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Original Article

Incidental lung findings on noncontrast computed tomography in patients presenting with renal and ureteric colic compliants

Pınar Özdemir Akdur

Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Department of Radiology, Ankara, Turkey

Abstract

Objective: In patients presenting to the emergency department with flank pain suggestive of acute colic, most centers worldwide are increasingly using computed tomography (CT) to evaluate renal and ureteric colic. This study was conducted to determine the incidental pulmonary findings in computed tomography performed for suspected renal and ureteric colic.

Methods: We retrospectively reviewed consecutive patients referred to our clinic with a prediagnosis of urolithiasis who underwent noncontrast abdominal CT between August 2022 and August 2023. In this study, we included 286 patients to evaluate pulmonary findings.

Results: Of the 286 patients, 212 (74.2%) were male and 74 (25.8%) were female. The mean age of the patients was 50.55±14.95 years. While 20% of the patients were 65 years of age or older, 80% were under 65 years of age. Tomographic evaluation of the lungs showed one or more findings in 34% (98) of the patients included in the study. The most common tomographic finding in the lungs was fibrotic changes in 12.9% (37), while the least common finding was bronchiectatic changes in only one patient (3.5%). Other incidental lung findings included atelectasis, lung nodules, effusion, increased pleural thickness, consolidation, ground glass appearance, infiltration, emphysematous lung changes, air cysts and lung mass, which were observed in three patients.

Conclusion: Incidental findings are often encountered in abdominal CT scans performed with a different diagnosis. Most of these findings are clinically insignificant. However, given that the clinical significance of incidental findings may increase with age or may lead us to a new diagnosis not previously known to the patient, findings of the lung parenchyma in the imaging field should be included in the radiological reporting of abdominal CT scans.

Keywords: Colic, computed tomography, incidental, lung findings, radiology, urolithiasis.

Address for correspondence: Pınar Özdemir Akdur, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Yenimahalle, 06200, Ankara, Turkey.
Phone: +90 533 387 12 89 **E-mail:** pinarozdemirakdur@msn.com **ORCID:** 0000-0003-0246-5912
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INTRODUCTION

Urolithiasis is a common urinary tract disease affecting individuals across a wide age range. Various radiological modalities, such as direct radiography, intravenous pyelography (IVP), ultrasonography and computed tomography (CT) are used in its diagnosis. CT is known to have high sensitivity, particularly in the evaluation of renal and uritic colic patients. With the development of multidetector CT technology, CT has become even more important in the evaluation process of renal and ureteric colic patients, since significant progress has been made in imaging with the ability to obtain sagittal and coronal reformat images that allow evaluation in different planes (1-3). In a significant percentage of many other emergency presentations, such as renal and ureteric colic, the increase in the resolution of CT scanning has led to a large number of other findings that are not related to the cause of the emergency presentation. The importance of these incidental findings ranges from insignificant lesions with no clinical significance to those that may significantly affect the health of the patient (4). There are even studies reporting that routine CT imaging in patients with unreliable physical examination reveals unsuspected findings at a rate of up to 38% and leads to treatment changes at a rate of 19-26% (5).

This study aimed to determine the incidental pulmonary findings in computed tomography performed for suspected renal and ureteric colic.

MATERIALS AND METHODS

This is a retrospective study conducted in accordance with the Helsinki Declaration. Before conducting it, we received permission of the Ethical Committee of the Clinical Research Ethics Committee of the University of Health Sciences, Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital (date: 25.05.2022, decision no: 2022-04/1789).

We retrospectively analyzed consecutive patients who were referred to our clinic with a prediagnosis of urolithiasis and underwent noncontrast abdominal computed tomography (CT) scans in our clinic between August 2022 and August 2023. We identified 308 patients for whom complete anamnesis information was available in hospital files and CT images retrieved from the hospital radiology archive system (PACS). Of these patients, 15 had previous thoracic investigations and had known chronic diseases (all chronic diseases including malignancies) that could affect the lung parenchyma. Consequently, these patients were excluded from the study. We also excluded seven patients with less than one segment of lung volume included in the imaging field. The remaining 286 patient sections containing lung tissue through the mediastinum and parenchyma window were evaluated by a radiologist. In this single-center retrospective study, two CT devices were used in our hospital: a 16-slice CT device (GE Revolution, General Electric Milwaukee, Wisconsin, USA) and a 16-slice CT device (Toshiba, Aquilion, Toshiba Medical Systems, Tokyo, Japan).

Statistical analysis

Data were analyzed using the Statistics Package for Social Science (SPSS 23.0-IBM, NY, USA). The characteristics of patients were reported as n (percent) for categorical variables or as mean±standard deviation for continuous variables.

RESULTS

Of the 286 patients, 212 (74.2%) were male and 74 (25.8%) were female. The mean age of the patients was 50.55±14.95 years. While 20% of the patients were 65 years of age or older, 80% were under 65 years of age. Tomographic evaluation of the lungs showed one or more findings in 34% (98) of the patients included in the study. Because the acquisition levels varied from one patient to another, we were able to evaluate the lower lobe posterior segments of both lungs in 100% (n=286): the lower lobe lateral segments of both lungs in 90% (n=257), the lower lobe anterior and medial segments of the right lung and the lower lobe anteromediobasal segments of the left lung in 60% (n=171), and the right lung middle lobe lateral and left lung lingula inferior segments in 15% (n=42) of patients.

The most common tomographic finding in the lungs was fibrotic changes in 12.9% (n=37) and the second most common finding was atelectatic changes in 7.3% (n=21). Of the 5.9% (n=17) pulmonary nodules located in

different locations, 80% of the nodules larger than 3 mm needed follow-up. Pleural thickening was observed in 5.2% (n=15) of the patients, one of which was in the form of calcified plaque. Consolidation in 3.5% (n=10), ground glass appearance in 2.8% (n=8), air cyst in 1.7%, hiatal hernia in 1.4% (n=4), emphysema in 1% (n=3), infiltration in 1% (n=3), lung mass in 1% (n=3) and bronchiectatic changes in only one patient (Table 1). Of the three patients with an incidental lung mass, one was subsequently diagnosed with lung adenocarcinoma, one was diagnosed with hamartoma, and one was diagnosed with a spiculated mass with tomographically malignant features. However, the diagnosis remains unknown to us since the ongoing follow-up was not performed in our hospital (Figure 1,2).

Table 1. Incidental findings: lung findings for both sexes

INCIDENTAL FINDINGS	Number (98)	%
Fibrotic changes	37	12.9
Atelectasis	21	7.3
Nodules	17	5.9
Pleural thickening	15	5.2
Pleural effusion	13	4.5
Consolidation	10	3.5
Ground glass opacity	8	2.8
Air cyst	5	1.7
Hiatal hernia	4	1.4
Infiltration	3	1
Emphysema	3	1
Bronchiectasis	1	0.3

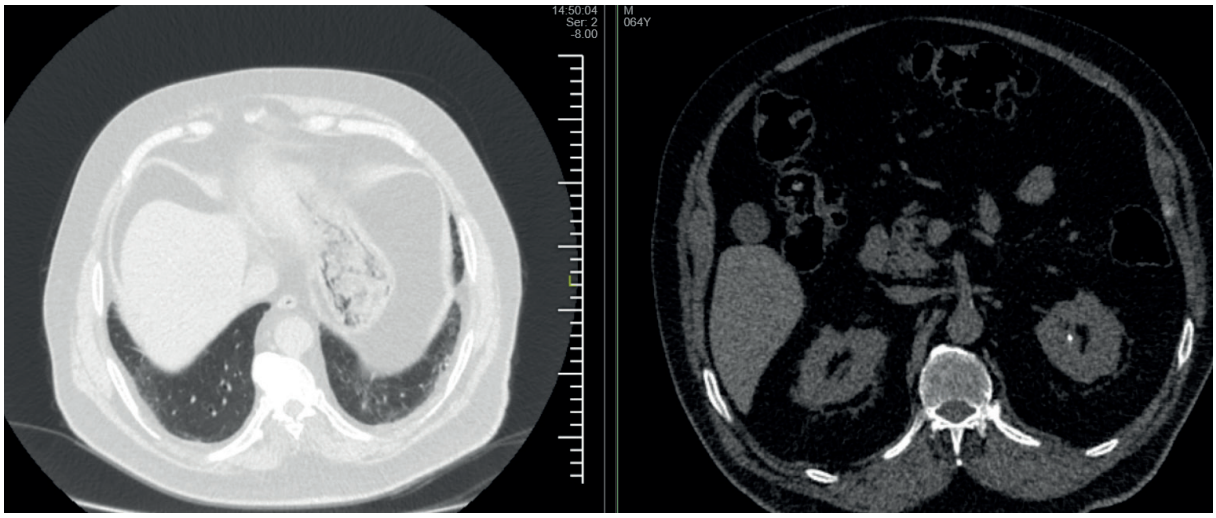

Figure 1. Calyceal calculi in the left kidney and pleural thickening and fibrotic changes in the posterobasal left lung in the lung window

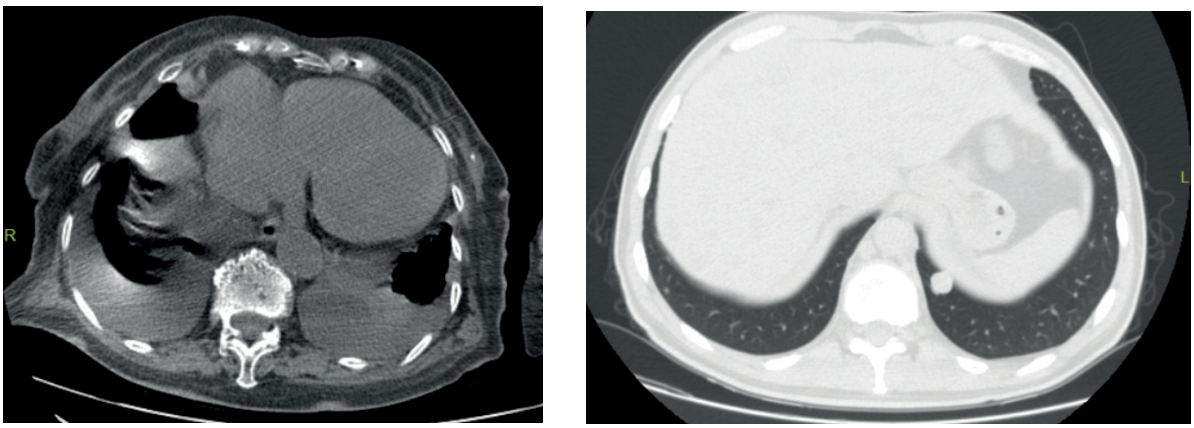

Figure 2. Bilateral massive pleural effusion and a 13 mm diameter nodule in the posterobasal lower lobe of the left lung in two different patients with renal colic (lung adenocarcinoma)

DISCUSSION

Noncontrast CT is the generally accepted as standard reference imaging modality for patients presenting with urolithiasis and scans the urinary tract for stones with high sensitivity and specificity. CT has become the first and most preferred diagnostic imaging modality in the patient evaluation process due to its wide list of indications, ease of application and widespread availability in hospitals. All abdominal organs and part of the lung parenchyma can be visualized with CT for urinary tract stones. Therefore, incidental imaging findings (IF) within or outside the urinary system are frequently encountered (6,7).

Currently, there is a significant increase in the detection of incidental findings that are not related to the primary target due to increased CT resolution and ongoing improvement. Various studies in the literature have reported the incidental finding at different rates. Some studies report an incidental finding rate of 70% when all imaging modalities are taken into consideration, while other studies report an incidental finding detection rate of 15% and a clinically significant incidental finding rate of 8%. Additionally, some studies have evaluated trauma and renal colic patients separately, investigating the incidental finding rates in trauma patients and renal colic patients, a group in which a large number of CT scans were performed. While incidental finding rates in abdominal CT scans in trauma patients vary between 34% and 43% (8,9), this rate increases up to 45% in renal colic emergency department patients (10). In short, the detection rate of incidental findings varies between 10-86%, although it varies between studies. The reason for this variation may be attributed to differing patient populations and to the fact that in some studies, all significant and nonsignificant incidental findings were recorded, whereas in other studies, only clinically significant findings were recorded (11-14). In our study, we evaluated only lung findings and found that 34% (n=98) of the patients had one or more findings on tomographic evaluation of the lungs.

Incidental findings are inevitable in all radiological images, including CT performed for trauma or any emergency. In addition, it is inevitable that the incidence of IFs is increasing and will continue to increase over time due to the aging population and continuous advances in imaging technology. Although the IFs that occur on CT scans may be unrelated to the actual prediagnosis, ignoring them or delaying their diagnosis may lead to poor outcomes, particularly in the elderly patient population. Because it is well known that the prevalence of various pathologies, such as degenerative and neoplastic diseases, increases with age, it is very important that we recognize potential IFs in the abdomen, chest and neck regions in addition to the findings related to the main prediagnosis, especially in the elderly (4).

Although studies on incidental findings in emergency trauma or renal and ureteric colic patients mostly include incidental abdominal findings, some of them further include the thorax along with other anatomical regions. In a study conducted in emergency patients, thoracic findings were the least common, followed by findings from the head and neck anatomical region, while abdominal findings were the most common. Higher rates of IF in abdominal organs are attributed to the large number and volume of internal organs. The higher prevalence of IF in women in CT scans observed in some studies may be explained by breast pathologies (4). Our study targeted incidentally detected thoracic findings and the most common thoracic finding in our study was lung nodules. In

another study that focused on noncontrast CT evaluations of colic patients, the most common pulmonary finding was pleural effusion (15). In another study that included 503 patients and evaluated whole body radiographs, granuloma was found in six patients, pulmonary nodule in four patients, apical thickening in one patient, pleural plaque in one patient and pleural effusion in one patient (16). In our study, the most common tomographic finding in the lungs was fibrotic changes with a rate of 12.9% (n=37) and the second most common finding was atelectatic changes with a rate of 7.3% (n=21). Of the 5.9% (n=17) pulmonary nodules in different locations, 80% of nodules larger than 3 mm needed follow-up. Pleural thickening was observed in 5.2% (n=15) of patients, one of which was a calcified plaque. Consolidation was found in 3.5% (n=10), ground glass appearance in 2.8% (n=8), air cyst in 1.7% (5), hiatal hernia in 1.4% (n=4), emphysema in 1% (n=3), infiltration in 1% (n=3), lung mass in 1% (n=3) and bronchiectatic changes in only one patient (Table 1). In addition, one of the three patients with an incidental lung mass in our study was later diagnosed with lung adenocarcinoma, one with hamartoma and one with a spiculated mass showing tomographically malignant features. However, we lack information about the diagnosis because the follow-up was not performed in our hospital.

As mentioned above, it is possible to discuss the serious rates of incidental findings detected at significant rates in many imaging modalities. However, some of the incidental findings have clinical significance for follow-up. One study emphasized that only more than eight in 10 of the incidental findings obtained from CT examinations were harmless or currently asymptomatic, (12) whereas some other studies emphasized that 1% to 46.9% of the incidental findings may affect the patient's health and may require urgent treatment or further investigation (17-19). In this respect, incidental findings are divided into three categories: (1) potentially serious conditions requiring diagnostic work-up, (2) findings requiring consultation with other specialities and active management, and (3) nonurgent findings. The most important of these findings in terms of determining patient follow-up and treatment processes is the discovery of an undiagnosed malignancy focus. Various studies have emphasized that the rate of occult malignancy diagnosis in CT scans varies between 3.4% and 15% (20-22). In addition, many studies show that cancer diagnosis in the emergency department is an increasingly important method of cancer diagnosis, whether incidental or due to symptom burden (20).

Incidentally detected pulmonary nodules in patients undergoing CT scans for any reason present a common diagnostic challenge in patient management. It is possible to discuss the presence of incidentally detected pulmonary nodules in millions of patients every year. With the increasing use of computed tomography (CT) and improved resolution, an increasing number of noncalcified solid pulmonary nodules can now be detected. In our study, the most common incidental finding was a solitary pulmonary nodule. A solitary pulmonary nodule (SPN) is a focal, round or oval area of increased opacity in the lung with a maximum diameter of less than 3.0 cm and is one of the most common chest radiography (CR) or CT abnormalities often detected incidentally in clinical practice. The prevalence of SPNs in the general population is estimated to be approximately 2.0% to 24.0% (21). The majority of SPNs are benign; however, a small proportion are clinically important, as they represent early, potentially curable lung cancer. Neoplasms, infection, inflammation, and vascular and congenital abnormalities are among the main causes of SPNs. The prevalence of malignancy in patients with SPNs varies between two and 23% across studies. It is important to accurately differentiate between benign and malignant SPNs before invasive treatments for solid nodules. Because conservative treatments such as medication or observation may be sufficient for benign SPNs, surgical treatments are usually needed as soon as possible for lung cancer and other malignant SPNs (22). In addition, while the five-year survival rate is over 60% in patients with stage IA lung cancer. Survival rates decrease rapidly as the stage of the disease increases. Early detection of an existing lung cancer incidentally leads to significant positive contributions in the treatment process of the patient and decreases morbidity and mortality (23-26). In our study, a pulmonary nodule detected in a patient was later confirmed histopathologically and the patient was diagnosed with lung adenocarcinoma.

Indeed, this situation gives rise to two main topics that may have different results. On the one hand, there is a conclusion about the chance of chance detection of serious diagnoses detected incidentally by imaging methods and the chance of early treatment. On the other hand, there is a statistic of findings of no clinical significance that may trigger unnecessary fear and panic in patients. One author has proposed the term "VOMIT" in relation to this issue: "Victims of Modern Imaging Technology" to emphasize the fact of increased incidental findings and anxiety among patients due to advances in technology and knowledge (17). As the technological capabilities

of imaging methods increase, this situation results in medicolegal problems at one end, and at the other end, a patient population that brings a serious financial and workload on the health system to reach the solution of unnecessary anxiety. Therefore, radiologists have a very important role in establishing this delicate balance. The report prepared by the radiologist should include incidental findings that may affect the diagnosis and follow-up process of the patient and may create legal problems when not reported. However, it should not cause unnecessary anxiety for the patient and therefore should be prepared to prevent unnecessary financial and workload in the healthcare system.

Limitations:

Our study has limitations, including being conducted at a single center and having a retrospective design. However, we believe that this reduces some of the limitations as consecutive patients were included and the applications to the emergency department of our hospital, which is a tertiary care center, are representative of the community.

CONCLUSION

Incidental nonstone findings on noncontrast abdominal CT are common, and most of them are clinically unimportant. However, a significant number of clinically significant findings requiring additional clinical examination and investigation may be detected incidentally. A radiologist should not only evaluate the examination in terms of stone detection but should also carefully examine all systems. While other abdominal organs are scanned more frequently and incidental findings related to abdominal organs are included in radiological reports, evaluations performed through the thoracic window may sometimes be neglected. However, it should not be forgotten that, as in our study, it is possible to find lung findings in the evaluation of calculi to a considerable extent, and even the diagnosis of lung cancer can be made during this search for incidental findings. Therefore, it is an important responsibility of radiologists to detect and report thoracic findings in addition to other incidental findings on noncontrast abdominal CT in a patient referred to a radiology clinic with a prediagnosis of calculi.

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Ethical approval: We conducted our study in accordance with the Declaration of Helsinki after obtaining permission from the Clinical Research Ethics Committee of our hospital (date: 25.05.2022, decision no: 2022-04/1789).
Peer review: Externally peer reviewed.
Authorship contributions: Idea/Concept: Design: Control/Supervision; Data Collection and/or Processing; Analysis and/or Interpretation; Literature Review; Writing the Article; Critical Review: P.O.A.

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