

Incidental Multi-Detector Computed Tomography (MDCT) Findings in Patients with COVID-19 Pneumonia

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Abstract

Background: With increase using chest MDCT scanning for follow-up and evaluation of patients with Covid-19, there is incidental findings (IFs) that in needing for further examinations and follow-ups for early treatment option.

Aim of Study: This study aimed to investigate the frequency and significance of incidental MDCT findings in patients with COVID-19 pneumonia.

Patients and Methods: Original 2364 radiology reports were evaluated retrospectively during August 2020 to March 2021 for the description of IFs, which were defined as any finding in the report not related to the purpose of the scan. Documented IFs were categorized according to clinical relevance into minor and potentially significant IFs and according to anatomical location into pulmonary, mediastinal, cardiovascular, breast, upper abdominal and skeletal categories. IFs were reported as frequencies and percentages; descriptive statistics were used.

Results: Among 2364 Covid-19 patients underwent follow-up MDCT scanning, 257 (10.87%) patients were detected with incidental COVID-19 pneumonia, 149 women and 108 men with mean age 45.77 years. Pulmonary findings were seen in 89 (3.8%), hepatobiliary findings; 76 (3.2%), cardiovascular findings 44 (1.8%), and breast 38 (1.6%). The prevalence of cancers among screened participants was 48 (2%). The most common malignancy was; hepatocellular carcinoma (20: 0.8%), followed by breast carcinoma (11: 0.5%), bony thoracic cage metastases (8: 0.3%), bronchogenic carcinoma (7:0.3%), and lymphoma (2: 0.1%).

Conclusion: Incidental findings of MDCT in patients with COVID-19 was 10.87%. So it is also important to define IFs other than pneumonia in patients who underwent chest CT examination during the pandemic.

Key Words: COVID-19 Pneumonia – Incidental findings – Multi-detector computed tomography.

Introduction

SEVERE acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is a novel member of the Sarbecoviruses within the Coronaviridae family causing the Coronavirus disease 19 (COVID-19) that emerged in Wuhan, Hubei province of China in December 2019 [1]. COVID-19 was declared a pandemic by the World Health Organization (WHO) on 11 March 2020. Since then, COVID-19 spread worldwide causing million deaths [2].

Multi-Detector computed tomography (MDCT) is considered a preferred tool for screening, diagnosis, severity assessment, and monitoring of COVID-19 pneumonia [3].

Findings that are common in the radiologist's interpretation of these scans, not related to the main complaint, and not related to emergency patient care are classified as "incidental findings (IFs)". Due to the widespread use and high resolution of multi-slice CTs, the rate of encountering IFs is increasing due to the fact that they reveal previously invisible structures and pathologies in detail. While radiologists focus on the main pathology, they may ignore other pathologies or findings in the cross-sectional area. Although these IFs sometimes cause unnecessary further examinations and follow-ups that result in cost and stress burden, they can sometimes cause patients to benefit from the early treatment option [4].

We could not find any study examining the rates of IFs in chest CT scans performed for COVID-19 pneumonia in our country during the pandemic. So current study aimed to investigate the frequency and significance of incidental MDCT findings in patients with COVID-19 pneumonia.

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Patients and Methods

A retrospective study included 2364 patients presented in Radiology Departments of Mansoura University for diagnosis and follow-up of Covid-19 during the period from August 2020 to March 2021.

Patients were identified using a computerized radiographic database that records all of the radiological studies performed by the radiology department.

Exclusion criteria comprised age younger than 18 years old, pregnancy, reduced consciousness and critical clinical condition (i.e. SpO₂ <88%, respiratory frequency >30/min, systolic blood pressure <100 or mean arterial pressure <60, oxygen requirement >5 L). CTs conducted because of other indications were also excluded.

Ethics:

This research was approved by the Non-invasive Clinical Research Ethics Committee of Mansoura University. The need for patient consent was waived due to the retrospective nature of the study.

MDCT technique:

MDCT chest examination was performed at the time of presentation, in supine position, and full inspiration without contrast administration. The examinations were performed on the Light-speed 64-detector CT (GE Healthcare) or the Siemens SOMATOM Emotion (16 slices) MDCT scanner. The imaging parameters were set at 2-3-mm section thickness; 0.6-2mm beam collimation; 120kVp tube voltage; 50-150mAs tube current; 0.75s tube rotation speed; and 0.5-0.75s gantry rotation time.

Image interpretation:

Image analysis: CT evaluations were performed independently, reaching a consensus, by three radiologists with 15, 12, and 8 years of experience using high-resolution and grayscale workstations. The axial and multi-plane reformatted images were evaluated in mediastinal and parenchymal windows in terms of COVID-19 pneumonia involvement in the lung parenchyma and incidental lesions detected as parenchymal and extraparenchymal, other than COVID-19 pneumonia.

Patients were classified in terms of COVID-19 pneumonia involvement according to the Expert Consensus Statement on the Reporting of Chest CT Findings of COVID-19 pneumonia, accepted by the Thoracic Radiology Association, the American College of Radiology, and the North American Society of Radiology (16). According to this reporting system, four categories have been proposed to report CT imaging findings potentially attributable to COVID-19. The typical appearance is the findings [peripheral, bilateral, or rounded morphology multifocal ground-glass opacities (GGO)] that are

described frequently and more specifically in COVID-19 pneumonia in the current pandemic in the literature. Indeterminate appearance includes findings described in COVID-19 pneumonia but not specific enough (such as round or non-peripheral multifocal, diffuse, perihilar, or unilateral GGO) to reach a relatively reliable radiological diagnosis. Atypical appearance is rare or absent findings in COVID-19 pneumonia (such as isolated lobar or segmental consolidation without GGO, discrete centrilobular small nodules, tree-in-bud appearance, cavitation) that are more typical for other diseases. The negative for pneumonia refers to the absence of any parenchymal finding that can be associated with infection (16). Incidental parenchymal findings were classified as malignant-benign extra-parenchymal lesions and other findings; were classified as mediastinum, chest wall, axilla, thyroid, bone, and abdomen in the cross-sectional area.

Statistical analysis:

Data were analyzed using the SPSS version 21.0 Statistical package (SPSS Inc.). Quantitative and qualitative data were presented as mean \pm SD, and frequency (percentage). Descriptive statistics were applied to explore and describe the data. Chi-square (χ^2) test was used to compare categorical variables while continuous variables were compared using one-way analysis of variance. All tests were two sided, and results were considered significant at the 95% level ($p < 0.05$).

Results

Of the 2364 patients in our study, Ifs were identified in 257 patients they were 108 males (42%) and 149 were females (58%), and the mean age was 45.77 ± 11.2 years. Among Ifs group, the largest group of adult patients aged between 40-49 years was 82 (31.9%). The number of patients aged 50-59 was 56 (21.8%) and patients aged 30-39 was 46 (17.9%). The most common comorbidities among patient group with Ifs was hypertension (35.4%) followed by diabetes (31.9%) then cardiovascular diseases (25.3%), COPD (3.9%) and lastly hypothyroidism (3.5%). There were no statistical significant differences between Ifs and free findings groups regard to demographic and comorbidities ($p > 0.05$) except Ifs group had higher BMI (27.05 ± 4.23) compared to free finding group (26.27 ± 3.66) ($p = 0.004$) (Table 1).

Except for COVID-19 pneumonia, pulmonary findings were seen in 89 (3.8%) as follows: Lung masses or cysts were seen in 42 (1.8%), bronchiectasis in 18 (0.8%), pulmonary tuberculosis in 15 (0.6%), bronchogenic carcinoma in 7 (0.3%) and bronchial wall thickening in 7 (0.3%).

Extrapulmonary thoracic cage metastases were detected in 8 cases (0.3%).

Hepatobiliary findings were seen in 76 cases (3.2%): Hepatomegaly seen in 22 cases (0.9%), HCC in 20 (0.8%), cholecystolithiasis in 16 (0.7%), splenomegaly in 12 (0.5%) and renal lesions seen in 6 cases (0.3%).

Cardiovascular findings were seen in 44 (1.8%): coronary artery calcification seen in 26 (1.1%), cardiomegaly seen in 8 (0.3%) and aortic valve calcification seen in 4 cases (0.2%).

Table (1): Descriptive data of the studied population (no:2364).

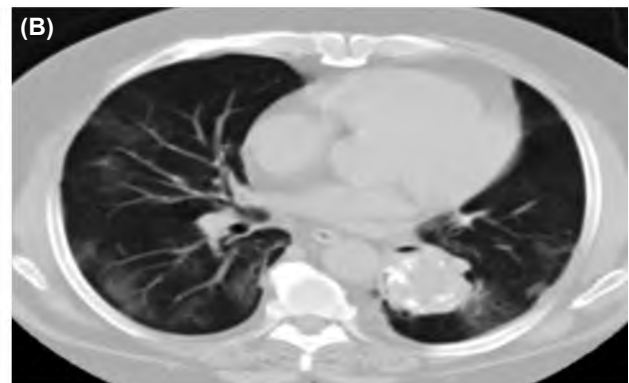
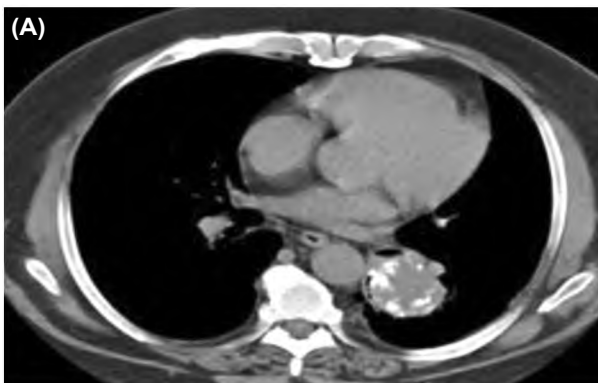
	IFs group No=257	No Ifs group No=2107	test	p-value
Sex no (%):				
Male	108 (42.0%)	927 (44.0%)	0.286	0.592
Female	149 (58.0%)	1180 (56.0%)		
Age (year)				
	45.77±11.2	44.6±8.76	1.955	0.0507
Age group... (year):				
<30	26 (10.1%)	252 (12%)	3.056	0.691
30-39	46 (17.9%)	400 (19%)		
40-49	82 (31.9%)	590 (28%)		
50-59	56 (21.8%)	505 (24%)		
60-69	35 (13.6%)	253 (12%)		
>70	12 (4.7%)	107 (5%)		
BMI..... (kg/m²)				
	27.05±4.23	26.27±3.66	2.866	0.004
Comorbidities..... no (%):				
Diabetes	82 (31.9%)	703 (33.4%)	4.939	0.293
Hypertension	91 (35.4%)	623 (29.5%)		
Cardiovascular disease	65 (25.3%)	570 (27.0%)		
COPD	10 (3.9%)	127 (6.0%)		
Hypothyroidism	9 (3.5%)	84 (4%)		

Regards to breast findings were seen in 38 cases (1.6%): Gynecomastia seen in 17 cases (0.7%), breast carcinoma seen in 11 (0.5%) and breast cysts seen in 10 cases (0.4%).

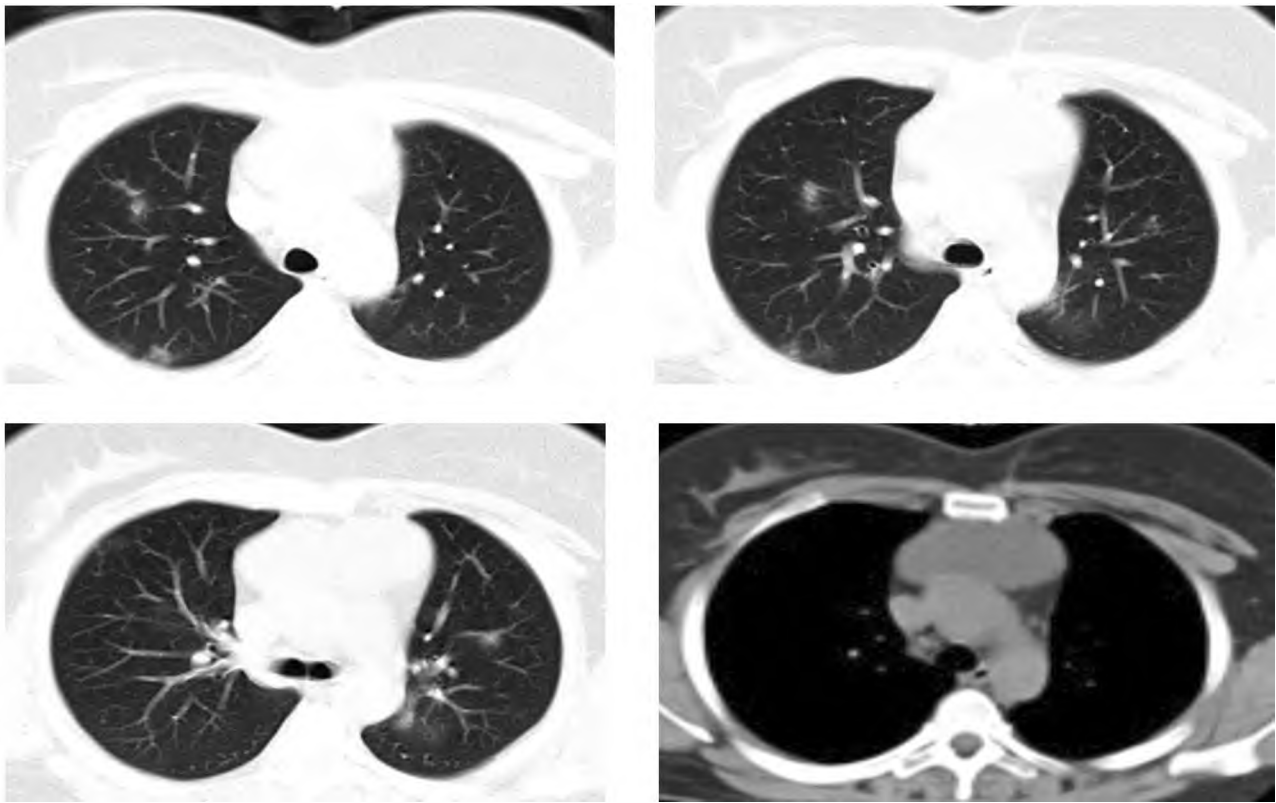
The most common malignancy was; hepatocellular carcinoma (20: 0.8%), followed by breast carcinoma (11: 0.5%), bony thoracic cage metastases (8: 0.3%), bronchogenic carcinoma (7: 0.3%), and lymphoma (2: 0.1%) (Table 2).

Table (2): Incidental MDCT findings of covid-positive group (no=257).

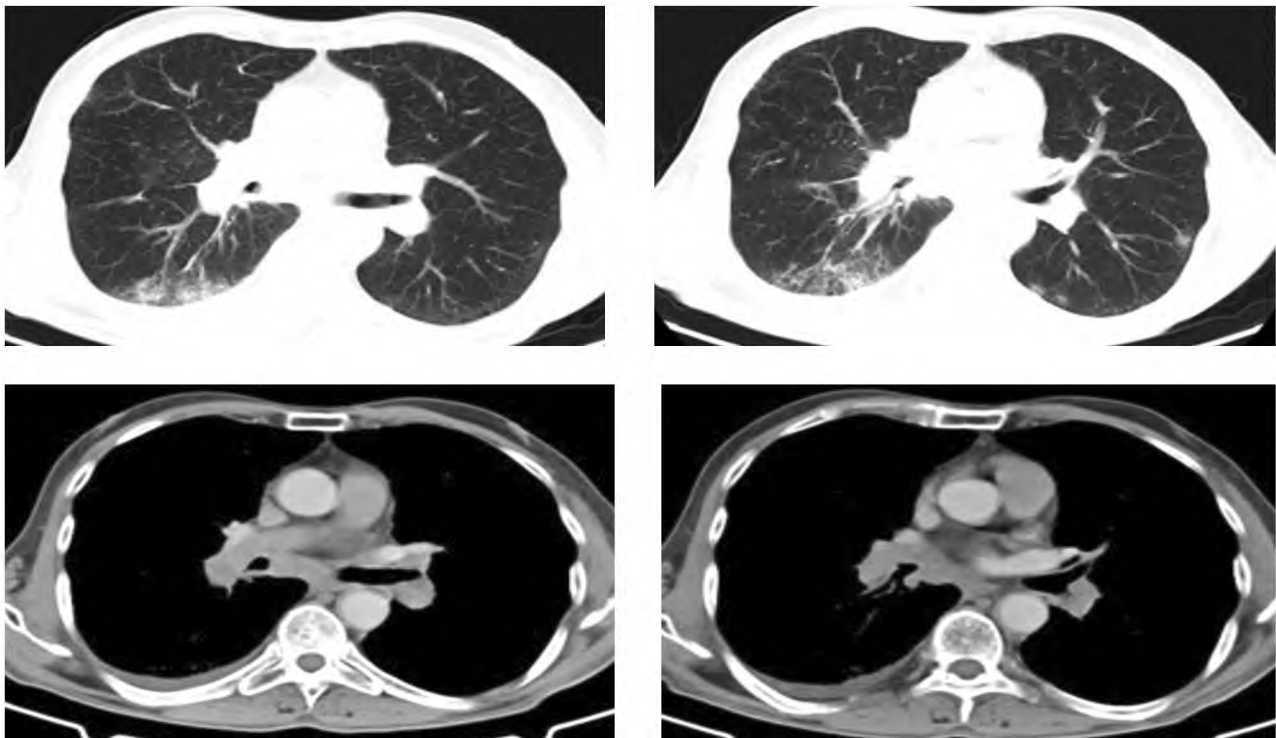
	No (%)
Pulmonary:	
Lung masses and cysts	42 (1.8%)
Bronchiectasis	18 (0.8%)
Pulmonary tuberculosis	15 (0.6%)
Bronchogenic carcinoma	7 (0.3%)
Bronchial wall thickening	7 (0.3%)
Extra-pulmonary:	
Bony thoracic cage metastases	8 (0.3%)
Hepatobiliary findings:	
Hepatomegaly	22 (0.9%)
Hepatocellular carcinoma	20 (0.8%)
Cholecystolithiasis	16 (0.7%)
Splenomegaly	12 (0.5%)
Renal lesions	6 (0.3%)
Cardiovascular findings:	
Coronary artery calcification	26 (1.1%)
Cardiomegaly	8 (0.3%)
Aortic valve calcification	4 (0.2%)
Others	6 (0.3%)
Breast:	
Gynecomastia	17 (0.7%)
Breast carcinoma	11 (0.5%)
Cyst	10 (0.4%)
Splenic focal lesion (lymphoma)	2 (0.1%)



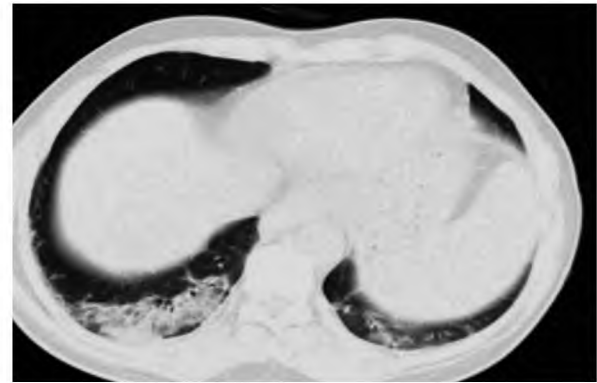
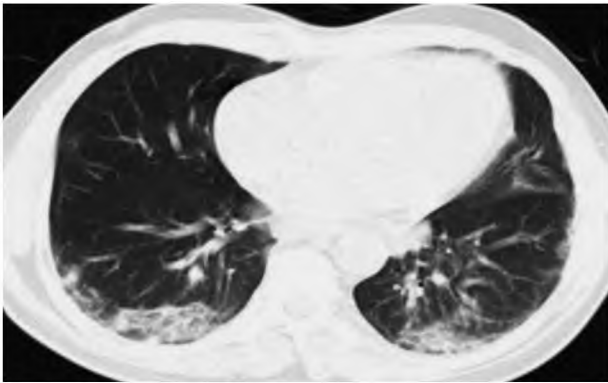
Case (1): 65-years-old male underwent non-contrast CT scan for evaluation of COVID-19 pneumonia. Incidental discovered of left lower lobe soft tissue mass with coarse calcifications inside.... Mostly calcified granuloma.



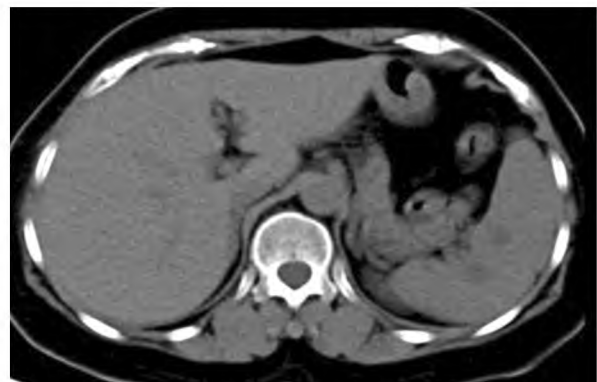
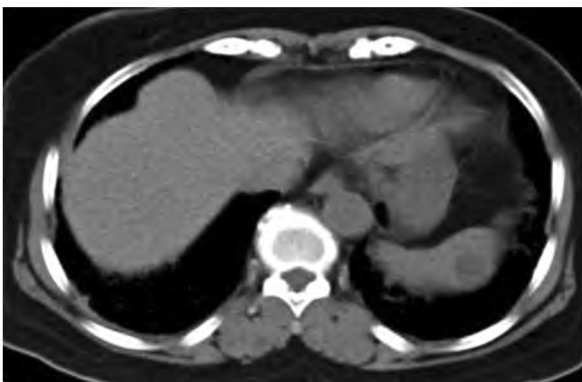
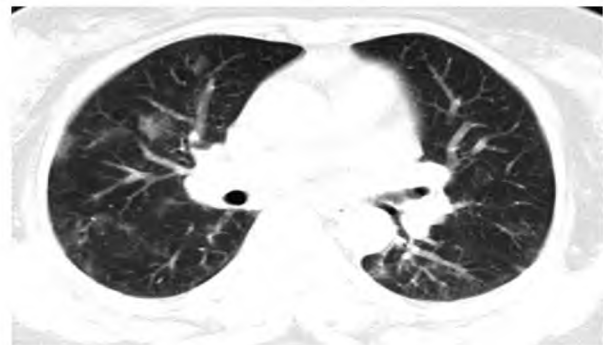
Case (2): 40-years-old female underwent non-contrast CT scan for evaluation of COVID-19 pneumonia. Incidental discovered of thymus cyst.



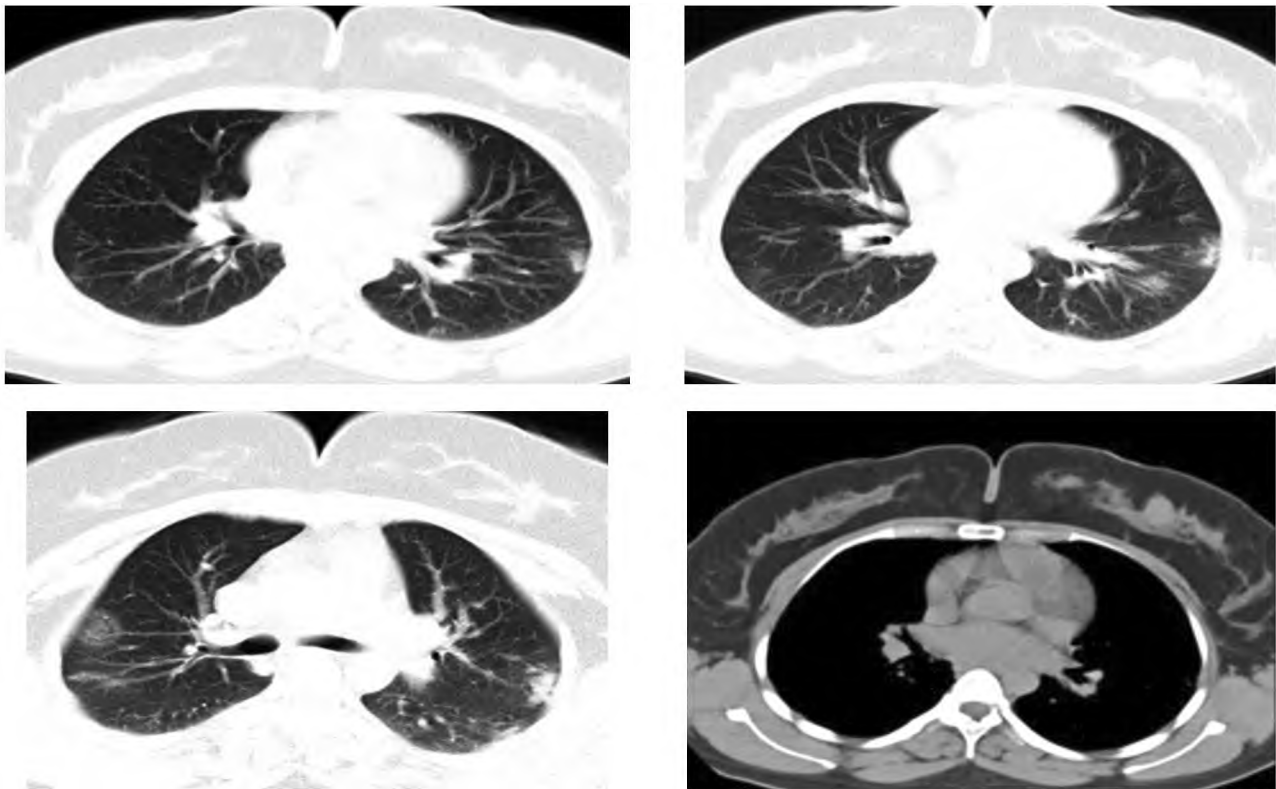
Case (3): 55-years-old male underwent post-contrast CT scan for evaluation of COVID-19 pneumonia. Incidental discovered of RT. hilar soft tissue mass with left hilar lymphadenopathy Further evaluation revealed bronchogenic carcinoma.



Case (4): 62-years-old male underwent non-contrast CT scan for evaluation of COVID-19 pneumonia. Incidental discovered of hepatic focal lesion Further evaluation revealed HCC.



Case (5): 58-years-old male underwent non-contrast CT scan for evaluation of COVID-19 pneumonia. Incidental discovered of splenic focal lesions Further evaluation revealed NHL.



Case (6): 36-years-old female underwent non-contrast CT scan for evaluation of COVID-19 pneumonia. Incidental discovered of left breast mass Further evaluation revealed mammary carcinoma.

Discussion

Incidental findings (Ifs) in imaging exams are defined as unexpected findings unrelated to the scope of the clinical indication. Ifs can be classified according to their clinical importance, as major, moderate, or minor. Major findings include lesions suspected to be malignant diseases, such as thyroid nodules, changes to the thickness of the intestinal wall, and solid pancreatic or renal masses. Moderate findings, i.e. findings possibly of clinical relevance, include gallstones and pleural fluid accumulations or pleural effusion. Minor findings, or findings without clinical relevance, include simple renal or hepatic cysts, degenerative changes to the spinal column, and calcification of vessels [5].

Of the 2364 patients in our study, Ifs were identified in 257 patients they were 108 males (42%) and 149 were females (58%), and the mean age was 45.77 ± 11.2 years. The most common comorbidities among patient group with Ifs was hypertension (35.4%) followed by diabetes (31.9%) then cardiovascular diseases (25.3%), COPD (3.9%) and lastly hypothyroidism (3.5%). That in line with previous studies of COVID-19 have shown that 11% to 40% of covid patients had cardiovascular comorbidities, most commonly hypertension, diabetes, and coronary cardiac disease, which are all factors that can be linked to vascular diseases [6,7,8].

With respect to a previous study (Harrison et al., 2021), risk factors associated with severe COVID-19 infection are known to be mainly cardiovascular conditions, in opposition to previous respiratory chronic lung diseases [9,10].

Except for COVID-19 pneumonia, among enrolled patients, pulmonary findings were seen in 89 of cases (3.8%) as follows: Lung masses or cysts were seen in 42 (1.8%), bronchiectasis in 18 (0.8%), pulmonary tuberculosis in 15 (0.6%), bronchogenic carcinoma in 7 (0.3%) and bronchial wall thickening in 7 (0.3%). Extrapulmonary thoracic cage metastases were detected in 8 cases (0.3%).

In agreement with our results, [4] revealed that primary malignant lung lesions were detected in a total of 2 patients (0.13%); benign lung lesions (8 solitary pulmonary nodules, 2 hamartomas, 1 tuberculosis, 1 air cyst) were detected in a total of 12 patients (0.77%).

Reis et al. [5] reported pulmonary findings in 63.2% of chest CTs (pulmonary nodule (18.3%), peribronchial thickening (13.1%), band atelectasis (11.4%), atelectasis (9.5%), and emphysema (5.7%). Higher percentage in their study may be due to 30% of their patients were over the age of 60.

In Abuladze et al. [11] study, incidental lung lesions were detected in 86 (6.5%) of patients. Out

of which: 26.7% – single pulmonary nodules; 16% – a lung mass; 14% – multiple pulmonary nodules; 43% – Otherwise undefined, suspicious pulmonary lesion.

Kilsdonk et al. [12] reported emphysema (17% of total minor IFs and 10 % of the total study population), bronchial wall thickening in (14% of total minor IFs and 8% of the total study population), with nonspecific pulmonary nodules (9% of total minor IFs and 5% of the total study population), bronchiectasis and liver cysts both (8% of total minor IFs and 5% of the total study population) being less prevalent.

Recently Sadigov [13] revealed solitary pulmonary nodule (28.43%) lung cancer (primary and metastatic) in (24.68%) patients. Bronchiectasis which was also commonest in patients with viral pneumonia. Emphysema was found in (2.69%). Lung tuberculosis with further histological and mycobacterial confirmation was as incidentally finding in (1.87%) (focal changes, lung infiltrate, cavitation). Pulmonary sarcoidosis was found totally in (1.48%) and idiopathic pulmonary fibrosis with typical features of usual interstitial pneumonia was found in (1.21%) patients.

Also a study by Canivet et al., [8], lung diseases were found in 19.4% of the population: 18% of the cohort showed COPD-associated lesions (mainly emphysematous lesions) and 1.4% signs of pulmonary fibrosis. Thyroid goiter was detected in 22% of the cohort. Incidental nodules were then identified in 18.8% of the total cohort. A newly identified suspicious mass or a suspicious lesion greater than 3 cm was found in 5%.

In current study, hepatobiliary findings were seen in 76 cases (3.2%): Hepatomegaly (0.9%), HCC (0.8%), cholecystolithiasis (0.7%), splenomegaly (0.5%) and renal lesions seen in (0.3%) of cases.

Dundar et al., [4] revealed that nephrolithiasis (1.49%), cholelithiasis (1.04%) were the most common IF detected in a total of 61 patients (3.96%) in the abdomen entering the cross sectional area.

Breast findings were seen in 38 of enrolled cases (1.6%): Gynecomastia seen in 17 cases (0.7%), breast carcinoma seen in 11 (0.5%) and breast cysts seen in 10 cases (0.4%).

In Dundar et al., [4] study, axillary lymphadenopathy in 25 patients (1.62%), and 1 cystic and 5 solid lesions in the breast in 6 female patients (0.38%) were detected. While 3 of the solid breast lesions were diagnosed as histopathological fibroadenoma, 2 were benign lesions that did not show any difference in clinic-radiological follow-ups but had no histopathological diagnosis.

Current study, incidental cardiovascular findings were seen in 44 Covid cases (1.8%): Coronary artery calcification seen in 26 (1.1%), cardiomegaly seen in 8 (0.3%) and aortic valve calcification seen in 4 cases (0.2%).

Similar to current findings, the most prevalent finding identified in Reis et al., [5] was aortic wall calcification (16.2%), followed by cardiomegaly (10.7%), and coronary calcification (4.5%).

Canivet et al. [8] in their retrospective analysis of incidental features showed that calcifying atheromatosis was the most frequent incidental de novo abnormality, with 35% represented in the sample with a percentage of more than half (60%) with already known calcifying coronary atheromatosis. The other cardiovascular parameters were less represented, with aneurysmal dilation of the ascending thoracic aorta in 9.7% and the presence of a significant pericardial effusion in 3.9%.

The coexistence of tumors and infectious diseases or noninfectious inflammatory diseases poses a serious medical challenge, especially in medical imaging. MDCT is an unparalleled tool in detecting active infectious/inflammatory diseases and managing neoplasms. As a noninvasive imaging method, MDCT plays an essential role in evaluating inflammatory and infectious pulmonary diseases, monitoring disease progression and treatment effects, and improving patient management (3). In current study, the most common malignancy was; hepatocellular carcinoma (20: 0.8%), followed by breast carcinoma (11: 0.5%), bony thoracic cage metastases (8: 0.3%), bronchogenic carcinoma (7: 0.3%), and lymphoma (2: 0.1%).

As well as patients with cancer were more susceptible than the general population to covid infection that in need for assessing by more currently tools of radiology, MDCT.

Cardiovascular and pulmonary diseases have become major causes of death worldwide. According to the World Health Organization, cardiovascular diseases account for a major part with 17.5 million deaths, followed by 8.2 million for oncological and pulmonary pathologies [8].

Limitation of our study includes retrospective of our analysis and shortage of long term follow-up.

Conclusion:

While radiologists focus on the main pathology, they may ignore other pathologies or findings in the cross-sectional area. Although these incidental findings sometimes cause unnecessary further examinations and follow-ups that result in cost and stress burden, they can sometimes cause patients to benefit from the early treatment option.

This retrospective study showed that in the context of the pandemic, clinicians and radiologists had the chance to identify non-COVID-19-associated chest CT abnormalities.

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نتائج التصوير المقطعي المحوسب متعدد الكاشفات (MDCT) العرضية لدى المرضى المصابين بالالتهاب الرئوى الناجم عن كوفيد

مع زيادة استخدام مسح الصدر لمتابعة وتقييم المرضى المصابين بكوفيد، هناك نتائج عرضية تشير إلى الحاجة إلى مزيد من الفحوصات والمتابعة لخيار العلاج المبكر. نحن نهدف إلى التحقيق في مدى تكرار وأهمية النتائج العرضية في المرضى الذين يعانون من الالتهاب الرئوى الناجم عن فيروس كورونا.

المرضى والطرق: تم تقييم ٢٣٦٤ تقريراً إشعاعياً أصلياً بأثر رجعى خلال الفترة من أغسطس ٢٠٢٠ إلى مارس ٢٠٢١ لوصف، والتي تم تعريفها على أنها أى نتيجة فى التقرير لا تتعلق بغرض الفحص. تم تصنيف الموثقة وفقاً لأهميتها السريرية إلى طفيفة ومن المحتمل أن تكون مهمة ووفقاً للموقع التشريحي إلى فئات رئوية ومنصفية وعائية القلب والأوعية الدموية والثدى والبطن العلوى والهيكل العظمى. تم الإبلاغ عن كترددات ونسب مئوية؛ تم استخدام الإحصائيات الوصفية.

النتائج: من بين ٢٣٦٤ مريضاً مصاباً بكوفيد-١٩ خضعوا لمسح المتابعة، تم اكتشاف ٢٥٧ (١٠,٨٧٪) مريضاً مصاباً بالتهاب رئوى عرضي بسبب كوفيد-١٩، و١٤٩ امرأة و١٠٨ رجال بمتوسط عمر ٤٥,٧٧ عاماً. شوهدت النتائج الرئوية فى ٨٩ (٣,٨٪)، نتائج الكبد الصفراوى. ٧٦ (٣,٢٪)، نتائج القلب والأوعية الدموية ٤٤ (١,٨٪)، والثدى ٣٨ (١,٦٪). كان معدل انتشار السرطان بين المشاركين الذين تم فحصهم ٤٨ (٢٪). وكان الورم الخبيث الأكثر شيوعاً؛ سرطان الخلايا الكبدية (٢٠:٨,٠٪)، يليه سرطان الثدي (١١:٥,٠٪)، وسرطان القفص الصدرى العظمى (٣:٨,٠٪)، وسرطان القصبات الهوائية (٣:٧,٠٪)، وسرطان الغدد الليمفاوية (١:٢,٠٪).

الخلاصة: بلغت النتائج العرضية لـ فى المرضى الذين يعانون من كوفيد-١٩ ١٠,٨٧٪. لذلك من المهم أيضاً تحديد حالات القصور الرئوى الأخرى غير الالتهاب الرئوى لدى المرضى الذين خضعوا لفحص الصدر بالأشعة المقطعية أثناء الوباء.