



Incidental Findings in CT Scans on Screening for COVID-19

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Abstract

Incidentalomas on computed tomography (CT) scans are incidental or unsuspected findings that are detected when obtaining a CT examination for an unrelated reason. Incidentalomas on CT scans are common. This study was conducted to examine the rates of incidental findings on CT chest in patients who were screened for COVID-19. Three thousand one hundred ninety-one CT scans were assessed for incidental findings. These CT scans were taken from an urban diagnostics laboratory in Hyderabad (IN) over a period of 2 months (April to May 2021) when the COVID-19 wave peaked. Data from these reports were tabulated with demographic information and findings. Out of 3191 scans, 277 (8.68%) showed incidental findings, the most common of which was lung nodules and other individual findings. There were 6 total malignancies detected and a further 92 cases that required follow-up. CT scans are important for the detection of incidental findings. Care should be taken to follow up on patients with incidental findings that are undetermined to catch a lesion in the early stage.

Keywords Incidentalomas · CT scans · COVID-19

Introduction

The role of CT scans of the chest in the COVID-19 pandemic has evolved with time. It is now used as a vital diagnostic tool. CT scan reports of COVID-19 patients have been useful to rule out or rule in the disease. It has also been vital in the triage of emergency department patients as findings could be stratified based on the severity of lung involvement. CT scan findings could be used to determine whether a patient needed hospitalization, ICU admission, or outpatient treatment.

Incidentalomas are defined as findings that are unrelated to the chief complaints. Incidentalomas are common in CT scans. They are mentioned in the section of “incidental findings” by the radiologist who interprets the CT scans. Increased use of CT scans as a diagnostic technique and advances in CT scan technology have increased the ability

to find subtle findings. Some of these incidental findings require follow-up, while others may not.

Studies have been conducted to examine the rates of incidental findings in the emergency departments and trauma centers [1, 2, 3, 4]. There have not been studies conducted that examine the rates and types of incidental findings in CT chest in a population screened for COVID-19. Our goal was to find out the rate of incidental findings and the frequency of individual incidental findings found in patients who underwent CT chest as a screening/diagnostic tool for COVID-19.

Methods

A list of all the CT chest scans done in an urban diagnostic center over a 2-month period (April to May 2021), during the peak of the second wave, was obtained. This included a total of 3191 patients who had CT chest scans. Care was taken to make sure that the patient had come to screen for COVID-19. This was done by reviewing the chief complaints’ section of the report. If there was uncertainty regarding the patient’s chief complaints, then the patient’s case sheets were reviewed to confirm the reason for the CT chest.

Then, using a structured data collection form, information such as name, age, gender, reason for CT scan, and

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incidental finding category was recorded. The reports that were used for data collection were the finalized CT reports as read by the attending radiologist.

Any finding on the CT scan that was not related to COVID-19 findings was considered an “incidental finding.” The evaluation of finalized CT scans and their reporting was done by a single person to maintain consistency in the report.

The incidental findings were divided into categories, after which the rates of incidental findings in a particular category were calculated and reported. Comparisons were made between gender and age brackets.

Results

Out of the 3191 CT scan reports reviewed, 277 showed incidental findings. In the overall distribution of incidental findings as seen in Figs. 1 and 2, the most commonly occurring incidental finding included lung nodules (57) and other individual findings. The least common findings included cardiomegaly [5]. The findings that have been categorized under “others” are noted in Table 1. Since there were multiple separate findings under liver lesions, the individual unique liver lesions are mentioned in Table 2. Similarly, all the lymph nodes were categorized under “lymph nodes”; the individual locations of lymph nodes are mentioned in Table 3.

Out of the 277 incidental findings, 6 (2.17%) malignancies were detected. These malignancies are listed individually in Table 4. Out of the 277 cases, 92 required follow-up of which 6 were malignancies, 17 were lymph nodes larger than 1 cm or having calcifications, and 24 were lung nodules that were either larger than 1 cm in size or calcified. Since

the cause of lymph nodal enlargement and lung nodules could be the COVID-19 infection itself, we did not include these findings in “Incidental findings that need to be followed up.” In lesions that needed to be followed up, the most frequent incidental findings were from the thyroid gland, the liver, and the breast as which is noted in Table 5.

The demographics showed that the maximum number of findings were in the age bracket of 51–60, as demonstrated in Table 6. There was a larger amount of incidental findings in males compared to females, as shown in Table 7.

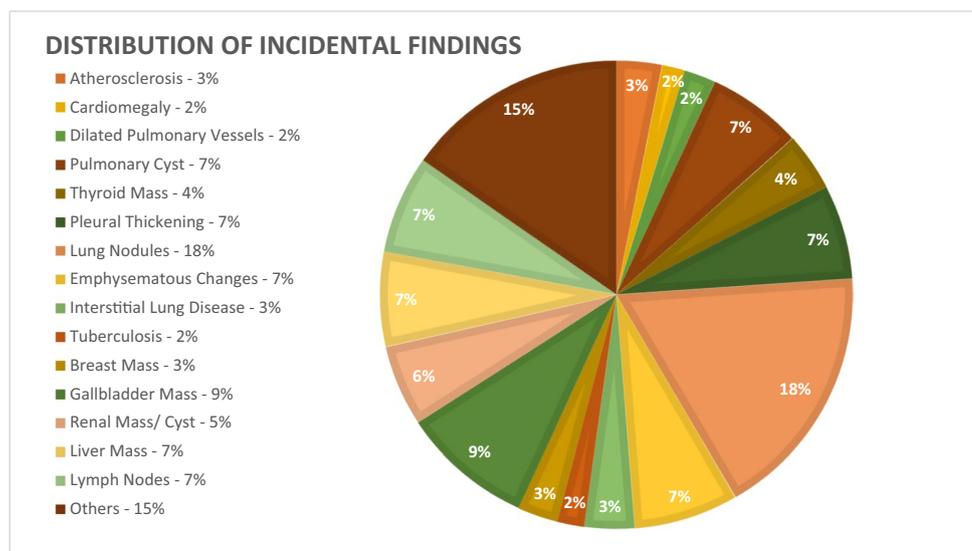
Discussion

A total of 3191 CT scan reports were examined to look for incidental findings in the period April to May 2021. The CT scans were solely taken to screen patients for COVID-19. They were taken either after a positive RT-PCR report or due to symptoms that correlated with the infection. This was confirmed by looking at the chief complaints’ section of the CT scan report.

Out of the 3191 reports examined, 277 (8.68%) of them showed incidental findings. The incidental findings include benign findings, potential malignancies that require follow-up, and confirmed malignancies. The number of findings reported in this study could be correlated with the findings found in a study conducted by Thompson et al. on Incidental Findings in CT Scans in the Emergency Department [5]. Thompson’s study reported 8.0% incidental findings upon performing CT Thorax in the ER. The correlation of these findings suggests that there is a prevalence of incidental findings in CT scans conducted in varied settings.

The most frequent incidental finding detected in this study was lung nodules (18%). This could also be

Fig. 1 Pie graph of the distribution of incidental findings



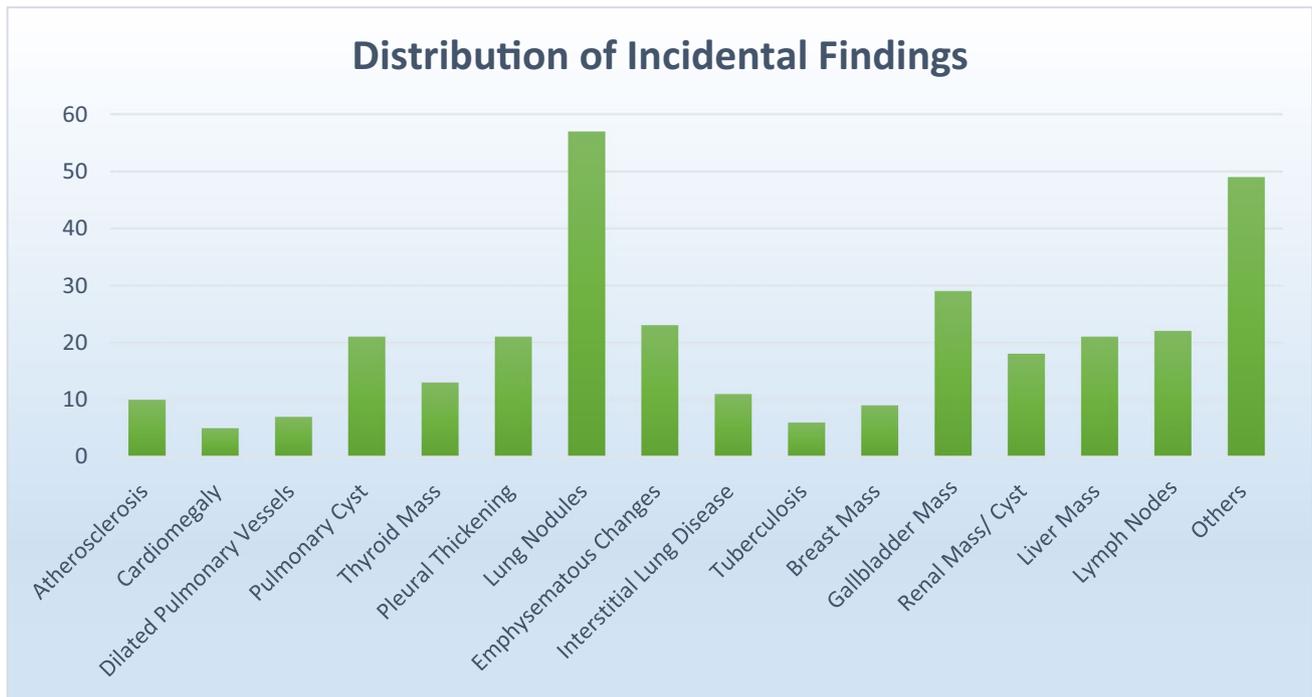


Fig. 2 Bar graph of the distribution of incidental findings

correlated with findings from another study conducted by Frank et al. on CT chest incidentalomas [6]. Frank's report suggested that lung nodules are the most common incidentalomas on CT chest examinations with 25–33% reportage. The percentage of gastrointestinal findings in this study amounted to 21% which is similar to Farhat's study [7] of incidental findings on HRCT of the chest which concluded as having 25.8% gastrointestinal findings.

Malignant Findings

Out of the six incidental malignant findings in the results, 5 of them are present in females (83%). Out of the 5 malignancies attributed to females, one is breast cancer, another is a potential thyroid papilloma, another is an enchondroma and a lymphoma, and the last is a nerve sheath tumor. The only cancer attributed to a male is lung carcinoma.

The age of the patient varied from 18 to 70, with each malignancy attributed to a different age group. These results show that malignancy as an incidental finding could be attributed to any age group and not necessarily just the older demographic despite a majority of the incidental findings centering around the 50–60 age group. Additionally, the gender discrepancy in this study could be due to the limitation of the sample size.

Cases to be Followed Up

Out of 277 cases, 92 cases required followed up to confirm for malignancy. Out of the 92 incidental findings, 45 (48.91%) included hypodense thyroid, liver and kidney lesions, enlargement of the thyroid gland, calcifications in the thyroid and liver; soft-tissue densities in the breast; and enlarged pulmonary vessels. The other 47 (51.08%) included lymph nodes larger than 1 cm or calcified, lung nodules larger than 1 cm or calcified and confirmed malignancies. It is not possible to discern whether the lung nodules and lymph nodes were incidental or due to the Covid infection, hence these findings were not included in table 5.

The demographics of findings in Table 5 are as follows:

The percentage of women who presented with findings requiring follow-up include 25 (58.13%) and the men included 18 (41.86%).

Amongst the women, the largest number of findings were attributed to breast mass [8] and thyroid lesions [8], followed by liver lesions [7].

Amongst the men, the largest number of findings was attributed to liver lesions [7] after which came thyroid lesions [5].

The age distribution varied with most of the lesions found in the 50–60 years age range. After which there was equal distribution amongst the 60–70 and 40–50 age range. This

Table 1 Findings that have been categorized under “others”

Other incidental findings	Number
Pericardial effusion	2
Situs inversus with dextrocardia	1
Respiratory bronchiolitis	1
Hypersensitivity pneumonitis	2
Degenerative changes in the dorsal spine	5
Osteophytes	4
Pleural tag	2
Hiatus hernia	3
Old infective sequelae	9
Volume loss and ipsilateral shift of mediastinum	2
Aortic valve in situ	1
Collapse of lung	2
Differential of papilloma/hamartoma (salivary gland origin)	1
Differential of fibrous dysplasia/enchondroma/Brown’s tumor	1
Pleural plaque	2
Bronchial atresia	1
Plaque like soft tissue density in anterior chest	2
Free air in mediastinum	1
Small airway disease	1
Differential of duplication cysts/ganglioneuroma/nerve sheath tumor	1
Fat stranding in central mesentery	1
Chronic pancreatitis	1
Osteochondromas	1
Hypodense lesion in spleen	1
Pulmonary thromboembolism	1
Sclerotic deposits in D5, D9, D10, D11 vertebral bodies in coracoid, glenoid process in left scapula (metastasis)	1
Cystic bronchiectasis	1
Thin walled bullae	1
Calcification of walls of bronchi	1
Traction bronchiectasis	1

Table 2 Individual unique liver lesions

Liver lesions	Number
Liver calcification	3
Liver hypodense lesion	11
Azygous lobe fissure	1
Cirrhosis and portal hypertension	1
Fatty infiltration	2
Liver parenchymal disease	2
Calcific granuloma	1
Interposed hepatic flexure	1

Table 3 Individual locations of lymph nodes

Lymph node locations	Number
Pretracheal, precarinal, paraaortic, AP window	12
Right hilum	3
Left hilum	1
Axillary and deep pectoral	1
Mediastinum	2
Upper abdomen	1
Axillary and posterior triangle of neck	1
Axillary	1

demonstrates the increase in incidental findings in the 40–70 age group range, peaking at 50 years.

The results described above show a high incidence of incidental thyroid and breast lesions that require follow-ups. Managing incidental thyroid lesions requires an

understanding of which cases require further work-up and which can be considered insignificant. An article written by Saeedan [8] mentions that of all the incidental intra-thyroid calcification, 48% are histopathologically proven to be malignant. Another finding mentioned by Saeedan is that

Table 4 Malignancies

Malignancies noted	Number
Malignant breast lesion	1
Papilloma/hamartoma	1
Fibrous dysplasia/Brown's tumor/osteochondroma	1
Ganglioneuroma/nerve sheath tumor/duplication cysts	1
Lymphoma	1
Lung carcinoma	1

Table 5 Incidental findings that require follow-up to rule out malignancy

Incidental findings that need follow-up to rule out malignancy	Numbers
Renal cysts/calcifications	6
Liver calcifications/hypodense lesions	15
Breast calcifications/densities	9
Thyroid calcifications/hypodense lesions/enlargement	13
Spleen lesions	1
Lung soft tissue density	1

Table 6 Demographics

Age group	Numbers of incidental findings
10–20	4
21–30	22
31–40	46
41–50	48
51–60	62
61–70	57
71–80	26
81–90	12

Table 7 Incidental findings in males compared to females

Gender	Number
Male	177
Female	100

thyroid papillomas may appear similar to simple thyroid cysts and care has to be taken to differentiate them. Finally, Saeedan's studies show that the highest incidence of thyroid malignancies appears to be papillomas which we can correlate with our findings as one of the malignant lesions appears to be a thyroid papilloma. On CT scans, a lesion is suspected for malignancy when it has ill-defined margins, invasion, or lymph node extension; however, Saeedan's research mentions that the absence of these features *do not* exclude

malignancy, especially papillary, follicular, and medullary thyroid carcinomas. Hence, they recommend using ultrasound and possibly FNAC to correlate any thyroid lesion findings.

The findings in our studies and Saeedan's studies highlight the importance of ensuring follow-up for what seem to be relatively non-urgent thyroid lesions. Neglecting to report lesions like calcifications could rid us of the chance of detecting a potential malignancy at an early stage. Care should be taken by doctors who discuss these reports with patients to ensure that they receive adequate information to make informed choices on follow-up.

When it comes to breast lesions, there have been numerous reports that indicate a lack of awareness amongst Indian women regarding breast cancer screening methods. There is a lack of education regarding basic breast examinations and steps to take following the detection of lumps. This could perhaps lead to an increased incidental breast lesion finding (benign or malignant) instead of lesions detected by patients themselves. In a study conducted by Sandeep Singh titled *Breast cancer screening existence in India: A non-existing reality* [9], they mention that Indian women's rate of breast cancer development is lower than their Western counterparts, but the mortality rate is higher. This is due to the fact that there is an emotional, cultural, educational, and social barrier that prevents women from getting tested. Nationwide breast cancer screening programs are also non-existent, which adds to the lack of information for women regarding their health. Early breast cancer accounts for only 30% in India, whereas in the world, it accounts for 60–70%. The findings in our study can correlate with the findings mentioned in Singh's article as the number of incidental breast lesions is high and distributed well in every age group.

Care should be taken by the government and hospitals to ensure that breast cancer awareness is spread rampantly in the Indian population. Nationwide screenings should be implemented so that breast cancer can be caught at an early stage and will reduce the mortality rate of this disease in India.

Although the immediate goal of this study is to address the frequency and prevalence of incidental findings in COVID-19 screenings, further questions should be raised regarding the protocols in place to inform patients regarding these findings. Care should be taken to prevent "over-informing" patients regarding benign, inconsequential findings as multiple studies have suggested that it can lead to anxiety and trepidation in patients [10]. An author has created an acronym "VOMIT" [11] standing for victims of modern information technology. This acronym describes the state of anxiety and dilemma that increased advancements in technologies have put patients in. Another problem that can occur is that over-reporting of incidental findings could lead to unnecessary invasive testing, radiation exposure, and

unnecessary expenses. Keeping this in mind, research should be done to understand which lesions are important to report and follow-up and which are not.

Further research should be conducted to assess the types of incidental findings, results of follow-ups with those findings, and how to accurately create a protocol to report incidental findings. These protocols should be researched in multiple settings as findings could be different. As technology advances, we have to make appropriate use of the detailed findings we obtain. Under-reporting could lead to negligence and could lead to late detection of a potentially life-threatening disease.

Declarations

Conflict of Interest The authors declare no competing interests.

References

- Chopra A (2012) Incidental findings on positron emission tomography/CT scans performed in the investigation of lung cancer. *Br J Radiol.* 85(1015):e229–e237
- Ekeh AP (2010) The prevalence of incidental findings on abdominal computed tomography scans of trauma patients. *J Emerg Med.* 38(4):484–489
- Devine AS, Jackson CS, Lyons L, Mason JD (2010) Frequency of incidental findings on computed tomography of trauma patients. *West J Emerg Med* 11(1):24
- Hayward R (2003) VOMIT (victims of modern imaging technology)—an acronym for our times. *BMJ* 11(1):24
- Westbrook JI, Braithwaite J, McIntosh JH (1998) The outcomes for patients with incidental lesions: serendipitous or iatrogenic? *AJR* 171(5):1193–1196
- Frank L, Quint LE (2012) Chest CT incidentalomas: thyroid lesions, enlarged mediastinal lymph nodes, and lung nodules. *Cancer Imaging.* 12(1):41
- Munk MD, Peitzman AB, Hostler DP, Wolfson AB (2006) Frequency and follow-up of incidental findings on trauma computed tomography scans: experience at a level one trauma center. *J Emerg Med* 38(3):346–350
- Bin Saeedan M, Aljohani IM, Khushaim AO, Bukhari SQ, Elnaas S (2016) Thyroid computed tomography imaging: pictorial review of variable pathologies. *Insights Imaging.* 7(4):601–617
- Farhat R, Gandhiraj D, Nayak R (2019) Incidental findings on high resolution CT scans of the chest. *Semantic Scholar.* 156(4):A1049
- Ryan J, Thompson SM (2011) Incidental findings on CT scans in the emergency department. *Emerg Med Int*
- Sandeep Singh JP (2015) Breast cancer screening existence in India: a nonexistent reality. *Indian J Med Paediatr Oncol*

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