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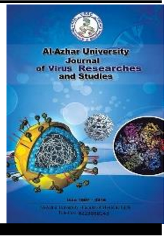

Role of MDCT in Diagnosis of Different Cystic Chest Lesions

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Abstract

Cystic lesions in the thorax can have a wide range of diagnostic features. They can be differentiated by different factors such as the size, shape, distribution, and content of the lesions. The cause of these lesions can be determined by the presence of these clinical features and the computed tomography findings. Currently, computed tomography is the preferred imaging modality for the diagnosis of cystic chest lesions. It is superior to chest radiography in terms of revealing the extent and presence of abnormalities. The objective of this study is to evaluate the role of the multiple capabilities of MDCT in the diagnosis and treatment of chest cystic lesions. Our study involved reviewing the MDCT results of 43 patients of different complaints and different diseases who were referred to Al-Haram Hospital radiology department from December 2018 to May 2021. We were able to recognize, locate, and detect several forms of chest cystic lesions utilizing MDCT chest to help with diagnosis, describe the differential diagnosis, and explain the pathophysiology where it is known, particularly in cases of diffuse cystic lung lesions. We concluded that the role of MDCT imaging in diagnosis and evaluation of different chest cystic lesions is central, being accurate and non-invasive.

Keywords: Cystic lesions – MDCT – Chest.

1. Introduction

A spherical area that is bounded by a fibrous or epithelial wall of varying thickness is referred to as a cyst. A cyst appears as a circular parenchymal translucency or low-attenuating region with a distinct contact with normal lung tissue on a CT scan. Cysts vary in their wall thickness, but most have thin walls of less than 2 mm [1].

An air or fluid-filled, localized, multifocal, or diffuse pulmonary cyst is possible. Pneumatoceles, congenital cystic lesions, traumatic lesions, and various infectious conditions, such as pneumocystis carinii pneumonia and hydatid disease, are included in the differential diagnosis of focal and multifocal lung illnesses. Cystic lesions, including metastatic lesions, can very rarely be found in malignant lesions [1].

Cysts may be the predominant abnormality in any number of widespread lung disorders, but lymphangioleiomyomatosis (LAM) and pulmonary Langerhans cell histiocytosis (PLCH) are the two that commonly occur with diffuse lung cysts.

Correct diagnosis may result from knowledge of these disorders and their distinctive imaging characteristics [2].

Empyema and parapneumonic collection are common and significantly increase the chest radiologist's workload. The underlying issues should be assessed with a contrast-enhanced CT scan. Before draining the effusion to dryness, a CT scan should be done since the pleural abnormalities that are surrounded by fluid will be easier to observe. While homogeneously echogenic effusions are typically caused by a hemorrhagic effusion or an empyema, the presence of pleural nodules within an effusion is a sign of malignancy. The preferred method for assessing pleural thickening is CT [3].

The best way to assess chest wall cystic lesions like hematoma, abscess, and hydatid cyst is with a CT scan. The mainstay of diagnostic imaging for diseases of the chest wall, CT has good spatial resolution and can show both osseous and soft tissue features. MDCT makes it possible to image a vast tissue volume quickly, which lessens the impact of respiratory motion on the thorax. Mineralization and bone involvement are revealed by CT, which helps to focus the differential diagnosis [4].

2. Patients and Methods

This study has taken 28 months and involved 43 patients, 26 males and 17 females, age range 15-70 years (average of 39.305 years). They presented by different chest manifestations and were all referred to the radiology department in Al-Haram Hospital for MSCT of the chest.

2.1 Methods

All patients were subjected to

1) Thorough clinical examination with history taking general and chest examination.

2) Different laboratory tests were considered according to the case e.g., tuberculin test, assessing for Hydatid disease and PCR test for COVID if suspected.

3) MSCT chest was done to all patients using 16 channels MSCT in Al-Haram Hospital. CECT was done to 26 cases, HRCT was done to 13 cases and NECT was done in 4 cases.

2.2 Technique of scan

In our study we used Toshiba Aquilion MSCT 16 slices set with scout parameters 110 Kv and 25 mA using helical scan type while asking the patient to hold breath. The slice thickness used in this study is 1.0 mm with 1.0 cm interval and the field of view depending on patient size (average 350mm) as well as total exposure time was 0.8 sec on non-contrast CT technique.

Frequent indications of NCCT chest are suspected cases or follow up of metastasis, bronchiectasis, ILD and pulmonary infections.

All non-contrast scans should be acquired in volumetric mode, scanning extending from thoracic inlet to caudally include upper abdomen. Patients are imaged in supine position in suspended deep inspiration with arms extended overhead to reduce beam hardening artifact. On contrast CT studies with used Omnipaque Non- ionic contrast 50 ml ampoule (contrast media volume 1–2 ml/kg), iodine concentration 350 and the injector flow is 3 ml/sec with pressure 250, scan delay of 55-70 seconds is kept following administration of contrast to allow for optimal enhancement of soft tissues, using the same parameters of non-contrast CT technique. The acquired CT images are reconstructed into soft tissue mediastinal window (20-30 kernel) and lung window (in sharp algorithm, 60-80 kernel) and in 1.2 -1.5 mm section thickness for interpretations.

2.3 Method of Evaluation

The cyst was evaluated for the following:

1. Site: lung, mediastinum, pleura or chest wall.
2. Size: in cm

3. Number: single or multiple.
4. Content: air or fluid.
5. The CT appearance of the cyst was considered and evaluated considering available clinical data and previous investigation.
6. Pathological assessment was done to indicate patients e.g., tuberculin test, assessing for Hydatid disease.

3. Results

This study involved 43 patients with cysts detected in their MSCT of the chest as follows:

1. Lung cysts:

Thirty cases had lung cysts. The following table summarizes the results of lung cysts.

2. Mediastinal cysts:

Five of our cases had mediastinal cysts, 3 males and 2 females; their age range was 19-60 years (average 31 years). All mediastinal cysts were single and contained fluid. Figure .3 summarizes the types of mediastinal cysts. All cyst's types were pathologically proven.

Table (1): Lung cysts.

Lung Cysts	Number of Cases	Age	Sex	Content	Number of Cysts
Pulmonary Hydatid cyst	3	33, 37 and 42	F, M and M	Fluid-Air	Single
Hepatic and lung hydatid cysts	1	51	F	Fluid	Single
Lung abscess	1	28	F	Air	Single
Post-primary tuberculosis	1	44	M	Air	Single
Bronchogenic cyst	2	22 and 46	F and F	Fluid	Single
Traumatic pneumatoceles	1	18	M	Air	Single
Post inflammation	1	45	M	Air	Single
Post infarction	2	55 and 62	M and M	Air	Single
LAM	3	17,34 and 35	F, F and M	Air	Multiple
PLCH	3	27, 28 and 70	F, M and M	Air	Multiple
LIP	2	42, 26	M and F	Air	Multiple
Birt-Hogg-Dubé syndrome	1	65	M	Air	Multiple
Cystic metastasis	2	58 and 66	M and M	Fluid	Multiple
Cicatricial collapse	3	46, 52 and 57	M, M and M	Air	Multiple
Bronchiectasis	1	28	M	Air	Multiple
Post inflammatory	2	29 and 47	F and M	Air	Multiple
Cystic adenomatoid malformation	1	23	F	Fluid	Multiple

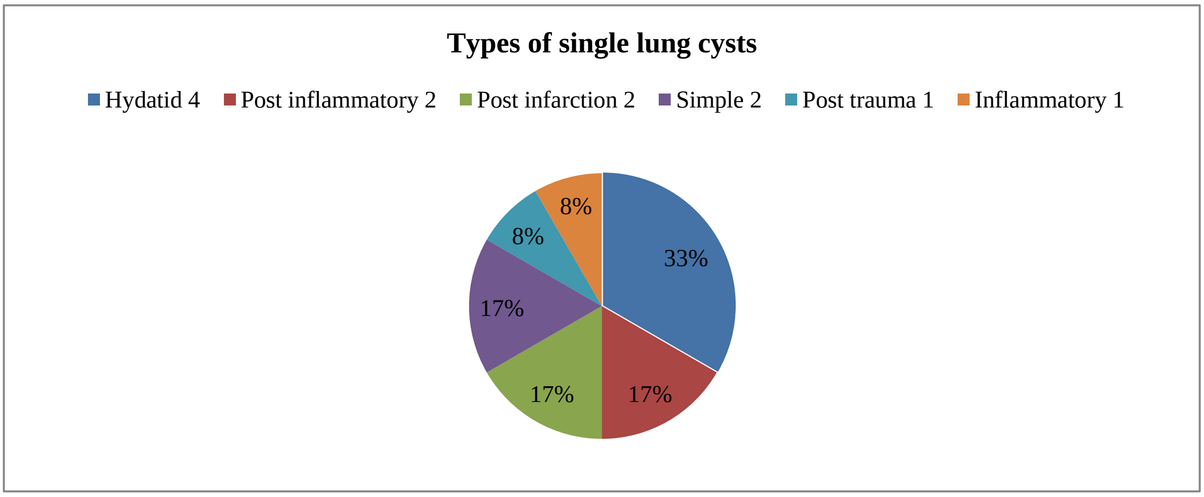


Figure (1): Types of single lung cysts.

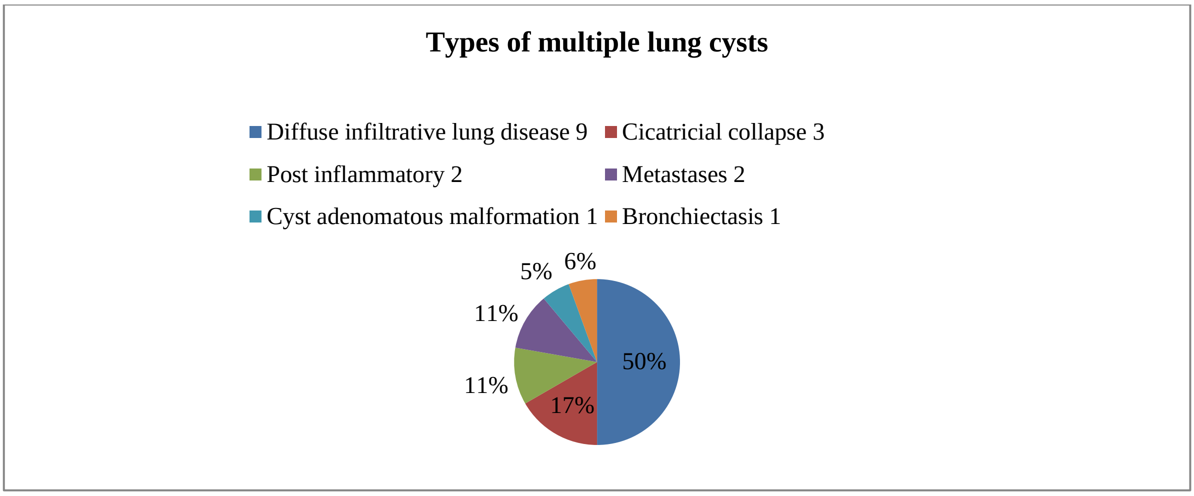


Figure (2): Types of multiple lung cysts.

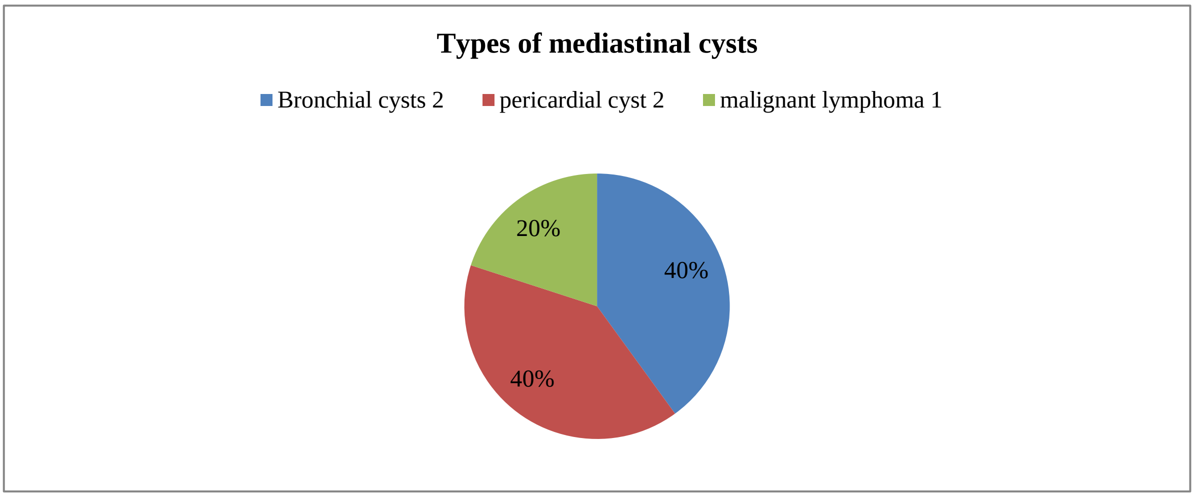


Figure (3): Types of mediastinal cysts.

Table (2): Mediastinal cysts.

Mediastinal Cysts	Number of cases	Age	Sex	Content	Number
Bronchial cyst	1	19	M	Fluid	Single
Bronchial cyst	1	30	F	Fluid	Single
Pericardial cyst	1	23	M	Fluid	Single
Pericardial cyst	1	21	F	Fluid	Single
Malignant lymphoma	1	60	M	Fluid	Single

3. Pleural cysts

Four of our cysts' cases were pleural in nature, 2 males and 2 females; their age range was 30-60 years (average 47.5 years). Multi-detector CT chest proved that three cases were loculated effusion and one female case of pleural hydatid cyst. See Figure 4 for the distribution of lesions along the pleura.

Table (3): Mediastinal cysts.

Pleural Cysts	cases	Age	Sex	Content	Distribution
Pleural hydatid cyst	1	30	F	Fluid	Left lateral pleural
loculated effusion	1	46	F	Fluid	Right lateral pleural and oblique fissure
loculated effusion	1	54	M	Fluid	Right diaphragmatic, medial and oblique fissure
loculated effusion	1	60	M	Fluid	Bilateral diaphragmatic, medial and oblique fissure

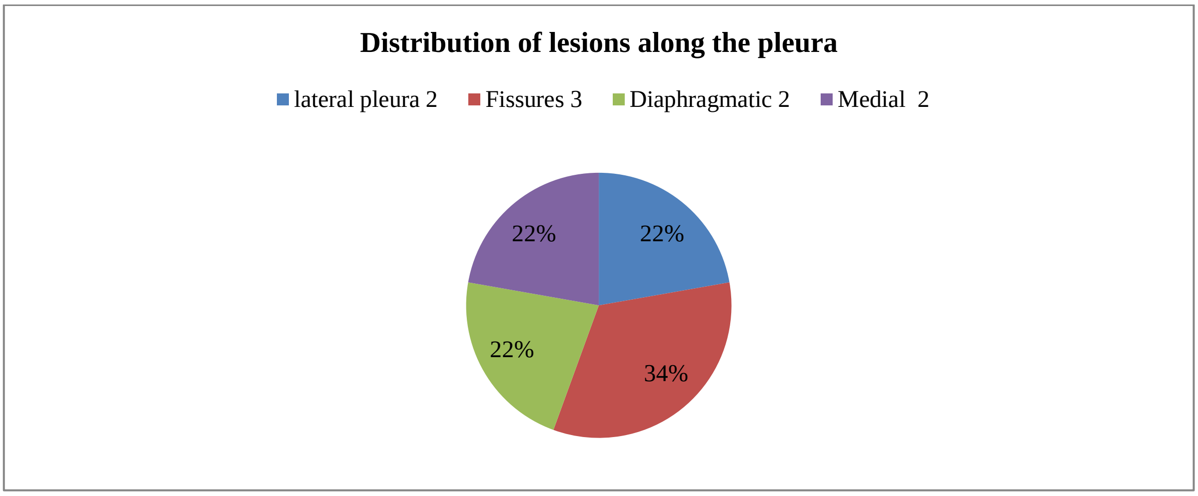


Figure (4): Distribution of lesions along the pleura.

4. Chest wall cysts

Four of our cases had chest wall cysts, 2 males and 2 females; their age range was 44-52 years (average 38.5 years). All chest wall cysts were single and contained fluid. Fig.5. summarize the types of chest wall cysts.

Table (4): Univariate analysis for risk factors of PJK.

Chest wall Cysts	Number of cases	Age	Sex	Content	Number
Hematoma	1	25	M	Fluid	Single
Empyema necessitates	1	52	F	Fluid	Single
Hematoma	1	23	M	Fluid	Single
Tuberculous abscess	1	44	F	Fluid	Single

Then, binary logistic regression based on the aforementioned parameters showed that larger preoperative thoracic kyphosis > 43°, larger preoperative and postoperative lumbar lordosis > 45° were the main risk factors of PJK with ORs of 0.429,0.863 and 1.024 respectively (Table 3). Figures (6,7,8) summarize the results of cysts, numbers, distribution and contents.

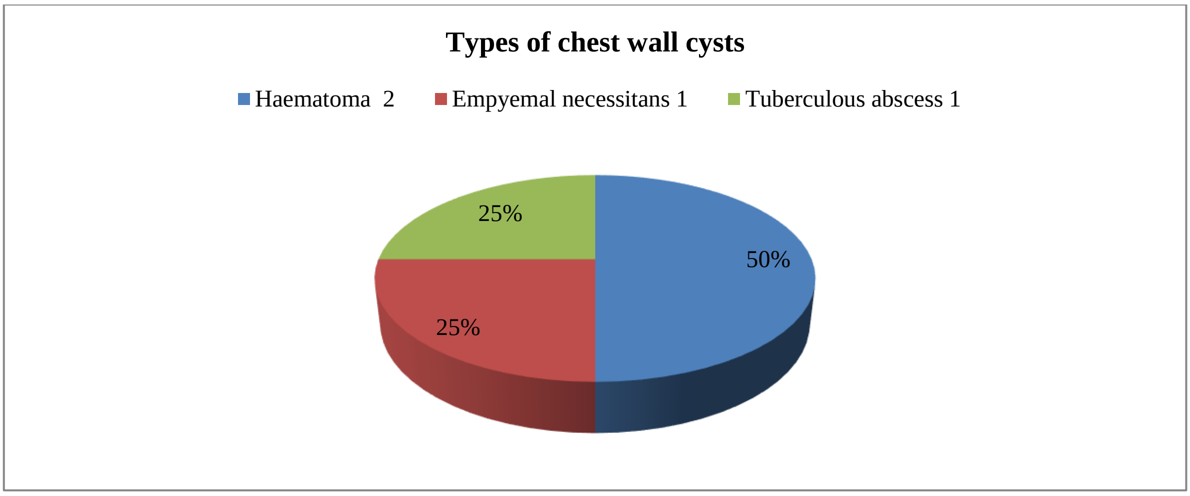


Figure (5): Distribution of lesions along the chest wall.

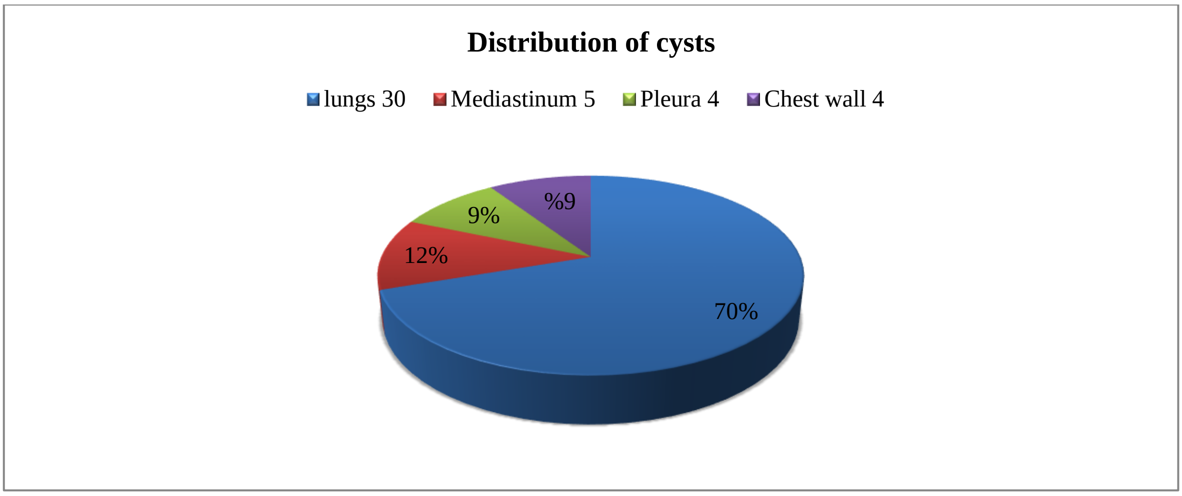


Figure (6): Distribution of cysts.

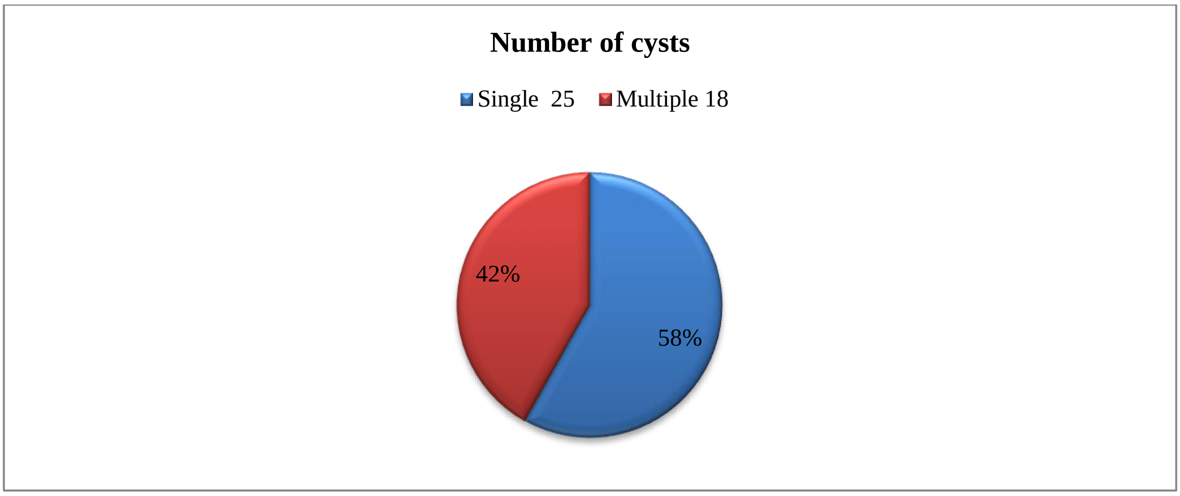


Figure (7): Number of cysts.

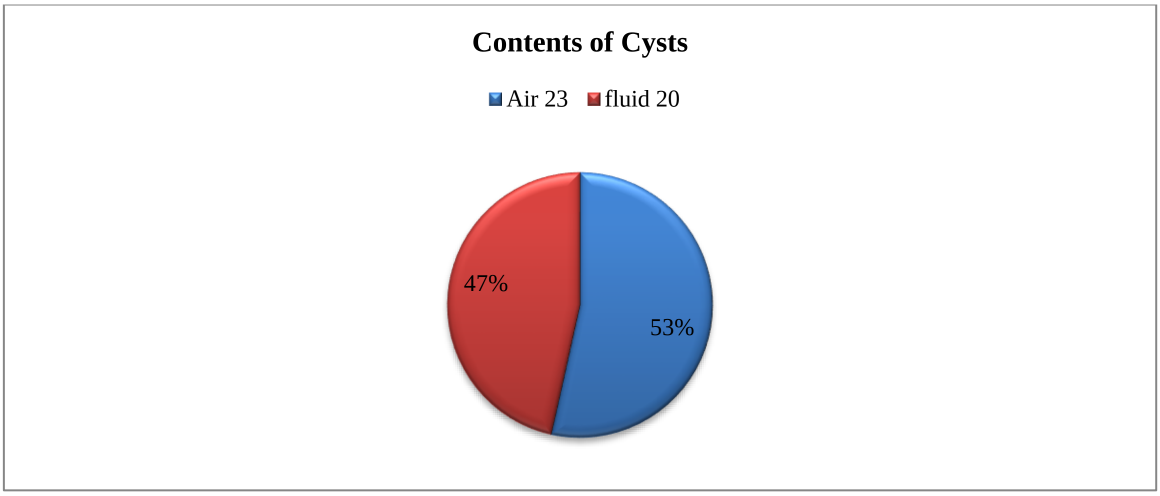
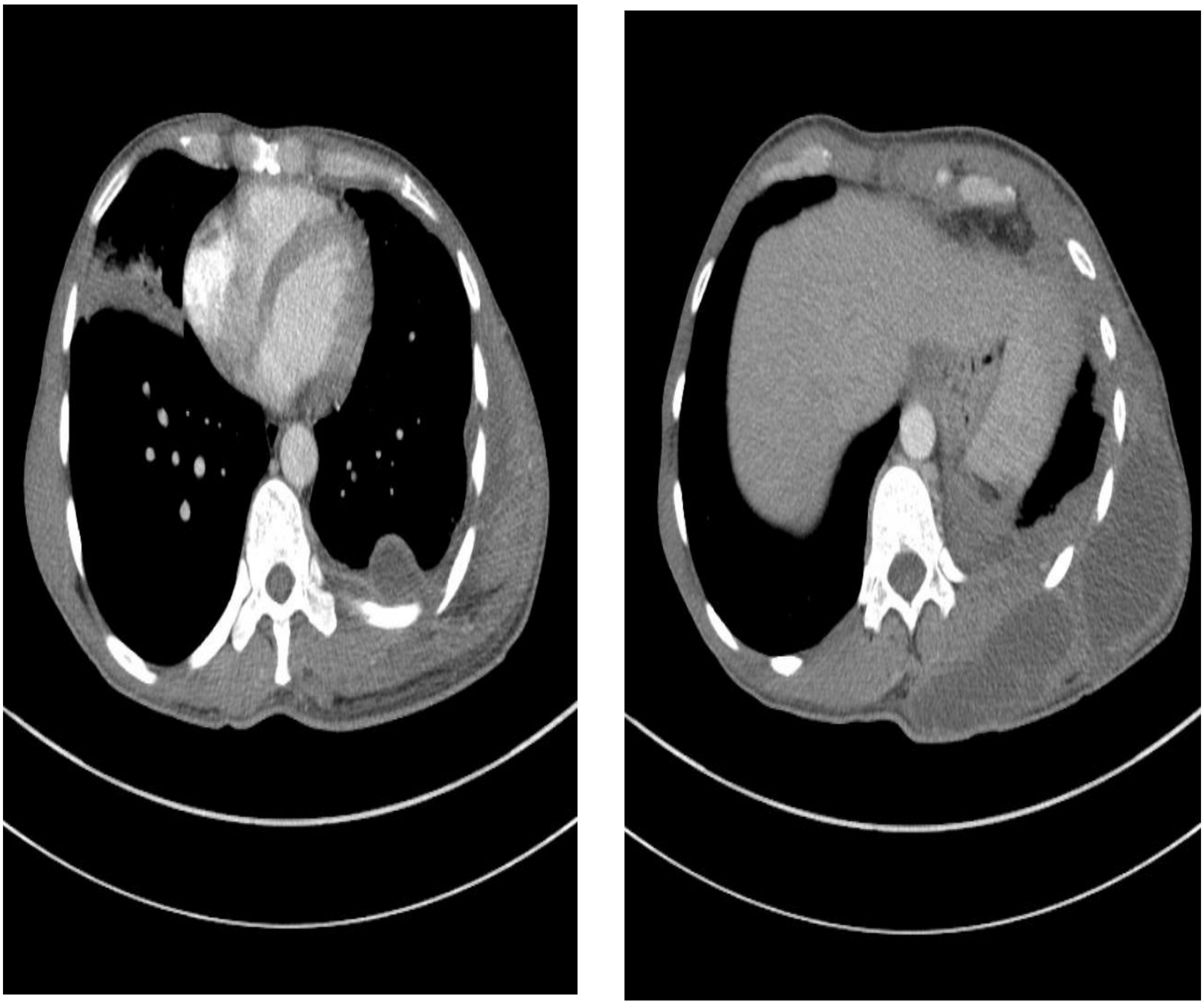


Figure (8): Contents of Cysts.

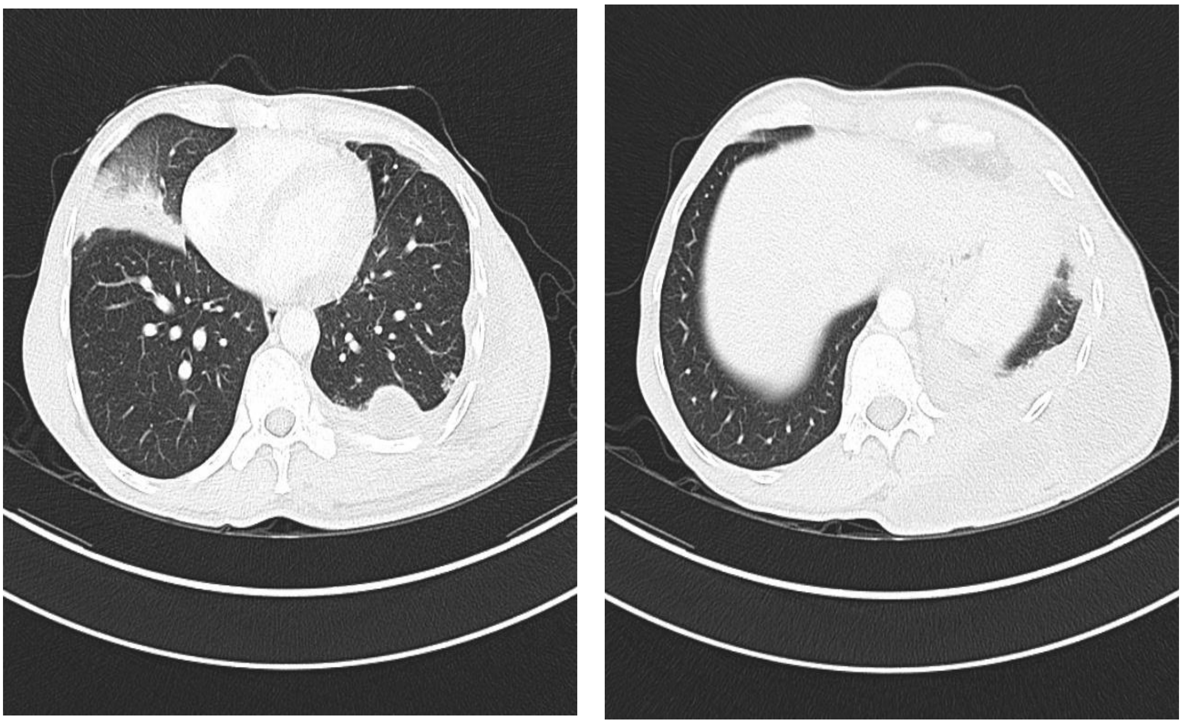
Case (1):

Patient Data: Age: 44 Gender: Female

Presentation: Mass on the posterior aspect of the back for 2 months. On admission low grade fever.



A) Axial C+ arterial phase (mediastinal window).



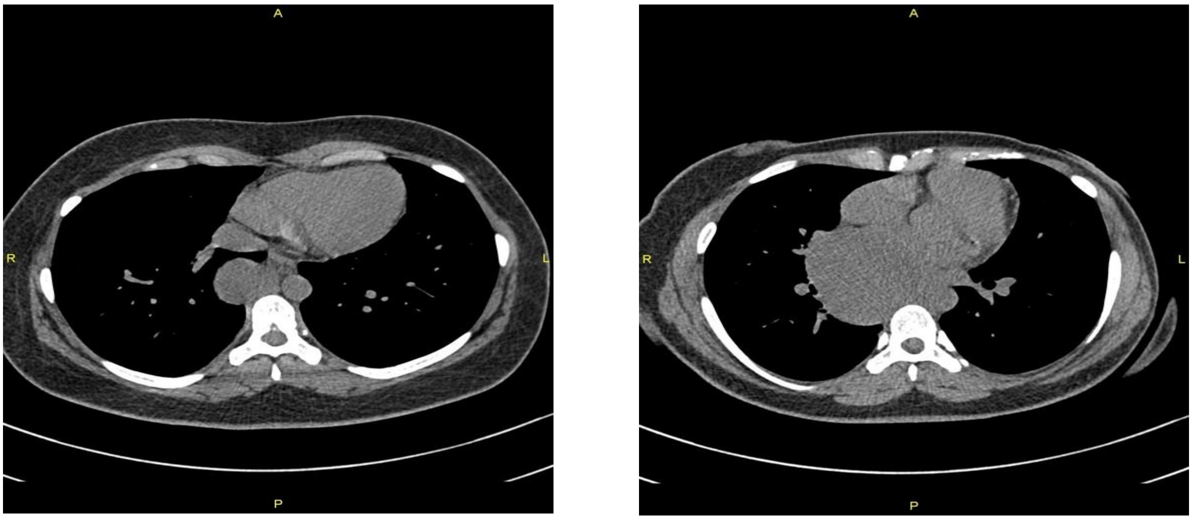
B) Axial lung window.

Figure (9): CT Findings: Large multi-loculated thick-walled abscess on the posterior aspect of the left chest wall and flank. Consolidation in the lateral segment of the right middle lobe. Diagnosis: Tuberculosis with chest wall cold abscess. Pathology: The chest wall abscess was aspirated yielding 500 mL of pus. An abundance of acid-fast bacilli was observed on microscopy, confirming the diagnosis of tuberculosis.

<u>Case (2):</u>

Patient Data: Age: 30 years Gender: Female

Presentation: Chronic dry cough and chest discomfort.



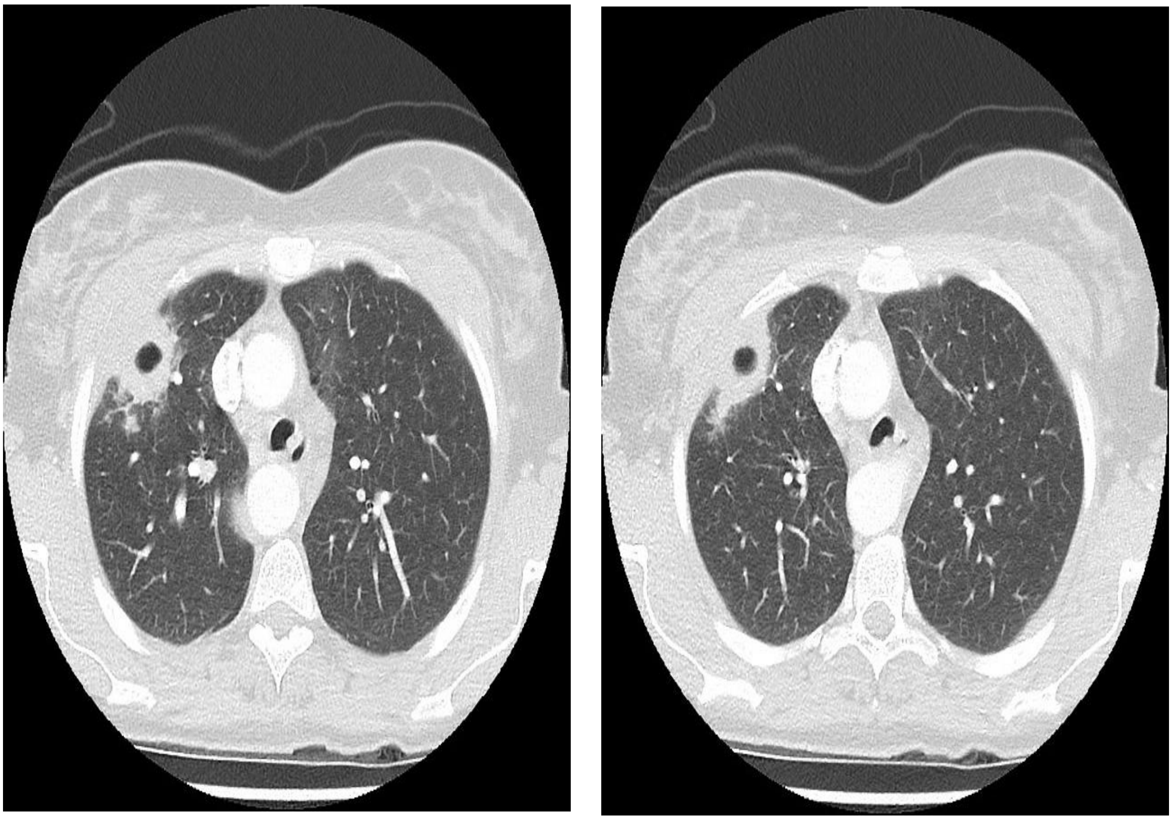
A) Axial mediastinal window

Figure (10): CT findings: Large well-defined extra-pulmonary subcarinal non-enhancing cystic mass having an average density of 28 HU (proteinaceous contents). Non calcified. Thin imperceptible walls. Splaying of the carina and mass effect over the main bronchus. Diagnosis: a bronchogenic cyst.

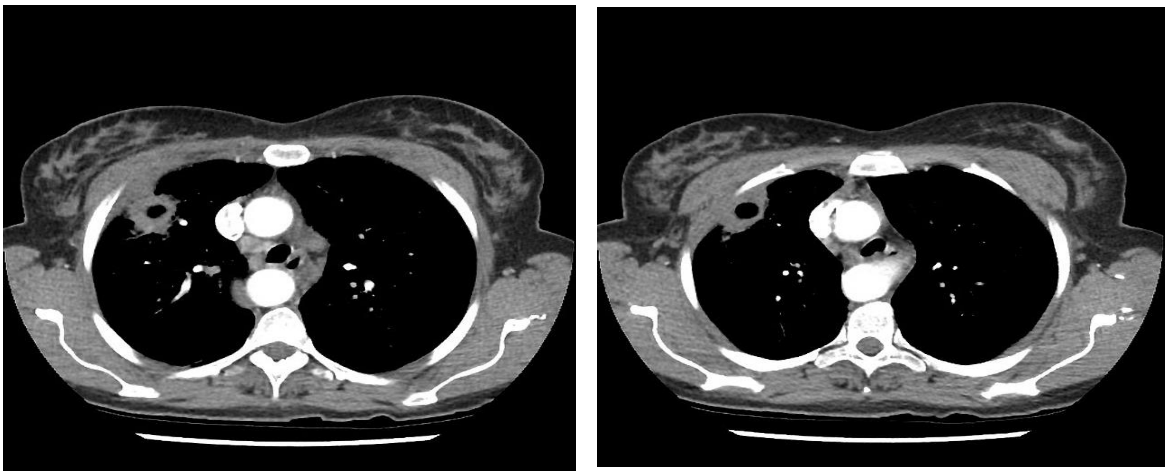
<u>Case (3):</u>

Patient Data: Age: 35 years, Gender: Female.

Presentation: Weight loss, fever.



A) Axial lung window



b) Axial C+ arterial phase (mediastinal window).

Figure (11): CT Findings: In the right upper lobe there is peripheral and somewhat wedge-shaped area of consolidation with internal cavitations that is surrounded by a thick enhancing rim. The lungs and pleural spaces are otherwise unremarkable.

4. Discussion

Cysts may be found in the chest wall, pleura, mediastinum, and pulmonary parenchyma. 15%–20% of all mediastinal masses are cysts. Cysts may be the main anomaly in many diffuse lung disorders. Pneumatoceles, congenital cystic lesions, traumatic lesions, and a number of viral conditions, such as Pneumocystis carinii pneumonia and hydatid disease, are examples of localized or multifocal cystic lung lesions. Cystic lesions, especially metastatic lesions, are extremely uncommon in malignant tumors [1]. Chest wall locations for tuberculosis are uncommon; less than 10% of cases of skeletal tuberculosis occur here. Chest wall involvement is still uncommon even when thoracic vertebral sites are considered [5]. The unique perspective offered by MDCT with reconstructed pictures offers insight into thoracic anatomy and pathology. Greater coverage, faster acquisition times, and better picture resolution are all made possible with MDCT [4].

5. Conclusion

A wide variety of differential diagnoses are available for thoracic cystic lesions. These lesions may affect the chest wall, pleura, various mediastinal compartments, and lung parenchyma. The location, distribution, form, size, accompanying CT findings, and associated clinical aspects of the cysts can all be used to pinpoint the source of these cystic lesions. Since MDCT is more effective than chest radiography at showing the existence and degree of chest abnormalities, it is currently the imaging modality of choice in the diagnosis of various cystic chest lesions. Our study involved reviewing the MDCT results of 43 patients of different complaints and different diseases who were referred to Al-Haram radiology department. Using MDCT findings, we were able to identify, detect, and localize various types of chest cystic lesions to aid diagnosis and to discuss the differential diagnosis and the pathogenesis where it is known especially in cases of diffuse cystic lung lesions. The role of MSCT imaging is essential in diagnosis and evaluation of different chest cystic lesions. To reach the cause of chest cystic lesions a multidisciplinary approach should be done. So, we concluded that the role of MDCT imaging in diagnosis and evaluation of different chest cystic lesions is crucial, central, being accurate and non-invasive.

6. Limitation

Some of our study limitation was that:

How to deliver the lowest effective dose of radiation: Typical effective radiation doses in adults range from about 8 to 10 mSv for CTs of the chest. These doses are high compared to those of natural background radiation, which is about 3 mSv/year. Thus, it would take a person 3.3 years to get the same amount of background radiation that chest CT delivers in less than a minute. Even more striking, one chest CT gives an effective dose of radiation equivalent to that of about 400 posteroanterior chest films.

False positives/negatives: Although CT is highly sensitive in the diagnosis of anterior mediastinal masses, its specificity is low with regard to differentiating benign from malignant lesions and in classifying malignant lesions of various histological types. There may be some overlap in characteristics among various mediastinal masses on CT with inflammatory or inhomogeneous low-attenuation mediastinal lesions and the correct diagnosis can only be made surgically.

Extrapulmonary involvement: Concomitant involvement of pulmonary and hepatic hydatidosis is high, varying from 16–23.1% in both children and adults. However, it may be higher in adults. The number of co-involvements with the liver may not reflect the exact number because not all patients underwent abdominal imaging. In some patients we were only able to investigate liver sections seen on thoracic CT. This may be a limitation of our study. Finally, we were only able to obtain follow-up chest CT images and pathological reports from a small number of patients, limiting our ability to perform dynamic observation and correlation.

7. Recommendation

First, all health-care professionals should use CT only when no other test or procedure can supply the information needed. Second, all radiologists, particularly those who deal with children, should strive to reduce the radiation dose in each patient to the lowest level capable of yielding acceptable image quality. They should also question the use of CT when the indications do not seem appropriate.

All thoracic CT scans should be acquired in volumetric mode in full inspiration. Sequential mode may be used while acquiring limited expiratory scans. Certain clinical situations mandate the use of intravenous (IV) contrast such as evaluation of pyrexia of unknown origin (PUO) or acute infections. Omission of contrast in such scenarios can lead to inadequate evaluation of critical findings like mediastinal lymph nodes or complications.

Use of low dose CT is a recent concept in imaging of ILD. An attempt should be made henceforth to modify unstructured protocols and achieve dose <3 mSv even in ILD patients. The current recommendations for performing CT for imaging evaluation of suspected ILD includes volumetric acquisition with sub-millimetric collimation, highest pitch and shortest rotation time. Tube voltage and tube current are determined based on patient size. The recommended acquisitions include supine sustained end-inspiratory phase (volumetric) and supine sustained end-expiratory (volumetric or sequential) phase.

Finally, we recommend dissemination of the use of PACS and archiving systems in all radiology and laboratory departments for proper and dynamic case observation and correlation.

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Conflicts of interest: No competing interest

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