THE ROLE OF MULTI-DETECTOR COMPUTED TOMOGRAPHY IN THE ASSESSMENT OF CYSTIC AND CAVITARY PULMONARY LESIONS

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ABSTRACT

Introduction: *Lung cysts and cavities are well defined lesions with definable walls containing air or fluid. The differential diagnosis is broad including congenital, idiopathic, infective or neoplastic lesions. Multidetector row CT is primary non-invasive evaluation of cystic and cavitary lesions.*

Objective*: To assess the role of multi-detector computed tomography (MDCT) in evaluation of cystic and cavitary lesions in the lung.*

Methods*: The study was conducted on 63 patients with cystic or cavitary pulmonary lesions and subjected to MDCT*

Results*: The study included 33 patients with infective lesions, 13 patients with idiopathic lesions, eight patients with congenital lesions, seven patients with neoplastic lesions and two patients with pseudocystic lesions proved to be due to diaphragmatic hernias.*

Conclusion*: MDCT is an accurate safe diagnostic modality in assessing cystic and cavitary lung lesions; it can assess wall thickness, size, contents and surrounding parenchyma.*

Keywords*: MDCT, pulmonary cavity, pulmonary cyst.*

Abbreviations:

- **MDCT**: Multidetector computed tomography
- **LCH**: Langerhan's cell histiocytosis
- **VRT**: volume rendering technique
- **BAC**: bronchoalveolar carcinoma.
- **TB**: tuberculosis
- **CCAM**: congenital cystic adenomatoid malformation
- **MinIP**: Minimum intensity projection

INTRODUCTION

Cysts or cavities are commonly encountered lesions on chest imaging, the underlying nature of the lesion can be readily diagnosed or can be a diagnostic challenge.(1) The terms cyst and cavity have overlapping meanings and are sometimes used interchangeably. This is unfortunate because the term cyst and cavity convey different meanings and ranges of diagnostic possibilities to clinicians and pathologists.(2) The term cyst can be used to describe a clearly defined space containing air or fluid surrounded by a relatively thin wall (<4mm) while the term cavity can be used to describe a lesion with a relatively thick wall.(3)

The differential diagnosis of cystic or cavitary pulmonary lesion is broad because many different processes can cause these abnormalities. Cystic or cavitary pulmonary lesions may be focal, multifocal, segmental or diffuse. The lesions may be due to:

Developmental causes; such as congenital lobar emphysema, congenital cystic adenomatoid malformation (CCAM), bronchogenic cyst, bronchopulmonary sequestration, cystic fibrosis. Infective causes; such as tuberculosis (TB), lung abscess, pneumatocele, hydatid cyst, fungal infection. Neoplastic cause; such as bronchial carcinoma, lymphoma, metastatic deposits. Airway disease such as blebs, bullae, bronchiectasis. Thromboembolic such as septic infarction. Idiopathic such as sarcoidosis, Langerhan's cell histiocytosis (LCH), Wegener's granulomatosis, idiopathic pulmonary fibrosis, lymphangiomyomatosis, tracheobronchial papillomatosis.(1,3,4,5,6)

The imaging characteristics including size, inner wall contour, nature of contents and location when correlated with the clinical context and tempo of the disease process provide the most helpful diagnostic clues, recent rapid technological advancement in CT has revolutionized the evaluation of lung disease. (4,7)

METHODS

Sixty three patients with known or suspected cystic or cavitary pulmonary diseases were subjected to MDCT examination using GE LightSpeed 4 or Siemens Emotion 6. The axial images were 1mm slice thickness with a high spatial frequency reconstruction algorithm and volumetric acquisition using detector collimation 1mm, helical mode, 120KVp, 240mAs and multiplanar reconstruction. The thin slices were sent to the workstation to view the data in axial, sagittal and coronal planes. Minimum intensity projection (MinIP) and volume rendering technique (VRT) were used.

Statistical Method:

Statistical analysis was done using numbers and

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percentages for descriptive purposes.

RESULTS

The study included 43 males and 20 females, their ages ranged between 40 days and 70 years with a mean age of 35 years. All patients complained of dyspnea, 58 patients had cough, 19 patients had expectoration and 10 patients had hemoptysis. The cystic and cavitary lesions were finally diagnosed to be infective in 33 patients, idiopathic in 13 patients, congenital etiology in eight patients, neoplastic lesion in seven patients and two lesions were proved to be due to pseudocavitary lesion due to fatty diaphragmatic hernia.

The commonest encountered infective lesion was bronchiectasis followed by necrotizing pneumonia, abscesses, pneumatocele and fungal infection (Table I). The commonest encountered congenital lesion was CCAM followed by cystic fibrosis (Table II). Emphysematous bullae were the commonest encountered idiopathic lung lesions (Table III). The neoplastic cavitary lesions included six patients with bronchial carcinoma and one patient with cavitary metastasis.

The diagnosis of cystic and cavitary lesions was confirmed by surgical excision biopsy in 15 patients, needle biopsy in 12 patients, bronchoscopy in five patients, clinical and laboratory follow up in 27 patients and there were four patients with emphysematous bullae and pneumatocele failed to be followed up. Surgical excision was performed for patients with bronchial carcinoma, abscess and bronchiectasis (Table IV). Needle biopsy was performed for necrotizing pneumonia and multiple cavitating lesions (Table V). Clinical and laboratory follow up were resorted to in patients with non-neoplastic lesions (Table VI). Bronchoscopy was performed in one patient with tracheobronchial papillomatosis, two patients with LCH and two patients with bronchiectasis.

CT classified cystic or cavitary lesions according to multiplicity or distribution of the lesions into four groups. Twenty four patients had focal lesions, 10 patients had multifocal lesions, 17 patients had segmental lesions and 12 patients had diffuse lesions. Bronchial carcinoma and necrotizing pneumonia were the commonest focal lesions (Table VII) (figures 1, 2). Pneumatocle, septic emboli and abscesses were the commonest multifocal lesions (Table VIII) (figures 3,4). Cystic bronchiectasis, cystic fibrosis and tuberculosis were the commonest segmental lesions (Table IX) (figures 5,6,7). Emphysematous changes was the commonest diffuse lesion (Table X) (figure 8).

The size of focal lesion was not pathognomonic for a certain pathological entity (Table XI). The thickness of wall of cystic or cavitary lesion was more pathognomonic for pathological diagnosis. Thin walls were found in congenital and idiopathic lesions (Table XII) (figures 9,10). Moderately thick walled lesions were either infective or neoplastic (Table XIII) (figures 11,12). There were six thick walled lesions with wall thickness more than 10mm proved to be due bronchial carcinoma (figure13)

The content of the cyst or cavitary lesions may be air, fluid, air and fluid or fat (Table XIV). Air was the commonest content (figure 14).Fluid was found in one patient (figure 15). Air and fluid were found in 17 patients (figure 16,17). Fat content was noticed in two patients proved to be pseudolesions sequel to diaphragmatic hernias (figure 18).

The lung parenchyma surrounding the lesion maybe normal or show infection, infiltration or fibrosis (Table XV) (figures 19,20).

Table I: Distribution of patients with infective lung lesions

Infective lesion	Number of patients (n=63)	%
Cystic bronchiectasis	9	14.2
Necrotizing pneumonia	5	7.9
Multiple abscesses and Septic emboli	4	6.3
Pneumatocele	4	6.3
Fungal (+actinomycosis)	4	6.3
Solitary abscess	3	4.7
Tuberculosis	3	4.7
Hydatid cyst	1	1.6

Table II: Distribution of patients with congenital lung lesions

Congenital lesions	Patients (n=63)	%
Congenital cystic adenomatoid malformation (CCAM)	3	4.7
Bronchogenic cyst	1	1.6
Cystic fibrosis	3	4.7
Congenital lobar emphysema	1	1.6

Table III: Distribution of patients with idiopathic lung lesions

Idiopathic lesions	(n=63)	%
Emphysematous bullae	9	14.2
LCH	2	3.2
Sarcoidosis	1	1.6
Tracheobronchial papillomatosis	1	1.6

Table IV: Distribution of lesions confirmed by surgical excision biopsy

Lesions	(n=63)	%
Bronchogenic carcinoma	5	7.9
Hydatid	1	1.6
Fungal	2	3.2
Solitary Abscess	3	4.8
Cystic bronchiectasis	2	3.2
Emphysematous bullae	2	3.2

Table V: Distribution of lesions confirmed by needle biopsy

Lesions	(n=63)	%
Necrotizing pneumonia	5	7.9
Multiple Abscesses	4	6.3
Bronchogenic carcinoma	1	1.6
Fungal	1	1.6
Metastatic cavitation	1	1.6

Table VI: Distribution of lesions confirmed by clinical and laboratory follow up

Lesions	(n=63)	%
Sarcoidosis	1	1.6
Cystic Fibrosis	3	4.8
Congenital lobar emphysema	1	1.6
Tuberculosis	3	4.8
Pneumatocele	2	3.2
Fungal	1	1.6
CCAM	3	4.8
Bronchogenic cyst	1	1.6
Pseudolesions	2	3.2
Cystic bronchiectasis	5	7.9
Emphysematous Bullae	5	7.9

Table VII: Distribution of patients with focal lesions

Classification	Lesions	(n=63)	%
Neoplastic	Bronchogenic carcinoma	6	9.5
Infective	Solitary Abscess	3	4.8
	Necrotizing pneumonia	5	7.9
	Fungal	4	6.3
Congenital	CCAM	3	4.8
	Bronchogenic cyst	1	1.6
Pseudolesion	Diaphragmatic hernia	2	3.2

Table VIII: Distribution of patients with multifocal lesions

Classification	Lesions	(n=63)	%
Neoplastic	Metastatic cavitation	1	1.6
Infective	Septic emboli and abscesses	4	6.4
	Hydatid	1	1.6
	pneumatocele	4	6.4

Table IX: Distribution of patients with segmental lesions

Classification	Lesions	(n=63)	%
Infective	Cystic bronchiectasis	9	14.4
	Tuberculosis	3	4.8
Congenital	Cystic Fibrosis	3	4.8
	Congenital lobar emphysema	1	1.6
Idiopathic	Sarcoidosis	1	1.6

Table X: Distribution of patients with diffuse lesions

Classification	Lesions	(n=63)	%
Idiopathic	Emphysematous Bullae	9	14.4
	Tracheobronchial papillomatosis	1	1.6
	LCH	2	3.2

Table XI: Distribution of focal lesions according to the size

Lesion's size	Diagnosis	(n=63)	%
Small <4cm	Bronchogenic carcinoma	1	1.6
	Abscess	1	1.6
	CCAM	2	3.2
	Fungal	2	3.2
Medium 4- <8cm	Bronchogenic carcinoma	4	6.4
	Abscess	1	1.6
	CCAM	1	1.6
	Necrotizing pneumonia	5	7.9
	Fungal	1	1.6
	Bronchogenic cyst	1	1.6
	Pseudolesions	2	3.2
Large 8cm or more	Bronchogenic carcinoma	1	3.2
	Abscess	1	3.2
	Fungal actinomycosis	1	3.2

Table XII: Distribution of lesions with wall thickness less than 4mm.

Classification	Lesion	(n=63)	%
Infective	Pneumatocele	4	4.8
Congenital	Congenital lobar emphysema	1	1.6
	Bronchogenic cyst	1	1.6
	CCAM	3	4.8
	Cystic bronchiectasis	9	14.4
	Cystic fibrosis	3	4.8
Idiopathic	Emphysematous Bullae	9	14.4
	Tracheobronchial papillomatosis	1	1.6
	LCH	2	3.2
	Sacoidosis	1	1.6
Psuedolesions	Diaphragmatic hernia	2	3.2

Table XIII: Distribution of lesions with wall thickness measuring 4-10mm.

Classification	Lesions	(n=63)	%
Infective	Solitary abscess	3	4.8
	Septic emboli	4	6.4
	Fungal	4	6.4
	Tuberculosis	3	4.8
	Necrotizing pneumonia	5	7.9
	Hydatid	1	1.6
Neoplastic	Metastatic cavitation	1	1.6

Table XIV: Distribution of lesions according to content.

Content	Lesion	(n=63)	%
	Cystic bronchiectasis	7	11.2
	Bronchogenic carcinoma	6	9.6
	Metastatic deposits	1	1.6
	Necrotizing pneumonia	3	4.8
	CCAM	3	4.8
	TB	3	4.8
	Pneumatocele	4	6.4
	Emphysematous bullae	6	9.6
	LCH	2	3.2
	Tracheobronchial papillomatosis	1	1.6
	Sarcoidosis	1	1.6
	Cystic Fibrosis	3	4.8
	Congenital lobar emphysema	1	1.6
	Fungal	2	3.2
Fluid	Bronchogenic Cyst	1	1.6
Air and Fluid	Infected Emphysematous bullae	3	4.8
	Hydatid Cyst	1	1.6
	Solitary Abscess	3	4.8
	Multiple abscess	4	6.4
	Fungal	2	3.2
	Infected cystic bronchiectasis	2	3.2
	Necrotizing pneumonia	2	3.2
Others (Fat)	Diaphragmatic fatty hernia	1	1.6
(Bowel)	Diaphragmatic hernia (Bochdalek)	1	1.6
Total		**63**	**100**

Table XV: Distribution of lesions according to surrounding parenchyma.

Surrounding parenchyma	Lesions	(n=63)	%
Apparently normal	Bronchogenic cyst	1	1.6
	CCAM	3	4.8
	Pseudolesions	2	3.2
	LCH	2	3.2
	Tracheobronchial papillomatosis	1	1.6
Consolidation	Necrotizing pneumonia	5	7.9
	Congenital lobar emphysema	1	1.6
Perifocal ground glass	Fungal	4	6.4
	Bronchogenic carcinoma	6	9.6
	Metastasis	1	1.6
	Multiple abscesses and septic emboli	4	6.4
	Emphysematous bullae	9	14.4
	Pneumatocele	4	6.4
Fibrosis	Tuberculosis	3	4.8
	Solitary abscess	3	4.8
	Hydatid cyst	1	1.6
	Cystic bronchiectasis	9	14.4
	Cystic fibrosis	3	4.8
	Sarcoidosis	1	1.6
Total		**63**	**100**

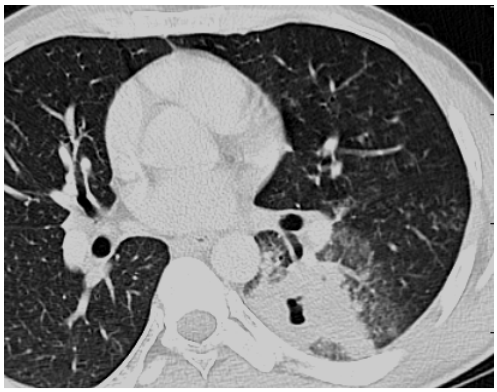

Fig 1: Axial CT, lung window at the level of the left atrium shows focal cavitating lesion at the apical segment of the left lower lobe proved to be bronchioloalveolar carcinoma.

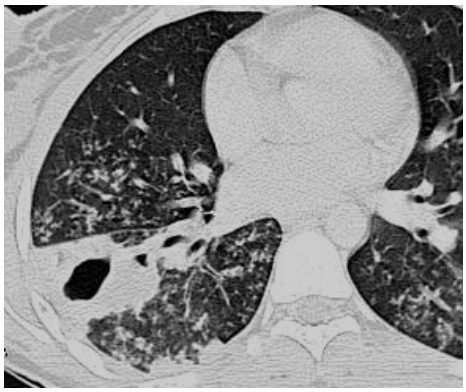

Fig 2: Axial CT, lung window at the level of the ventricles reveal focal cavitating lesion at the anterior basal segment of lower lobe of right lung. The adjacent parenchyma shows fluid filled alveoli proved to be necrotizing pneumonia.

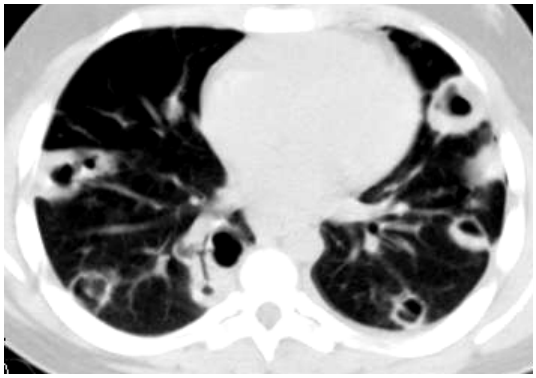

Fig 3: Axial CT, lung window at the level of the ventricles shows multifocal cavitating lesions at lower lobes of both lungs proved to be septic emboli. Arrow points to feeding vessel supplying the cavitary lesion.

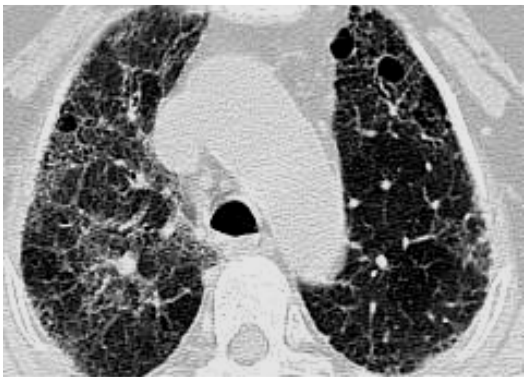

Fig 4: Axial CT, lung window at the level of the aortic arch reveals multifocal small air filled cavities at anterior segments of upper lobes of both lungs in immunocompromised patient proved to be pneumatoceles.

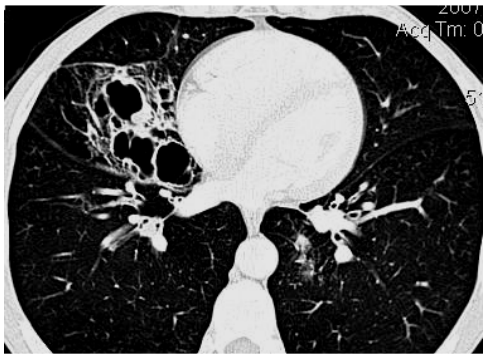

Fig 5: Axial CT, lung window at the level of the ventricles shows segmental distribution of thin walled variable sized air filled communicating cysts at central part of middle lobe prove to be bronchiectasis.

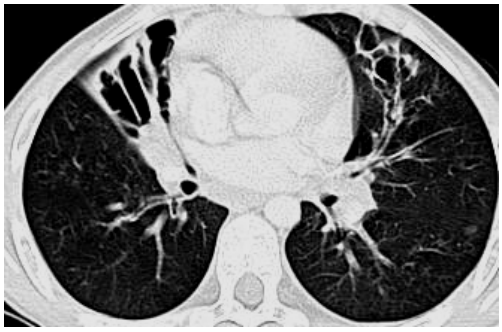

Fig 6: Axial CT, lung window at the level of the ventricles reveals bilateral segmental cavitary lesions at middle lobe and lingula showing saccular and tubular forms of bronchial dilatation in child proved to be cystic fibrosis.

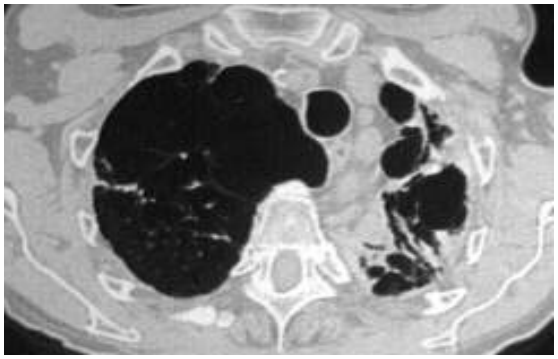

Fig 7: Axial CT, lung window at the level above the aortic arch shows bilateral segmental upper lobar fibrocavitary lesions more extensive on left side proved to be due to tuberculosis.

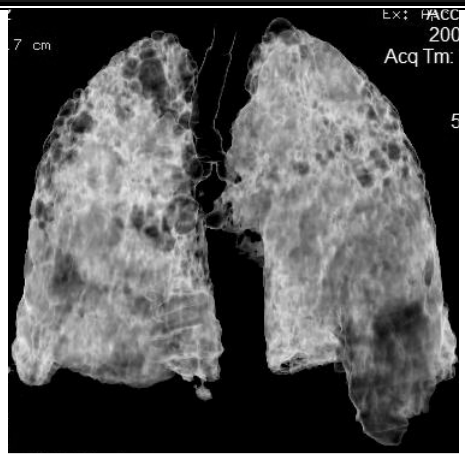

Fig 8: Volume rendering technique (VRT) reveals diffuse innumerable air filled cavities distributed in a paraseptal and centrilobular pattern proved to be diffuse emphysematous process.

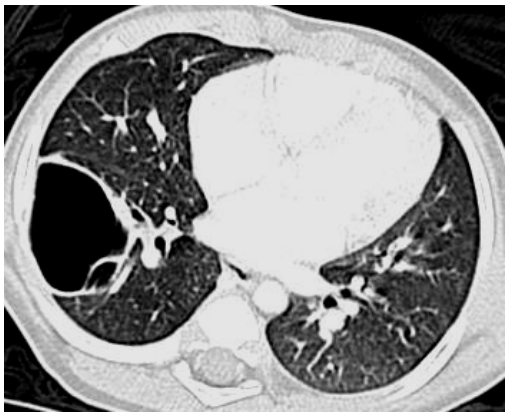

Fig 9: Axial CT, lung window at the level of the ventricle shows thin walled air filled cavity at lateral basal segment of lower lobe of right lung with adjacent small cyst in a child with stationary course on follow up proved to be CCAM.

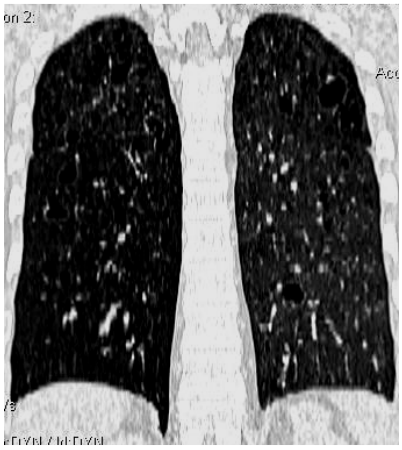

Fig 10: Coronal reformatted CT, lung window at level of vertebral bodies reveals multiple thin walled cysts diffusely scattered in both lungs proved to be LCH**.**

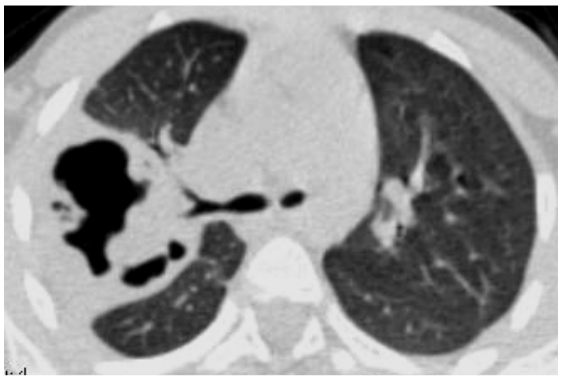

Fig 11: Axial CT, lung window at the level of bronchus intermedius bifurcation shows ill-defined irregular thick walled cavitary lesion at right lung involving the posterior part of middle lobe and anterior part of lower lobe proved to be necrotizing pneumonia.

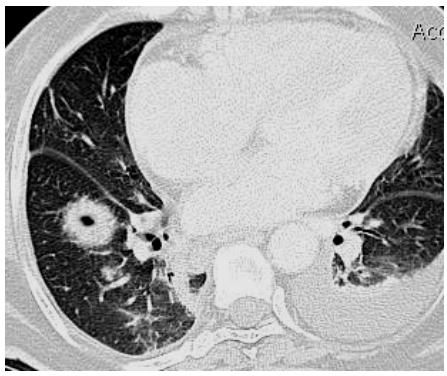

Fig 12: Axial CT, lung window at the level of right lung base reveals cavitating thick wall neoplastic lesion at lower lobe of right lung proved to be cavitating metastatic deposit from squamous cell carcinoma.

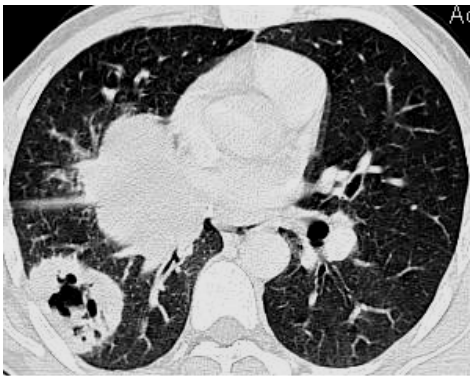

Fig 13: Axial CT, lung window at the level of left atrium shows thick walled cavity with permeating spiculated margins at lower lobe of right lung associated with right bronchopulmonary lymphadenopathy proved to be bronchial carcinoma.

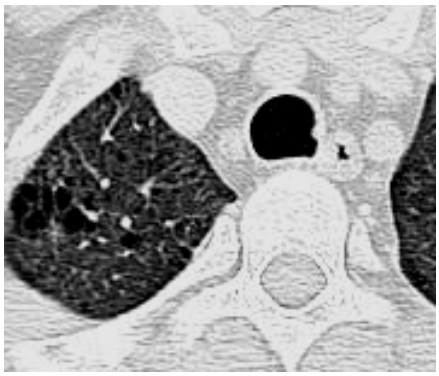

Fig 14: Axial CT, lung window at the level thoracic inlet shows small air filled cysts with tracheal outgrowths proved to be tracheobronchial papillomatosis.

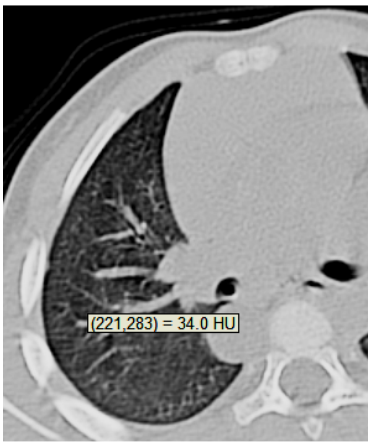

Fig 15: Axial CT, lung window at the level left atrium reveals fluid filled cystic lesion adjacent to right main bronchus proved to be due bronchial cyst.

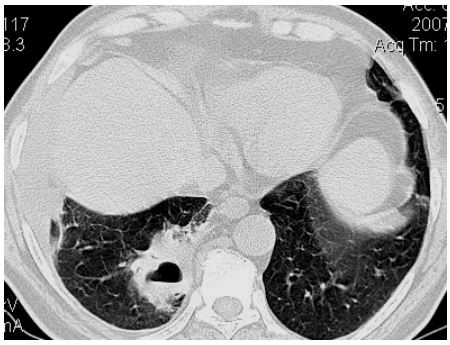

Fig 16: Axial CT, lung window at the level of diaphragm shows a cavity with an air fluid level with adjacent pneumonic changes proved to be post inflammatory lung abscess.

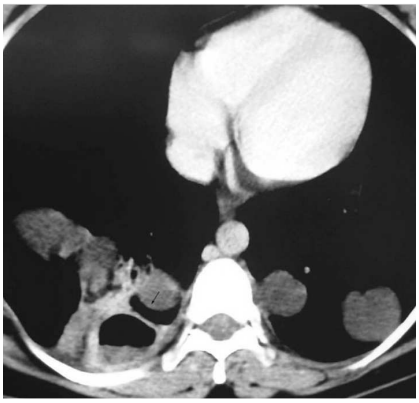

Fig 17: Axial CT, mediastinal window at the level the ventricles reveals multiple parenchymal fluid filled lesions at lower lobes of both lungs with air fluid level in one lesion and air crescent sign within another lesion. There is consolidation adjacent to right basal lesions. The lesions were proved to be hydatid cysts.

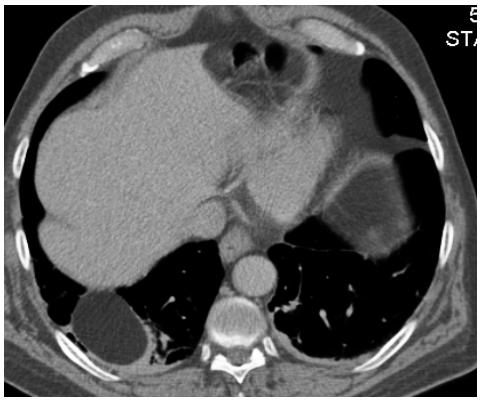

Fig 18: Axial CT, mediastinal window at the level of diaphragm shows a well defined lesion at right lung base with attenuation values consistent with fat proved to be Bochdalek hernia.

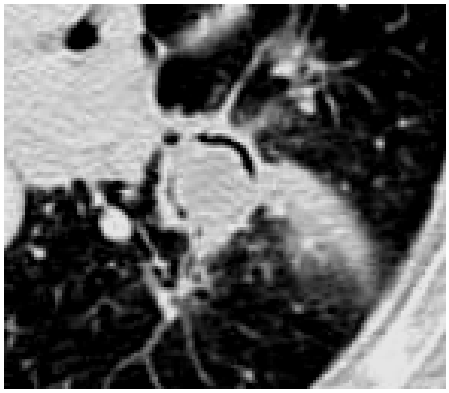

Fig 19: Axial CT, lung window zoomed up image at the level the left pulmonary artery reveals a cavitary lesion at apical segment of lower lobe of left lung with a soft tissue density mass seen with air crescent sign. There is adjacent ground glass opacity, CT halo sign proved to be fungal infection.

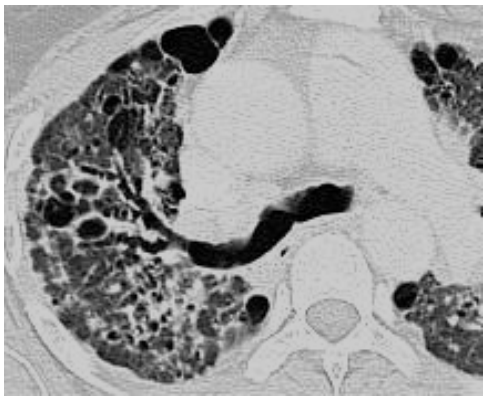

Fig 20: Axial CT, lung window at the level of right upper lobe bronchus shows bilateral air filled cavities with perivascular septa proved to be sarcoidosis.

DISCUSSION

Cysts and cavities are commonly encountered lesions in the lungs. They are seen as lesions with definable walls either containing air or fluid. The differential diagnosis of such lesions is broad because many different diseases of acquired or congenital origin can cause these lesions.[1,8]

Multidetector row CT of the chest has revolutionized the evaluation of lung disease. Recent rapid technological advancements in CT such as postprocessing techniques including multiplanar and three dimensional reformations has allowed CT to assume a pivotal role in the non-invasive evaluation of cystic and cavitary lesions.[8]

In this study all examinations have been performed on MDCT scanners and the acquired data were viewed on highly specialized workstations and the acquired data were not only viewed on coronal and sagittal scans but also on oblique images to straighten tortuous feeding vessels or trace a bronchus in question. Minimum intensity projection (MinIP) rendered views were also used for better appreciation of the air space diseases.

The distribution of lesions as focal, multifocal, segmental or diffuse is supposed to be the base of differential diagnosis for cystic or cavitary lesions. There were 24 focal lesions, two of which were considered pseudolesions because they were diagnosed on plain X-ray as fluid filled cysts but CT confirmed the fat contents of these lesions that were herniated mesenteric fat through congenital diaphragmatic defects.

There was one patient with fluid filled cyst adjacent to right main bronchus and encroaching on apical segment of lower lobe of right lung proved to be bronchial cyst. Yohena el al[9] reported that bronchial cysts located adjacent to trachea and esophagus or close to the carina. Chang et al [10] stated that bronchial cysts are more common in the lower lung lobes at subpleural region.

Thin walled air filled cysts were encountered in three infants. The cysts showed variable sizes and multiple loculations. All lesions were incidentally discovered and followed up as the lesions were asymptomatic they were diagnosed CCAM. These findings were consistent with data reported by Oh et al [11] and Butterworth et al.[12]

There were 18 focal acquired lesions with necrotic cavitating center, six patients proved to be neoplastic and 12 patients were inflammatory. There were four patients showing soft tissue mass within the cavity surrounded by parenchymal haziness in three patients proved to be due to fungal infection. Pinto[13] reported that CT halo sign is a useful diagnostic clue for diagnosis of pulmonary fungal infection. Akimoto el al [14] stated that the most common form of pulmonary involvement with aspergillus is mycetoma. Yella et al [15] found that recognized air crescent within infective lesion gives the appearance of intracavitary mass.

There were three patients with solitary lung abscess with a well defined smooth wall with thickness averaging 3-5mm containing air and fluid. Moreira el al [16] stated that retained contents within the abscess due to obstruction of the drainage bronchus. They mentioned that CT is important in assessment of the abscess cavity wall to exclude or confirm the presence of bronchial carcinoma.

Irregular thick walled 5-8mm cavitary lesions were noticed in five patients. These lesions were air-filled with no detectable fluid and surrounded by areas of consolidation; proved to be necrotizing pneumonia. Needle biopsy that was performed for all patients revealed inflammatory cells without definite

neoplastic changes. Eo et al [17] reported that necrotizing pneumonia appears on CT as multiple irregular air filled cavities aggregated together without definite mass effect surrounded by consolidation. Yella et al [15] stated that there is an association between necrotizing pneumonia and fungal, tuberculous or anaerobic lung infection. Fungal infection may be due to aspergillosis, actinomycosis, norcardiosis and histoplasmosis. They mentioned that cavitation extent depends on aggressiveness and necrotizing nature of the infection process and eventually leads to the formation of a lung abscess. [15]

There were six patients proved to have focal neoplastic lesion due to bronchial carcinoma presented by thick walled air filled cavity with wall thickness measuring more than 10mm, the lesions show spiculated margins infiltrating the adjacent lung parenchyma. One of the lesions showed invasion of adjacent rib. Air bronchogram sign is seen within the cavitating mass lesion in two patients with bronchoalveolar carcinoma (BAC). Sokhandon et al [18] reported that central necrosis is common in large tumors. They mentioned that squamous cell carcinoma is the most likely to cavitate.[18] They stated that bronchial neoplastic lesions have an irregular or indistinct margin due to tumor infiltration, irregular desmoplastic response or irregular contraction in the central portion of the tumor.[18] Zwirewich et al[19] mentioned that air bronchograms were more frequently seen in (BAC) than in other malignant lesions.

Multifocal lesions were encountered in 10 patients. The lesions were either infective in nine patients or neoplastic in one patient. Thin walled small air filled cavities were seen in four patients proved to be pneumatoceles. The lesions were found in children and old immunocompromised patients. The children were proved have staphylococcus infection. The immunocompromised patient proved to have nosocomial pneumonia. Schimpl and Schneider[20] reported that pneumatoceles most often occur as a sequel to acute staphylococcal pneumonia. Vilar et al[21] emphasized the importance of diagnosis of nosocomial infection due to its association with high mortality.

One patient showed multifocal fluid filled lesions at both lungs proved to be hydatid cyst, one lesion contained air and fluid and another lesion showed air crescent sign due to presence of complications. Hosch et al [22] and Polat et al [23] reported similar CT features for lung hydatid cyst. They stated that air crescent sign is due to erosions induced by growing cyst to adjacent bronchioles. Air enters between the endocyst and pericyst. They also found air fluid level within the cyst and considered that as an unusual finding.[22,23]

There were multifocal relatively thick walled air-filled cavitating lesions in four patients. The lesions showed peripheral distribution and were either rounded or wedged shape with visualization of fluid leveling in some cavities. There was a feeding vessel leading to the cavity in most of the lesions (feeding vessel sign). These lesions were proved to be due to septic emboli and small abscesses. Dodd et al [24] found similar CT features for septic emboli.

There was one patient with thick walled air filled cavities scattered within both lungs proved to be metastases from squamous cell carcinoma. Amir et al[25] reported that metastatic cavitation is more common in metastatic lesions of the squamous cell carcinoma than adenocarcinoma. Lachanas et al[26] supported that pulmonary metastases may cavitate especially from squamous cell carcinoma but also metastases from adenocarcinoma, sarcomas, melanomas and osteosarcomas may cavitate.

The cavitary lesions show segmental distribution in 17 patients. Infective lesions were the commonest including bronchiectasis and tuberculosis. Segmental dilatation of bronchi was noticed in nine patients. Reconstructed images were helpful in confirming the interconnections of dilated bronchi. The dilated bronchi appeared on CT as air filled cavities with thin walls. Dodd et al[27] and Revel et al [28] agreed that MDCT is the modality of choice for detection of bronchiectasis. MDCT should precede bronchoscopy as the first line investigation for patients with hemoptysis.

There were thin walled air-filled cavities at the upper lobes of both lungs in three patients with adjacent extensive scarring and small nodules associated with incomplete consolidation cystic bronchiectasis and emphysematous changes proved to be due to tuberculosis. Kim et al[29] and Tateishi et al[30] reported that tuberculous cavities commonly involve the upper lobes. After treatment the tuberculous cavity may disappear, occasionally, the wall becomes paper-thin and an air filled cystic disease remains. The wall of a chronic cavity varies from 1cm to less than 1mm in thickness. It may be difficult to distinguish true tuberculous cavities from bullae, cysts or pneumatoceles. They also emphasized that tuberculous cavities are associated with marked fibrotic response and atelectasis of the upper lobe with elevation of the hilum and mediastinal shift as well as hyperinflation of lower lobes.[30]

There were four children in this study with congenital segmental lesions. Three of them had thin walled air filled cavities representing saccular and tubular forms of bronchial dilatation at upper and middle lobes of both lungs. The cavitary lesions are surrounded by ground glass opacities. The lesions proved to be sequel to cystic fibrosis. Cademartiri et al[31] stated that CT is more sensitive

than pulmonary function test for detecting early changes of cystic fibrosis. There was a 40 days old infant with an air trapped lesion at upper lobe of left lung proved to be congenital lobar emphysema. Berrocal et al[32] and Daltro et al[33] mentioned tat congenital lobar emphysema should be differentiated from other causes of air filled cysts by detection of bronchovascular channels within the over distended lobe.

The last patient with segmental distribution of air filled cavitary lesions showed subpleural cysts and traction bronchiectasis surrounded by ground glass opacities, consolidations, fibrotic bands and associated with mediastinal lymphadenopathy proved to be sarcoidosis. Akira et al[34] and Abehsera et al[35] stated that honeycomb filled cysts in patients with sarcoidosis represent end stage irreversible damage.

There were 12 patients with diffusely scattered air filled cysts. Nine patients showed variable sized air filled cavities with imperceptible walls and increased lung volume proved to be due to emphysema. Koyama et al[36] and Mineo et al[37] stated that the most important distinguishing feature of emphysematous bullae is the lack of perceptible wall. Two heavy smoking patients showed diffusely dispersed small sized cystic air filled lesions with thin walls not exceeding 15mm proved to be LCH. Gerald et al[38] and Vassallo et al[39] emphasized the association of LCH with malignant neoplasm. They stated that LCH show small air filled cysts measuring less than 10mm on CT. The last patient with diffusely scattered air filled cysts showed innumerable variable sized small thin walled air filled cavities in both lungs with small polypoid outgrowths in the tracheobronchial airway proved to be tracheobronchial papillomatosis.[38] Prince et al[40] stated that air way obstruction in tracheobronchial papillomatosis may lead to air trapping. Distal polypoid lesions may cavitate leading to thin walled cysts. Abe et al[41] and Lam et al[42] emphasized on the role of MDCT in assessment of tracheobronchial papillomatosis and its complications.

MDCT has proved to be an indispensible modality in studying and assessing air and fluid filled cavitary lesions. It can assess the size, number, location, wall thickness and surrounding parenchyma to limit the differential diagnosis and define the lesions requiring needle biopsy or surgical excision.

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