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**Original Research Article**

# Role of computed tomography scan in diagnosis of retroperitoneal masses

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## ABSTRACT

**Background:** In the vast and ever-expanding field of surgery there are only few subjects which have provoked controversy; curiosity related to correct management of patients suffering from various condition of the abdomen. This becomes very true when the patient has a retroperitoneal mass clinically. The problem of retroperitoneal mass was intriguing, fascinating and certainly most perplexing. The present study was planned with the objective to study the various clinical presentations of retroperitoneal mass, and their radiological findings, and co-relation between these various findings.
**Methods:** This was a prospective, cross-sectional study. The study included 30 patients clinically diagnosed having retroperitoneal mass, attending the department of general surgery.
**Results:** The most common affected age group was of 40-50 years (9, 30.00%). The most frequent presenting symptoms were abdominal lump (28, 93.33%). Pallor was the commonest clinical sign (20, 66.67%). Retroperitoneal lymph node masses were the commonest (12, 40.00%) malignant lesions. Retroperitoneal lymphadenopathy was the most common lesion.
**Conclusions:** The retroperitoneum has long been an area poorly visualised by conventional radiographic techniques and in this respect, computed tomography scan has great advantages over other modalities. Hence the modern surgeon should no longer be considered a 'shadow-gazer' but an anatomist *in-vivo*.

**Keywords:** Computed tomography scan, Diagnosis, Retroperitoneal mass

## INTRODUCTION

Retroperitoneal space may be defined as the area between the peritoneum and posterior wall of the abdominal cavity.[1] It is bounded above by the diaphragm below by the pelvic brim, laterally it extends to the tips of the twelfth ribs.[1] Retroperitoneal masses constitute a heterogeneous group of lesions, originating in the retroperitoneal spaces.[2] The majority of tumours that arise in the retroperitoneal compartment derive from the major retroperitoneal organs like pancreas, kidneys and adrenals.[3] Other tumours may be lymphoma, sarcoma, rhabdomyosarcoma as well as those arising from connective tissue, fat, fascia and metastases.[3]

Among various retroperitoneal masses, the majority cases are of malignant tumours, and among them approximately 75% are of mesenchymal in origin.[4,5] Though they can affect any age, such tumours are commonly prevalent in adults.[5] Retroperitoneal masses can be classified as primary, when they are originated from tissues other than organs such as the kidneys, adrenal glands, pancreas, or bowel loops.[6] They can be further categorized as solid or cystic, based on their appearance on imaging.[7] Depending on the origin, solid

tumours can be divided into four groups mesenchymal, neural, germ cell and lymphoproliferative.[4] Among the cystic tumours, the commonest are lymphangioma and cystic mesothelioma.[4,8,9] There are also non-neoplastic lesions, primarily retroperitoneal fibrosis, non-Langerhans histiocytosis, and extramedullary hemato-poiesis.[10]

In the vast and ever-expanding field of surgery there are only few subjects which have provoked controversy; curiosity related to correct management of patients suffering from various condition of the abdomen. This becomes very true when the patient has a retroperitoneal mass clinically. The problem of retroperitoneal mass was intriguing, fascinating and certainly most perplexing in the past when the facility of radiodiagnosis was not available and the final diagnosis was made after exploratory laparotomy.[11] With the advent and advances in the field of radiological and imaging techniques, the diagnosis of retroperitoneal mass can be made with greater accuracy than previous years. The better diagnostic facilities like ultrasonography, computed tomography (CT) scan and magnetic resonance imaging (MRI) shows mass lesions directly in their entirety.[10]

The advent of CT scan had made it possible to assess the relation of any neoplasm to its neighboring structures, as well as lymph node metastases.[12] The facility to demonstrate the size, shape and position of the normal pancreas is helpful by CT scan.[13] Increase in size, irregularity of outline, heterogenicity of density and loss of mobility are all imply diseases.[13] Demonstration of the extent and location of pseudocyst in relation to adjacent viscera is valuable preoperative information.[14] Carcinoma of the head of pancreas or body of pancreas is commonly identified by CT scan as a localised hypodense mass of variable attenuation distorting the local anatomy.[13] Tumour extension beyond the confines of pancreas to encase adjacent vascular structures can be assessed with intravenous contrast infusion. The only reliable evidence of malignancy in the presents of a pancreatic mass is the detection of focal intrahepatic lesions and enlarge lymph nodes.[13]

CT scan has proved the most useful and most widely accepted newer imaging techniques, since it provides an accurate diagnosis in all but tiniest of adrenal ours.[15] CT is excellent for diagnosing pheochromocytoma. For neuroblastoma, will not only delineate the tumour but may also yield information about invasion adjacent tissue or organs.[15] In the investigation of renal mass the main advantage of CT scanning are ability to demonstrate direct extra renal extension and venous involvement, it can demonstrate small masses and in particular, anterior and posterior subcapsular masses when the urogram is normal, ability to demonstrate metastatic deposits in the lymph glands liver and lungs, in cystic diseases, ability to demonstrate the presence of associated cystic diseases of liver, pancreas and it has better resolution than USG and is less dependent on the skill of the operator.[16]

CT scan gives a very accurate anatomic definition of the size and position of the retroperitoneal tumours e.g. lymph node metastasis, lymphomas fibrosarcoma, rhabdomyosarcoma, leiomyoma.[10] CT scan can give the exact extent and adjacent organ involvement for retroperitoneal tumours. For non-Hodgkin's lymphoma CT scan alone is adequate.[10] Within short span, CT scan there have been rapid technical advances, which has provided us with high quality images but at a substantially increased cost.

With this background, the present study was an attempt to study the various clinical presentations of retroperitoneal mass, and their radiological findings, and co-relation between these various findings.

## METHODS

This was a prospective, cross-sectional study, carried out Department of General Surgery, NAMO Medical Education and Research Institute, Silvassa, U.T. of Dadra and Nagar Haveli from March 2019 to December 2019. The research protocol was presented and approved by the Institutional Ethics Committee. The study included 30 patients clinically diagnosed having retroperitoneal mass, attending the department of general surgery.

### *Inclusion criteria*

The patients with retroperitoneal mass irrespective of age, sex, caste, religion, socio-economic status, duration and severity of illness were included in this study.

### *Exclusion criteria*

The patients who were not willing for treatment and follow-up, patients with life threatening morbidities and pregnant women were excluded.

Patients was recruited in the study on pro-rata basis and all the patients participating in the study were explained clearly about the purpose and nature of the study in the language they can understand and written informed consent was taken before including them in the study. Patients with clinical suspicion of having retroperitoneal masses were further evaluated with CT scan. Whenever possible, patients were further evaluated by fine needle aspiration cytology, biopsy, and/or other operative procedure for comparison. The CT scan examinations were performed using a Philips Tomoscan Cx/Q machine which is a 3rd generation CT scanner manufactured in 1991.The scanning gantry consists of an X-ray source that produces a highly collimated fan-shaped beam mounted opposite an array of 30 Sodium crystalline detectors. The X-ray source and detectors rotate around the patient at 10 increments for a total of 180, with a linear transverse scan occurring at each of the 18 rotational points. A single scan, completes in 20 seconds; producing one tomographic slice. The information obtained during each scan is processed by a computer,

and the reconstructed image is presented on a television monitor for viewing and photographic recording. Each tomographic section produced is formed by a series of picture elements representing the absorption coefficient of a volume of tissue 1×1×10 mm for the 10-inch scanning circle.

The 80,000 individual picture elements are assembled and displayed in the form of a circular matrix with a diameter of 320 picture elements. Even though each picture element is displayed in two dimensions as an area lxl mm, the absorption coefficient depicted actually represents a volume of tissue 10 mm deep. The reconstructed image can be recorded on films and can be changed on the display of console to permit a selective display of any particular absorption value from the wide spectrum of values obtained during a scan.

The examination is carefully planned in advance and a decision is made regarding the location, number and thickness of slices to be made. Oral and intravenous contrast are given before the examination. The patient is usually starved 6 hours prior to the examination. The oral contrast is water soluble usually gastrograffin, patient is given, 30 minutes before the examination, IV infusion of contrast is given while scanning the patient. The patient is usually put in supine position in the gantry.

The examination is carried out while the patient is holding his/her breath. Respiration motion results in artifacts that seriously degrade image quality. The CT scan interpretation of results are done by the radiologist in the CT scan room. CT scan diagnosis of these lesions was made and confirmation was obtained by fine needle aspiration biopsy, open biopsy, or postoperatively. The data from these studies were recorded in case record form.

The collected data were subjected to statistical analysis using Microsoft Office Excel. Data was expressed as absolute numbers with or without percentages, as means with standard deviation or as medians with ranges.

## RESULTS

During the study period, a total of 30 patients, who fulfilled the selection criteria, were included in the present study. The patients with pathologies outside the retroperitoneum like liver and gall bladder diseases, carcinoma of stomach and ascites were excluded from the study. The age distribution was from 21-84 years and this followed a normal distribution curve. The most common affected age group was of 40-50 years (9, 30.00%) followed by 50-60 years (8, 26.67%), >60 years (6, 20.00%) and others (Table 1). The group studied included 18 males and 12 females making 60.00% and 40.00%, respectively (Figure 1).

The most frequent presenting symptoms were abdominal lump or mass (28, 93.33%) followed by abdominal pain (26, 86.67%), weight loss (25, 83.33%), anorexia (20, 66.67%), fever (19, 63.33%), jaundice (18, 60.00%), hematuria (12, 40.00%) and others (Table 2). Many clinical presentations occurred in combination like abdominal mass with abdominal pain. On clinical examination of the patients, pallor was the commonest clinical sign (20, 66.67%) followed by icterus (14, 46.67%), pedal edema (3, 10.00%), and neck vein engorgement (3, 10.00%) (Table 3).

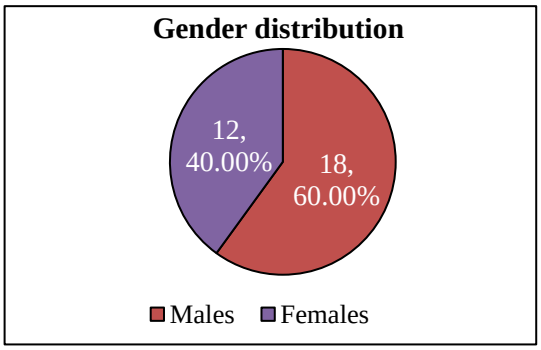


**Figure 1: Distribution of the patients according to gender (n=30).**

**Table 1: Distribution of the patients according to age (n=30).**

| Age (in years) | No. of patients | Percentage |
|---|---|---|
| **20-30** | 2 | 6.67 |
| **30-40** | 5 | 16.67 |
| **40-50** | 9 | 30.00 |
| **50-60** | 8 | 26.67 |
| **>60** | 6 | 20.00 |
| **Total** | 30 | 100.00 |

**Table 2: Distribution of the patients according to presenting symptoms (n=30).**

| Symptoms | No. of patients | Percentage |
|---|---|---|
| **Lump** | 28 | 93.33 |
| **Abdominal pain** | 26 | 86.67 |
| **Weight loss** | 25 | 83.33 |
| **Anorexia** | 20 | 66.67 |
| **Fever** | 19 | 63.33 |
| **Jaundice** | 18 | 60.00 |
| **Hematuria** | 12 | 40.00 |
| **Clay colored stool** | 10 | 33.33 |
| **Burning micturition** | 7 | 23.33 |

On the basis of diagnosis, it was found that retroperitoneal lymph node masses were the commonest (12, 40.00%) malignant lesions. Renal cell carcinoma (6, 20.00%), neuroblastomas (3, 10.00%), and para-gangliomas (2, 6.67%) adenocarcinoma were the next most common lesions. Among 4 benign lesions, renal abscess and retroperitoneal lymphangioma were found in 2 patients for each. In this study, retroperitoneal

lymphadenopathy was the most common lesion. (Table 4).

**Table 3: Distribution of the patients according to clinical signs (n=30).**

| Clinical signs | No. of patients | Percentage |
|---|---|---|
| **Pallor** | 20 | 66.67 |
| **Icterus** | 14 | 46.67 |
| **Pedal edema** | 3 | 10.00 |
| **Neck vein engorgement** | 3 | 10.00 |

**Table 4: Distribution of the patients according to diagnosis (n=30).**

| Diagnosis | | No. of patients | Percentage |
|---|---|---|---|
| **Malignant lesions** | Retroperitoneal lymph node mass | 12 | 40.00 |
| | Renal cell carcinoma | 6 | 20.00 |
| | Neuroblastomas | 3 | 10.00 |
| | Paragangliomas | 2 | 6.67 |
| | Pancreatic adenocarcinoma | 2 | 6.67 |
| | Wilm's tumor | 1 | 3.33 |
| | Total | 26 | 86.67 |
| **Benign lesions** | Renal abscess | 2 | 6.67 |
| | Retroperitoneal lymphangioma | 2 | 6.67 |
| | Total | 4 | 13.33 |

## DISCUSSION

Most retroperitoneal tumours arise in the kidneys or adrenals, of the remainder, primary non-specific retroperitoneal tumours other than lymphomas are uncommon.[4,5] Approximately 80% of retroperitoneal tumours are malignant.[4] Most retroperitoneal tumours in adults are mesenchymal in origin, the three commonest being liposarcoma, leiomyosarcoma and malignant fibrohistiocytoma. Metastatic disease in the retroperitoneum is usually recurrence of a urological or gynaecological malignancy.[4,5]

Although, CT scan is nonspecific, in many cases, when present a number of CT scan features and clinical findings may suggest specific diagnosis. Normal non-opacified lymph nodes are routinely seen on CT scans.[17] They appear as small soft tissue densities, ranging from 3-10 mm in size. In the retroperitoneum, lymph nodes can be found adjacent to the anterior, posterior, medial and lateral walls of inferior vena cava and aorta. Lymph nodes are also found in the roots of the mesentery and along the course of major venous structures draining to the inferior vena cava and portal veins.[17] The diagnosis of retroperitoneal lymphadenopathy by CT is based on recognition of nodal enlargement, with displacement or obscuration of normal structures. Lymph nodes are considered unequivocally abnormal if they exceed 2 cm in cross-section diameter.[18]

Lymph nodes in the retrocrural space are probably pathologic if they exceed 6 cm in size. An isolated abdominal or pelvic lymph node between 1 and 2 cm is regarded as a suspicious finding; clustering of nodes of this size should increase the index of suspicion.[19] Lymph nodes may be homogenous or heterogenous in attenuation. On CT they can be low density, necrotic or even filled with fat. Calcification may also occur. Contrast enhancement is variable within lymph nodes and when present, homogenous, heterogenous or rim enhancement have all been described.[20]

CT scanners are incapable of demonstrating intranodal architecture, lymph nodes that are normal in size but infiltrated with neoplastic cells cannot be distinguished as abnormal by CT. Furthermore, CT usually cannot differentiate between benign and malignant causes of lymph node enlargement. A lymphangiogram or a CT guided percutaneous needle biopsy may be indicated in such problem cases.[21]

By comparing pre-contrast CT scans with those obtained following intravenous contrast injection, assessment of the perfusion, function and structural integrity of the kidney can be made. No standards of normal size based on CT scan data have yet been published. For clinicians who need to know whether kidney size is abnormal, excretory urography and ultrasound are the diagnostic studies of choice.[22] The principal role of CT scan is as adjunct to ultrasound in assessing the nature of a renal mass.[23] When obesity or overlying gas precludes imaging of the kidney by ultrasound, CT can then be used. CT scanning is also useful in confirming presence and extent of a renal mass.[23] CT is acknowledged to be superior to IV urography and ultrasound for diagnosis and evaluation of renal masses.[24] The limitation here is the fact that it is not possible to tell malignant from benign masses. This can be resolved by doing ultrasound or CT guided biopsy of the mass. In telling whether a mass is cystic or solid, ultrasound is superior to other imaging modalities.[25] CT scan has the advantage over ultrasound in accurately delineating a renal mass and differentiating pseudomasses and anatomical variants.[26] Following the treatment of renal masses, CT scan is the method of choice for post nephrectomy renal fossa surveillance.[27] CT is better than ultrasound in staging of Wilm's tumour.[28] Tumours are staged in order to provide patients with optimum therapy and prediction of prognosis. CT identify lymph node metastases, but it will miss tumour in normal sized lymph nodes. CT is probably also the best modality for identification of liver metastases, chest metastasis and inferior vena cava involvement.[28]

The pancreas has a uniform homogenous attenuation of 35-40 HU; it lies obliquely in the upper retroperitoneal region. Its oblique orientation does not allow all of it to

be included in a single axial slice.[29] Neoplasm of the pancreas is normally identified at CT scan as a localized mass of variable attenuation distorting the local anatomy. Over 80% of all pancreatic tumours are adeno-carcinoma.[30] The rest include cystadenoma, cyst-adenocarcinoma and endocrine tumours. Metastatic disease also occurs.[30]

CT scan has become the most important imaging modality of the adrenal glands since the advent of high resolution body scanners in the late 1970's. A modern body scanner will demonstrate the normal adrenal glands in all but exceptional cases, and tumours of 1 cm diameter or less can be identified.[15]

A knowledge of the range of CT scan appearances and various clinical settings should assist the surgeon as well as radiologist in making an appropriate CT scan interpretation when one of them is encountered. CT scan has a major role in the diagnosis of retroperitoneal tumours and their recurrence. Even in the cases of advanced tumours, the knowledge provided by CT scan is invaluable in developing a national approach to management. Accurate assessment of the extent of tumour and its relation to adjacent structures is especially important in pre-operative surgical planning. For patients receiving chemotherapy or radiation, CT scan is an excellent method of monitoring tumour progression and response.[31]

## CONCLUSION

The retroperitoneum has long been an area poorly visualised by conventional radiographic techniques and in this respect, CT has great advantages over other modalities. Hence the modern surgeon should no longer be considered a ‘shadow-gazer' but an anatomist *in vivo*.

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