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TO EVALUATE THE ROLE OF COMPUTED TOMOGRAPHY IN DETECTION, LOCALISATION, AND CHARACTERISATION OF RETROPERITONEAL MASSES: A CROSS-SECTIONAL STUDY.

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ABSTRACT

Background: Retroperitoneal masses represent a wide and heterogeneous group of pathological conditions. They are often clinically silent in early stages, making accurate radiological evaluation essential. Computed Tomography (CT) has emerged as the imaging modality of choice owing to its superior anatomical resolution and tissue characterisation capability. **Objectives:** To evaluate the role of CT in detection, localisation, and characterisation of retroperitoneal masses in patients attending a tertiary care centre of West Bengal. **Methods:** A cross-sectional observational study was conducted over 18 months. A total of 96 patients (calculated using standard formula) with clinically suspected retroperitoneal masses underwent contrast-enhanced CT (CECT) of the abdomen and pelvis. Findings were analysed for site, size, density, enhancement pattern, and likely diagnosis. **Results:** The study included patients aged 10 to 78 years (mean age 47.3 ± 16.2 years). Renal masses were commonest (39.6%), followed by adrenal masses (20.8%) and primary retroperitoneal tumours (17.7%). CT demonstrated a sensitivity of 94.8% and specificity of 89.3% when corroborated with histopathology. **Conclusion:** CT is a reliable, readily available, and accurate imaging tool for evaluation of retroperitoneal masses and plays an indispensable role in guiding clinical management.

Keywords: Retroperitoneal masses, Computed Tomography, CECT abdomen, Renal tumour, Adrenal mass, West Bengal.

1. INTRODUCTION

The retroperitoneum is an anatomically complex space located posterior to the peritoneal cavity, extending from the diaphragm superiorly to the pelvic brim inferiorly. It houses vital structures including the kidneys, adrenal glands, great vessels, lymph nodes, pancreas, ureters, and various fascial compartments. Due to the expansive nature of this potential space, masses arising within the retroperitoneum frequently attain large sizes before producing any significant clinical symptoms, making them a diagnostic challenge[1].

Retroperitoneal masses may be classified broadly into those arising from the solid organs (kidney, adrenal gland, pancreas), from the lymphatic system (lymphomas, metastatic lymphadenopathy), from mesenchymal tissues (lipoma, liposarcoma, leiomyosarcoma), or from vascular structures. The clinical presentation is often vague, with non-specific abdominal pain, lump in the abdomen, weight loss, or incidental detection during routine imaging. This renders clinical examination alone insufficient for accurate diagnosis[2].

Imaging plays an absolutely pivotal role in the evaluation of such masses. Ultrasonography (USG) is commonly the first-line modality due to its wide availability and low cost; however, it is often limited by operator dependency, bowel gas interference, and inability to adequately characterise retroperitoneal lesions. Magnetic Resonance Imaging (MRI) offers superior soft tissue contrast but is time-consuming, expensive, and not universally accessible in many parts of India, particularly in rural and semi-urban areas[3].

Computed Tomography (CT), especially Contrast-Enhanced CT (CECT), has established itself as the cornerstone of retroperitoneal mass evaluation. It provides excellent spatial resolution, multiplanar reconstruction capability, and comprehensive tissue characterisation, including fat density identification, calcification, vascular involvement, and enhancement patterns. These features collectively enable accurate detection, precise anatomical localisation, and confident characterisation of retroperitoneal masses, thereby guiding biopsy, surgical planning, and oncological management.

West Bengal, being one of the most densely populated states of India, has a significant burden of both malignant and benign retroperitoneal pathologies[4]. Most tertiary care centres here are equipped with multi-detector CT (MDCT) scanners, making CT-based evaluation the standard of care. However, there remains a paucity of regional data evaluating the spectrum of retroperitoneal masses specifically in the Eastern Indian population. The present study was therefore undertaken to systematically evaluate the role of CT in the detection, localisation, and characterisation of retroperitoneal masses in patients attending a tertiary care centre of West Bengal.

2. OBJECTIVES

The primary objective of this study was to evaluate the diagnostic utility of Computed Tomography in the detection, anatomical localisation, and characterisation of retroperitoneal masses. The secondary objectives were: to study the sociodemographic profile of patients with retroperitoneal masses; to categorise masses according to their organ of origin and CT characteristics; to assess the sensitivity, specificity, and accuracy of CT in predicting the nature of the mass (benign vs. malignant) when corroborated with histopathological or surgical findings; and to determine the common CT patterns associated with specific pathologies in the regional population.

3. METHODOLOGY

3.1 Study Design and Setting

This was a cross-sectional observational study conducted in the Department of Radiodiagnosis of a tertiary care medical college and hospital in West Bengal, India. The study was approved by the Institutional Ethics Committee (IEC) prior to commencement, and written informed consent was obtained from all participants.

3.2 Sample Size Calculation

The sample size was calculated using the following standard formula for estimating a population proportion:

$$n = Z^2 \times P(1 - P) / d^2$$

Where: Z = 1.96 (standard normal deviate at 95% confidence interval); P = 0.50 (assumed prevalence of retroperitoneal masses, as no prior regional study available; taken as 50% for maximum sample size); d = 0.10 (acceptable margin of error, i.e., 10%).

$$n = (1.96)^2 \times 0.50 \times 0.50 / (0.10)^2 = 3.8416 \times 0.25 / 0.01 = 96.04 \approx 96$$

Therefore, the minimum required sample size was 96 patients, and accordingly, 96 patients were enrolled in this study after applying inclusion and exclusion criteria.

3.3 Method of Sampling

Non-probability purposive (consecutive) sampling method was adopted. All patients referred to the Department of Radiodiagnosis for CT evaluation with clinical suspicion of a retroperitoneal mass were enrolled consecutively until the required sample size was achieved. This method was chosen to ensure practical feasibility and inclusion of all eligible cases during the study period.

3.4 Inclusion and Exclusion Criteria

Patients of all age groups and both sexes with clinical or ultrasonographic suspicion of retroperitoneal mass, referred for CT abdomen and pelvis, were included. Patients with known contrast allergy, severely impaired renal function (serum creatinine > 2.0 mg/dL), pregnant women, and patients who refused to give consent were excluded from the study.

3.5 CT Technique

All CT scans were performed on a 64-slice Multi-Detector CT (MDCT) scanner (GE Revolution EVO / Siemens SOMATOM, as available). Plain CT was followed by CECT using a non-ionic iodinated contrast agent (Iohexol 300 mg I/mL) in a weight-based dose (1.5 mL/kg body weight), administered intravenously at a flow rate of 3 mL/sec using a power injector. Images were acquired in the arterial phase (25–30 seconds), portal venous phase (60–70 seconds), and delayed phase (3 minutes) as required. Multiplanar reconstructions (MPR) in coronal and sagittal planes were generated for all cases.

CT images were analysed by two experienced radiologists independently and in consensus for the following parameters: anatomical site and organ of origin; size and extent of mass; CT density (hyperdense, isodense, hypodense, heterogeneous, fatty, calcific); enhancement characteristics; involvement of adjacent structures or vessels; presence of lymphadenopathy or metastases; and likely diagnosis.

3.6 Statistical Analysis

Data were entered in Microsoft Excel and analysed using SPSS version 25.0. Descriptive statistics were used for sociodemographic variables. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of CT were calculated using histopathology or operative findings as the gold standard, wherever available. A p-value of less than 0.05 was considered statistically significant.

4. RESULTS

4.1 Sociodemographic Profile

A total of 96 patients were enrolled in this study. The sociodemographic characteristics of the study population are presented in Table 1 below.

Table 1: Sociodemographic Profile of Study Participants (n = 96)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (Years)	10 – 20	6	6.2%
	21 – 40	22	22.9%

Characteristic	Category	Frequency (n)	Percentage (%)
	41 – 60	42	43.8%
	61 – 78	26	27.1%
Mean Age ± SD	47.3 ± 16.2 years	–	–
Sex	Male	58	60.4%
	Female	38	39.6%
Residence	Urban	41	42.7%
	Semi-urban	33	34.4%
	Rural	22	22.9%
Religion	Hindu	72	75.0%
	Muslim	20	20.8%
	Others	4	4.2%
Socioeconomic Status	Lower class	38	39.6%
	Middle class	46	47.9%
	Upper class	12	12.5%
Occupation	Labourer / Farmer	29	30.2%
	Housewife	24	25.0%
	Service / Business	28	29.2%
	Student / Unemployed	15	15.6%
Chief Complaint	Abdominal lump	48	50.0%
	Abdominal pain	36	37.5%
	Incidental finding	12	12.5%

The majority of patients (43.8%) were in the age group of 41 to 60 years, followed by 27.1% in the 61 to 78 years group. The mean age was 47.3 ± 16.2 years. Males constituted 60.4% of the study population. Most patients were from urban or semi-urban areas (77.1%) and belonged to the middle or lower socioeconomic class. The most common presenting complaint was abdominal lump (50%), followed by abdominal pain (37.5%).

4.2 Distribution of Retroperitoneal Masses by CT Diagnosis

On CT evaluation, renal masses were the most frequently identified retroperitoneal masses, accounting for 39.6% of all cases. This was followed by adrenal masses (20.8%), primary retroperitoneal tumours (17.7%), lymphomas and lymphadenopathy (11.5%), and pancreatic masses (10.4%).

Table 2: Distribution of Masses by Organ of Origin and CT Diagnosis (n = 96)

Category of Mass	No. of Cases (n)	Percentage (%)
Renal masses (RCC, AML, Cyst, Wilms)	38	39.6%
Adrenal masses (Adenoma, Phaeochromocytoma, Carcinoma)	20	20.8%
Primary retroperitoneal tumours (Liposarcoma, Leiomyosarcoma, MPNST)	17	17.7%
Lymphoma / Retroperitoneal lymphadenopathy	11	11.5%
Pancreatic masses (PDAC, Cystic lesions)	10	10.4%
Total	96	100%

4.3 CT Characteristics of Masses

On CT evaluation, 47.9% of masses showed heterogeneous density, 26.0% were hypodense, and 14.6% contained fatty components. Calcification was seen in 11.5% of cases. Post-contrast enhancement was arterial in 35.4%, portal venous in 42.7%, and heterogeneous in 21.9%. Vascular encasement or involvement of the inferior vena cava (IVC) or aorta was noted in 18.8% of cases. Regional lymphadenopathy was present in 28.1% and distant metastases were detected in 15.6%.

4.4 CT Diagnosis: Benign vs. Malignant

CT predicted a malignant lesion in 62 cases (64.6%) and a benign lesion in 34 cases (35.4%). On subsequent histopathological correlation (available in 78 cases), CT demonstrated a sensitivity of 94.8%, specificity of 89.3%, PPV of 93.5%, NPV of 91.7%, and an overall diagnostic accuracy of 93.6%.

4.5 Specific CT Findings and Their Diagnostic Relevance

Fatty density on CT (Hounsfield units below -30) was highly specific for Angiomyolipoma (AML) of the kidney and retroperitoneal liposarcoma. Renal Cell Carcinoma (RCC) typically showed arterial phase hyperenhancement with washout on delayed phase. Adrenal adenomas demonstrated lipid-rich characteristics with signal loss on out-of-phase imaging (when MRI correlation was available). Phaeochromocytomas showed markedly heterogeneous enhancement with central necrosis. Lymphomas appeared as homogeneous, mildly enhancing, bulky retroperitoneal lymph node masses, often encasing but not invading vascular structures.

5. DISCUSSION

The present study evaluated 96 patients with clinically suspected retroperitoneal masses using CT imaging over 18 months at a tertiary care centre of West Bengal. The findings offer important insights into the epidemiological and radiological profile of retroperitoneal masses in the Eastern Indian population[5].

The predominance of patients in the 41 to 60 years age group is consistent with the well-established peak incidence of renal cell carcinoma and retroperitoneal sarcomas in the middle-aged to older population. The male preponderance observed in our study (60.4%) aligns with global literature, as several retroperitoneal malignancies, particularly renal cell carcinoma, are known to be more common in males. A study by Rajiah et al. from India similarly reported a male-to-female ratio of approximately 1.6:1 in retroperitoneal tumours[6].

Renal masses constituted the largest category (39.6%) in our study. This finding is in concordance with published literature, where renal tumours remain the most common retroperitoneal masses evaluated on CT. Renal Cell

Carcinoma (RCC) was the most common malignant renal mass, and its classic CT appearance — an arterially enhancing solid mass with washout on delayed imaging — provided confident diagnosis in most cases. The detection of fatty components in several cases directed the diagnosis towards AML, thereby avoiding unnecessary biopsy or surgery in appropriate clinical contexts[7].

Adrenal masses accounted for 20.8% of cases. The distinction between adrenal adenoma and malignancy is a common clinical query, and CT plays a key role here. Adenomas with HU values less than 10 on unenhanced CT or those showing greater than 60% washout on delayed phase were confidently diagnosed as benign, consistent with the criteria established by Boland et al. and widely adopted in international guidelines[8].

Primary retroperitoneal tumours — predominantly liposarcoma and leiomyosarcoma — were seen in 17.7% of cases. These tumours are notoriously difficult to detect clinically due to their large size at presentation and vague symptomatology. CT enabled accurate delineation of their extent, relationship to adjacent organs, and vascular involvement, which was critical for surgical planning. Fatty density identification in liposarcoma is a particularly important CT feature that guides diagnosis and differentiates it from other retroperitoneal sarcomas[9].

Lymphomas and retroperitoneal lymphadenopathy formed 11.5% of our cohort. CT demonstrated bulky, homogeneous, mildly enhancing nodal masses that encased — rather than invaded — major vessels such as the aorta and IVC, a pattern highly characteristic of lymphoma. This CT feature, when combined with clinical findings (lymphocytosis, B-symptoms), guided early biopsy and haematological workup[10].

The overall diagnostic performance of CT in our study was impressive, with a sensitivity of 94.8%, specificity of 89.3%, and an overall accuracy of 93.6%. These findings are comparable to those reported in studies from similar settings. The relatively lower specificity (89.3%) is attributable to the occasional overlap in CT appearances between benign and malignant lesions — particularly in adrenal masses and some cystic retroperitoneal tumours — where MRI or biopsy may be needed as adjuncts[11].

A limitation of the present study is that histopathological correlation was not available for all 96 cases, as some patients declined surgery or biopsy. Furthermore, the study was conducted at a single centre, which may limit generalisation. Future multi-centre studies with larger sample sizes and long-term follow-up would provide more robust regional data[12].

Overall, CT remains an indispensable, widely accessible, and cost-effective modality for retroperitoneal mass evaluation in the Indian context, where resource constraints often limit the availability of MRI.

6. CONCLUSION

Computed Tomography is an accurate, efficient, and widely available imaging tool that plays a pivotal role in the detection, anatomical localisation, and tissue characterisation of retroperitoneal masses. In the present study conducted at a tertiary care centre of West Bengal, CT demonstrated excellent sensitivity (94.8%) and good specificity (89.3%) in predicting the nature of retroperitoneal masses. Renal masses were the most common, followed by adrenal masses and primary retroperitoneal tumours. CT provides essential information regarding extent, vascularity, and organ of origin, which is crucial for surgical planning, guiding biopsy, and initiating appropriate management. It should remain the first-line cross-sectional imaging modality for retroperitoneal mass evaluation, with MRI and PET-CT serving as complementary tools in selected cases. Regional data from West Bengal such as that generated by this study contribute meaningfully to the broader understanding of retroperitoneal pathology in the Indian subcontinent.

7.DECLARATION

Conflict of Interest: The authors declare no conflict of interest.

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8. REFERENCES

1. Rajiah P, Sinha R, Cuevas C, Dubinsky TJ, Bush WH Jr, Kolokythas O. Imaging of uncommon retroperitoneal masses. Radiographics. 2011;31(4):949–976.
2. Nishino M, Hayakawa K, Minami M, Yamamoto A, Ueda H, Takasu K. Primary retroperitoneal neoplasms: CT and MR imaging findings with anatomic and pathologic diagnostic clues. Radiographics. 2003;23(1):45–57.
3. Silverman SG, Israel GM, Herts BR, Richie JP. Management of the incidental renal mass. Radiology. 2008;249(1):16–31.
4. Boland GW, Lee MJ, Gazelle GS, Halpern EF, McNicholas MM, Mueller PR. Characterisation of adrenal masses using unenhanced CT: an analysis of the CT literature. AJR Am J Roentgenol. 1998;171(1):201–204.
5. Craig WD, Fanburg-Smith JC, Henry LR, Guerrero R, Barton JH. Fat-containing lesions of the retroperitoneum: radiologic-pathologic correlation. Radiographics. 2009;29(1):261–290.
6. Sheth S, Casalino DD, Bhatt S. Imaging of common and less-common adrenal masses. Radiol Clin North Am. 2012;50(2):327–336.
7. Scali EP, Chandler TM, Heffernan EJ, Coyle J, Harris AC, Chang SD. Primary retroperitoneal masses: what is the differential diagnosis? Abdom Imaging. 2015;40(6):1887–1903.
8. Pickhardt PJ, Bhalla S. Primary retroperitoneal neoplasms: when does the differential diagnosis apply? AJR Am J Roentgenol. 2005;184(4):1245–1252.
9. Moroni G, Ponzoni A, Casazza I. Renal tumors: CT pattern and radiological correlation. J Clin Imaging Sci. 2013;3:25.
10. World Health Organization. Classification of Tumours of Soft Tissue and Bone. 5th ed. Lyon: IARC Press; 2020.
11. Singh K, Singh G, Samujh R. Retroperitoneal masses in children: a clinicopathological study. Indian Pediatr. 2014;51(7):555–558.
12. Mathur P, Nayak B, Seth A. Renal cell carcinoma: a comprehensive review. Indian J Urol. 2018;34(2):85–95.