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Original Research Article

Role of multidetector computed tomography in evaluation of retroperitoneal masses

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ABSTRACT

Background: Diagnostic imaging plays an important role in the evaluation of abdominal masses. Many imaging modalities are available ranging from conventional modalities to the cross-sectional modalities like USG, CT and MRI. The main principles of imaging are to determine the origin of mass, its measurement, extent, characterisation and assessment of its effect on contiguous organs. In the past, the mainstay was conventional imaging modalities like plain radiograph, Gastrointestinal contrast studies and I.V.U. Modern imaging modalities allow an early and accurate pre-operative diagnosis resulting in a higher rate of surgical resection and improvement of survival.
Methods: A Cross-sectional observational study was done in 30 patients. Patients of either sex of any age group who had presented with involvement of retroperitoneal organs detected by routine ultrasound and postoperative patients with recurrence were included in our study.
Results: Ultrasound is the initial imaging modality of choice since it is inexpensive, easy to perform and no radiation exposure. On USG, the retroperitoneal masses are classified as solid or cystic or mixed. Since most of the retroperitoneal masses have hetroechoic/mixed pattern, they cannot be characterized by ultrasound alone and hence need further evaluation.
Conclusions: Multidetector computed tomography is the imaging modality of choice for further evaluation and characterization. CT protocol for evaluation of the retroperitoneum consisted of both non-enhanced and contrast-enhanced scans for localisation and characterisation of the masses. Multiplanar reconstructions allowed the images to be viewed in any plane chosen including a curved plane thus helping in defining the exact location and extent of the lesion. With MIP and volume rendered images, the relationship of the vessels with the mass lesions was clearly visualized.

Keywords: Multidetector computed tomography, Retroperitoneal masses, Diagnostic imaging

INTRODUCTION

The retroperitoneum represents a complex potential space containing multiple vital structures limited anteriorly by the peritoneum, posteriorly by the posterior abdominal wall, superiorly by the 12th rib and vertebra, inferiorly by the base of the sacrum and iliac crest, and laterally by the borders of the quadratus lumbora.

The retroperitoneum is broadly divided into the anterior and posterior pararenal, perirenal, and great vessel spaces. The anterior pararenal space is bordered anteriorly by the posterior parietal peritoneum, posteriorly by the anterior renal fascia (Gerota fascia), and laterally by the lateroconal fascia. The anterior pararenal space is subdivided into the pancreaticoduodenal space, which contains the pancreas

and duodenum, and the pericolonic space, which contains the ascending and descending colon.

The posterior pararenal space is situated between the posterior renal fascia (Zuckerkandl fascia) and the transversalis fascia, whereas the perirenal space is located between the anterior renal fascia and the posterior renal fascia. Below the level of the kidneys, the anterior and posterior pararenal spaces merge to form the infrarenal retroperitoneal space, which communicates inferiorly with the prevesical space and extraperitoneal compartments of the pelvis. Because of loose connective tissue in the retroperitoneum, tumors can have widespread extension before clinical presentation.[1]

The iliopsoas compartment is generally considered to be retroperitoneal even though it is behind the transversalis fascia because it is frequently involved in processes that begin in the retroperitoneum.[2] Several diagnostic modalities can be applied for the evaluation of these mass lesions. The conventional methods include plain radiography, IVU, retroperitoneal lymphography and angiography. Each of these methods has its own advantages disadvantages. The diagnosis of tumours arising from retroperitoneal tissue can be readily accomplished with CT even when they are relatively small. Retroperitoneal masses can be broadly categorized as:

- Primary retroperitoneal masses
- Arising from major retroperitoneal organs.

Tumors arising from retroperitoneal organs

- Pancreatic tumour: carcinoma of pancreas, islet cell tumours, cystadenoma and cystadenocarcinoma,
- Renal tumours: renal cell carcinoma, Wilm's tumor, angiomyolipoma,
- Adrenal tumours: adenomas, adrenal carcinoma, adrenal metastasis.

CT is the primary modality for detection, diagnosis and staging of RCC. Tumour calcification occurs in as many as 31% of cases and may take the form of amorphous internal calcification or curvilinear calcification, which may be peripheral or central.

Others: retroperitoneal lymphadenopathy, neuroblastoma, duodenal carcinoma, colorectal carcinoma, lymphoma, fetus in fetu.

METHODS

This Cross-sectional Observational study was conducted in the Department of Radio-diagnosis at P.G.I.M.E.R and Dr. Ram Manohar Lohia Hospital, New Delhi from 1st November 2016 to 31st March 2018. Patients of either sex of any age group who had presented with involvement of retroperitoneal organs detected by routine ultrasound and postoperative patients with recurrence were included in our study. Patients who had history of allergy to intravenous contrast agents, deranged kidney function tests and, pregnant women were excluded from our study.

A written informed consent was taken from all patients. A detailed history was taken with complete physical and systemic examination of the patient. Relevant biochemical investigations were done wherever required.

Ultrasonography

Ultrasound abdomen of the patient was performed as an initial modality in patients with suspected retroperitoneal mass. Ultrasound was performed using 3MHz convex transducer. Acoustic gel was used for skin transducer coupling.

Computed tomography

CT was performed on Philips 40-slice multi-detector scanner (Brilliance). Images were acquired with 1- to 3-mm collimation, and a pitch of up to 2:1 to allow coverage of the area of interest in single breath-hold. Pre-contrast images were obtained to assess the presence of calcification or ossification, macroscopic fat, haemorrhage and cystic or necrotic changes. Arterial phase enhanced images were obtained in few cases to characterise hypervascular retroperitoneal lesions such as paraganglioma. Delayed phase or excretory phase enhanced image were useful for retroperitoneal disease that communicated with the urothelial tract.

RESULTS

The present study was conducted in the Department of Radiodiagnosis, PGIMER, Dr. Ram Manohar Lohia Hospital, New Delhi. A total of 30 cases suspected of having retroperitoneal masses on the basis of clinical profile, prior imaging profile underwent CT examination. The cases encountered in our study were in the age range of 2-75 years. Most common retroperitoneal masses encountered in our study were primary retroperitoneal masses accounting for 43.33% (13/30) of cases. Benign lesions accounted for 33.33% of the study and malignant lesions for 66.66%.

Renal cell carcinoma accounted for majority of renal masses (66.66%) and was associated with a male to female ratio of 5:3. On non-enhanced CT scan all renal carcinoma masses were predominantly hypodense in character and on contrast enhanced scan lesions showed heterogenous enhancement with necrotic areas within (Figure 1A, B and C). Distant metastasis to lung, liver and bones were seen.

Pancreatic carcinoma on CT, was seen as an ill defined poorly enhancing lesion in the region of head and body of pancreas. There was dilation of CBD and pancreatic duct proximal to the mass. The lesion encased the SMV at its junction with the lesion. Pseudocyst of pancreas **(**Figure

2A and 2B), on CT was seen as a well-defined thin walled cystic lesion anterior to body of pancreas. It showed no post contrast enhancement. There was no evidence of calcification, fat, haemorrhage or involvement of any vessel.

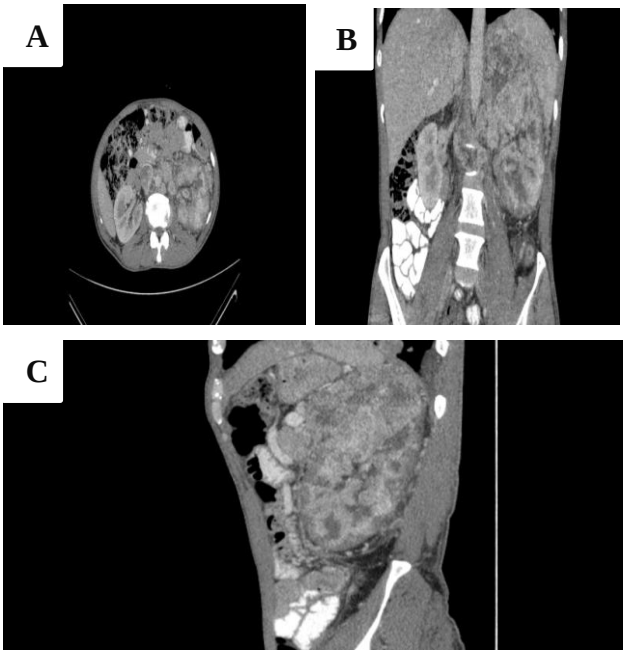

Figure 1: Case of renal cell carcinoma. Contrast enhanced CT abdomen. (A) Axial image. (B) Reformatted coronal image. (C) Reformatted sagittal image. scans show lobulated heterogeneously enhancing soft tissue mass with necrotic areas within.

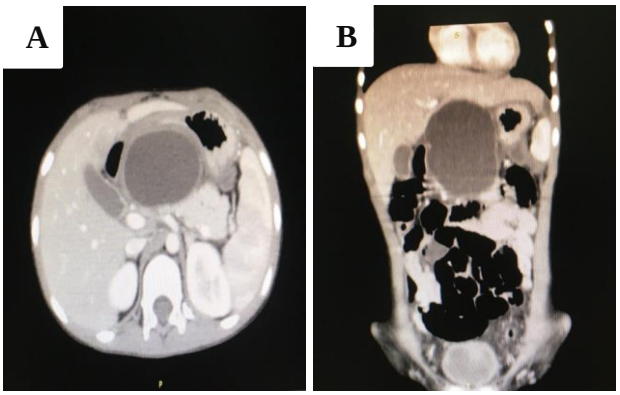

Figure 2: Case of pancreatic pseudocyst. Contrast enhanced CT Abdomen (A) Axial image. (B) Reformatted coronal image.

Maximum cases diagnosed as primary retroperitoneal masses in our study were lymph node masses 23% (3/13). Extragonadal germ cell tumor was noted in a young male with history of testicular neoplasm and presented on CT with a large well defined heterogenous mass. Rretroperitoneal lymphangioma, on CT was seen as a well defined hypodense mass with no enhancement on post contrast scan (Figure 3A, B and C). No evidence of haemorrhage, fat, calcification or lymphadenopathy. Lymphoma presented, on CT, as a large homogenously enhancing mass. It extended upto the anterior abdominal wall and right cardiophrenic angle. Moderate ascites and B/L pleural effusion was noted. No evidence of haemorrhage, fat, calcification.

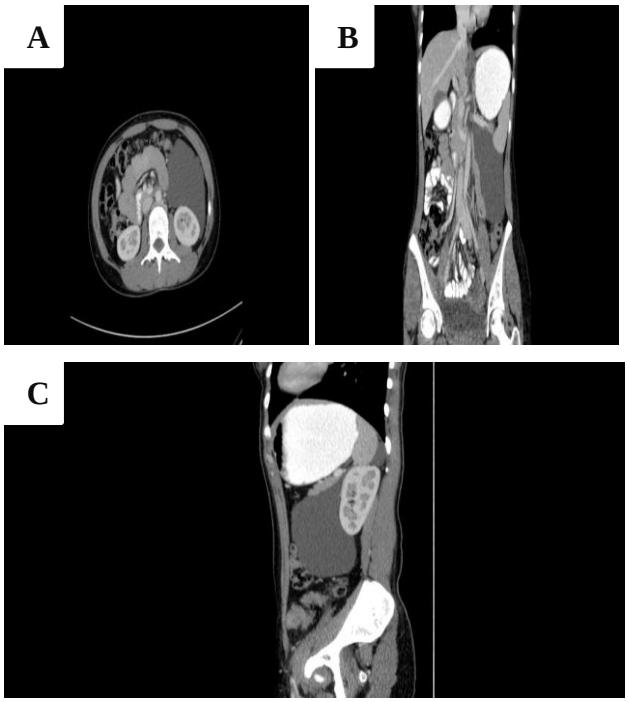

Figure 3: Case of retroperitoneal lymphangioma. Contrast enhanced CT abdomen. (A) Axial image. (B) Reformatted Coronal image. (C) Sagittal image.

DISCUSSION

Multidetector Computed Tomography (MDCT) remains the most widely available and most effective modality for detection and characterisation of retroperitoneal mass. A total of 30 patients were referred to our department with clinically diagnosed retroperitoneal mass or USG detected retroperitoneal masses.

Renal cell carcinoma, on non enhanced scan was seen as hypodense lesion and showed heterogenous post contrast enhancement. Zagoria et al, in 1990 reported that calcifications were visible in 31% of RCCs.[4] Necrosis was noted in 87.5% (7/8) patients. P Hatimota in 2005 showed that necrosis was found in 94% cases of RCC.[5] Tolia BM et al, in 1975 concluded in their study that approximately a quarter to a third of the patients with renal cell carcinoma had evidence of distant metastasis when they were first seen. This was consistent with our study where metastasis was seen in 3/8(37.5%) patients at the time of diagnosis.[6]

Elwira et al, in 2014 reported more than 80% of children are diagnosed with Wilms' tumor below the age of five years, and the median age at diagnosis is 3.5 years which

is consistent with our study.[7] On post contrast scan it showed heterogenous enhancement with necrotic areas within. Raza et al, in 2012 showed six CT features were most diagnostically specific for identifying intrarenal TCCs: tumor centered within the collecting system; focal filling defect in the pelvicalyceal system; preserved renal shape; absence of cystic or necrotic change; homogeneous tumor enhancement; and tumor extension toward the ureteropelvic junction (sensitivity, 68–82%; specificity, 79-89%; AUC, 0.75-0.84).[8] Bosniak et al, in 1988 reported that detecting the existence of fat in a renal lesion will establish the diagnosis of Angiomyolipoma and is the only radiologic finding that can differentiate it from renal cell carcinoma.[9]

Woo S, in 2015 reported that on CT, small Oncocytomas typically appear as solitary, well-demarcated, homogeneously enhancing renal cortical tumors.[10] Adrenal adenoma showed homogenous enhancement the key feature which differentiates benign from malignant was presence of significant intracellular cytoplasmic lipid.[11]

EK Fishman in 1987 reported that adrenal carcinomas exhibited central areas of low attenuation representing tumor necrosis, irregular contrast enhancement, detectable calcification, and a thin, capsule like rim surrounding the tumor.[12]

Pseudocyst pancreas Arkovitz in 1997 reported that Pancreatic trauma occurs in up to 10% of all cases of blunt pediatric trauma and computed tomographic scans, performed with intravenous and oral contrast were 85% sensitive for diagnosing a pancreatic injury.[13]

Kayahara M, in 2000 reported that the paraaortic lymph nodes are frequent sites of metastasis from pancreatic carcinoma. 76% with carcinoma in the pancreatic head 83% with carcinoma of the pancreatic body and tail had lymph node involvement.[14] Lee ES, in 2014 reported that MDCT has shown the best performance for the evaluation of vascular involvement, which is the most important factor for predicting the tumor resectability.[15]

Primary retroperitoneal masses primary retroperitoneal masses constituted maximum patients in our study with lymph node mass (23%) being the maximum. Liposarcoma: Liposarcoma, on CT it presented as a large (21cm), ill defined heterogenous mass. It showed mild enhancement on post contrast scan. Gebhard in 2002 reported in their study that the tumor size ranged from 2 to 23 cm (median 10).[16] Calcification or ossification was seen in 30% on unenhanced CT in patients with liposarcoma.[17] Megibow AJ, in 1985 reported in their study that the sarcomas were larger (average 12cm) had an irregular shape and had a nonhomogeneous appearance both before and after contrast enhancement. Central zones of low density were surrounded by variable thicknesses of soft-tissue-density material.[18]

Goldstein et al, in 2004 described that paraganglioma may be functional in upto 60% of the patients and may cause chronic or intermittent hypertension, headaches or palpitations however in our study both cases presented with hypertension.[19]

On CT a well-defined hypodense mass was seen. Hayasaka K et al, in 1994 stated that lymphangioma showed water density which is consistent with our study.[20]

Lymphoma was diagnosed in one case which presented on CT as a large homogenously enhancing mass. The mass insinuated and encased abdominal vessels without any compression or thrombosis.

CONCLUSION

Retroperitoneum is complex in its anatomy and radiological investigations remain the primary mode in evaluating retroperitoneal masses. Retroperitoneal masses have to be classified as primary retroperitoneal masses or those arising from the retroperitoneal organs. Ultrasound is the initial modality used as it is inexpensive, easy to perform and has no radiation exposure. USG can comment on the nature of the lesion whether solid or cystic or mixed but characterization of the lesion is best by multidetector computed tomography.

MDCT is the modality of choice for further evaluation and characterization. It has the advantage of depicting the organ of origin, extent of the lesion, surrounding organ/tissue invasion, assessment of lymph nodes, intraspinal extensions and distant metastasis thereby helping in correct diagnosis and staging of malignant lesions. The disadvantages of MDCT is that some retroperitoneal malignant mesenchymal tumors having overlapping features like leiomyosarcoma and pleomorphic liposarcoma where little or no fat is seen, cannot be clearly differentiated on CT.

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REFERENCES

1. Rajiah P, Sinha R, Cuevas C, J Dubinsky T, Bush W, Kolokythas O. Imaging of uncommon retroperitoneal masses. Radiogr Rev Publ Radiol Soc N Am Inc. 2011 Jul 1;31:949-76.
2. Coffin A, Boulay-Coletta I, Sebbag-Sfez D, Zins M. Radioanatomy of the retroperitoneal space. Diagn Inter Imaging. 2015 Feb 1;96(2):171-86.

3. Shaaban AM, Rezvani M, Tubay M, Elsayes KM, Woodward PJ, Menias CO. Fat-containing Retroperitoneal Lesions: Imaging Characteristics, Localization, and Differential Diagnosis. Radio Graphics. 2016 May 1;36(3):710-34.
4. Zagoria RJ, Wolfman NT, Karstaedt N, Hinn GC, Dyer RB, Chen YM. CT features of renal cell carcinoma with emphasis on relation to tumor size. Invest Radiol. 1990 Mar;25(3):261-6.
5. Hatimota P, Vashist S, Aggarwal K, Kapoor A, Gupta NP. Spectrum of US and CT findings in renal neoplasms with pathologic correlation. Indian J Radiol Imaging. 2005 Feb 1;15(1):117.
6. Tolia BM, Whitmore WF. Solitary metastasis from renal cell carcinoma. J Urol. 1975 Dec 1;114(6):836-8.
7. Szychot E, Apps J, Pritchard-Jones K. Wilms' tumor: biology, diagnosis and treatment. Trans Pediatr. 2014 Jan;3(1):12-24.
8. Raza SA, Sohaib SA, Sahdev A, Bharwani N, Heenan S, Verma H, et al. Centrally infiltrating renal masses on CT: differentiating intrarenal transitional cell carcinoma from centrally located renal cell carcinoma. Am J Roentgenol. 2012 Apr 1;198(4):846-53.
9. Bosniak M, Megibow A, Hulnick D, Horii S, Raghavendra B. CT diagnosis of renal angiomyolipoma: the importance of detecting small amounts of fat. Am J Roentgenol. 1988 Sep 1;151(3):497-501.
10. Woo S, Cho JY. Imaging Findings of Common Benign Renal Tumors in the Era of Small Renal Masses: Differential Diagnosis from Small Renal Cell Carcinoma: Current Status and Future Perspectives. Korean J Radiol. 2015;16(1):99-113.
11. Korobkin M, Brodeur FJ, Yutzy GG, Francis IR, Quint LE, Dunnick NR, et al. Differentiation of adrenal adenomas from nonadenomas using CT attenuation values. AJR Am J Roentgenol. 1996 Mar;166(3):531-6.
12. Fishman E, Deutch B, Hartman D, Goldman S, Zerhouni E, Siegelman S. Primary adrenocortical carcinoma: CT evaluation with clinical correlation. Am J Roentgenol. 1987 Mar 1;148(3):531-5.
13. Arkovitz MS, Johnson N, Garcia VF. Pancreatic Trauma in Children: Mechanisms of Injury. J Trauma Acute Care Surg. 1997 Jan;42(1):49.
14. Kayahara Masato, Nagakawa Takukazu, Ohta Tetsuo, Kitagawa Hirohisa, Ueno Keiichi, Tajima Hidehiro, et al. Analysis of paraaortic lymph node involvement in pancreatic carcinoma. Cancer. 2000 Nov 19;85(3):583-90.
15. Lee ES, Lee JM. Imaging diagnosis of pancreatic cancer: A state-of-the-art review. World J Gastroenterol WJG. 2014 Jun 28;20(24):7864-77.
16. Gebhard S, Coindre JM, Michels JJ, Terrier P, Bertrand G, Trassard M, et al. Pleomorphic liposarcoma:clinicopathologic,immunohistochemical, and follow-up analysis of 63 cases: a study from the French Federation of Cancer Centers Sarcoma Group. Am J Surg Pathol. 2002 May 1;26(5):601-16.
17. Tateishi U, Hasegawa T, Beppu Y, Satake M, Moriyama N. Primary dedifferentiated liposarcoma of the retroperitoneum: prognostic significance of computed tomography and magnetic resonance imaging features. J Comput Assist Tomogr. 2003 Oct;27(5):799.
18. Megibow A, Balthazar E, Hulnick D, Naidich D, Bosniak M. CT evaluation of gastrointestinal leiomyomas and leiomyosarcomas. Am J Roentgenol. 1985 Apr 1;144(4):727-31.
19. Erickson D, Kudva YC, Ebersold MJ, Thompson GB, Grant CS, Heerden V, et al. Benign paragangliomas: clinical presentation and treatment outcomes in 236 patients. J Clin Endocrinol Metab. 2001 Nov 1;86(11):5210-6.
20. Hayasaka K, Yamada T, Saitoh Y, Yoshikawa D, Aburano T, Hashimoto H, et al. CT evaluation of primary benign retroperitoneal tumor. Radiat Med. 1994;12(3):115-20.

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