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Prevalence of Adrenal Incidentalomas: A Prospective Study

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Abstract
Purpose: The aim of this prospective study was to ascertain the nature and prevalence of incidentally discovered adrenal masses on routine chest and abdominal CT scans in patients with no known malignancy. Study was conducted in a tertiary care hospital in northern state of India. **Methods and Materials:** We analyzed the scans of 4469 patients in our hospital performed between December 2014 to April 2015. We found 240 incidental adrenal masses in 213 (5.12%) patients while reviewing the scans. Patients with no known malignancy and no suspicion for a hyperfunctioning adrenal mass were further isolated. A total of 337 patients were excluded. The remaining 4132 patients who fulfilled the criteria constituted the study group. The number, size and imaging features of the adrenal mass in each patient was recorded. Biochemical and demographic details were recorded. **Results:** A total of 240 adrenal incidentalomas were identified, including 27 bilateral lesions in 213 patients with a prevalence of 5.15%. The male patients had a slightly higher prevalence of AI than females (5.86% vs. 4.24%. These lesions were characterized with following methods: Histopathology (*n*=8), Imaging characterization (*n* = 220), Clinco-Laboratory diagnosis (n=12). In our study the most common type of adrenal mass was adenoma (n=169, 70.45%). Next common lesion was myelolipoma seen in 16(6.66%) patients. Haematoma was seen in 13 (5.41%) cases and cyst was seen in 12 (4.58%) cases. Metastaic disease was diagnosed in 10 (4.16%) cases , 4 cases were diagnosed on histology and 6 were were confirmed on imaging. There was 1 (0.41%) case of pheochromocytoma in our study. Macronodular hyperplasia was seen in 3 (1.28%) patients. A total of 16 lesions in 8 patients showed features suggestive of tuberculosis. **Conclusion:** Adrenal incidentalomas being common lesions need complete evaluation as there can be risk of malignancy or hormonal hyperfunction. The imaging features can predict the underlying pathology and biochemical evaluation should be done for hormonal hyperfunction. Thus there should be comprehensive reporting and selective testing strategy, so that these lesions are not missed.

Keywords: Incidentaloma, CT, Adenoma, Pheochromocytoma

1. **Introduction**:

An adrenal incidentaloma is an adrenal mass discovered, incidentally during routine radiologic examination performed for indications other than evaluation of adrenal disease.[1] The adrenal gland is a frequent site of involvement by different disease processes. With wide spread use of CT examination for different abdominal and chest conditions, adrenal lesions are frequently diagnosed in daily radiology practice seen in some 5% of CT examination.[2,3] It is difficult to know the true prevalence of the incidentalomas on cross sectional imaging as there are varied definitions and lack of standardised protocols for adrenal imaging. Autopsy series show prevalence as high as 9% in patients 70 years of age or older and 1% in patients 30 years or younger.[4] These patients usually do not have any adrenal symptoms as most of these lesions are benign and non- functioning. However, these lesions need complete evaluation as there can be risk of malignancy or hormonal hyperfunction.[3,5] The primary aim of this study was to ascertain the nature and prevalence of AI diagnosed by CT scans of the thorax and abdomen.

2. Materials and Methods

Patients

We performed a prospective study on all patients who were referred to Radiology department to perform CT Chest or Abdomen between December 2014 to April 2015. We analyzed the scans of 4469 patients in our hospital during this period. We found 240 incidental adrenal masses while revieving the scans in 213 (5.12%) patients. A total of 337 patients were excluded. Fifty nine patients had known malignancy or there was high-risk adrenal metastasis. Two seventy eight patients were excluded in whom adrenal assessment was not possible because of poor examination technique. The remaining 4,132 patients constituted the study group. The number, size and imaging features of the adrenal mass in each patient was recorded. Biochemical and demographic details were recorded.

Computed tomography

All the abdominal and chest CT scans were done on Siemens Syngo 16 slice scanner. Abdominal CT, both unenhanced and contrast-enhanced scans, were used to

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diagnose incidental adrenal lesions. Postcontrast scans were done during the portal venous phase (60-70 seconds) after 100 ml non- ionic contrast material was administered intravenously. Depending upon the body part to be imaged collimation varied between 3 to 7 mm. Most of chest CT examinations were unenhanced. For contrast-enhanced chest CT 100 ml non- ionic contrast material was given intravenously. Dedicated adrenal study with contrast washout estimation was also done in few patients. Adrenal CT was performed for characterization of the incidentally-discovered adrenal masses. Unenhanced study was obtained with 2.5 mm collimation through the adrenal glands. The field of view was 25-28 mm on average. The region of interest (ROI), an ellipse in the adrenal mass, was identified and its density measured. If the density of ROI was greater than 10 HU, 100 ml non-ionic contrast material was administered intravenously at 3 ml/s. Imaging was repeated 60s after injection and again 10-15 minutes later, without changing imaging parameters.

3. Results

The study group comprised of 4132 low risk patients, 2319(56.12%) males and 1813(43.88) females. The mean age of patients was 53.3 +_ 20.4 years. Regarding the type of examination, 1230(29.77%) cases were chest CT, 2199(53.21%) abdominal CT and 703(17.01%) were CT chest and abdomen cases.

Table 1: Clinical and Demographic characteristics of Patients

Variable		Value
Mean Age (years)		53.2 +_20.4
Sex	Male	2319(56.12%)
	Female	1813(43.88%)
Procedure	Inpatients	2766(66.94%)
	Outpatients	1366(33.06%)
Type of Examination	Chest	1230(29.77%)
	Abdomen	2199(53.21%)
	Chest and Abdomen	703(17.01%)

A total of 240 adrenal incidentalomas were identified, including 27 bilateral lesions in 213 patients with a prevalence of 5.15%. The male patients had a slightly higher prevalence of AI than females (5.86% vs. 4.24%). Among admit patients prevalence was 5.54% as compared to out patients with prevalence of 4.88%. It was also observed that prevalence increased with increasing age, with prevalence of 1.32% under 30 years of age and rising to 6.29% in patients above 60 years of age.

Table 2: Prevalance of Adrenal Incidentaloma as per Age, Sex and procedure

Variable		No. of Patients	No. of cases	P value
Sex	Male	2319	136(5.86%)	
	Female	1813	77(4.24%)	
Age range(years)	>60	1796	113(6.29%)	
	30-60	1657	91(5.49%)	
	<30	679	9(1.32%)	
Procedure	Inpatients	2766	94(5.54%)	
	Outpatients	1366	119(4.88%)	

The Table 3 presents the radiological features observed in incidental adrenal lesions in 213 patients. In 118(55.40%) cases right adrenal was involved and in 68(31.92%) cases, lesion was seen in left adrenal. Bilateral lesions were seen in 27(12.67%) patients. Regarding the size of the lesions, 117(48.75%) patients had lesions of size less than 2.0cms, 11(46.66%%) lesions were between 2.0 and 4.0cm and 11(4.58%), lesions were greater than 4.0 cms in size.

Table3: Radiological features of Adrenal incidentalomas

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Characteristic Feature		No. of patients
Laterality	Right Adrenal	118(55.40%)
	Left Adrenal	68(31.92%)
	Bilateral	27(12.67%)
Contour	Regular	179(74.58%)
	Irregular	61(25.41%)
Size(cms)	<2.0	117(48.75%)
	2.0-4.0	112(46.66%)
	>4.0	11(4.58%)
Enhancement	Homogenous	105(43.75%)
	Heterogenous	96(40.0%)
	Absent	39(16.25%)
Calcifications	Present	25(10.42%)
	Absent	215(89.58%)

Two hundred forty lesions were evaluated as follows: histologic diagnosis (*n* = 8), imaging characterization (*n* = 220), and clinical and laboratory evaluation (*n*= 12). A specific diagnosis was established in 197 adrenal lesions, at the time of the initial CT, and the remaining 43 masses required further workup.

Table 4: Methods to Establish Diagnosis of Adrenal Lesions

Method		No. of Masses
Histological diagnosis		8
Imaging diagnosis	Unenhanced CT	103
	Contrast Enhanced CT	89
	Adrenal CT with washout	28
Clinco-Laboratory diagnosis		12

In our study the most common type of adrenal mass was adenoma (n=169, 70.45%). Next common lesion was myelolipoma seen in 16(6.66%) patients. Haematoma was seen in 13(5.41%) cases and cyst was seen in 12(4.58%) cases. Metastaic disease was diagnosed in 10(4.16%) cases , 4 cases were diagnosed on histology and 6 were were confirmed on imaging. There was 1(0.41%) case of pheochromocytoma.in our study. Macronodular hyperplasia was seen in 3(1.28%) patients. A total of 16 lesions in 8 patients showed features suggestive of tuberculosis.

Table:5 Pathology Results for All Adrenal Lesions

Diagnosis	No. (%) of Lesions
Adenoma	169(70.41%)
Myelolipoma	16(6.66%)
Haematoma	13(5.41%)
Cyst	12(4.58%)
Metastasis	10(4.16%)
Pheochromocytoma	1(0.41%)
Macronodular Hyperplasia	3(1.28%)
Tuberculosis	16(11.25%)

4. Discussion

With the advent of state-of-the-art cross sectional imaging technique there is growing interest in the evaluation of incidentally discovered adrenal lesions. With the use of high resolution CT scanners in recent years adrenal incidentalomas are now discovered more frequently.

In our study the prevalence of adrenal incidentalomas was 5.15%. Same prevalence was seen in previous studies.[7,8] The prevalence of adrenal incidentalomas on imaging has approached to that of autopsy series [9] although not as high as that reported of 9%,[10] as there may be microscopic involvement of adrenals which is not seen on imaging . In older studies the prevalence was reported to be 1-2%. [11]

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The reason for their low prevalence may be due to poor resolution of older CT scanners. Additionally, these low rates may be attributed to the fact that more dedicated scanning for adrenal lesions is done in research protocol while in a routine case radiology department particularly focuses on the patient's presenting complaint.

In our study the most common kind of adrenal mass was adenoma (n=169, 70.45%). Majority of adenomas were diagnosed on imaging. Only 2 adenomas were diagnosed by histology as they did not meet the criteria of benign lesion on imaging. With the use of dedicated adrenal CT and chemical shift MRI, biopsy is now occasionally used for diagnosis of adenoma. [12] In this study, most (82.22%) adenomas were diagnosed on unenhanced CT, using the criteria of ≤ 10 HU, which is similar to that reported by previous studies. [8,13] In our study 13% of adenomas were diagnosed on dedicated adrenal CT with characteristic washout.

Next common lesion was myelolipoma seen in 16 (6.66%) patients which is similar to 6.0% reported by Song et al. [8] However, much lower prevalence (0.08–0.2%) is reported in autopsy series.[14] All the myelolipomas were diagnosed on imaging as they contain macroscopic fat.

In our series haematoma was seen in 13 (5.41%) cases. Hematomas are easily diagnosed on CT because they have characteristic appearance of a high-density lesion, and they occur in distinct clinical settings, with most of patients (80%) having history trauma.[15] In an autopsy series of severe trauma, a prevalance of 28% was reported,[16] however a much smaller prevalence of 2% has been reported on imaging in patients with severe abdominal trauma. [17, 18] There should be resolution of hematomas on follow up examinations.

In this study cysts were seen in 12 (4.58%) cases. Cysts have characteristic low density on CT with thin wall, unless there is secondary infection or haemorrhage. Metastaic disease was diagnosed in 10 (4.16%) cases. Four cases were confirmed on histology. In remaining 6 cases, diagnosis was made on imaging as primary malignancy was seen in other organs. In his study Ferreira et al., reported a higher prevalence of metastaic lesion because they have included oncologic patients.[19]

There was 1 (0.41%) case of pheochromocytoma in our study which was proven by biopsy after surgical resection which is similar to 0.4% reported by Sen et al.[20] Pheochromocytomas can be clinically silent, however most patients with an incidentally found pheochromocytoma have a history of hypertension. In his series Motta-Ramirez et al., [21] reported that 58% of all pheochromocytomas were detected incidentally. The National Institutes of Health (NIH) consensus conference recommends biochemical evaluation for hormonal excess in its guideline for management of clinically inapparent adrenal masses.

A total of 16 lesions in 8 patients showed features suggestive of tuberculosis . In 4 patients calcifications was seen in bilateral adrenals. In remaining 4 patients there were hypodense lesions in adrenals. All these patients showed lung parenchymal lesions with mediastinal lympadenopathy. . Together with clinical and laboratory findings diagnosis of tuberculosis was made in these patients. No tuberculosis lesion was seen in some recent studies which may be attributed to high prevalence of infections in this part of world.

5. Conclusion

Adrenal incidentalomas are common with our study showing the prevalence of 5.16%. These lesions need complete evaluation as there can be risk of malignancy or hormonal hyperfunction. The imaging features can predict the underlying pathology and biochemical evaluation should be done for hormonal hyperfunction.Thus there should be comprehensive reporting and selective testing strategy, so that these lesions are not missed.

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