THE ROLE OF CT SCAN IN THE EVALUATION OF RETROPERITONEAL DISEASES

PROSPECTIVE AND RETROSPECTIVE STUDY DONE AT KENYATTA NATIONAL HOSPITAL

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DECLARATION

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This dissertation is my original work and has not been presented for a degree in any other University.

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ABBREVIATIONS

AA	Aortic aneurysm
Ab	Psoas abscess
AD	Adrenal masses
AG	Angiography
Ao	Aorta
AR	Adrenal gland
Ba	Barium studies
BT	bladder tumours
CT	Computed Tomography
Dx	Radiotherapy
Ec	Echocardiography
FB	Foreign body
H	Haematuria
HD	Hydronephrosis
HO	Hypoglycaemia
HP	Hypotension
HT	Hypertension
HY	Hydatid disease
IV	Intravenous
IVU	Intravenous urography
Ja	Jaundice
K	Kidney
L	Lymphoma
M	metastasis
MRI	Magnetic Resonance Imaging
MP	Abdominal pain
MS	Abdominal mass
N	Normal
NRD	Non specific retroperitoneal diseases
OT	Ovarian tumours
P	Pancreas
Pa	Chronic Pancreatitis
Pc	Pancreatic tumours
PP	Pancreatic Pseudocyst
Ps	Pelvic mass
PT	Pelvic tumour
PTC	Percutaneous Transhepatic Cholangiography
PV	Pelvic organ disease
Rc	Renal cyst
RE	Retroperitoneal mass
RH	Renal haematoma
RI	Retroperitoneal infections
RL	Retroperitoneal Lymph'adenopathy
RP	Retroperitoneal tumours
RT	Renal tumours
Rx	Chemotherapy
Sx	Surgery
US	Ultrasound
UT	Uterine tumours
XR	Plain Radiography

SUMMARY

A two year retrospective and prospective study was carried out at the Kenyatta National Hospital to establish the pattern and type of retroperitoneal diseases as shown by CT. 140 patients were studied.

The study group included 82 (58.6%) males and 58 (41.4%) females. The age distribution was from 0-85 years and this followed a normal distribution curve.

The most frequent signs and symptoms was abdominal mass 72 (43.4%), followed by pelvic mass 26 (15.6%) then abdominal pain 21 (12.7%). Most patients had a combination of abdominal mass with other symptoms like abdominal pain, jaundice, hypertension, haematuria and hypoglycaemia.

The commonest disease involved in the retroperitoneum were primary non specific retroperitoneal diseases 39 (26.5%), followed by renal diseases 34 (23.2%), then pancreatic diseases 29 (19.7%). Normal abdominal CT scans was found in 20 (13.6%) of patients.

OBJECTIVES

Broad Objectives

To find the pattern and type of retroperitoneal diseases shown by CT Scan at Kenyatta National Hospital.

To determine the role/usefulness of CT Scan in the management of patients with retroperitoneal diseases at Kenyatta National Hospital.

Specific Objectives

To establish for which retroperitoneal conditions is CT Scan of the abdomen most requested at Kenyatta National Hospital

To show the age and sex distribution of patients sent for CT Scan of abdomen at Kenyatta National Hospital

To establish the most common presenting signs/symptoms and relate this to CT findings.

INTRODUCTION

In the past, evaluation of abdominal, especially retroperitoneal structures by conventional radiography had been difficult due to super-imposition of various shadows, with the arrival of CT scanners in 1972, the CT Scan has become an increasingly useful imaging modality in abdominal pathology. However, ultrasound has remained an important diagnostic tool in radiology. Firstly because ultrasound can differentiate fluid-filled from non-fluid filled masses with a high degree of accuracy, secondly, it requires no ionizing radiation, thus making it particularly valuable for children and pregnant women, thirdly, it is portable, relatively inexpensive and quickly available in most institutions, and with the use of real-time, can provide an infinite number of scan planes. [1]

Ultrasound has the disadvantage in that it is user dependent and a good ultrasonologist is needed for good and accurate diagnosis. Ultrasound also needs good bowel preparation as the abdominal gas may obscure good visualization, especially in retroperitoneal structures. Fat in obese patients prevent ultrasound waves propagation, and hence difficulty in reaching the deep organs.

Although CT Scan is more expensive, time consuming and employs ionizing radiation and iodinated contrast media, it enjoys some advantages over ultrasonography. It is more accurate in delineating abdominal masses, size, extend and surrounding structures. CT gives additional information previously not available like adjacent organ involvement, displacement and metastatic manifestations that are often unsuspected. CT has better resolution than ultrasound and is less dependent on the skill of the operator. W

Magnetic resonanse imaging (MRI) is revolutionizing abdominal imaging because it does not use ionizing radiation nor iodinated contrast and allows for multiplanner scanning. MRI also aids in clarifying the origin and extent of large retroperitoneal masses as well as in the preoperative staging of tumour extensions. It may be useful and perhaps superior to CT in some conditions. Patients who have a sensitivity to contrast medium or have had an equivocal examination usually benefit from MRI evaluation [23] MRI however is still quite

expensive and unavailable for most patients in Kenya. CT is relatively cheaper and more available. It is therefore the widely used modality in imaging both intra abdominal and retroperitoneal structures.

LITERATURE REVIEW

GENERAL INTRODUCTION

The retroperitoneal portion of the abdomen has always been considered a difficult region in terms of anatomic definitions, clinical evaluation and radiological diagnosis.

Anatomically, the retroperitoneum is that part of the abdomen which is bonded anteriorly by the posterior parietal peritoneum, posteriorly by the transversalis fascia and laterally by the lateroconal ligaments. It is largest posteriorly but continues anteriorly as the preperitoneal fat compartment. It extends from the pelvic brim inferiorly to the diaphragm superiorly. The retroperitoneum contains the adrenals, kidneys, ureters, the duodenal loop and the pancreas, the great vessels with their branches, and the ascending and descending portions of the colon including the caecum. It can be divided into three distinct compartments by the fascial planes it contains. (4)

Clinically it is commonly recognized that retroperitoneal effusions are difficult to diagnose. The area is not accessible to the bed side modalities of auscultation, palpation or percussion. Symptoms and signs may be obscured, delayed, non specific or misleading. The advent of modern cross-sectional imaging technique, capable of depicting the internal anatomy of the retroperitoneum has enabled detailed study of the anatomy and diseases in this area. 6>

Fascial Planes

Today with the precise visualization of this area by CT scanning, the anatomy and the fascial borders of the different spaces within the retroperitoneum can be defined for more exactly. With the kidneys as reference point anatomically, the retroperitoneum has been divided into the three compartments:

The anterior pararenal space

The perirenal or perinephric spaces

The posterior pararenal space [7]

1) Anterior Pararenal Space

Limited anteriorly by the posterior parietal peritoneum, posteriorly by the anterior renal fascia and laterally by the lateroconal fascia. It contains the extraperitoneal gastrointestinal structures, i.e., the ascending and the descending colon, the second through fourth parts of the duodenum and the pancreas. It is potentially continuous across the midline. [(1)]

2) Perirenal Spaces

These are two areas encompassing both kidneys. They are shaped like a vertical cone with the apex of the cone pointing downwards. They encompass the kidneys and its investing fat and are limited by the anterior and posterior renal fascia. The peri-renal spaces have no communication and their fat content is most abundant in posterolateral to the lower poles of the kidneys. w The suprarenal glands are embedded in the fat contained in the perirenal spaces superiorly [7]

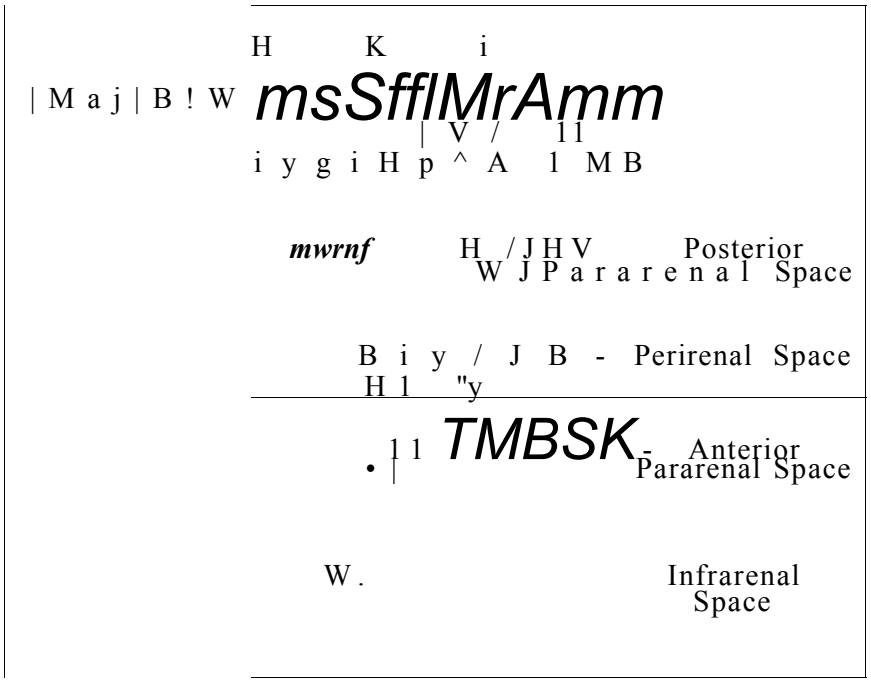
3) Posterior Para renal space

Limited anteriorly by the posterior renal fascia and posteriorly by the transversalis fascia. This space contains no organ but has a thin layer of fat, is open laterally and internally and recognized on a conventional abdominal radiograph as the flank radio lucent stripe. [5]

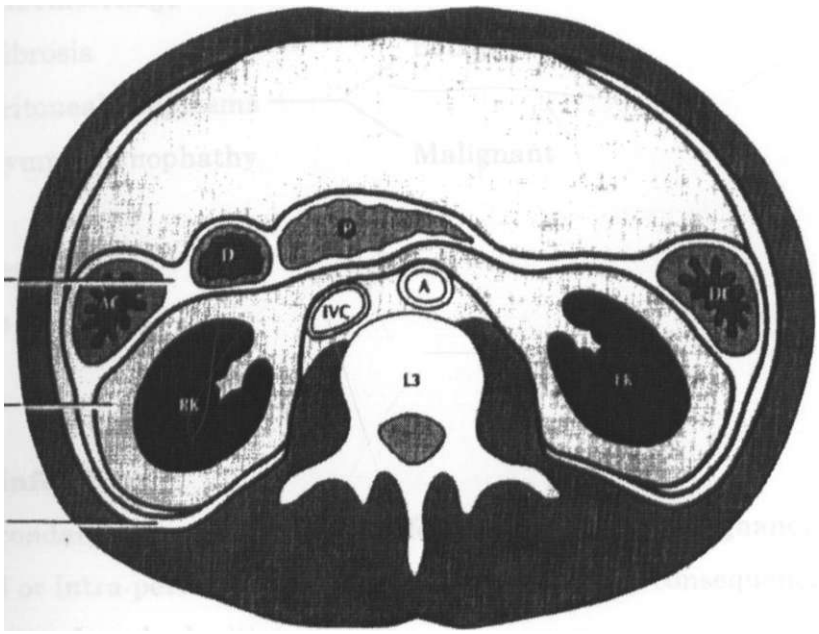
The retroperitoneal space is generally C-shaped, with its convexity projecting anteriorly in the midline. This shape results both from the particular relationship between the abdominal walls and the accommodation to the lordotic curvature of the lumbar spine. As a result, some retroperitoneal structures like body of pancreas and duodenal loop, lie significantly more anteriorly than other retroperitoneal viscera, like the kidneys [7]

The Retroperitoneal Spaces

Saggital diagram of three retroperitoneal spaces through the right kidney (5,6,7)
D= duodenum, A= adrenal gland, K= Kidney



Axial diagram of three retroperitoneal spaces at the level of the renal hilar (1,5,7)



AC = ascending colon D = duodenum, P= pancreas

DC = descending colon, RK= right kidney, LK left kidney

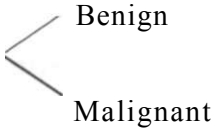
L3 = Third lumbar vertebral body

A = Aorta

IVC = Inferior Vena Cava

Retroperitoneal region is of great clinical interest because of the following conditions:-

1. **Retroperitoneal infections**
2. **Retroperitoneal vascular** Diseases
3. Retroperitoneal Haemorrhage
4. Retroperitoneal fibrosis
5. Primary Retroperitoneal neoplasms
6. **Retroperitoneal lymphadenophathy**
7. Renal Diseases
8. Pancreas Diseases
9. Adrenal Diseases
10. Pelvic Diseases



Retroperitoneal infections

This is usually secondary, a complication of infection, injury or malignancy in adjacent peritoneal or intra-peritoneal organs. Only, rarely is it a consequence of bacteria or suppurative lymphadenitis.

The predominant symptoms of retroperitoneal infections are chills, fever, abdominal or flank pain, nausea, vomiting, night sweats and weight loss. The clinical cause is usually insidious and the initial symptoms can be non specific that the correct diagnosis is usually not considered. Constitutional symptoms may be present for weeks or months before localizing symptoms develop. With pressure on the retroperitoneal nerves, pain may be referred to the groin, hip, thigh or knee with little or no complaint of abdominal or back pain. Urologic symptoms are rare, even with perirenal abscess. [6]

The ability of CT to identify the compartments joined by the fascial planes assures considerable importance in the accurate localization of retroperitoneal fluid collections and the understanding of the spread of both infection and new

growth Abnormal thickening of Gerotas fascia is an important indicator of pathological process in the retroperitoneum. [7]

Most frequently, perirenal abscesses are encountered as a consequence of an inflammatory process of the kidney e.g. in pyelonephritis, curbuncle or tuberculosis. Less frequent is the spread of inflammation from a more distant site. For example, a pseudocyst of the pancreas or in acute haemorrhagic necrotic pancreatitis there can be discharge in the perirenal space.[6]

Howard K. O'Neil et al showed that pancreatitis, appendicitis and diverticulitis mainly involves the anterior pararenal space. Urinomas, perirenal abscesses, and leaking abdominal aortic aneurysms mainly involve the perirenal spaces. Fluid or haemorrhage from trauma may affect any of the three retroperitoneal spaces.[8]

The incorporation of gas formed by bacteria (E.Coli, Aerobacter and Clostridia) which may be already recognizable in the plain film of the abdomen, can also be demonstrated by computed tomography. [6-9]

The anterior pararenal compartment is the most common site of retroperitoneal infection. Alvemeir and Alexander reviewed 160 Patients with retroperitoneal abscess, 84% of these the process was confined to the anterior pararenal space. Most arise from primary lesions of the alimentary tract, especially, the colon retroperitoneal appendix, pancreas and duodenum. The exudates originate from perforating malignancies, inflammatory conditions, perforating peptic ulcers and accidental or iatrogenic trauma. The radiodensity of exudate on CT depends on the protein contents and on the age of the process. Density values of 0 - 30 HU are usually demonstrable. [6-9]

Infection within the psoas muscle is commonly due to direct extension from contiguous structures such as the spine, kidney, bowel loops and the pancreas. Tuberculosis is a major cause of psoas abscess. On CT Scan, the involved muscle is often diffusely enlarged, usually with central areas of necrosis. Loss of visualization of the lateral margin of the psoas muscle on plain radiograph has

been considered the hall mark of retroperitoneal effusions. This sign however, is unreliable since 25% of normal individuals show unequal visualization of the psoas border. [10]

Retroperitoneal Vascular Diseases

The great vessels lie anterior to the spine in the retroperitoneum. The abdominal aorta enters the abdomen at approximately LI and descend to L4 where it bifurcates into the common iliac arteries. At the level of the crura the aortic lumen measures 2-3 cm depending on age, tapering to 1 cm at the bifurcation. The coeliac axis, superior mesenteric artery and renal artery are all usually visualized on CT Scan. [4]

The commonest encountered vascular pathology is aortic aneurysms. Dilatation of the abdominal aorta due to aneurysm formation is easily detected. The commonest cause of this, is atherosclerosis. Syphilitic, mycotic and traumatic causes are uncommon. Calcification in the atheromatous aorta is frequent. The true wall of the aneurysmal aorta unless calcified, may, however be indistinguishable from intraluminal blood. CT angiography is then necessary to display the true lumen. This is especially so in dissecting aneurysm and in the presence of intraluminal thrombi. A recently raptured abdominal aneurysm is recognised by characteristic attentation values between 40-70 HU; a portion of this mass may enhance after intravenous contrast material injection. Chronic leakage may appear as an inhomogenous mass indistinguishable from retroperitoneal tumour. [1,9]

Doppler ultrasound remains the diagnostic procedure of choice in patients with suspected abdominal aortic aneurysm because of its ease of performance, non-ionizing radiation, lower cost and the ability to obtain longitudinal scans as well as cross-sectional images. However, CT can be helpful in cases where ultrasound is unsuccessful either due to post surgical scar tissue, obesity or abundant bowel gas. CT is also superior to ultrasound in demonstrating aortic grafts and leaking abdominal aortic aneurysm. [11]

The inferior vena cava originates at the junction of the two common iliac veins to the right of L5 and continues cephalad on the right side of the spine, widening

after receiving the renal veins. It lies within a grove in the bare area of the liver that can occasionally completely enclose it. Just before penetrating the diaphragm at the level of T8 to T9, it turns anteriorly towards the right atrium and receives the hepatic veins.(9- ">

The calibre of the inferior vena cava varies greatly, depending on the phase of respiration, it can normally appear thin and slit-like. A vasalva maneuver can be used to distend a normal inferior vena cava so that it becomes more obvious. (12)

Retroperitoneal Haemorrhage

Haemorrhage into the retroperitoneal space may create a diagnostic dilemma. The **symptoms** and signs are usually vague (abdominal pain, low grade fever, **sluggish** bowel sounds). These may be ambiguous or misleading. Retroperitoneal **haemorrhage** is detectable on **the** CT scan as an abdominal soft tissue density, which results in obscuring, displacing or compression of normal retroperitoneal **structures.** Attenuation **values** within **the** haematoma are 20 - 60 HU **the highest** values occur in the most acute collections.(612)

Trauma is the most common cause of retroperitoneal haemorrhage. Leakage from an aortic aneurysm and diseases associated with haemorrhagic diasthesis or anticoagulant therapy may also lead to retroperitoneal bleeding. Additionally, retroperitoneal haematomas may arise from adrenal or renal disorders especially neoplastic.(13)

It is doubtful that CT scan alone is capable of distinguishing retroperitoneal haemorrhage from abscess. Fortunately, the clinical setting customarily permits the distinction. <P>

Retroperitoneal Fibrosis

Retroperitoneal fibrosis usually extends from the pelvic brim and can reach up to tne mediastinum. The estimated incidence in the normal population is 1:200,000. The mortality rate is 10 - 20%. There are two distinct forms - a primary form which is idiopathic, the other is secondary. The secondary form is induced by inflammatory drugs like methysergide. Trauma, aneurysm, radiation

injury or carcinoma are other causes. Overall, men are affected more frequently that women (ratio 3:1), in the idiopathic type. <[14,15]>

Inadequate fibrinolysis in response to inflammatory stimulation results in connective tissue organization of the unabsorbed exudate (fibrin). This is held pathogenetically responsible for idiopathic retroperitoneal fibrosis.(14)

The ureters, inferior vena cava, renal arteries, mesenteric arteries, aorta and even the common bile duct may be involved. On excetory urography, the changes are usually bilateral (75%) with medial displacement of the mid third of the ureters, which are dilated and obstructed. Retrograde catheters pass easily up the ureters ([9> 12]) CT and MRI show diffuse encasement, which may enhance following the administration of contrast medium. Definitive diagnosis is histology and is done by CT or ultrasound guided biopsy.(23)

Idiopathic retroperitoneal fibrosis shares many feature with certain other clinical conditions affecting the retroperitoneum including peri-aneurysmal fibrosis (PAF) inflammatory abdominal aortic aneurysm (IAAA) and inflammatory aortitis and these may appear similar on CT. Other conditions which may simulate retroperitoneal fibrosis on CT include Periaortic haematoma and amyloidosis.(16)

Retroperitoneal tumours

Most retroperitoneal tumours arise in the kidneys or adrenals, of the remainder, primary non-specific retroperitoneal tumours other than lymphomas are uncommon. Approximately 80% of retroperitoneal tumours are malignant. 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. <[2]>

Although, CT is non specific, in many cases, when present a number of CT features and clinical findings may suggest specific diagnosis. The presence of a calcific tumour in a child usually suggests neuroblastoma. Presence of fat in a

mass lesion of heterogenous density is most likely a liposarcoma, hypervascularity is common in haemangioma and teratoma has characteristic mixed components.[17]

A knowledge of the range of CT appearances and various clinical settings for this rare group of neoplasm should assist the radiologist in making an appropriate CT interpretation when one of them is encountered. [17]>

CT 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 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 is an excellent method of monitoring tumour progression and response.[18]

Classification of primary non specific Retroperitoneal tumours [9]

	Malignant	Benign
Mesenchymal	Liposarcoma Leiomyosarcoma Rhabdomyosarcoma Fibrosarcoma Myxosarcoma Malignant fibrous Histocytoma	Lipoma Leiomyoma Rhabdomyoma Fibroma, Fibromatosis Myxoma
Vascular	Haemangiopericytoma Angiosarcoma Lymphangiosarcoma	(haemangioma) Lymphangioma
Neurogenic	Malignant Schwammona	Neurilemmoma Neurofibroma
Tumours of sympathetic nerve origin	Neuroblastoma Ganglioneuroblastoma Malignant paraganglioneuroma Extra-adrenal phaeochromocytoma	Ganglioneuroma Paraganglioneuroma
Giant cell tumours	Malignant Teratoma Embryonal carcinoma Seminoma malignant chordoma	Benign teratoma chordoma

Retroperitoneal lymphadenopathy

Normal unopacified lymph nodes are routinely seen on CT scans. 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 mesentry and along the course of major venous structures draining to the inferior vena cava and portal veins. (14)

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.(9)

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. (10)

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. (12)

CT scanners are incapable of demonstrating intranodal architecture, lymph nodes that are normal in size but infiltrated with neoplastic cells cannot be distingushed 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. W

Renal Diseases

The kidneys are well demonstrated by CT as a result of the surrounding perirenal and renal sinus fat. Normal unenhanced renal parenchyma is of low a tenuation (30-50 HU) than adjacent organs (50-80 HU). Perirenal fat gives

negative attenuation values. The anterior, superior and posterior aspects of the renal outline and the margins of the parenchyma adjacent to the renal sinus are demonstrated significantly more clearly by CT than by conventional radiology.(1)

By comparing precontrast 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 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. a 12)

The principal role of CT is as adjunct to ultrasound in assessing the nature of a renal mass. 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.(19)

CT is acknowledged to be superior to I V urography and ultrasound for diagnosis and evaluation of renal masses. (26) 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. (20) CT has the advantage over ultrasound in accurately delineating a renal mass and differentiating pseudomasses and anatomical variants. Following the treatment of renal masses, CT is the method of choice for post nephrectomy renal fossa surveillance. 0>

CT is an effective, non invasive method of accurately assessing the extent of renal injury in children who have suffered blunt abdominal trauma. Detailed CT evaluation of renal injuries aids in the clinical decision of whether or when to intervene surgically. <12 21>

CT is better than ultrasound in staging of wilm's tumour. Tumours are staged in order to provide patients with optimum therapy and prediction of prognosis. CT w 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.[22]

Advances in CT, ultrasound and isotope techniques have contributed to a reduction in the need for renal angiography. However it still remains important in renal tumours where it outlines the mass with abnormal vascular supply. Renal angiography is also important in showing renal artery stenosis, arteriovenous malformations and in renal transplant patients [12]

CT, ultrasound or MRI will demonstrate thrombus in the renal veins and inferior vena cava, and other sites of diseases such as hepatic metastasis and retroperitoneal lymphadenopathy. [1]

Unenhanced CT, is used increasingly for the examination of patients with renal calculi and is more effective than IV urography. [26]

The Pancreas

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.[1]

Increase in size, irregularity of outline, heterogenous density and loss of mobility all imply disease, but none are specific to any particular disease entity. Sometimes there is calcification, intra or extrapancreatic cysts and duct dilatation.

The principal diagnostic features of chronic pancreatitis on CT include calcification, dilation of the pancreatic duct, obliteration of fascial planes, contuor irregularity, changes in density and loss of mobility.[12]

In acute pancreatitis, the gland may frequently be diffusely enlarged, irregular outline and heterogenous in density. However, a gland appearing normal in CT does not exclude a diagnosis of acute pancreatitis which is primarily a clinical diagnosis. The identification of intra or extrapancreatic fluid collection is

important evidence in favour of the inflammatory nature of the disease. Complications like necrosis, haemorrhage or pseudocyst may occur. Pancreatic abscess diagnosis can be made reliably if gas is visualized within the mass.[1]

In a study done to establish the value of CT in acute pancreatitis, it was found that the limitations of the CT examination are related to the unlikely but potential development of complications in patients with a normal pancreas who may develop pancreatic necrosis. For these reasons, it was recommended that CT examination should be performed in all patients with moderate or severe clinical forms of pancreatitis to evaluate the presence and severity of the initial attack and to assess its clinical evolution. [23,24]

Neoplasm of the pancreas is normally identified at CT as a localized mass of variable attenuation distorting the local anatomy. Over 80% of all pancreatic tumours are adenocarcinoma. [27] The rest include Cystadenoma, cystadenocarcinoma and endocine tumours. Metastatic disease also occurs. [12]

The Adrenal glands

The adrenal grands are retroperitoneal structures that lie just above the kidneys and are composed of a cortex and medulla. The adrenal glands are embeded in the fat contained in the perirenal spaces superiorly. [6]

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.[12] CT scan has superceded retroperitoneal air insufflation which was widely practised in 1950's for the demonstration of adrenal masses. Phlebography is also superceded by CT, but is still occasionally used for infarction of the adrenal gland or of small adrenal tumours. <»

The right adrenal gland is anterior and superior to the right kidney and immediately posterior to the inferior vena cava and right lobe of the liver. The lateral posterior limb of the right gland is shorter and at a more caudal level

than the medial limb, and it often merges with the adjacent liver. The left gland **is superior** and inferior to the left kidney. It has a larger body than the right **gland.** The left gland is more variable in position than the right. Its ventral surface is in contact with the tail of the pancreas and the splenic vein. (19)

Neoplasms of the adrenal gland can be classified as cortical (carcinoma and adenoma) or medullary like neuroblastoma, phaeochromocytoma and ganglioneuroma. Metastasis have also been found in these glands(25) Other mass lesions include granulomas like tuberculosis, histoplasmosis and blastomycosis. Cysts have also been found, haematoma and amyloidosis can also be present. Bilateral adrenal hyperplasia also present as mass lesions.

CT guided biobsy is important for lesions found accidentally and not causing symptoms. (3)

Pelvic Diseases

In the pelvis, the structures which are considered to be included in the retroperitoneal space are those between the peritoneum and levator ani muscles. The structures in this compartment enclose the bladder, prostate, seminal vesicles, uterus and the extraperitoneal parts of the rectum. (7)

Pelvic diseases are included in this study because signs and symtoms may first manifest in the abdomen. Testicular tumor may be detected by enlarged lymphodes of the renal hilum. This is due to the nature of its blood supply. [6]

Effusions, abscess, haemorrhage or even gas originating in the pelvis may spread upwards into the posterior pararenal space. (6) Perinephric collections such as haematomas and urinomas, have at least a potential conduit across the midline or into the pelvis. [5]

Anterior pararenal processes, such as pancreatitis or appendicitis, can extend into the pelvis. [6]

Pelvic masses can compress on the ureters and cause hydronephrosis and this can present as an abdominal mass.

MATERIALS AND METHODS

This study was done at K.N.H X-ray department on patients referred for CT scan examination of the abdomen from 01/01/1997 to 30/12/1998. 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 tranverse 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 x 1 x 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 1 x 1 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.

Currently, all requests for CT examination are reviewed carefully and approved by a radiologist or a senior registrar. The examination is carefully planned in advance and a decision is made regarding the location, number and thickness of slices to be made. In our department oral and intravenous contrast are given before the examination. The patient is usually starved 6 hrs prior to the examination. The oral contrast is water soluble usually gastrografin, 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.

Computed tomography is now accepted as an important diagnostic tool in the assessment of a child with an abdominal mass. However, body CT in children has unique problems not present in adult CT. These include lack of abdominal fat and the need for sedation to reduce movement by the patient. [1]

This study is retrospective and prospective. Details of reports/films were collected in the fashion shown in Appendix A. The CT scan interpretation of results are done by the radiologist in the CT scan room. No histology or lab reports are used in the study. Recommendations are suggested for a follow up study which will correlate Radiological diagnosis and Histology diagnosis.

Sample Size

These include all patients on whom abdominal CT scan was done between 01/01/97 to 31/12/98 at K.N.H. -

Limitations of the study

- The accuracy of the final diagnosis is based on the radiologist's report and not histological report.
- The time is limited to 24 months
- The records may not be up to date, some records are lost and sometimes patients take important films away, seeking second opinion.
- In retrospective study, you do not have the chance to examine the patient and take any additional history. The CT protocol that was used cannot be altered.
- Previous radiological investigations were sometimes absent.
- CT breakdown.
- Due to financial constrains, some patients were lost from the study.

Ethics (Medicolegal Considerations)

The patients names are not used in this study.

A request to conduct this study was submitted together with a copy of the study protocol to the ethical committee who approved the study.

Confidentiality was maintained and no use of details for other purposes other than for this study.
There is ionizing radiation in CT scan, hence only patients sent for evaluation of the abdomen by the attending physician are considered. No repeat examinations were done.

Results(Representation of Data)
This is in form of tables and graphs to fulfill aims/objectives

Representative Films are presented in photographs for demonstration and illustration.

Rationale / Justification
This study has not been done before in Kenya

It is important to establish the role of CT/**Scarv**^of the abdomen in the evaluation of retroperitoneal diseases in Kenyatta National Hospital. This being a National and Referral Hospital, the study will give information on the pattern of retroperitoneal diseases countrywide.

RESULTS

Table 1 Age Sex distribution

Age (years)	Male	Female	% Percentage
0 - 5	10	8	12.9
6 - 1 0	2	3	3.8
1 1 - 1 5	6	2	5.7
1 6 - 2 0	1	3	2.9
2 1 - 2 5	2	3	3.8
2 6 - 3 0	8	3	7.9
3 1 - 3 5	3	3	4.3
3 6 - 4 0	3	4	5
4 1 - 4 5	6	3	6.4
4 6 - 5 0	11	4	10.7
5 1 - 5 5	4	3	5
5 6 - 6 0	5	4	6.4
6 1 - 6 5	5	2	5
6 6 - 7 0	2	0	1.4
71 - 7 5	1	2	2.1
7 6 - 8 0	2	1	2.1
>80	2	1	1.4
Not specified	9	9	12.9
Total	82	58	100

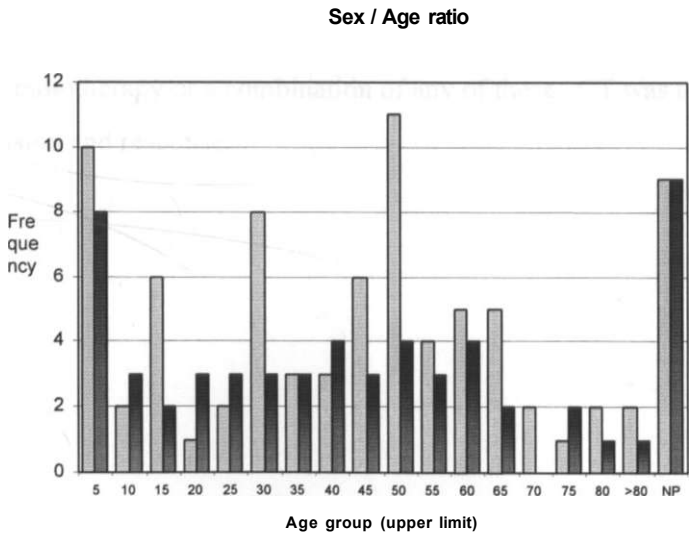


Table 3 Frequency of presenting signs and symptomss

Signs / Symptoms	***Frequency***	***% / re que nay***
Foreign body	1	0.6
Haematuria	2	1.2
Hypoglycaemia	2	1.2
Hypotension	1	0.6
Hypertension	7	4.3
Jaundice	14	8.4
Abdominal pain	21	12.7
Abdominal mass	72	43.3
Pelvic mass	26	15.6
Retroperitoneal malignancy pre/post treatment	20	12.0

Signs and symptoms (Table 3), constituted a total of 166. This is because some patients in the study group had a combination of clinical history and diagnosis. This included abdominal mass with abdominal pain, abdominal mass with jaundice, pelvic mass with pre/post treatment.

Pre treatment scans were retroperitoneal tumours with histological report being planned for radiotherapy.

Post treatment scans were retroperitoneal tumours which had undergone either surgery, chemotherapy, radiotherapy or a combination of any of these. CT was used to monitor tumour progression and response.

Table 4 Radiological Diagnosis

Radiological diagnosis	Frequency	% Frequency
Aortic pseudoaneurysm	2	1.4
Psoas abscess	3	2.1
Adrenal masses	4	2.8
Bladder tumours	4	2.8
Foreign body	1	0.7
Hydronephrosis	9	6.3
Hydatid disease	1	0.7
Lymphoma	15	10.6
Metastasis	2	1.4
Ovarian tumour	2	1.4
Chronic pancreatitis	5	3.5
Pancreatic tumour	18	12.7
Pancreatic pseudocyst	4	2.8
Pelvic tumour	8	5.6
Renal cyst	6	4.2
Renal Haematoma	2	1.4
Retroperitoneal tumours	15	10.6
Renal tumours	21	14.8
Uterine tumours	2	1.4
Normal	18	12.7
Total	142	100

Radiological diagnosis, (table 4) constituted a total of 142 cases. This is because hydronephosis appeared in combination with pelvic mass like bladder tumour.

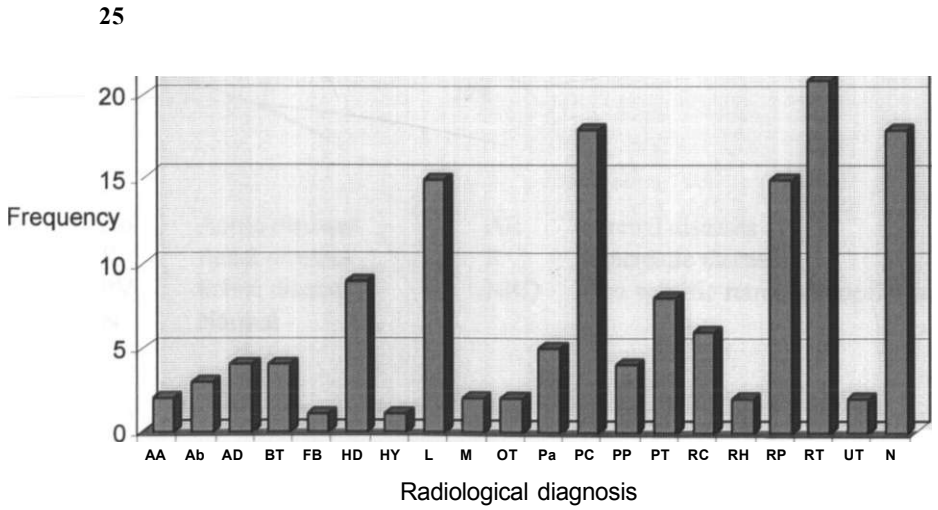
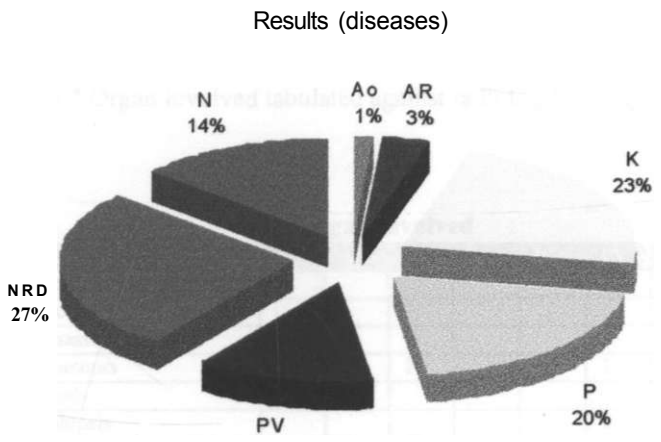


Table 5 General analysis of results

Diseases	**Frequency**	% Frequeue)
Aortic diseases	2	1.4
Adrenal diseases	5	3.4
Renal diseases	34	23.2
Pancreatic diseases	29	19.7
Pelvic diseases	18	12.2
Non-specific retroperitoneal diseases	39	26.5
Normal	20	13.6
Total	147	100

Table 5 shows results of the general analysis. There were a total of 147 . This was due to some pathological diseases appearing in more than one organ like pelvic mass with hydronephrosis, pancreatic pseudocyst with renal cyst.



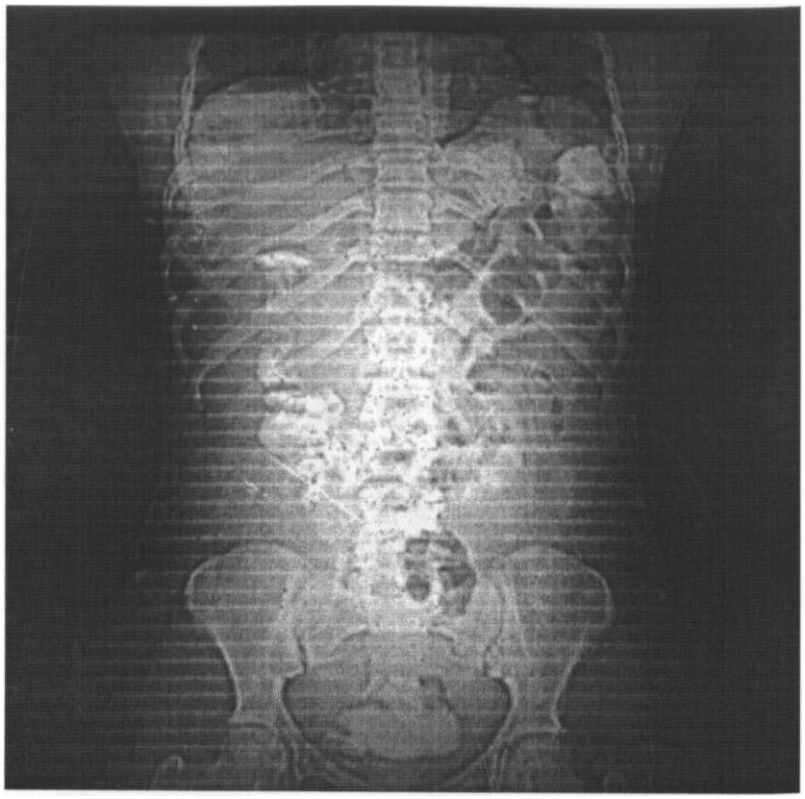
Ao	Aortic diseases	AR	adrenal diseases
K	Renal diseases	P	Pancreatic diseases
PV	Pelvic diseases	NRD	Non specific retroperitoneal diseases
N	Normal		

Table 6 Organ involved against age group

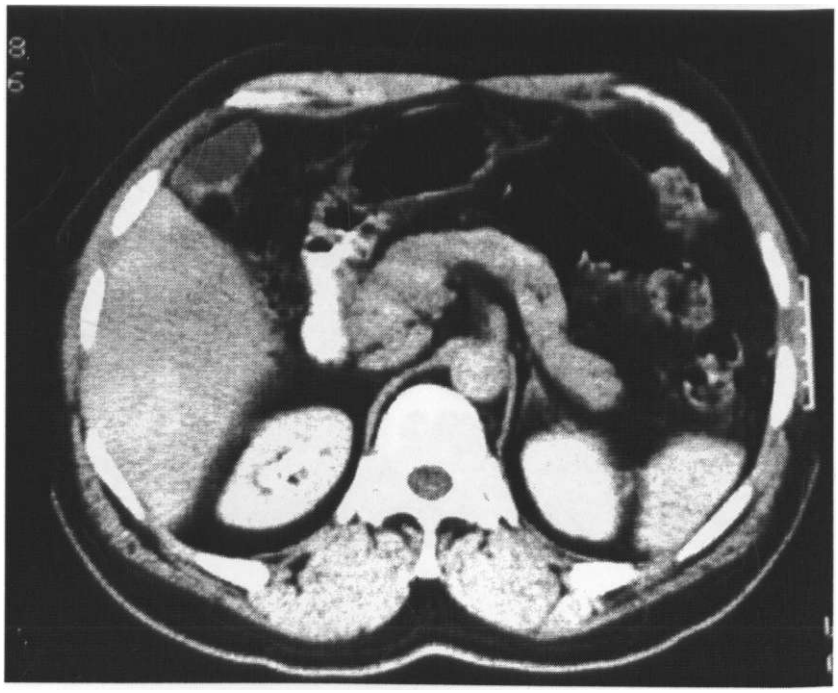
Age group								
0-5 '		2	7			3	6	
6-10			1	3			1	
11-15			2	1		1	4	
16-20		1	1				1	1
21-25	1			1		1	2	
26-30			1	2	4	1	3	
31-35			1	1		2	1	1
36-40			1	2	2	1	1	
41 -45					4	3	2	
46-50	1	1	6	3	2	1		
51 -55			1	2	3	1		
56-60			1	1	2	3	3	
61-65		1	1		3		1	1
66-70					1	1		
71 -75			1	1			1	
76-80			2		1			
>80			1		3			
Not specified			2	3	5		6	1
Total	2	5	29	20	30	18	32	4

Table 7 Organ involved tabulated against radiological diagnosis

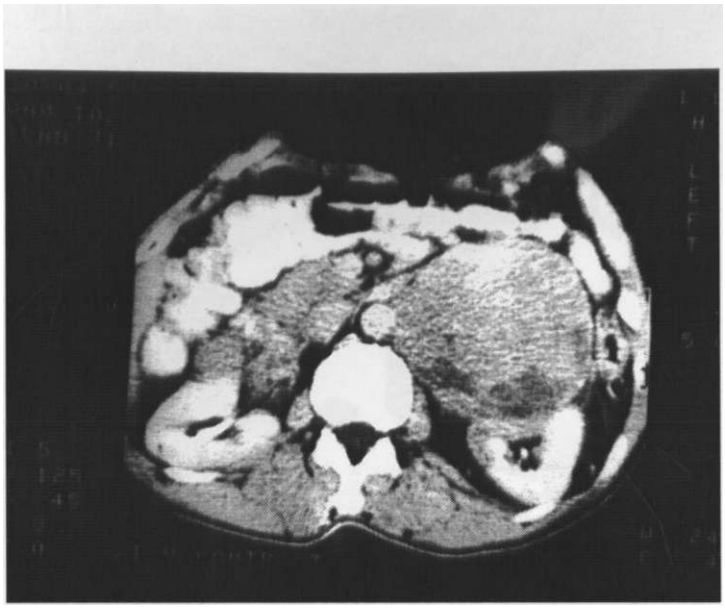
	Organ involved							
Ku<linlo<>ic;il fl-<>• lit*								
Aortic pseudoaneurysm	2							
Psoas abscess								3
Adrenal masses		5						
Bladder tumours			1			3		
Foreign body							1	
Hydronephrosis						5	1	1
Hydatid disease			2			2	1	
Lymphoma			1			1	15	
Metastasis				2				
Ovarian tumour						2		
Pancreatic tumour					4			
Chronic pancreatitis					18			
Pancreatic pseudocyst					6			1
Pelvic tumour			2			9	1	
Renal cyst			5		1			
Renal Haematoma			2					
Retroperitoneal tumours							14	
Renal tumours			20			1	2	
Uterine tumours						2		
Normal				17				
Total	2	5	33	19	29	25	35	5



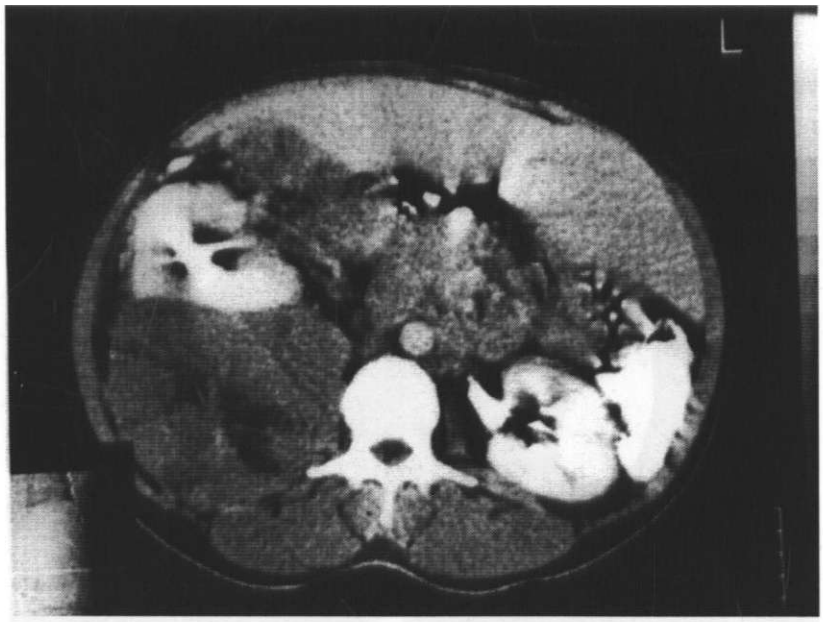
Scanogram



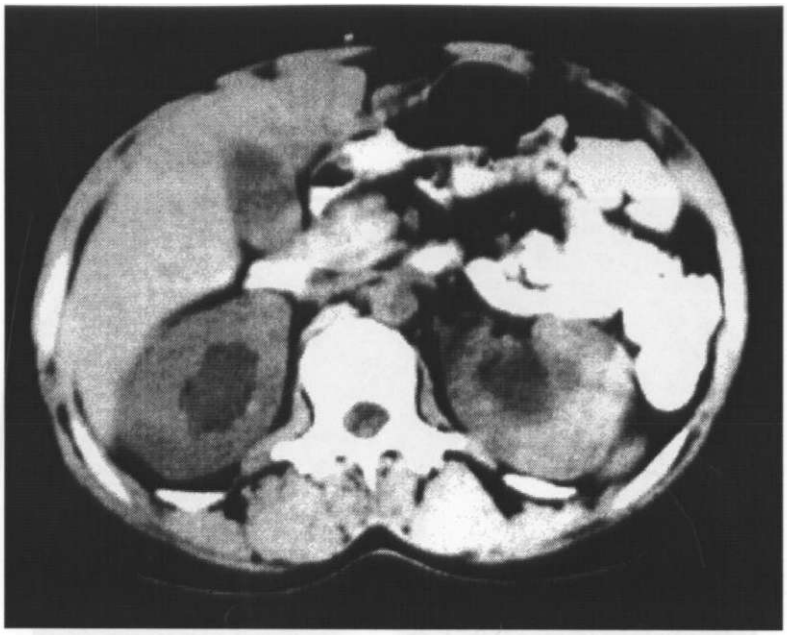
Normal axial scan at the level of Li vertebral body



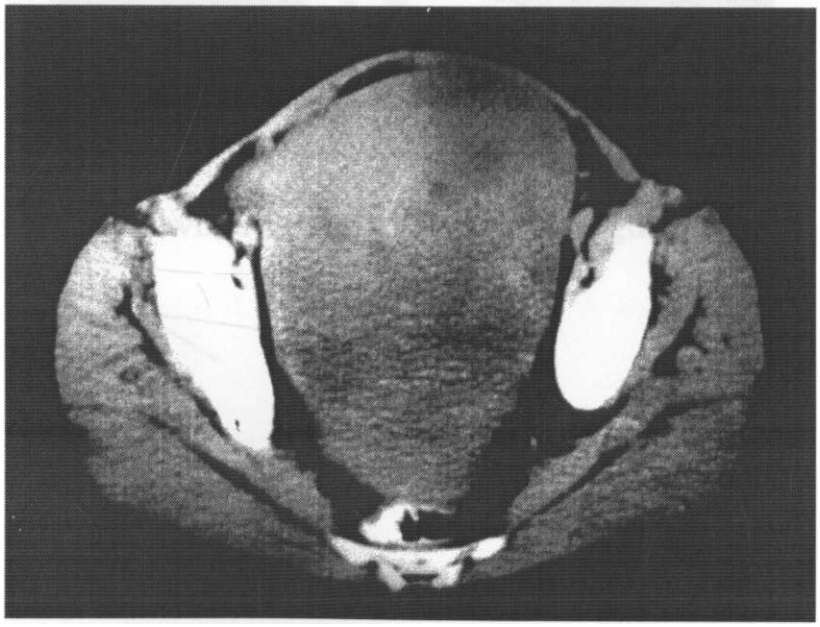
Left Adrenal tumour

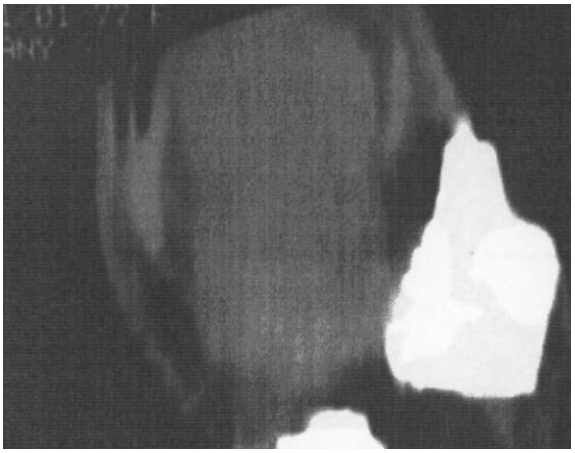


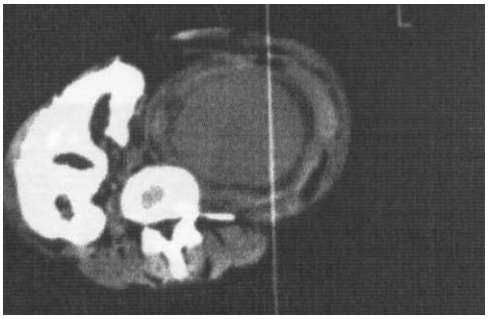
Rhabdomyosarcoma displacing right kidney anteriorly



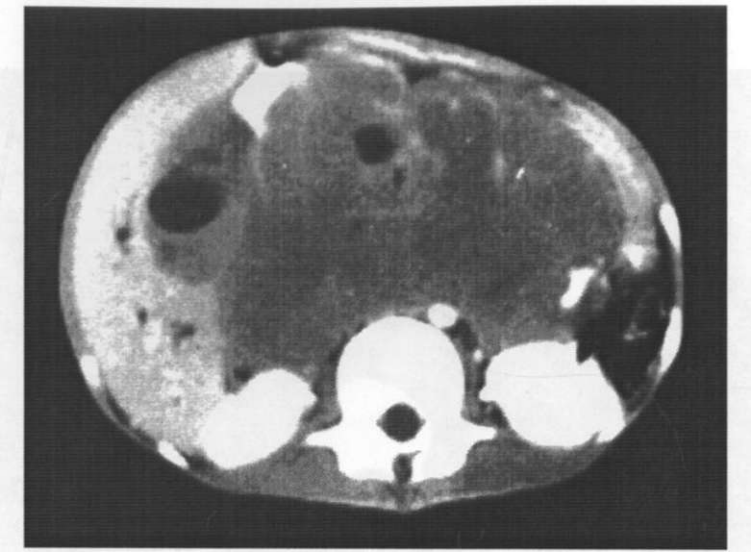
Hydronephrosis due to the pelvic mass below



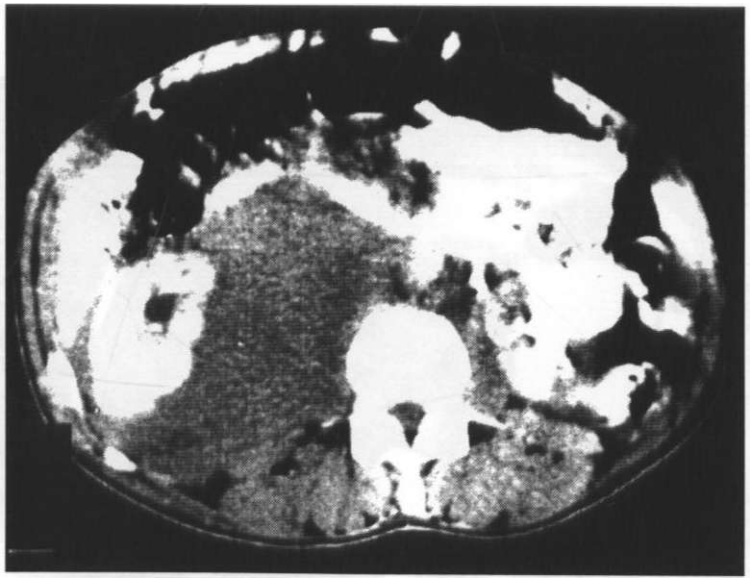




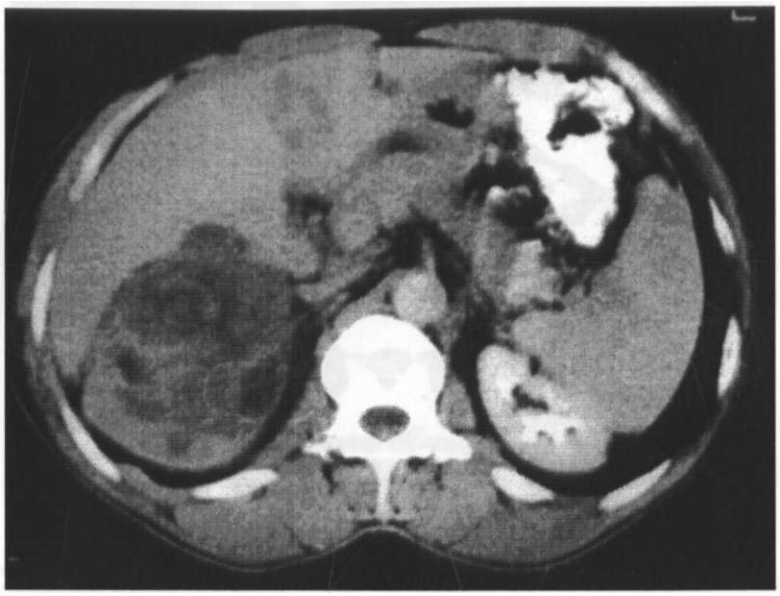
Aortic Aneurysm shown in axial scan and with saggital reconstruction



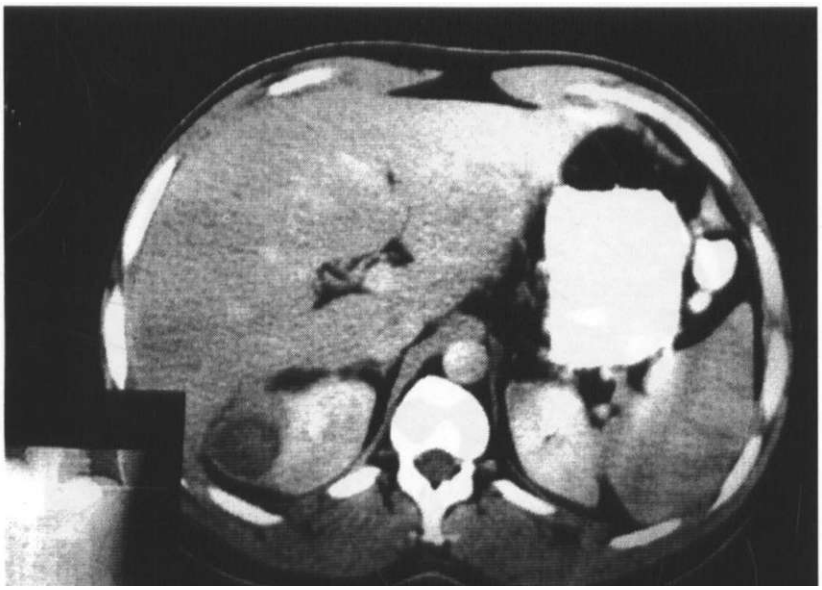
Lymphoma



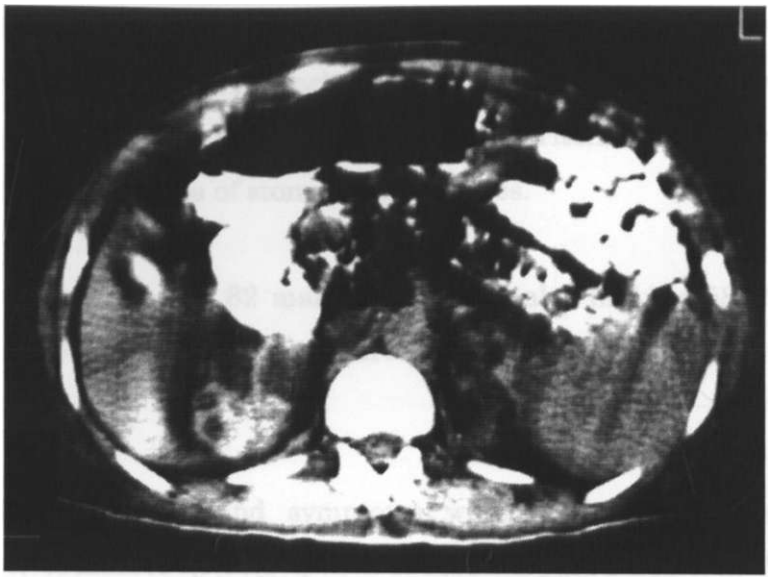
Right Psoas abscess



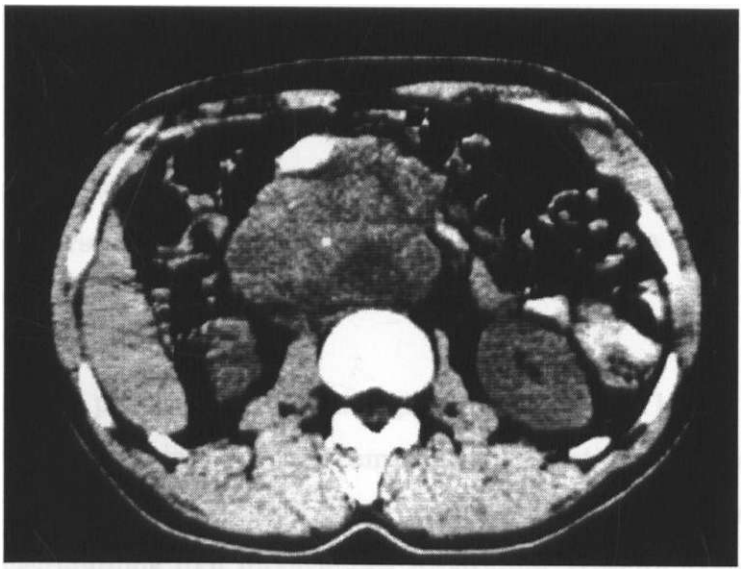
Right Wilm's tumour



Subcapsular haematoma of the right kidney



Chronic pancreatitis with multiple cysts in the kidneys



Carcinoma of the pancreas

DISCUSSION OF RESULTS

During the study period from 01/01/97 to 31/12/98, a total of 166 patients were referred to the Radiology Department for abdominal CT scan examination. Out of these, 140 patients qualified for inclusion in this study. The rest were excluded because they had pathologies outside the retroperitoneum like liver and gall bladder diseases, carcinoma of stomach and ascites.

The group studied included 82 males and 58 females making 58.6% and 41.4% respectively. The age distribution was from 0-85 years and this followed a normal distribution curve.

The most frequent signs and symptoms were abdominal masses 72(43.5%) followed by pelvic masses 26(15.6%) then abdominal pain 21(12.7%). Many clinical diagnosis occurred in combination like abdominal mass with abdominal pain, other less frequent signs and symptoms were jaundice 14(8.4%), hypertension 7(4.3%), haematuria and hypoglycaemia 2(1.2%) of each. Radiotherapy and chemotherapy constituted 20(12.0%) of the clinical history.

The commonest diseases in the retroperitoneum were non specific retroperitoneal diseases, 39(26.5%), followed by renal diseases, 34(23.2%), then pancreatic diseases, 29(19.7%). Normal abdominal CT scans were found to be 20(13.6%).

The most frequent radiological diagnosis was renal tumours 21(14.8%), followed by pancreatic tumours 18(12.7%), then lymphomas 15(10.6%) and primary non specific retroperitoneal tumours was 15 (10.6%).

80% of patients had previous other radiological investigations before they came for the CT scan examination. The commonest investigation was abdominal ultrasound 75%. Of these, 17.1% of the ultrasounds were done in combination with other investigations like intravenous urography, percutaneous transhepatic cholangiography, barium meal and even aortography. This is because ultrasound is less expensive, easy to perform, does not require ionizing radiation and has very little patient preparation [1].

However, CT proved to be very useful in the retroperitoneum where it provided more information in accurately delineating abdominal masses, size, extend and surrounding structures [112]. Rarely patients came directly for abdominal CT scan examination before other radiological investigations were done.

At age group 0-5 years, the commonest diseases involved the kidney 38.9% followed by primary non specific retroperitoneal masses 33.3% then pelvic masses 16.7% and adrenal masses was 11.1%. There were no pancreatic and vascular diseases found at this age group. These results differed with the textbook findings that place renal masses first followed by neuroblastomas and then pelvic tumours. Pelvic tumours included teratomas, ovarian tumours and pelvic rhabdomyosarcoma. Primary non specific retroperitoneal tumours are rare [1].

In another study, solid retroperitoneal tumours seen at the hospital for sick children in a 5 year period showed wilms tumour 45.9%, neuroblastoma 37.9%, rhabdomyosarcoma 5.8%, adrenal tumours 5.8%, teratomas 2.3% and undifferentiated sarcoma 2.3%.[28]

In my study probably because there was no pathology report correlation, there may have been misdiagnosis in the radiology report.

Primary Non Specific Retroperitoneal Diseases

Primary non specific retroperitoneal diseases constituted 39 (26.5%). The commonest radiological finding was lymphoma 42.9% followed by primary non specific retroperitoneal neoplasm 40.0%. There was one case of a foreign body in the retroperitoneum following the bomb blast. Another unique case was hydatid cysts in the retroperitoneum without liver, lung or renal involvement.

The diagnosis 6f lymphoma was made on CT by showing para-aortic node enlargement or matted nodes with masses elsewhere. This was difficult to distinguish from metastasis although in metastasis, the primary diagnosis will have been established by the time the retroperitoneal disease is discovered*[18]).

Renal Diseases

These constituted 34(23.3%) of all retroperitoneal diseases. Of these group, renal tumours were 60.6%. The renal tumours constituted mainly of wilm's tumour which was reflected on peak age 0-5 years and renal cell carcinoma where the peak age was 46-50 years. CT scan was done mainly to show extent of tumour involvement and staging which assist in patient management**[9]**.

Other renal diseases were renal cysts 15.2%, renal trauma 6.1%, hydronephrosis 6.1%. The percentage of hydronephrosis was low because most of these diagnosis was made on ultrasound. Hydronephrosis due to obstruction by mass compressing on the ureter or in the pelvis was the majority in this study.

Pancreatic Diseases

These were 29(19.7%) of all diseases in the retroperitoneum. The commonest disease in this group was carcinoma of the pancreas 62.1%. CT scan proved to be the definitive diagnosis for carcinoma of pancreas[(27)]. Other pancreatic diseases were chronic pancreatitis 13.8% and its complications pancreatic pseudocyst which was 20.7%. These pancreatic diseases were seen from ages 26 years and above.

Pelvic Diseases

Pelvic diseases constituted 18(12.2%) of all diseases in the retroperitoneum. 36% were pelvic tumours. These were arising either from soft tissue, skeletal muscle or bone. Next were bladder tumours 12%. CT of the abdomen was done for staging and planning for radiotherapy. Ovarian tumours were 8% and uterine tumours were also 8%. Hydronephrosis was present in 8% of all patients with pelvic masses.

Adrenal Diseases

These were 5(3.4%) of all retroperitoneal diseases. 40% of the patients were aged 0-5yrs and had a radiological diagnosis of neuroblastoma. The rest were adults who presented with labile hypertension and a diagnosis of phaeochromocytoma was made. Metastasis disease to the gland was present from carcinoma of the bronchus.

Neuroblastomas account for 7 to 10% of all paediatric malignancies and most often present early in life about 2 years[12], over half of them arise from the adrenal glands. The large percentage of neuroblastoma in this study is probably due to the small sample size of 3.6%.

Retroperitoneal Vascular Diseases

This was only 1.4% of all the retroperitoneal diseases. They were aortic aneurysm and dissecting aorta. This shows that abdominal CT scan was not the important imaging modality for these diseases in our set up. Doppler ultrasound and aortography were the mainly used imaging modalities.

Normal Abdominal CT Scan

These were 13.6 % of all the retroperitoneal diseases. The question of a retroperitoneal mass may have been raised by radiographic findings such as a soft tissue density on an abdominal radiograph or urographic suggestion of renal or ureteral displacement. In such cases, CT provided easy and accurate solution.

Perhaps as important clinically as the detection and differential diagnosis of a retroperitoneal tumour is the exclusion of a suspected tumour.

CONCLUSION

CT scan of the abdomen is an expensive radiodiagnostic procedure. Hence it is important to make a good selection of patients to undergo the procedure. However, the conclusions and recommendations made here will help in reducing the rate of unproductive use to a minimum.

Most of the patients who attended Kenyatta National Hospital for CT scan abdomen examination are/were referred by clinicians who make their decision according to the results of the other radiological investigations or following recommendation by the radiologist.

Many abdominal masses are first evaluated by intravenous urography combined with ultrasound. Solid masses were then considered for CT scan and this achieves its maximum advantage in retroperitoneal masses.

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 radiologist should no longer be considered a [v]shadow-gazer' but an anatomist in vivo.

RECOMMENDATIONS

1. Clinicians should have more frequent consultations with the radiologists in order to make effective use of CT scan of the abdomen, and all other radiological examinations.

2. A fast scanning unit or spiral CT scan is recommended especially for paediatric abdominal CT and very sick patients. This is because of movement blur from an uncooperative or sick patients and poor definition of fascial planes due to lack of body fat in paediatric age group. Very ill patients also cause motion blur and cannot be told to stop breathing when using the 3rd generation CT scanner.

3. Follow up studies on patients found to have retroperitoneal masses and to be correlated with surgical and pathologic findings. This would improve on the accuracy of the radiological reports.

4. It would also be important to study the CT findings of specific organ diseases characteristics, pattern, sex distribution, etc in our own setup and to correlate this with studies done elsewhere.

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Appendix

List of the study sample

SERIAL NO	AGE(YRS)	SEX	CLINICAL HISTORY CLINICAL DIAGNOSIS	RADIOLOGICAL DIAGNOSIS	OTHER RADIOLOGICAL INVESTIGATIONS	ORGAN INVOLVED
1	11	M	MS	L	US, XR	RE
2	60	M	MS,MP	L	US, IVU	RE, PV
3	21	F	MS	AA	US, AG	Ao
4	49	M	MS	AD	XR,US,IVU	AR
5	32	F	PS	PT, HD	US	PV, K
6	30	M	H	RH	US, IVU	K
7	47	M	MS	RT	US, IVU	K
8	45	M	Ja	Pa	us	P
9	40	F	MS	RT	US, IVU	K
10	50	F	MS, MP	Pa	us	P
11	30	M	MS	PP	us	P
12	50	M	MS	RT	US, IVU	K
13	A	F	MS	RP	Ba	RE
14	28	F	Ja,MS,MP	PP	US	P
15	40	F	PS, DX	N	US	N
16	A	M	MP	Pa	US	P
17	A	F	MP	Pa	us	P
18	8	F	MP	N		N
19	A	F	MP	RP	US, IVU	RE
20	A	M	MS, MP	L	us	RE
21	22	M	MS	RT	us	RE
22	62	M	MP	RP	us	RE
23	36	F	MS	PC	US, IVU	P
24	64	F	HT	AD	XR,	AR
25	60	M	PS, DX	BT, HD		K, PV
26	35	M	MP	Ab	us	RI
27	58	F	MP, Ja	PC	us	P
28	82	M	Ja	PC	us	P
29	4	M	HP	AD	US, Ao, Ec	AR
30	90	F	Ja	PC	US	P
31	65	F	Ja	PC	US	P
32	A	M	MS	PT	US	RE
33	29	M	DX	N		N
34	55	M	MP	PC	us	P
35	62	M	Ja	PC	us	P
36	20	F	MS	Ab	us	RI
37	65	M	MS	RT	us	K
38	4	M	MS	AD	us	AR
39	37	M	MS	N		N
40	16	M	HT	AD		AR
41	A	M	MS	PC		P
42	A	M	MS, MP	PP+ RC	us	P + K
43	80	F	MS	HD	us	K
44	A	F	MS	RP	us	RE
45	15	F	MS, DX	RP	us	RE
46	36	M	PS, DX	BT,		PV
47	3.5	F	MS	RP	us	RE

SERIAL NO	AGE(YRS)	SEX	CLINICAL HISTORY CLINICAL DIAGNOSIS	RADIOLOGICAL DIAGNOSIS	OTHER RADIOLOGICAL INVESTIGATIONS	ORGAN INVOLVED
48	34	F	MS	RT	US	K
49	48	M	MS	PT		PV
50	21	F	Ja	RP	us	RE
51	9.5	F	HT	M	us	N
52	14	M	H	RH	US, IVU	K
53	3	M	MS	L	US	RE
54	53	M	Ja	PC	us	P
55	14	M	MS	RT	us	K
56	65	M	MP	PC	us	P
57	46	F	HT	AA	us	Ao
58	4 1/2	F	MS	L,	us	RE
59	A	M		HD	us	K
60	48	M	MS	RT	us	K
61	60	M	PS, DX	BT, HD	us	PV, K
62	56	M	PS, DX	N		N
63	70	M	Ja	PC	us	P
64	75	M	Sx	RT	us	K
65	51	M	MP, MS	N	us	N
66	42	M	Ja	PC	us	P
67	60	F	PS, DX	RP, UT		PV, RE
68	48	M	MP, MS	RC	US, IVU, XR	K
69	A	M	MS	N		N
70	11	M	Ja	L	us	RE
71	46	M	MS	N		N
72	3	M	MS	RT	US.IVU	K
73	50	F	MS, MP	PP	us	P
74	3.5	M	MS	L	us	RE
75	A	F	MS	N		N
76	A	F	HO	PC	us	P
77	28	M	MS	PC	us	P
78	10	F	DX, PS	N	us	N
79	40	F	MS	HY	us	RE
80	45	F	PS	UT	IVU, us	PV
81	2.5	F	PS	RP	us	RE
82	1.6	M	MS	RP	us	RE
83	52	M	Ja	PC	US, PTC	P
84	55	F	MS	RT	US, IVU	K
85	43	F	PS, DX	RP	us	RE
86	53	F	MS	N	Ba	N
87	42	M	MS	RP	XR	RE
88	16	F	DX, MS	RT		K, RE
89	50	M	MS	RT	IVU, us	K
90	36	M	MP	PC	Ba, US	P
91	32	M	DX, PS	M		N
92	A	F	PS	RP	US	RE
93	50	M	HT	RC	US	K
94	58	F	MS	L	us	RE
95	25	F	MS	OT	US, IVU	PV
96	27	M	FB	FB		RE
97	10	M	PS	RP		RE

SERIAL NO	AGE(YRS)	SEX	CLINICAL HISTORY CLINICAL DIAGNOSIS	RADIOLOGICAL DIAGNOSIS	OTHER RADIOLOGICAL INVESTIGATIONS	ORGAN INVOLVED
98	41	F	HO	PC	US	P
99	33	M	MS	L	US	RE
100	A	F	MP, MS	L	**us**	RE
101	74	F	MS	L	**us**	RE
102	65		PS	UT+HD	**us**	RI, K
103	32	F	PS	HD	**us**	PV+K
104	A		HT	Ab	**us**	K
105	A		MP	PP	**us**	RI
106	60	F	MP	N	**us**	P
107	71	F	PS, DX	N		N
108	50		MS	L, HD		K, RE
109	42		PS, DX	HD, PT		PV, K
110	30	F	MS	L	**us**	RE
111	53	F	PS	PT	**us**	PV
112	47	F	PS, DX	N		N
113	2.5		MS	PT	**us**	PV
114	3.9/12		PS	PT	**us**	PV
115	2	F	MS	RT	**us**	K
116	80		MS	RC	**us**	K
117	1.5	F	PS	RT	**us**	PV
118	85	M	HT	RC	**us**	K
119	68	M	PS	BT		PV
120	25	M	MS	N		N
121	3	M	MS	RT	IVU, **us**	K
122	7	M	HT	RT	IVU, **us**	K
123	4.5	M	MS	RT	US, IVU	K
124	18	F	MS	RP	**us**	RE
125	1.6	F	MS	RT	US, IVU	K
126	44	M	PS	PT		PV
127	26	F	PS	PT		PV
128	49	M	MS	N	**us**	N
129	27	M	MS	L	**us**	RE
130	3	F	RX, MS	RT	**us**	K
131	11	F	PS	OT	**us**	PV
32	11	M	MS	RP	**us**	RE
133	A	F	MS	N		N
134	3	F	RX, MS	RT		K
135	41	M	DX, MS	Pa		P
136	28	M	MP	N	**us**	N
137	80	M	Ja	PC	**us**	P
138	57	M	MS	L	**us**	RE
139	27	M	MS	PP	**us**	P
140	15	M	RX, MS	N		N