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Incidental pulmonary findings on chest computed tomography scans of 3010 non-COVID patients in Istanbul

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ABSTRACT

BACKGROUND: *Chest computed tomography (CT) was obtained from many patients with or without the Coronavirus disease 2019 (COVID-19) due to the pandemic. This study aimed to define incidental findings on CTs of the patients.*

MATERİALS AND METHODS: *From March 2020 to October 2020. three-thousand ten adults (age ≥ 18 years) with no radiological evidence of pneumonia and no known malignancy or lung disease were included in our study. CT images were evaluated for findings, including incidental nodules and subtypes due to Fleischner Society guidelines, bronchial distortion, bronchiectasis, sequela calcific lymph node, sequela changes, emphysema, and pneumoconiosis suspicious findings like asbestos plaques and malignancy suspicious findings due to Fleischner Society guidelines.*

RESULTS: *The mean age was 46.49 ±16.92, ranging from 18 to 96. Fifty-five percent of the patients were men. Incidental nodule was detected in 12% of the patients. Bronchial distortion/bronchiectasis ($p = 0.012$), emphyssema ($p < 0.001$), incidental pneumoconiosis suspicious findings ($p = 0.004$), incidental malignancy suspicious findings ($p = 0.026$) were more common in men. The most of smokers were men ($p <$*

0.001). Emphysema was more common in smokers (p = 0.008).

CONCLUSIONS: *The incidental findings on 3010 chest CTs obtained on the population were summarized. This study is the one with the largest number of participants in Turkey. Our results can help describe incidental findings in our population.*

KEYWORDS: *Chest CT; incidental findings; lung; pulmonary, pulmonary nodule.*

INTRODUCTION

COVID-19, which causes pandemics in a short time worldwide, can cause asymptomatic infection, mild upper respiratory tract infection, acute respiratory distress syndrome, and even death.

The diagnosis of COVID-19 is made by detecting the specific sequence of the virus's RNA by real-time reverse transcription-polymerase chain reaction (RT-PCR) test by taking the swab from the nasopharynx and oropharynx.

Despite the high specificity of RT-PCR, it has been reported that the sensitivity of RT-PCR is 60-70% (1,2). Besides, chest computed tomography (CT) sensitivity is 97% in patients with positive RT-PCR results (1).

On the other hand, it has been reported that early chest CT findings can predict the course of COVID-19 (3). CT is recommended to determine the severity of the disease or to detect advanced disease early.

For these reasons, CT was performed on many patients during the pandemic. In addition to these, the importance of screening programs is increasing day by day, since the early diagnosis of lung cancer, which is the leading cause of cancer-related death, reduces mortality rates. Nonetheless, incidental findings on chest CT have also increased significantly (4,5). In a pictorial essay, the highly variable rate of incidental findings detected by screening was reported as a lack of reporting and management standards for incidental findings (6). In addition, since incidental findings are an important cause of anxiety and stress in patients, it is important to define incidental findings and act accordingly.

Until now, there is one study investigating incidental pulmonary nodule frequency with 603 cases in Turkey (7). However, this study concerned only incidental pulmonary nodules. There is no enough data in the literature about incidental chest CT findings with Turkish people. Therefore we aimed to examine the CTs obtained and to detect incidental findings.

MATERIALS AND METHODS

Patients: Our institutional review board approved this retrospective study (approval number: 2020/970). Due to the retrospective nature of the study, informed consent was waived.We evaluated thorax CT images obtained for various reasons between the dates of 11.03.2020 and 12.09.2020. 3010 adults (age ≥ 18 years) with no radiological evidence of pneumonia and no known malignancy or lung disease were included in our study.

Information about the patients' age, gender and smoking history was included in the study. Data of patients whose tomography images were unsuitable for our study were excluded.

CT Image Acquisition: All chest CT examinations were performed with the patients in the supine position at the end of the inspiration using a 64-detector scanner (Aquilion, Canon, Japan).

The scanning protocol included the following parameters: Tube voltage, 120 kV; tube current-time product, 50–150 mAs; pitch, 0.85–1.4; image slice thickness, 1–5 mm;

reconstruction interval, 1 mm. An intravenous contrast agent was not administered.

CT Image Interpretation: Under the supervision of two radiologists with 24 and 19 years of experience, six radiologists with 4 to 6 years of experience analyzed all CT images on a PACS workstation (ExtremePacs, Istanbul, Turkey) in consensus.

The CT images were viewed using a window width of 1500 to 2000 Hounsfield Unit (HU) and a window level of –450 to 700 HU for lung parenchyma window, and a window width of 300 to 400 HU and a window level of 40 to 60 HU for the mediastinal window.

CT images were evaluated for findings, including incidental nodules and subtypes due to Fleischner Society guidelines, bronchial distortion, bronchiectasis, sequela calcific lymph node, sequela changes, emphysema, and pneumoconiosis suspicious findings like asbestos plaques and malignancy suspicious findings due to Fleischner Society guidelines (8).

Main points: Chest computed tomography (CT) was obtained from many healthy people due to the Coronavirus disease 2019 (COVID-19) pandemic. Incidental parenchymal findings are rarely seen in the healthy population and do not require screening. Chest CT can be applied for screening only in patients with risk factors.

Statistical analysis: Descriptive statistics were used to summarize data. The Chi-square test or Fisher exact test, where appropriate, were used to compare the proportions in different groups. The Student's t-test was used to compare means. A value of $p < 0.05$ was considered statistically significant. Statistical analyses were performed using the SPSS software version 22 (IBM Inc, USA).

RESULTS

A total of 3010 patients have included in this study. The mean age was 46.49 ±16.92, ranging from 18 to 96 (Table 1).

Fifty-five percent of patients were men. Incidental nodule was detected in 12% of the patients, bronchial distortion / bronchiectasis in 6%, sequela calcific lymph node in 8.1%, emphysema in 13.1%, incidental neumoconiosis suspicious findings in 0.5%, incidental malignancy suspicious findings was detected in 1.3%.

Most of the incidental nodules were solitary (257/360, 71.3%) and smaller than 6 mm (229/360, 63.6%). Men were younger than women ($p = 0.038$) (Table 2).

Bronchial distortion / bronchiectasis (7% (n = 116) vs. 4.8% (n = 65), $p = 0.012$), emphyssema (18.8% (n = 312) vs. 6% (n = 81), $p < 0.001$), incidental pneumoconiosis suspicious findings (0.8% (n = 13) vs. 0.1% (n = 1), $p = 0.004$), incidental malignancy suspicious findings (1.8% (n = 29) vs. 0.8% (n = 11), $p = 0.026$) were more common in men. Only 788 patients' smoking histories (26.2%) were obtained (Table 3).

The proportion of smokers was 23.5% (185/788). Smokers were younger than non-smokers ($p = 0.049$). The most of smokers were men ($p < 0.001$). Emphysema was more common in smokers (12.4% (n = 23) vs. 6.5% (n =39), $p = 0.008$).

Table 1. Characteristics of patients and CTs

Characters	N = 3010
Age	46.49 ±16.92 (range, 18-96)
Gender	
Men	1657 (55%)
Women	1353 (45%)
Smoking	
Yes	185
No	603
Unknown	2422
Incıdental nodule presence	360 (12%)
Number of nodules in 360 patients	2.31 ±2.47 (median 1, range 1-16)
Lobes	
Right upper	70 (2.3%)
Right mid	33 (1.1%)
Right lower	63 (2.1%)
Left upper	40 (1.3%)
Left lower	41 (1.4%)
Type of nodules	
Solid	257 (8.5%)
Part-solid	35 (1.2%)
GGO	68 (2.3%)
Lenght of nodules	
<6 mm	229 (7.6%)
6-8 mm	58 (1.9%)
>8 mm	73 (2.4%)
Bronchial distortion, bronchiectasis	181 (6%)
Sequela calcific lymph node	244 (8.1%)
Sequela changes	
Tuberculosis	104 (3.6%)
Pachypleurite	21 (0.7%)
Plura-parenchimal band	686 (22.9%)
Emphysema	393 (13.1%)
Centrilobular emphysema severity	
Trace	101 (3.4%)
Mild	82 (2.7%)
Moderate	43 (1.4%)
Confluent	31 (1%)
Advanced	7 (0.2%)
Paraceptal-panlobular emphysema	
Mild	217 (7.2%)
Substantial paraceptal	66 (2.2%)
Incidental pneumoconiosis	14 (0.5%)
Incidental malignancy	40 (1.3%)
Lung central	18 (0.6%)
Lung peripheral	11 (0.4%)
Metastasis	3 (0.1%)
Lymphoma	3 (0.1%)
Mediastinal	3 (0.1%)
Pleural	1 (0.03%)

Esophageal	1 (0.03%)

* statistically significance

Table 2. Comparison of findings by gender

Characters	Men (n=1657)	Women (n=1353)	P
Age	45.85 ±16.83	47.14 ±17.22	0.038*
Incıdental nodule presence	210 (12.7%)	150 (11.1%)	0.182
Number of nodules (n=210 vs 150)	2.46 ±2.69 (median 1, range 1-16)	2.11 ±2.12 (median 1, range 1-13)	0.185
Lobes			0.304
Right upper	37 (2.2%)	33 (2.4%)	
Right mid	20 (1.2%)	13 (1.0%)	
Right lower	32 (1.9%)	31 (2.3%)	
Left upper	27 (1.6%)	13 (1.0%)	
Left lower	22 (1.3%)	19 (1.4%)	
Type of nodules			0.285
Solid	150 (9.1%)	107 (7.9%)	
Part-solid	17 (1.0%)	18 (1.3%)	
GGO	43 (2.6%)	25 (1.8%)	
Lenght of nodules			0.082
<6 mm	127 (7.7%)	102 (7.5%)	
6-8 mm	32 (1.9%)	26 (1.9%)	
>8 mm	51 (3.1%)	22 (1.6%)	
Bronchial distortion, bronchiectasis	116 (7%)	65 (4.8%)	0.012*
Sequela calcific lymph node	137 (8.3%)	107 (7.9%)	0.719
Emphysema	312 (18.8%)	81 (6.0%)	<0.001*
Incidental pneumoconiosis	13 (0.8%)	1 (0.1%)	0.004*
Incidental malignancy	29 (1.8%)	11 (0.8%)	0.026*

* statistically significance

Table 3. Comparison of findings by smoking history

Characters	**Smoking (n=185)**	**No smoking (n=603)**	**P**
Age	41.91 ±14.23	44.51 ±16.07	0.049*
Gender			<0.001*
Men	132 (71.4%)	292 (48.4%)	
Women	53 (28.6%)	311 (51.6%)	
Incıdental nodule presence	16 (8.6%)	59 (9.8%)	0.645
Number of nodules (n=16 vs. 59)	1.5 ±0.82 (median 1, range 1-3)	2.29 ±2.58 (median 1, range 1-13)	0.234
Lobes			0.419
Right upper	4 (2.2%)	11 (1.8%)	
Right mid	1 (0.5%)	8 (1.3%)	
Right lower	1 (0.5%)	12 (2.0%)	
Left upper	4 (2.2%)	4 (0.7%)	
Left lower	2 (1.1%)	9 (1.5%)	
Type of nodules			0.913
Solid	(5.9%)	(6.8%)	
Part-solid	(0.5%)	(1.0%)	
GGO	(2.2%)	(2.0%)	

Lenght of nodules			0.639
<6 mm	10 (5.4%)	38 (6.3%)	
6-8 mm	4 (2.2%)	8 (1.3%)	
>8 mm	2 (1.1%)	13 (2.2%)	
Bronchial distortion, bronchiectasis	12 (6.5%)	27 (4.5%)	0.270
Sequela calcific lymph node	15 (8.1%)	31 (5.1%)	0.132
Emphysema	23 (12.4%)	39 (6.5%)	0.008*
Incidental pneumoconiosis	0	4 (0.7%)	0.578
Incidental malignancy	1 (0.5%)	6 (1.0%)	0.564

* statistically significant

DISCUSSION

During the pandemic, CT was performed in many patients who were diagnosed with or suspected COVID-19. Due to the ability of COVID-19 to be transmitted to people from everyone in the society, albeit it is usually to the elderly, chest CTs enabled lung of people to be screened. Thus, the lungs of many healthy individuals were scanned. In the present study, the incidental findings on CTs of 3010 non-COVID patients were summarized.

In a systematic review, the average lung nodules detection rate per scan was 20%. This rate was varied from 3-30% in randomized controlled studies and 5-51% in cohort studies (9).

In the only study published in 2019 in our country investigating incidental lung nodules, incidental nodules were detected in 48.25% of 603 cases (7). In this study, the excess incidental nodules were attributed to granulomatosis processes related to tuberculosis, occupational, and environmental causes, which are more significant problems in Turkey than the developed countries. However, our results are parallel to the literature. Additionally, the current study investigating incidental findings on chest CT is the one with the largest number of participants in our country.

In previously published screening studies, incidental malignancies were detected in 0.07-0.92% of participants (10-14). Our results are consistent with these findings. Despite the low incidental malignancy rate in healthy people, The National Lung Cancer Screening Trial indicated that lung cancer screening with low-dose chest CT resulted in a 20% reduction in lung cancer mortality in patients with high risk compared with chest radiography (15). Additionally, in a study including 3,118,169 members screened between 2006 and 2012, 3,557 (0.11%) of those who had a positive CT scan with suspicious nodule were diagnosed with lung cancer within two years (16).

In our study, the frequency of emphysema was higher in smokers. Smoking is the primary cause of emphysema, especially of centrilobular and paraseptal emphysema (17). The presence of emphysema on cardiac CT is associated with increased all-cause mortality and respiratory and lung cancer mortality in the general population, independent of age, sex, BMI, smoking status, and pack-years (18). Emphysema was detected in 13% of our series. Further examinations and treatments may be beneficial in the high-risk population of these patients.

In the current study, the rates of emphysema and incidental malignancies were higher in men. Approximately three-fourths of 788 patients whose smoking data were available were men. Although we do not have access to all patients' smoking

data, emphysema and incidental malignancies may be more common in men due to smokers' higher rate. Besides, the incidental pneumoconiosis rate was found to be higher in men in the present study. The patients' occupational information was not collected in the study; nevertheless, this result may be explained by the fact that more men in occupations where the dust or powder is inhaled.

The major limitation of the study is the retrospective design. Additionally, this study was not selective in patient selection criteria.Therefore,the results of the study should not be directly compared with screening studies and should be interpreted with caution. Also, CTs were used to identify incidental findings in a population, not identify COVID-19 findings. Because the study was designed as a large CT scan study, the patients' clinical data were lacking. Besides these, the strength of the study was a large number of participants.

In conclusion, we summarized the incidental findings on chest CTs obtained from a healthy population during pandemic. This study is the one with the largest number of participants in Turkey. Our results can help describe incidental findings in our population.

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