiated (DDL) (33.3%) and 1 (16.7 %) case fatty retroperitoneal malignant lesion. This was in agreement with **Lu (2014)** [19] who found in his study group of 47 cases that 29 (61.7%) of them were WDL and 11 (23%) were DDL; and with **Singer** (2003) [20] who found in his study group of 177 cases that WDL was the most common among them representing 56% with 99 cases and DDL representing 37% of the cases with 65 cases. And with **Al-Dasuqi** (2020) [21] who said that among all retroperitoneal liposarcoma subtypes "well -differentiated liposarcomas are the most common, followed by the dedifferentiated subtype"

In our study we found out at 6 months follow up CT scans that only 15.4 % of the patients diagnosed with adrenal adenomas had an increase in size of their adrenal adenomas and this was relatively in agreement with **Comlekc** (2010) who found out in his study that 16.6 % of his patients diagnosed with adrenal adenomas had increase in size with their adrenal adenomas. And relatively with **Bülow** (2006) [23] who found out that only 7.4% of the patients diagnosed with adrenal adenomas had an increase in size in their diagnosed adenomas.

In our study we found out that only 8.3 % of the diagnosed renal angiomyolipomas increased in size at 6 months CT scan follow up study; this was relatively in agreement with **Bhatt** (2016) [11] who found out in his study that only 9 % of his patients had an increase in size in their renal angiomyolipomas at the follow up study. And relatively with **Fittschen** (2014) [18] who found out in his study that only 3.3% of his patients showed growth in their diagnosed renal angiomyolipomas at the follow up study.

Positive results were obtained in 33 lesions out of total 34 cases, and negative results were obtained in only 1 lesion out of total 34 cases, with CT accuracy about 100% in diagnosis of benign lesions and 83.3% accurate in diagnosis of malignant lesions this was in agreement with ***Shalaan. (2017)*** [23], who reached to similar results to our study, with reported 74% CT accuracy assisted by postulated scheme in diagnosis of 50 included cases of retroperitoneal lesions (positive results in 37 cases, and negative results in 13 cases), and was in agreement with a study done by ***Küster et al., (2003)*** [24], where CT examinations were done for 287 patients and concluded that CT should be used in the first place in the course of diagnostic staging procedures of patients with retroperitoneal tumors and tumor recurrence, this was justified by an overall diagnostic accuracy of 90%.

CONCLUSION

Multi-detector computed tomography (MDCT) has many advantages in diagnosis, such as higher temporal and spatial resolution, radiation dose reduction, and powerful post-processing capabilities. All studies were performed using CT scan machine Toshiba Alexion 16 slice. The study was done on 34 patients with 28 cases were proven to be benign and 6 cases were malignant. In our study 15 out of 34 cases were adrenal lesions while 12 were renal and the remaining 6 cases were retroperitoneal. The study was done for evaluation of the diagnostic accuracy and clinical value of CT in the detection of renal and adrenal region fatty lesions. It also has a high accuracy in differentiation of malignant from benign lesions and detection of lymph node involvement & metastasis. There by improving the prognosis. Finally MDCT could improve diagnosis, extensive staging and follow up of different renal and adrenal region fatty masses.

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