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Research Article

ROLE OF MULTI DETECTOR COMPUTED TOMOGRAPHY IN THE EVALUATION OF RETROPERITONEAL MASSES

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ABSTRACT

Retroperitoneal masses are one of the diagnostic challenges. Multidetector computed tomography (MDCT) is considered as ideal imaging modality in evaluating the retroperitoneal masses. The objective of this study was to locate, differentiate and diagnose the retroperitoneal masses. It is a prospective study where72 patients were evaluated at JJMMC, Davangere over a period of 2 years from October 2016 to October 2018.Out of the 72 cases of retroperitoneal masses, 23 cases (32%) were primary retroperitoneal mass lesions. Further, out of the 49 cases (68%) of masses arising from retroperitoneal organs, 19% were of pancreatic origin, 17 % of renal origin, 12 % adrenal origin and 2% of aortic origin. The present study concludes that using MDCT it is possible to localise, differentiate and diagnose the retroperitoneal masses. Based on characteristic features and relevant clinical information narrowing of differential diagnosis is possible.

INTRODUCTION

The retroperitoneum is a fat containing compartment extending from the diaphragm superiorly to the pelvis inferiorly and is situated between the posterior parietal peritoneum anteriorly and the transversalis fascia posteriorly.[1] In addition to fat, it contains true embryonic organs being adrenal gland, kidneys, ureters and gonads. Many other abdominal viscera are not completely within the retroperitoneum but closely associated with the posterior abdominal wall being partly covered by the peritoneum. These structures include the aorta, inferior vena cava and their branches, pancreas, portions of the duodenum and colon, and many lymph nodes and nerves.[2]

Retroperitoneal masses are one of the diagnostic challenges which include precise localization, determination of extent of involvement and characterization of specific pathologic type.[3]

To most clinicians and radiologists, the retroperitoneum was merely a diffuse vague space located between the posterior peritoneum and posterior abdominal wall.[4] Today, with detailed visualization of this area by CT scanning, the anatomy and fascial boundaries can be explained and visualised better.[4] Ultrasonography plays a relatively limited role in evaluation of retroperitoneal masses except for the assessment of vascular invasion which could be performed better with CT and MRI imaging.[1]

Multidetector computed tomography (MDCT) is considered as ideal imaging modality in evaluating the retroperitoneal masses since it provides discrete cross sectional images of organs and retroperitoneal compartments.[5]

Familiarity with MDCT and clinical features of various retroperitoneal lesions facilitates accurate diagnosis and in obtaining clinically significant information which in turn helps in their management.[3]

Objective of the Study

- To locate, differentiate and diagnose the retroperitoneal masses.
- To evaluate the nature, morphology and extent of the mass and its relationship to adjacent structures.
- To compare the CT finding with the surgical and histopathological findings wherever possible.

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MATERIALS AND METHOD

Source and method of collection

It is a prospective study conducted on 72 cases at JJMMC, Davangere over a period of 2 years from October 2016 to October 2018. All the patients were subjected to MDCT on TOSHIBA Activion 16 slice MDCT machine. Plain and post-contrast dual phase study of the abdomen and pelvis will be done. Bowel opacification will be achieved orally with 1000ml of diluted contrast for differentiating fluid filled bowel loops. It consists of acquisition of contiguous axial sections, of thickness 5mm of abdomen and pelvis in cranio-caudal direction from the level of the xiphisternum to pubis symphysis before and after administration of iodinated intravenous contrast. IV contrast opacification is achieved with 100-120ml of non ionic contrast media (0.9ml/kg body weight) by infusing at the rate of 3ml/sec. Dual phase study will be done with arterial phase at 20-40sec and venous phase at 70-90ses. The window width for soft tissue is 350-400HU and for bone is 1500-2000HU. The window level for soft tissue is 50HU and for bone is 450HU. MDCT Findings were correlated with the surgical and HPE findings wherever applicable.

Inclusion Criteria

- Patients of all age groups and gender with clinical suspicion presenting with symptoms of involvement of retroperitoneal structures
- Patients of all age groups and gender with involvement of retroperitoneal organs detected incidentally by routine ultrasonography of abdomen.

Exclusion Criteria

The study will exclude

- Patients presenting with non-retroperitoneal lesions excluded by initial/routine ultrasonographic screening
- Patients with altered renal parameters are excluded from the study as intravenous contrast agent cannot be administered in such patients.
- Patients with sensitivity to contrast agent (Allergic reactions).
- Patients in whom a CT examination is contraindicated (Example: Pregnancy).

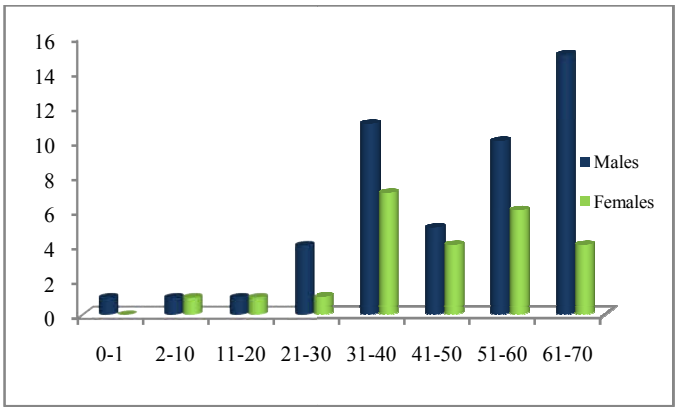
Statistical analysis

Statistical analysis was performed using percentages and proportions.

RESULTS

Table 1 Age and Sex Distribution

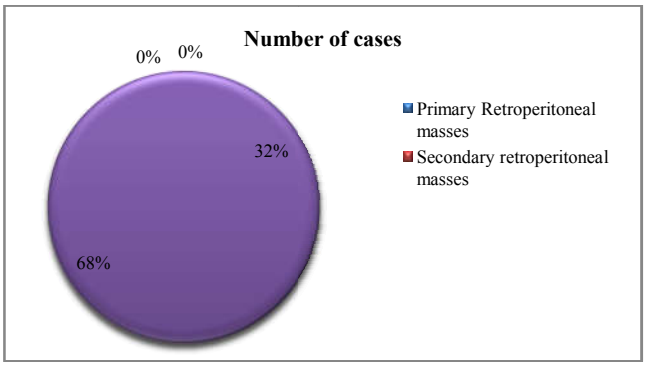
Age Range	Number of Males	Number of Females	Total
0-1	1	0	1
2-10	1	1	2
11-20	1	1	2
21-30	4	1	5
31-40	11	7	18
41-50	5	4	9
51-60	10	6	16
61-70	15	4	19
Total	48	24	72



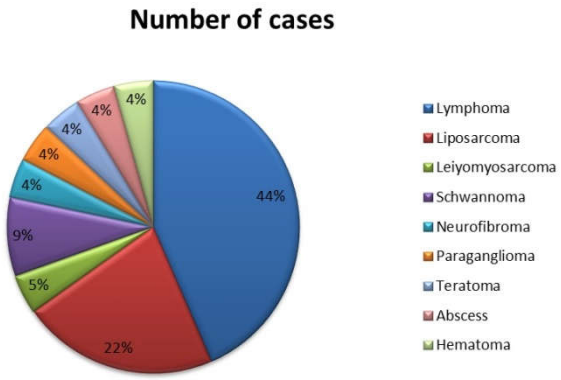
Graph 1 Age and Sex Distribution

Table 2 Primary retroperitoneal masses vs masses arising from retroperitoneal organs/secondary retroperitoneal masses

Primary retroperitoneal masses	Secondary retroperitoneal masses	Total
23	49	72



Graph 2 Primary retroperitoneal masses vs masses arising from retroperitoneal organs/secondary retroperitoneal masses



Graph 3 Primary Retroperitoneal masses spectrum

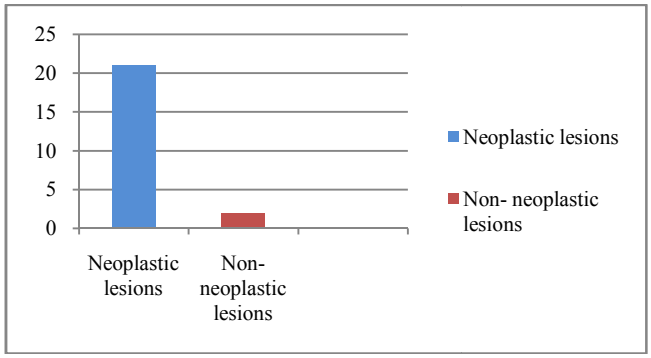
Table 3 Primary Retroperitoneal mass spectrum

Primary Retroperitoneal mass	Number of cases
Lymphoma	10
Liposarcoma	5
Leiyomyosarcoma	1
Schwannoma	2
Neurofibroma	1
Paraganglioma	1
Teratoma	1
Abscess	1
Hematoma	1

Total	23

Table 4 Primary Retroperitoneal mass: neoplastic vs non-neoplastic lesions

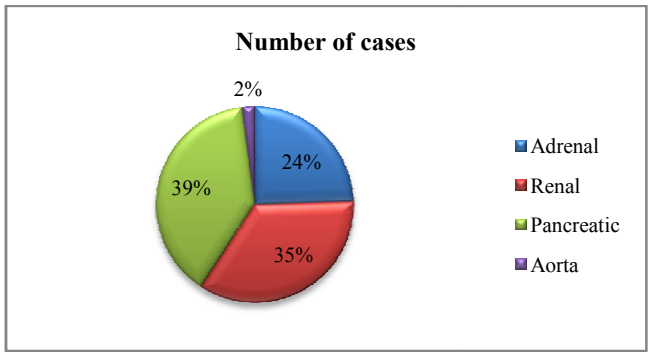
Neoplastic lesions	Non- neoplastic lesions	Total
21	2	23



Graph 4 Primary Retroperitoneal mass: neoplastic vs non-neoplastic lesions

Table 5 Secondary retroperitoneal masses - organ of origin

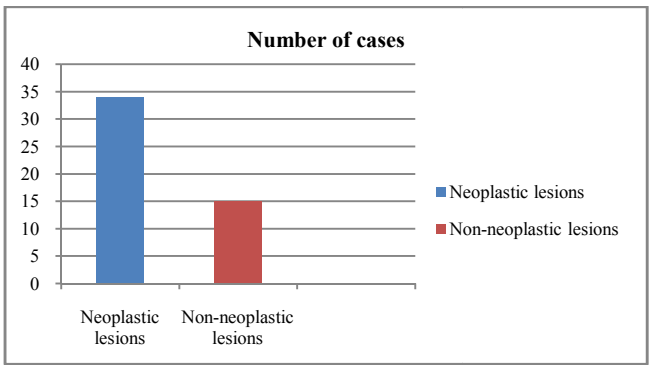
Organ of origin of retroperitoneal masses	Number of cases
Adrenal	12
Renal	17
Pancreatic	19
Aorta	1
Total	49



Graph 5 Secondary retroperitoneal masses - organ of origin

Table 6 Secondary retroperitoneal masses: neoplastic vs non-neoplastic lesions

Neoplastic lesions	Non-neoplastic lesions	Total
34	15	49



Graph 6 Secondary retroperitoneal masses: neoplastic vs non-neoplastic lesions

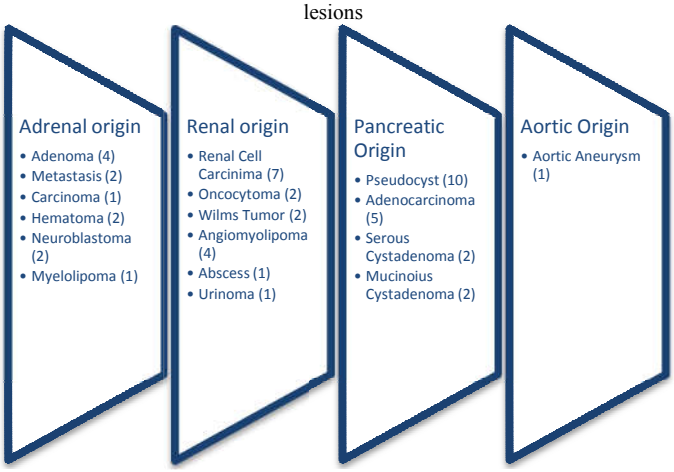
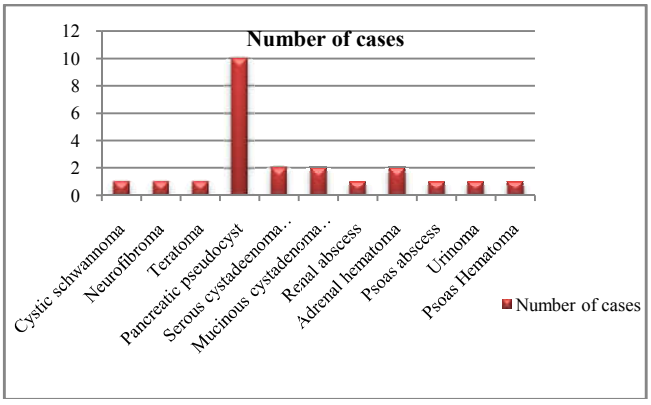


Fig 1 Secondary retroperitoneal masses spectrum

Table 7 Cystic Retroperitoneal masses

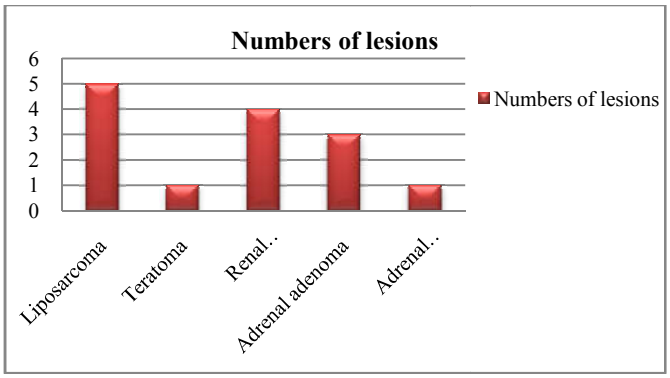
Cystic Retroperitoneal masses	Number of cases
Cystic schwannoma	1
Neurofibroma	1
Teratoma	1
Pancreatic pseudocyst	10
Serous cystadeenoma pancreas	2
Mucinous cystadenoma pancreas	2
Renal abscess	1
Adrenal hematoma	2
Psoas abscess	1
Urinoma	1
Psoas Hematoma	1
Total	23



Graph 7 Cystic Retroperitoneal masses

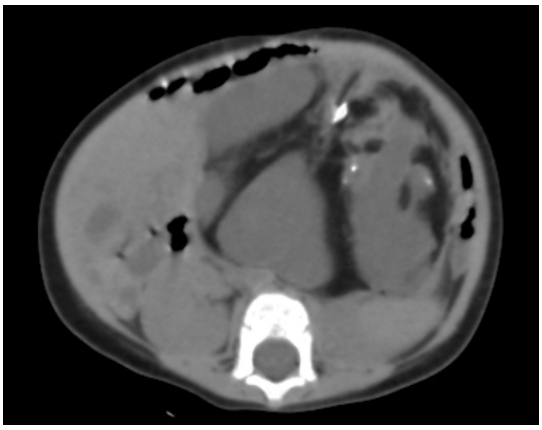
Table 8 Fat containing retroperitoneal masses

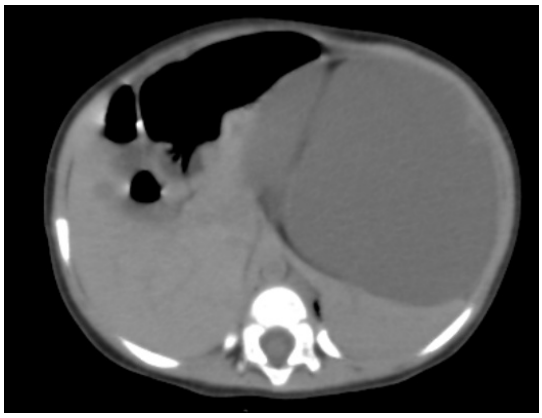
Fat containing retroperitoneal masses	Numbers of lesions
Liposarcoma	5
Teratoma	1
Renal angiomyolipoma	4
Adrenal adenoma	3
Adrenal myelolipoma	1
Total	14



Graph 8 Fat containing retroperitoneal masses

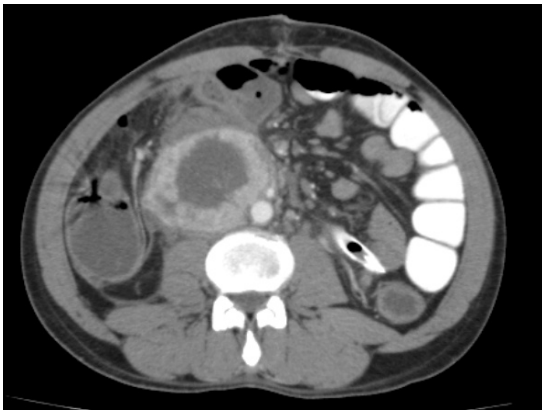
Cases

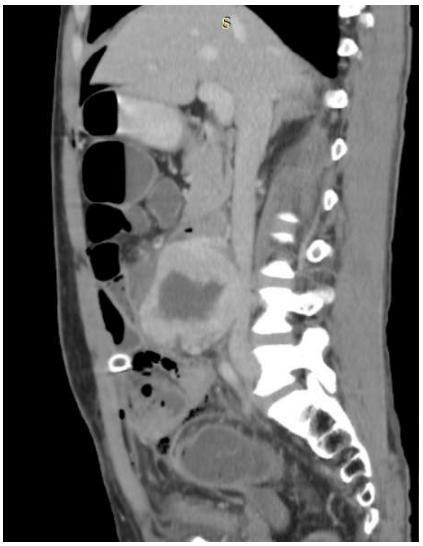




Case 1 Benign cystic teratoma

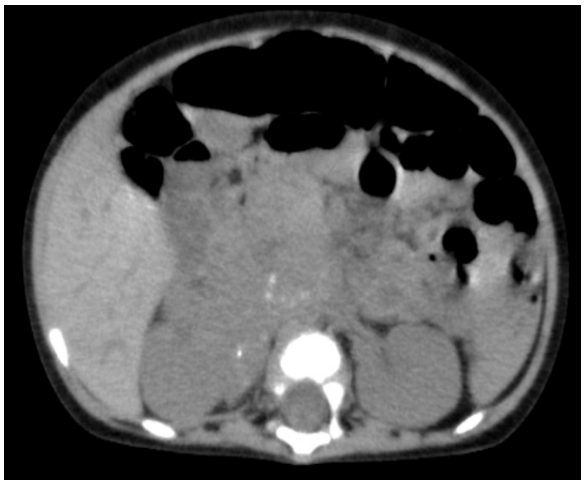
Findings: NECT axial images showing large lobulated retroperitoneal cystic lesion with thin internal septations, fat component and few calcific foci.

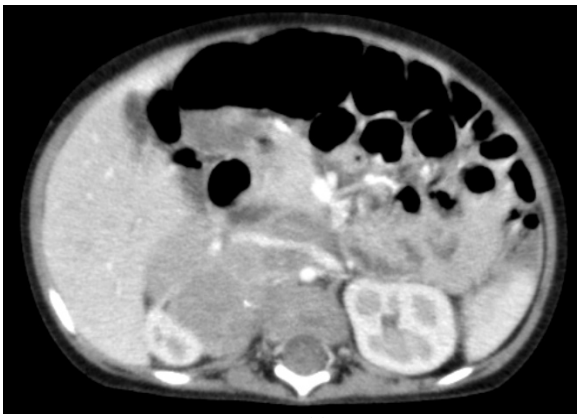




Case 2 Leiyomyosarcoma

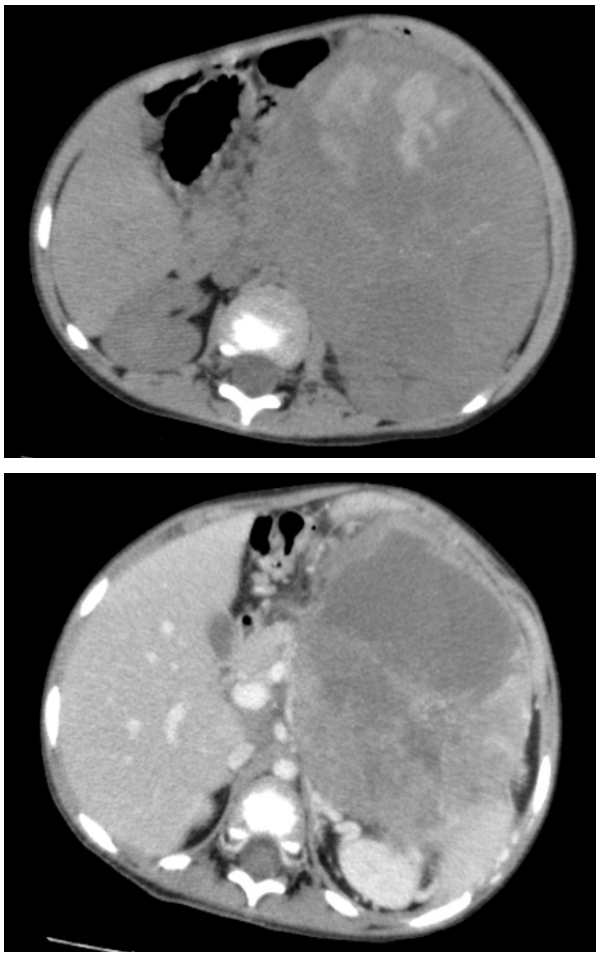
Findings: CECT axial and sagittal images retroperitoneal lesion showing central extensive necrosis and heterogeneous enhancement. The lesion showed involvement of adjacent IVC with loss of fat plane between them and associated IVC thrombus.





Case 3 Neuroblastoma

Findings: CECT axial imagesshowing well defined heterogeneously enhancing retroperitoneal mass with few areas of calcification and necrosis. Lesion is encasing the IVC all around the circumference and bilateral renal vessels.



Case 4 Paraganglioma

Findings: CECT axial images showing large well defined lobulated heterogeneous retroperitoneal mass with haemorrhagic areas.

DISCUSSION

Symptoms due to retroperitoneal tumours are vague and non-specific and present late in course of disease by compression of organs and obstructive phenomena.[6] Diagnosis is made by radiological methods and after histopathological examination and surgery. Diagnosis is often challenging for radiologists.[3]Thus retroperitoneal pathologies are a unique category in diagnostic radiology and need a logical stepwise, feasible approach for diagnosis.

The first step is to characterisetumour location and organ of origin and look for specific features of various retroperitoneal tumours.[3] CT is an easily performed, rapid and safe, diagnostic imaging modality and is highly accurate in determining the organ of origin, characterization and extent of the mass.[7]

This was a prospective study in the Department of Radiodiagnosis, JJMMC, Davangere aimed at studying the role of MDCT in evaluation of retroperitoneal masses.

Pathologies

Out of the 72 patients who were evaluated, 23 cases (32%) were found to be primary retroperitoneal masses. The rest 49 cases (68%) were masses arising from retroperitoneal organs.

Primary retroperitoneal masses: Among the 23 cases of primary retroperitoneal mass lesions, 21 were found to be neoplastic and 2 were non-neoplastic lesions. Rest of the lesions weretumours of neurogenic origin, teratoma, psoas abscess and hematoma.

Lymphoma: Lymphomas accounted for 43.5% and formed the majority among the primary retroperitoneal mass lesions which was consistent with findings of the study by Chaudhari*et al*.[8]

Rajiah *et al* described lymphomas at CT as well defined homogenous masses with mild homogeneous enhancement spreading between normal structures without compressing them. The study also described the anterior displacement of aorta and IVC producing the classical floating aorta/ CT angiogram sign. It is also stated that calcifications and necrosis are unusual before therapy. [1]

In our study, we found that out of the 10 cases of lymphomas, 6 had well defined lobulated margins, and majority of 8 of them showed the classical floating aorta sign and vascular encasement. On post contrast study, 6 showed mild homogeneous enhancement and rest showed heterogeneous. Only 2 cases showed necrosis.

Mesodermal tumors: In our study, the 2nd largest group was mesodermal neoplasm forming 26% (6 cases) with liposarcoma being the most common. This is consistent with the study by Rajiah *et al*. Liposarcoma showed thick, irregular, and nodular septa. On post contrast study, they showed enhancement. These features help in differentiating it from lipoma as described above.[1]

The study included a case of leiomyosarcoma which was ill defined heterogeneous mass with extensive area of necrosis and extending into the surrounding vasculature and associated IVC thrombosis. This finding is consistent with that found in the article by Rajiah *et al*. Which describes leiomyosarcoma to arise from combination of extravascular and intravascular components. The extensive area of necrosis with adjacent vascular involvement found in the lesion points towards the diagnosis of leiomyosarcoma.[1]

Neurogenic tumors: Four cases in the study diagnosed as primary retroperitoneal masses on CT were confirmed to be neurogenic tumors on histopathological examination. Among them two cases were of schwannoma, one each of neurofibroma and paraganglioma.

The mass diagnosed as schwannoma appeared as a well defined homogenous mass in the paravertebral region with heterogeneous enhancement on post contrast study.

Paraganglioma was seen as a large well-defined lobulated mass with haemorrhage and intense enhancement on post contrast study suggesting hypervascularity of the tumor, the finding of which is consistent with the description by Rajiah *et al*. [1]

***Germ cell tumor*:** The retroperitoneal teratoma in this study appeared as a complex mass that contained multiple well-circumscribed fluid components, fat, and calcification in a tooth like configuration. This was consistent with the characteristic imaging features of teratoma as described by Shin *et al*.[9] The non -neoplastic primary retroperitoneal masses included psoas abscess and hematoma.

Masses arising from retroperitoneal organs

In our study, the retroperitoneal masses were of pancreatic, adrenal, renal and aortic origin.

Out of the 19 masses of pancreatic origin, 10 were of pseudocysts, 5 were of adenocarcinoma, 2 each of serous and mucinous cystadenomas. Pancreatic pseudocysts showed variable presentations with two of them showing splenic and portal vein thrombosis. And one case being associated with pancreatico-pleural fistula.

Renal lesions consisted 7 cases of RCC, 2 cases of oncocytoma, 2 cases of Wilms tumour and 2 cases of angiomyolipoma. Out of the 7 cases of RCC that were included in the study, 5 showed embedded organ sign, one showed beak sign, and the other showed both embedded organ & beak sign. 2 cases had distant metastasis. One of the two cases of renal tumors diagnosed on HPE showed central stellate scar.

Adrenal lesions consisted of 4 cases of adenoma, 2 of metastasis, 1 of carcinoma, 2 of neuroblastoma and 1 of myelolipoma. Of the four adrenal adenomas, 3 showed HU value of less than 10. While one lesion of HU value of around 20 showed washout of >60% on delayed study, findings consistent with the findings of adrenal adenoma. All the adrenal adenomas showed phantom sign. Both the adrenal metastatic lesions were found to be from primary lung malignancy.

Both the cases of neuroblastoma included in the study were seen in paediatric age group. On CT, both were seen as heterogeneous masses with calcifications. One of which showed embedded organ sign while the other showed floating aorta sign in addition to it along with distant metastasis.

The case of adrenal myelolioma in the study was a heterogeneous mass with areas of fat and enhancing soft tissue, consistent with description of adrenal myelolipomas by Rajiah*et al*.[1]

CONCLUSION

To most clinicians and radiologists, the retroperitoneum was merely a diffuse vague space located between the posterior peritoneum and posterior abdominal wall, which gets affected by few pathologies.[1] Symptoms due to retroperitoneal pathologies are vague and non-specific and present late in course of disease by compression of organs and obstructive phenomena.[6] Today with detailed visualization of this area by CT scanning , the anatomy and facial boundaries can be explained and visualised better.[1]

Thus, the diagnosis of this unique category in diagnostic radiology has become feasible with logical stepwise approach using MDCT. The first step being identification of the mass as a retroperitoneal mass and the organ of origin based on specific imaging signs. Next steps being the identification of specific patterns of spread and characteristic tumour components

The present study concludes that using MDCT it is possible to localise, differentiate and diagnose the retroperitoneal masses. It is also possible to evaluate the nature, morphology and extent of the mass and its relationship to adjacent structures.

However, assigning a specific diagnosis for every mass lesion might be difficult, considering the overlapping imaging features, but based on characteristic features and relevant clinical information narrowing of differential diagnosis is possible.

In addition to diagnosing the pathologies, MDCT helps in staging and guided biopsies of the retroperitoneal masses. CT also helps in assessment after radiotherapy or chemotherapy treatment.

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