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COMPUTED TOMOGRAPHIC EVALUATION OF RETROPERITONEAL MASSES

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ABSTRACT: OBJECTIVE: The retroperitoneum is one of the most complex regions of human anatomy. A variety of mass lesions affect the retroperitoneal space. **METHODS:** Patients were selected from OPD and indoor wards of various departments. Patients from both sexes and all ages were included as part of the study. Contrast enhanced Computed Tomography were done. **RESULTS:** 86 cases of suspected retroperitoneal masses were studied and among 86 cases, 72 were male and 14 were female. Commonest masses diagnosed were nodal masses (34.8%). The most common primary retroperitoneal mass was liposarcoma (33.3%). Other parameters like type of tumours, pattern of tumours, adjacent organ involvement etc. were evaluated and tabulated. **CONCLUSION:** The retroperitoneal nodal mass lesions were the largest group of masses in our study comprising 34.8 % of cases which is followed by the renal masses (26%). CT is able to determine the organ of origin of the mass lesion in 100% of the cases.

KEYWORDS: Liposarcoma, Renal cell carcinoma, Wilm's tumour, Lymphoma, Neuroblastoma.

INTRODUCTION: The retro peritoneum is one of the most complex regions of human anatomy as it contains variety of organs and structures from different systems. A variety of mass lesions affect the retroperitoneal space. These mass lesions may arise from the kidneys, adrenals, pancreas, and lymph node besides primary and secondary tumor of the space itself. Retroperitoneal tumors can cause a diagnostic dilemma and present several therapeutic challenges because of their rarity, relative late presentation and anatomical location, often in close relationship with several vital structures in the retroperitoneal space.^{1,2} Primary retroperitoneal neoplasms are an extremely rare group of tumors. The most common type is soft tissue sarcoma (90%).³

Several diagnostic modalities can be applied for the evaluation of these mass lesions. The conventional methods include plain radiography, IVU, retroperitoneal pneumography, lymphography and angiography. Each of these methods has its own disadvantages.

Computed tomography is currently the imaging modality of choice for the evaluation of the retroperitoneal masses. It gives excellent information about the retro peritoneum providing discrete cross sectional images of the organs, fascial planes and the retroperitoneal compartments which are not hindered by air or fat. MRI can also be used in assessment of retroperitoneal lesions as it has no risk of ionizing radiation but it is more expensive than CT and not widely available. Current imaging with helical computed tomography and multi planar reformations permit a detailed analysis of the complex anatomy in this region and is the key to understanding many of its mass lesions.⁴

AIMS AND OBJECTIVES:

1. To study the different presentations of the retroperitoneal masses.
2. To determine the organs of origin.
3. To define the extent and involvement of the adjacent structures.
4. To determine the diagnostic accuracy of CT.

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MATERIALS AND METHODS: This study was carried out on 86 cases of clinically suspected cases of masses of retroperitoneal origin, in the department of Radiology, Gauhati Medical College and Hospital, Guwahati, from January 2014 to December 2014. All the patients were selected from OPD and indoor wards of various departments. Patients from both sexes and all ages were included as part of the study.

METHODS: Brief clinical history of the patients was taken. The history comprised of mode of onset, duration of illness, chief complaints, occupational history, personal history and past history. Both general, systemic and laboratory examinations of the patients were done. After taking history, the patients were prepared for CT scanning.

IMAGING: For CT examinations, patients were kept on empty stomach for at least 6 hrs. Written consent of the patient or attendants was taken. Before performing the scan the procedure and objective were explained to the patient. The machine used is PHILIPS MX16 (16 SLICE CT) scanner.

The Small and Large Bowel Loops were Opacified with Oral Contrast. CT Scan were Performed using the following Protocols:

1. Positioning: Patients were scanned in the supine position with their arms above their heads. Scans were performed in the axial axis from cephalic to caudal levels.
2. Scanning: After positioning the patient, the topogram or scannogram was taken. Spiral scanning were done. The upper abdomen scan were obtained contiguous 5mm slice. Both plain and contrast enhanced CT scans were obtained. About 100 ml of a non-ionic water soluble contrast medium were injected intravenously as a bolus dose to image the abdomen. Delayed sections through the upper abdomen were obtained to see the delayed enhancement pattern of the mass, excretion of both kidneys and through the pelvis to delineate contrast filled urinary bladder and pelvic ureters.

RESULTS AND OBSERVATIONS:

Etiology	No. of Cases	(%)
Retroperitoneal Nodal Masses	30	34.8%
Renal Masses	22	25.5%
Adrenal Masses	17	19.7%
Primary retroperitoneal masses	9	10.4%
Pancreatic masses	8	9.3%

Table 1: Etiological breakup

Maximum number of cases were retroperitoneal nodal masses (34.8%) followed by renal masses (25.5%).

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Age Group	No. of cases	(%)
0-10	12	13.9%
11-20	8	9.3 %
21-30	6	6.9%
31-40	10	11.6%
41-50	14	16.2%
51-60	22	25.5%
61-70	13	15.1%
71-80	1	1.1%

Table 2: Age distribution

The commonest age group of the retroperitoneal masses was in the 5th decade.

Sex	Number of Cases	Percentage (%)
Male	72	83.7 %
Female	14	16.2 %

Table 3: Sex distribution

In our study the prevalence of retroperitoneal masses was very high in the males with a percentage of about 83.7%.

I) PRIMARY RETROPERITONEAL MASSES: Number of cases: 9.

Type of Masses	Number of Cases	(%)
Liposarcoma	3	33.3%
Malignant fibrous histiocytoma	2	22.2%
Leiomyosarcoma	1	11.1%
Rhabdomyosarcoma	1	11.1%
Neurofibroma	1	11.1%
Schwannoma	1	11.1%

Table 4: Different types of primary retroperitoneal masses

The commonest malignant primary retroperitoneal mass lesion in our study was liposarcoma (33.3%) followed by malignant fibrous histiocytoma (22.2%)

Age Group	Number of Cases	Percentage (%)
0-10	1	11.1%
11-20	0	0%
21-30	0	0%
31-40	2	22.2%
41-50	3	33.3%
51-60	3	33.3%

Table 5: Age distribution of primary retroperitoneal masses

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The commonest age of presentation is in the 5th and 6th decade with equal number of cases in our study.

Total Cases	Malignant Cases	Benign Cases
9	7	2
Percentage	77.7%	22.2%

Table 6: Pathological diagnosis of primary retroperitoneal masses

So in our study, 77.7% were malignant 22.2% cases were benign. The 2 benign cases were schwannoma and neurofibroma.

CT features	Fat	Soft tissue	Calcification	Necrosis
No. of cases	3	9	2	3
(%)	33.3%	100%	22.2%	33.3%

Table 7: CT features of Primary Retroperitoneal masses

The primary retroperitoneal masses had soft tissue components in 100% cases. However fat and necrosis being present in 33.3% cases.

II) RENAL MASSES: Total number of cases: 22.

Types	No. of Cases	(%)
Renal cell carcinoma	14	63.6%
Lymphoma	4	18%
Wilm's tumour	4	18%

Table 8: Different types of renal masses

The largest number of renal masses was renal cell carcinoma (63.6%) in our study.

Age Group	No. of Cases	(%)
0-10	4	18%
11-20	3	13.6%
21-30	1	4.5%
31-40	2	9%
41-50	2	9%
51-60	5	22.7%
61-70	4	18%
71-80	1	4.5%

Table 9: Age distribution of renal masses

The highest group of presentation is in the 5th decade in our study.

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1) Renal Cell Carcinoma: Total number of cases: 14.

Age Group	No. of Cases	(%)
0-10	0	0%
11-20	1	7%
21-30	1	7%
31-40	1	7%
41-50	2	14%
51-60	5	35%
61-70	3	21 %
71-80	1	7%

Table 10: Age distribution of renal cell carcinoma

So in our study, commonest age group affected was 6th decade.

CT Character	Calcification	Node	Renal vein/ IVC thrombus	Pre contrast		Post Contrast
				Isodense	Mixed	Necrosis
No. of cases	3	3	2	4	10	4
(%)	21.4%	21.4%	14.2%	28.6%	71.4%	28.6%

Table 11: CT features of renal cell carcinoma

So in our study, 21.4% cases showed calcification. 71.4% of cases had mixed attenuation followed by necrosis in 28.6% of cases.

2) Renal lymphoma: The total number of cases: 4.

Different patterns	Cases	(%)
Multifocal	2	50%
From contiguous LN	1	25%
Solitary	1	25%

Table 12: Patterns of renal involvement in lymphoma

So in our study, multifocal lymphomatous involvement was seen in majority cases (50%).

3) Wilm's tumour: Total number of cases: 4

No. of cases	Average age	Ratio(M: F)
4	4.2	3: 1

Table 13: Age & sex distribution of Wilm's tumour

The average age of presentation being 4.2% years and male to female ratio was 3: 1.

Necrosis	Encasement of Aorta	Heterogeneous	Calcification
2	1	4	0
50%	25%	100%	0%

Table 14: CT characterization of Wilm's tumour

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So all case in our study was heterogeneous and necrosis was present in 50% cases.

III) ADRENAL MASSES: Total number of cases: 17.

Mass	No. of Cases	(%)
Neuroblastoma	6	35.3%
Adrenal metastasis	4	23.6%
Adrenal adenoma	2	11.8%
Myelolipoma	2	11.8%
Adrenocortical carcinoma	1	5.9%
Pheochromocytoma	1	5.9%
Calcified adrenal mass	1	5.9%

Table 15: The different types of adrenal masses

The commonest adrenal mass in our study was neuroblastoma (35.3%).

Age Group	No. of Cases	(%)
0-10	6	35%
11-20	2	11.7%
21-30	1	5.8%
31-40	0	0 %
41-50	3	17.6%
51-60	2	11.7%
61-70	3	17.6%

Table 16: Age distribution of adrenal masses

The commonest age group in our study with adrenal mass was the 1st decade.

1) Neuroblastoma: Total number of cases: 6.

No. of Cases	Average age	Ratio (M: F)
6	2.3yrs	5: 1

Table 17: Age & sex distribution of neuroblastoma

The average age of presentation of neuroblastoma was 2.3 years with male preponderance.

CT features	Calcification	Necrosis	Adjacent organ invasion	Vascular invasion/ encasement	Adenopathy	Calvarial Metastasis
Number of cases	4	2	1	1	3	3
Percentage	66.6%	33.3%	16.6%	16.6%	50%	50%

Table 18: CT imaging findings in neuroblastoma

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In our study, calcification was present in 66.6% cases. Calvarial metastasis and adenopathy were present in 50% cases.

2) Adrenal metastasis: Total number of cases: 4

Primary	Lung	Ovary
Number of cases	3	1
Percentage	75%	25%

Table19: Primary of adrenal metastasis

So in our study, in majority cases primary growth was in lung (75%).

Mass	Adrenal metastasis	Adrenal adenoma
Pre contrast	23HU	10HU
Post contrast	43HU	24HU

Table 20: Mean CT attenuation of adrenal metastasis

IV) PANCREATIC MASSES: Total number of cases: 8.

Age group	Number of cases	Percentage
31-40	1	12.5%
41-50	2	25%
51-60	5	62.5%
61-70	1	12.5%

Table 21: Age distribution of pancreatic masses

So commonest age group of pancreatic masses in our study was 5th decade.

1) Pancreatic Carcinoma: The most common site of pancreatic carcinoma in our study was head and uncinete process (87.5%).

Imaging Features	Heterogeneous	Necrosis	Vascular Invasion/ Encasement	Adjacent Organ Invasion	Adenopathy	Dilated CBD and MPD
Number of cases	4	1	3	1	4	4
Percentage	50%	12.5%	37.5%	12.5%	50%	50%

Table 22: CT findings in pancreatic carcinoma

So 50% cases had heterogeneous attenuation, adenopathy and dilated CBD/MPD in our study.

V) NODAL MASSES: Total number of cases: 30.

Etiology	Lymphomatous	Metastatic	Tubercular
No.	13	11	6
%	43.3%	36.6%	20%

Table 23: Etiology and number of cases of nodal masses

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The largest group of nodal masses in our study was lymphomatous origin with 43.3%.

Age Group	No. of Cases	(%)
0-10	2	6.6%
11-20	3	10%
21-30	4	13.3%
31-40	5	16.6%
41-50	4	13.3%
51-60	7	23.3%
61-70	5	16.6%

Table 24: Age distribution of nodal lesions

So commonest age group of nodal lesions in our study was 5th decade.

The lymph nodes were assessed in terms of nodal size (Short axis diameter), attenuation characterization, features of necrosis, enhancement pattern (Homogenous/non homogenous/ring like, conglomerated and vascular encasement primarily the aorta and the IVC).

Imaging features	Homogenous	Rim enhancement	Vessel encasement
No. of cases	20	10	14
%	66.6%	33.3%	46.6%

Table 25: CT findings of nodal masses

Etiology	Lymphomatous	Metastatic	Tubercular
Homogenous	11(84.6%)	8(72.7%)	0
Rim enhancement	2 (15.4%)	3(27.3%)	6 (100%)

Table 26: Pattern of enhancement of nodal masses

Nodal masses with lymphomatous origin and metastatic nodal lesions showed homogenous enhancement in most of the cases (84.6% and 72.7% respectively).The tubercular nodal lesions showed rim enhancement in all the cases in our study (100%).

1) Metastatic Nodal Masses:

Primary	RCC	PAN	UB	PROSTATE	COLON	TESTIS	NEURO
Number of cases	3	2	1	1	1	1	2
Percentage	27.3	18.2	9	9	9	9	18.2

Table 27

The most common primary malignant lesion with metastatic retroperitoneal lymphadenopathy was renal cell carcinoma in our study.

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Fig 1: Contrast Enhanced CT showing a large retroperitoneal liposarcoma (White arrows).

Fig. 1

Fig 2: (A) Axial & (B) Coronal CECT showing a case of RCC in the left kidney showing perinephric extension (Thick arrows).

Fig. 2A

Fig. 2B

Fig 3: Axial CECT image in (A) showing large right renal mass in a child proved to be Wilm's Tumour. (B) Delayed coronal Image in the same patient.

Fig. 3A

Fig. 3B

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Fig 4: Axial CECT image in (A) reveals right adrenal adenoma (Thin arrow) and axial image in (B) in a different patient shows left adrenal metastasis (Thin arrow). Hepatic metastasis is also seen. (Curved arrow).

Fig. 4A

Fig. 4B

Fig 5: MDCT Axial image in (A) showing left adrenal myelolipoma (arrow) and coronal image in (B) in a different patient showing a large HPE proven case of left adrenal cortical carcinoma (arrow).

Fig. 5A

Fig. 5B

Fig 6: A case of right adrenal neuroblastoma in a young child. Arrows showing calcification in the right adrenal mass.

Fig. 6

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Fig 7: Axial image showing a case of carcinoma pancreas involving the body. White arrow in image (A) pointing to the mass. (B) Axial image in a different patient showing mass in the pancreatic head.

Fig. 7A

Fig. 7B

Fig 8: Axial CT images in (A) showing metastatic retroperitoneal nodes. Lymphomatous nodes in image (B) and Tubercular nodes in image (C). Nodes are shown in arrows.

Fig. 8A

Fig. 8B

Fig. 8C

DISCUSSION:

Nodal Masses: The nodal masses constituted the largest group of our study comprising 35% of the total cases. Out of the 30 cases 13 were diagnosed as lymphomatous origin, 11 as metastatic adenopathy from various primaries and the rest 6 cases were tubercular adenopathy.

84.6% of the lymphomatous nodes showed homogenous soft tissue enhancement. The rest 15.4% had rim enhancement.⁵ Post radiotherapy cases showed low density center with rim enhancement.⁶

In our study metastasis was suspected when a lymph node was greater than 1 cm in short axis diameter. Most of the malignant nodes showed homogenous enhancement (72.7% of cases) and the rest 27.3% had enhancing rim.⁷

In our study, out of 6 cases of tubercular origin, all cases show low attenuation center with rim enhancement with associated findings like ascites and omental thickening.

Renal Masses: Renal masses comprised the second largest group comprising of 28% cases in our study. Renal cell carcinoma constituted the largest number of renal masses followed by wilm's tumour and lymphoma.

In our study, 71.4% cases of renal cell carcinoma showed mixed attenuation and 28.6% showed necrosis on post contrast study.⁸ Calcification seen in 21.4% cases, tumour thrombus in the renal vein is seen in 14.2% cases. Zagoria et al.⁹ in their series of 78 patients, found calcification in 31% of cases.

Out of 4 cases of renal lymphoma in our study, 2 cases (50%) had multifocal involvement followed by contiguous extension to the kidney from adjacent nodal lesions and solitary involvement is seen in 1 case each (25%).¹⁰

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Wilm's Tumour: Wilm's tumour constituted 25% cases of the renal masses in our study. The average age of presentation of Wilm's tumour was 4.2 years.¹¹ In our study; we found heterogeneous intrarenal masses in all the cases. Necrosis was present in 25% of cases. Vessel encasement was seen in 25% cases. Reiman T A et al.¹² found that Wilm's tumour is predominantly heterogeneous tumor with areas of necrosis and invasion of the renal vein and inferior vena cava being not uncommon.

Adrenal Masses: The total number of adrenal masses in our study was 20% of the total cases.

Neuroblastoma consisted largest group of patients followed by adrenal metastasis. Calcification was seen in 66.76%, necrosis was seen in 33.3% cases, retroperitoneal adenopathy in 50% cases and aortic encasement in 16.6 % cases, 50% cases presented with calvarial metastasis.

The average age of presentation of neuroblastoma in our study was 2.3 years and the male to female ratio was 5: 1.⁸

The adrenal metastasis constituted the second largest number of adrenal masses. The mean CT attenuation of adrenal metastasis in our study was 23 HU in pre contrast study and showed wash out of less than 50% on post contrast study.¹³

In our study, adrenal adenoma was found in 11.8% cases. All the cases were <3cm in size, well defined and low density with rapid enhancement on post contrast scan and washout of more than 50% on delayed scan.¹³

Adrenal myelolipoma showed characteristics negative Hounsfield unit value owing to macroscopic fat.

In our study, recurrent adrenocortical carcinoma was seen in a female child of 12 years who presented with Cushing's syndrome. The CT features was a large heterogeneous mass lesion with areas of necrosis and thrombus which was seen extending into the IVC.¹⁴

In our study, 1 case of pheochromocytoma showed well defined enhancing mass with areas of central necrosis. On proper clinical and laboratory findings we diagnosed the case as pheochromocytoma.¹⁵

Pancreatic Masses: In our study, pancreatic carcinoma constituted the largest group of pancreatic masses. Pancreatic adenocarcinoma was seen in all the cases with commonest presentation in 5th decade. The most common location was head and uncinate process in 87.5% cases. The masses were heterogeneous in 50% of cases and vascular invasion/encasement seen in 37.5% cases associated peripancreatic and paraaortic adenopathy and dilated MPD and CBD were noted 50% of the cases. Our study correlated well with study by Min-Jie Yang et al.¹⁶

Primary Retroperitoneal Masses: The number of primary retroperitoneal masses was 9 in our study out of which 7 were malignant and 2 were benign.

Primary Malignant Retroperitoneal Masses: The most common primary retroperitoneal mass in our study was liposarcoma.¹⁷ All the masses were quite large at the time of presentation with the liposarcoma showing areas of fat and soft tissue components. The features were similar to the findings in a series as observed by Kim et al.¹⁸

The next commonest retroperitoneal mass was malignant fibrous histiocytoma. Calcification was seen in all the cases and necrosis was seen in one of the cases. According to lane et al¹⁹ dystrophic calcification is seen in 25% of cases which is uncommon in other retroperitoneal malignancies.

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Rhabdomyosarcoma was seen in an 8 year old boy. The CT features was a large heterogeneous mass in the retroperitoneum with areas of necrosis.¹⁹

Leiomyosarcoma was also presented as large heterogeneous soft tissue mass lesion with areas of necrosis in 54 years old without any evidence of calcification or fat density within which we diagnosed as only case of retroperitoneal sarcoma as the leiomyosarcoma. Myxoid and poorly differentiated liposarcomas cannot be differentiated imaging wise as proposed by Lane et al.¹⁹

Benign Retroperitoneal Masses: The benign primary retroperitoneal tumours in our study were one case each of neurofibroma and schwannoma. The neurofibroma case presented as a well-defined homogeneous mass with low density with very minimal enhancement.¹⁷

Kim et al.¹⁸ found that schwannoma presents as heterogeneous mass on enhanced CT scans. Similar findings were seen in our case.

CONCLUSION: A total of 86 cases of retroperitoneal masses were evaluated with the computed tomography including all age group.

The commonest age group was the 5th decade and the study showed a distinct male preponderance with the percentage of male involvement was 83.7%.

The retroperitoneal nodal mass lesions were the largest group of masses in our study comprising 35% of cases which is followed by the renal masses (26%), adrenal masses (20%), primary retroperitoneal masses (10%) and the pancreatic masses with 9% of the cases.

The role of CT in the Evaluation of these Retroperitoneal Masses was studied and the following Conclusion was Arrived:

1. CT is able to determine the organ of origin of the mass lesion in 100% of the cases.
2. The diagnostic accuracy of CT was 88% giving correct diagnosis in 76 cases.
3. CT was helpful in staging the malignant masses especially in the context of renal cell carcinoma.
4. With CT, examination of all the other organs can done simultaneously which is especially useful in cases of malignancies as all potential sites for metastasis including the lungs can be evaluated. Furthermore the renal function can also be assessed by CT.

CT is thus a rapid, safe, noninvasive reliable and accurate method for the evaluation of retroperitoneal mass lesions. CT helps in identifying its organ of origin and assesses its extent. It also provides an accurate and wider range of diagnostic information. In our opinion at the present time with wider availability of CT, with excellent image resolution and rapid scanning time it serve as an ideal comprehensive imaging modality for the patients with retroperitoneal mass lesion.

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