

# Incidental thorax imaging findings in abdominal computed tomography: Results of a tertiary center

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## Ethics Committee Approval

The study protocol was approved by the  
Adiyaman Training and Research Hospital Ethics  
Committee (2020/9-12).

All procedures in this study involving human  
participants were performed in accordance with  
the 1964 Helsinki Declaration and its later  
amendments.

## Conflict of Interest

No conflict of interest was declared by the  
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## Abstract

**Background/Aim:** Abdominal computed tomography (ACT) is a frequently used imaging modality. The large imaging area often results in the inclusion of lower sections of the thorax. It is known that some thoracic pathologies have symptoms that mimic upper abdominal pathologies. It is possible to detect many pathologies with careful examination of these levels. Previous studies have been conducted to detect incidental chest findings in imaging methods performed for emergency reasons such as trauma, but there is no study in the literature investigating incidental chest findings in ACT imaging. The aim of this study is to determine the incidental findings detected in thoracic sections included in abdominal computed tomography (CT) images and the prevalence of these findings in a tertiary center.

**Methods:** This descriptive study includes 1133 patients who were admitted to Adiyaman Training and Research Hospital between 2017-2020 due to abdominal pain, diarrhea, vomiting, weight loss, constipation, and recurrent urinary tract infection, and underwent abdominal CT scanning. The necessary local ethics committee approval was obtained. Incidental findings in thoracic areas shown in the abdominal CT images included mediastinal findings, infectious findings, pulmonary lesions, pleural findings, lung parenchyma and pleural findings.

**Results:** The mean age of the patients was 43.8 (18.7) years. Incidental findings were detected in 49.2% of the patients, the most common being those related to the lung parenchyma and the pleura (20.7%). The most common lung lesions were pulmonary nodules smaller than 1 cm (5%). In addition, 116 (10.2%) patients had infectious findings, among which the images of 31 (2.7%) suggested bacterial pneumonia factors, and 17 (1.5%) had interstitial pneumonia findings due to the SARS-CoV2 virus.

**Conclusion:** According to the results of this study, evaluation of pathologies detected incidentally in the thorax in ACT sections may affect the treatment of patients. In addition, evaluation, follow-up, and early treatment of lung nodules that can be detected incidentally can prevent possible advanced stage malignancies. Although the symptoms and clinical statuses of the patients are very useful in evaluating the images, examination of every structure included in the imaging field may play a role in the early diagnosis and treatment of some pathologies.

**Keywords:** Abdominal computed tomography, Chest computed tomography, COVID-19, Incidental findings, Pulmonary nodule

## Introduction

Major advances in computed tomography (CT) in the recent years provide radiologists with the opportunity for early diagnosis and treatment of many abdominal, thoracic, mediastinal, and cardiac pathologies. The early detection of pathologies such as lung cancer, hepatocellular carcinoma, gastrointestinal tumors, or aortic aneurysm may decrease mortality, but also cause misdiagnosis or over-diagnosis [1].

Another important factor in computed tomography (CT) evaluation by radiologists is the possibility of incidental findings. The rapid increase in the number of CT scans and the evaluation performance have made the detection of these findings easier. Incidental findings are generally defined as imaging abnormalities unrelated to the indication requiring CT imaging [2]. All abnormal findings that cannot be associated with the primary pathology before exposure fall into this group. These are divided into 4 groups to facilitate the examination and clinical evaluation: 1- Findings with results that need immediate treatment (e.g. newly diagnosed malignancy), 2- Findings with good prognoses but require follow-up (e.g. calcifications in the heart valves), 3- Findings with possible clinical / prognostic significance requiring follow-up (pulmonary nodules) and 4- Findings without a proven clinical/prognostic significance (sclerotic bone islands in the vertebrae) [2].

CT scans after trauma are used very commonly as they are a fast and effective diagnostic tool [3-5]. The rates of CT findings detected incidentally in trauma patients reach 45% [6]. Many studies have been conducted to determine these rates, and the clinical value of incidental findings has been investigated [7, 8].

A significant portion of the lung parenchyma, mediastinal area and soft tissue and bony structures in the thoracic region are included in abdominal CT studies. Data belonging to these regions can be stored and evaluated thanks to permanent storage. For example, the abdominal CT images of a patient obtained 6 months ago due to right upper abdominal pain was viewed when they visited the Pulmonology clinic with the complaint of hemoptysis for the first time and pulmonary nodules in the right lower lobe were observed. A new thorax CT imaging allowed comparison of their sizes and properties.

It is of great importance to know and evaluate the prevalence of incidental findings detected on CT images. This study aimed to determine the incidental findings detected in thoracic sections included in abdominal CT images in a tertiary center.

## Materials and methods

### Patient selection

This descriptive study includes 1133 patients who were admitted to Adiyaman Training and Research Hospital for abdominal pain, diarrhea, vomiting, weight loss, constipation, and recurrent urinary tract infection between 2017-2020. The necessary local ethics committee approval was obtained for the study (2020 / 9-12). This study was carried out in accordance with the Declaration of Helsinki.

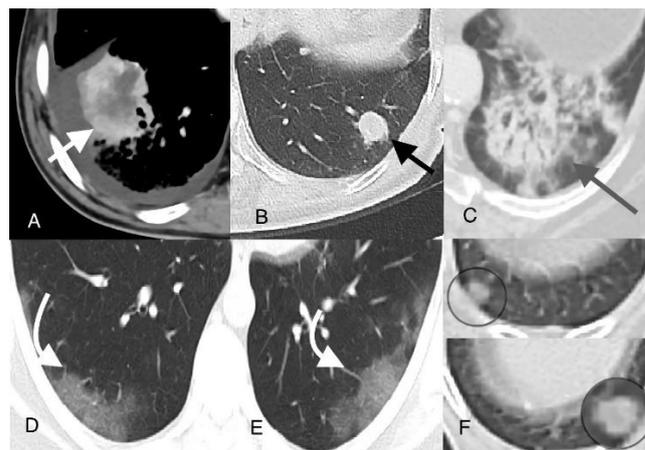
### Imaging protocol and evaluation

Imaging was performed on a 64-slice computed tomography device (Toshiba Medical Systems), with or without contrast, while holding the breath after a deep inspiration in the supine position. The scanning parameters were as follows: 120 kV, 80 mAs, 0.35 second spin time, pitch: 1.5. Images were obtained by intravenous (i.v.) bolus contrast agent injection in 421 of the patients included and reconstructed at a slice thickness of 1 mm using a high frequency reconstruction algorithm.

### Data collecting

Images of 1133 patients who underwent abdominal CT imaging were retrospectively analyzed. Inclusion criteria in the study were being between the ages of 18-60 years and having had an abdominal CT scan with suspicion of an abdominal pathology. Patients with a known history of malignancy, lung infection in the last 6 months, those admitted with a history of trauma, and a history of degenerative bone pathology were excluded from the study. Thorax, inferior mediastinal area, and mediastinal structures (descending aorta, heart, pulmonary arteries, paratracheal, pretracheal, precarinal areas and mediastinal lymph nodes), adjacent bone structures (costae, thoracic vertebrae), subcutaneous fatty tissue and soft tissues were evaluated. Results were classified as mediastinal findings, infectious findings, pulmonary lesions, pleural findings, pulmonary parenchymal findings, and pleural findings. Mediastinal findings included increased cardiothoracic ratio, atherosclerotic changes in vascular structures, mediastinal lymphadenopathies, and pericardial effusion. Infectious findings comprised an infiltration suggestive of acute bacterial pneumonia, or interstitial pneumonia caused by SARS-CoV-2 virus, pleural effusion, and bronchiectasis (Figure 1). Among lung lesions, air cysts were classified as pulmonary nodules smaller or equal to or larger than 1 cm. Pulmonary parenchymal findings and pleural findings included interstitial lung diseases, atelectatic changes, emphysematous lung disease findings, pleural plaques suggesting asbestosis and acute pulmonary edema. The images were evaluated by two radiologists with 4 and 10 years of experience.

Figure 1: A: A mass lesion with cystic necrotic areas, contoured to the spicule, located peripherally in the posterolateral segment of the right lower lobe of the right lung and adjacent pleural effusion (white arrow). B: Peripherally located solid nodule with irregular contours in the posterolateral segment of the left lower lobe of the left lung (black arrow). C: Consolidated lung areas with air bronchograms and peribronchial thickening are observed in the anterior, posterior and lateral segments of the left lower lobe of the lung. These findings are associated with infective lung diseases (black arrow). D: In the lower lobe posterolateral segment of the right lung, there is a peripheral geographic interlobular septal thickening and ground glass density (white arrow). E: In the left lung lower lobe, posterolaterally and peripherally located ground glass density areas are observed (white arrow). F: Small pulmonary nodules with lobulated contours, irregular borders, located in the basal segments of the lower lobes in the right and left lungs



## Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS Inc. Chicago, IL, version 22.0). Data were expressed as numbers and percentages.

## Results

The mean age of the patients was 43.8 (18.7) years. Among them, 582 (51.4%) patients were female and 551 (48.6%) were male. Incidental findings were detected in 49.2% of the patients (Table 1).

Table 1: Findings found incidentally in chest sections included in abdominal computed tomography

Incidental finding	Number	%
<b>Mediastinal findings</b>		
Cardiothoracic rate increase	33	2.9%
Vascular atherosclerotic changes	71	6.2%
Mediastinal lymphadenopathies	8	0.7%
Pericardial effusion	9	0.8%
<b>Infectious findings</b>		
Pulmonary infiltration	31	2.7%
COVID-19 pneumonia	17	1.5%
Pleural effusion	59	5.2%
Bronchiectasis	9	0.8%
<b>Pulmonary lesions</b>		
Pulmonary nodule	57	5%
≥ 1 cm pulmonary nodule	17	1.6%
Air cyst	14	1.2%
<b>Pulmonary parenchymal diseases and pleural involvement</b>		
Atelectatic changes	113	9.9%
Asbestosis	79	6.9%
Acute pulmonary edema	19	1.7%
Emphysematous changes	17	1.6%
Interstitial lung disease	7	0.6%

Mediastinal findings were detected in 118 (10.4%) patients, of which 33 (2.9%) had increased cardiothoracic ratio, 71 (6.2%) had vascular atherosclerotic changes, 8 (0.7%) had mediastinal lymphadenopathies and 8 (0.6%) had pericardial effusion.

Infectious findings were present in 116 (10.2%) of the patients. Infection findings suggestive of bacterial pneumonia were present in 31 (2.7%) of these patients, findings of interstitial pneumonia due to SARS-CoV2 virus were observed in 17 (1.5%), pleural effusion, in 59 (5.2%), bronchiectasis was observed in 9 patients (0.8%).

There were lung lesions in 88 (7.8%) of the patients. Of these lesions, 14 (1.2%) were air cysts, 57 (5%) were pulmonary nodules smaller than 1 cm, and 17 (1.6%) were pulmonary nodules larger than 1 cm. Patients with pulmonary nodules ≥1 cm were diagnosed with lung malignancy after necessary clinical examination and evaluation.

There were pulmonary parenchymal findings and pleural involvement in 235 (20.7%) of the patients. Atelectatic changes were present in 113 (9.9%) of these patients, pleural plaques secondary to asbestosis were seen in 79 (6.9%), findings of acute pulmonary edema were observed in 19 (1.7%), and emphysematous lung disease was present in 17 (1.6%). Seven patients (0.6%) had findings of interstitial lung diseases.

## Discussion

In this study, we investigated the rate of incidental imaging findings detected in chest structures included in ACT images, which was 49.1%, similar to the rate of chest findings found incidentally in trauma patients recently [9]. The most common incidental finding in our patients was atelectatic changes (9.9%). Suspicious pulmonary nodules were detected in 1.6%. This data in our study was quite low compared to other

studies investigating the incidental detection of suspicious pulmonary nodules [10, 11].

In another study investigating the presence of incidentally detected pulmonary nodules in ACT, the incidental detection rate of pulmonary nodules was reported as 3% [12]. This rate was higher in our study. According to studies conducted in previous years, thorax CT scans have increased today. This increase can be attributed to reasons such as easy access to technological devices and malpractice [13]. In addition, it has facilitated the detection of incidental chest findings in thorax CT, which is used as a diagnostic tool in COVID 19 pneumonia. Therefore, the incidental rate of pulmonary nodules detected in our study may be lower.

In whole-body CT studies investigating traumatic pathologies due to blunt trauma, the most common incidental chest finding is pulmonary nodules, followed by atherosclerosis [14]. Detection of infection, infiltration, and pleural findings was also very low in other publications [2, 15, 16].

In our study, unlike other studies, lung parenchymal findings suggesting infective infiltration were the most common. In addition, pneumonic infiltration due to COVID 19 infection were detected in 1.7% of the patients. The high rate of infective pathology in our study may be due to the Coronavirus pandemic. In a case series published at the onset of the pandemic, patients who presented with complaints of lower abdominal pain, fever, nausea, persistent vomiting and weakness and who underwent ACT showed signs of pneumonic infiltration in both lungs' lower zones [17]. Incidental detection of COVID-19 pneumonia is not surprising in this study, in which ACT images of patients presenting with symptoms such as abdominal pain, vomiting, nausea, and diarrhea were included. According to these results, COVID 19 pneumonia should also be considered in the pre-diagnosis of individuals without underlying health problems.

Frequent and convenient access to CT and many imaging methods increases the number of patients viewed and the images obtained. Not only the image capturing methods, but also the development of data evaluation and storage technology increase the importance of the requested imaging area as well as the neighboring structures. Misinterpreting images, failure, or lack of evaluation of non-symptomatic findings may cause important findings to be overlooked and lead to false/incomplete diagnosis. At this point, it is very important for radiologists to identify and categorize these non-clinical findings and convey them to other clinicians.

### Limitations

This study has some limitations. First, there may be a bias since the study was carried out retrospectively. Although the data were obtained from the hospital database, unnoted symptoms and anamnesis may cause bias in the study results. Second, the patient age range included in the study is wide. Therefore, it may not be possible to evaluate age-related pathologies with increasing frequency. For this reason, prospective studies can be conducted with large patient groups divided according to their age to generalize the results.

### Conclusion

Examination of chest structures entering the imaging field in ACT may be useful in the early diagnosis and treatment of pulmonary infections and pulmonary nodules that are

precursors of malignancy. Cross-sectional imaging methods are important diagnostic tools that are used in the evaluation of patients and offer a wide examination area. Independent of clinical information and symptoms, evaluation of every structure in the imaging field plays a role in the early diagnosis of many pathologies.

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