ESSENTIALS OF RADIOLOGY
CHEST: Cystic Lung Disease

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Case 1

Multifocal cystic lesions

21-year old man with cough
Case 1
Case 1

Multifocal cystic lesions

21-year old man with cough

**Imaging Findings:**

Mural nodules in the trachea

Nodules, cavitary nodules, and cysts

Variable size, lower lungs, dorsal aspects
Case 1

Multifocal cystic lesions

21-year old man with cough

Differential Diagnosis:

Multifocal cavitary primary lung cancer
Tracheobronchial papillomatosis
Vasculitis
Pneumocystic jiroveci pneumonia (PCP)
Squamous cell carcinoma

Lung cancer

30% of all lung cancers
Cigarette smokers

Imaging:
Central > peripheral
Airway involvement
Cavitation and secondary infection occur
Pneumocystis jiroveci pneumonia
PCP

Risks: AIDS, Lymphoproliferative disorders, transplantation

Imaging:
Bilateral, symmetric GGO or fine reticulation
HRCT: may see “crazy paving” pattern
Tends to be perihilar
May be diffuse, mainly upper, or mainly lower
Pneumocystis jiroveci pneumonia
PCP

Other imaging findings:
Cystic changes – upper lobes, Pneumothorax
Focal consolidation, “mass”
Nodules / miliary pattern / reticulation
Pleural effusion
Lymphadenopathy
Normal CXR: 10%
Pneumocystis jiroveci pneumonia
PCP
Vasculitis

Wegener Granulomatosis

Nodules / masses; may be angiocentric
CT “halo sign” (surrounding GGO)
Cavitation (typically nodules > 2 cm)
Wedge-shaped nodules / consolidations
May cavitate; thick-walled may evolve to cystic
Airway stenosis, endoluminal nodules / masses
Vasculitis

Wegener Granulomatosis
Teaching Points

Tracheobronchial papillomatosis CT

Multifocal pulmonary nodules

Thi-walled cavitary nodules or masses

Endoluminal soft-tissue nodules or masses

Postobstructive atelectasis / consolidation

*Increasing mass or consolidation if malignant*

*transformation to Squamous cell carcinoma*
Laryngeal Papillomatosis: Demographics and Etiology

Human papilloma virus - HPV types 6 and 11
0.1% of infants develop LP. Predilection for first-born infants
50% of mothers have genital tract involvement
HPV spread transvaginally at birth
Infects oropharyngeal secretions of child
Papillomatosis Imaging

Multiple, well-defined nodules
Perihilar, Posterior thorax
Grow to several centimeters
Cavitate, 2 - 3 mm thick walls
Air-fluid levels may develop
Papillomatosis Imaging

Cavities may represent:
- Papillomatosis
- Squamous cell ca
- Abscess
  (obstructive pneumonitis)
Papillomatosis Imaging

29-year old female

Papillomatosis

Since 3-years of age.
Papillomatosis

Squamous cell ca

Risk for Squamous cell ca

15-years after diagnosis

Risk factors:

Radiation, smoking,
other carcinogens

19-year old female
Case 1

**Diagnosis:** Tracheobronchial papillomatosis
Case 2

Multifocal cystic lesions and nodules

34-year old woman with cough
Case 2

Multifocal cystic lesions

34-year old woman with cough

Imaging Findings:

Irregular centrilobular nodules
Small cavitary nodules
Thick- and thin-walled cysts
Relative sparing of lung bases
Case 2
Multifocal cystic lesions
34-year old woman with cough

Differential Diagnosis:
Sarcoidosis
Silicosis
Pulmonary Langerhans cell histiocytosis (PLCH)
Infection (M. tuberculosis, M. avium complex, histoplasmosis)
Teaching Points

Pulmonary Langerhans cell histiocytosis

Nodules and cysts
Normal intervening pulmonary parenchyma
Poorly defined centrilobular (1-15mm) nodules
Solid or cavitating nodules (progression to cysts)
Cysts vary in size, shape; thin, thick or irregular cyst walls
Relative sparing of lung bases
Mycobacterium avium complex
MAC

Upper lobe cavitary form
Thin-walled upper lobe cavities
Apical pleural thickening

Nodular bronchiectatic form
Bilateral nodular or reticulonodular opacities
Centrilobular nodules / tree-in-bud opacities
Bronchiectasis: predominantly RML and Lingula
Mycobacterium avium complex (MAC)

Upper lobe cavitary form
Thin-walled upper lobe cavities
Apical pleural thickening
Mycobacterium avium complex MAC

Nodular bronchiectatic form

Centrilobular nodules and tree-in-bud opacities

Bronchiectasis: predominantly RML and Lingula
Histoplasmosis

Chronic histo: upper lobe consolidation/cavitation

DDx:
Healed TB
Sarcoid IV
Staphylococcus aureus

Less common:
Homogeneous consolidation
Nodules
Wedge-shaped opacities (septic emboli)
Abscess 15-30%
Pneumatocele
PTX
Pleural effusion / empyema
Septic emboli

Indwelling catheters, IVDU
Pelvic thrombophlebitis
Head and neck infections

**Imaging**
Nodular opacities, bilateral, circumscribed or poorly defined
Cavitation common
Wedge-shaped, subpleural consolidations
CT: nodules frequently peripheral, lower
Septic emboli

Indwelling catheters, IVDU
Pelvic thrombophlebitis
Head and neck infections

Imaging
Nodular opacities, bilateral, circumscribed or poorly defined
Cavitation common
Wedge-shaped, subpleural consolidations
CT: nodules frequently peripheral, lower zones
Reticulonodular
Upper-and-mid
Predominant

**DDx:**
Sarcoid
Silicosis
Tuberculosis
PLCH (“EG”)
...others
Pulmonary Langerhans Cell Histiocytosis

- Uncommon
- > 90% Smokers.
- Young adults
- Cough, dyspnea, PTX
- Peribronchial granulomas
- Langerhans cells, eosinophils
- Lung destruction
Pulmonary Langerhans Cell Histiocytosis

HRCT

- Nodules
- Cavitary nodules
- Cysts
- Upper-zone predominance
- Spares lung bases
Pulmonary Langerhans Cell Histiocytosis

HRCT

Spares lung bases
Pulmonary Langerhans Cell Histiocytosis

Distribution constant
Sparcs lung bases
Case 2

**Diagnosis:**

Pulmonary Langerhans cell histiocytosis
Case 3

Basilar “cystic” lesions

54-year old man with weight loss
Case 3

Basilar “cystic” lesions

54-year old man with weight loss

Imaging findings:

Multiple nodules, some angiocentric
Nodules vary in morphology, solid to cystic
Predominantly involve lower lung zones
Case 3

Basilar “cystic” lesions

54-year old man with weight loss

Differential Diagnosis:

Pulmonary angiitis and granulomatosis
Cystic metastases
Septic emboli
Septic Emboli

Courtesy of Dr. Elizabeth Moore
Honeycombing
UIP

Cystic air spaces  3mm-3cm
Thick, clearly defined walls
Cystic spaces share walls
Several contiguous layers
Peripheral, subpleural
Basilar predominant
“End-stage lung” / Fibrosis
Metastases

Cavitation

4% of metastases

Primary malignancies:

Squamous cell ca 69%
(Head and neck, cervix)

Adenocarcinoma 31%
(colon, breast)

Sarcomas (bone) - pneumothorax
Case 3

Diagnosis: Metastases (colon cancer)
Case 4

Localized multicystic lesion

18-year old man with hemoptysis
Case 4

Localized multicystic lesion

18-year old man with hemoptysis

Imaging Findings:

Multicystic lesion in left lower lobe
Posteromedial aspect
Adjacent pleural thickening
Two associated feeding vessels from aorta
Staphylococcus aureus

Less common:
Homogeneous consolidation
Nodules
Wedge-shaped opacities
(septic emboli)
Abscess 15-30%
Pneumatocele
PTX
Pleural effusion / empyema
Lung abscess

- Spherical, central necrosis
- Frequent cavitation
- Air-fluid levels common
- Wall thickness <15 mm

**CT:**
- Spherical; central low-attenuation,
- Rim enhancement

Most common organisms:
- Anaerobic bacteria, Staph aureus,
- Pseudomonas aeruginosa
Active TB
Incompletely treated
Localized multicystic lesion

Infected Bullae

COPD
Chronic debilitating illnesses
Diabetes mellitus
Malnutrition
Alcoholism
Advanced age
Corticosteroid therapy, prolonged

COPD / anaerobic pneumonia
Case 4

Localized multicystic lesion

18-year old man with hemoptysis

Differential Diagnosis:

Lung abscess

Bronchiectasis with secondary infection

Infected bulla

Intralobar sequestration
Staphylococcus aureus

3% of CAP  
15% of nosocomial  
IVDU, ICU patients

**Imaging:**  
Patchy unilateral 60%  
Bilateral 40%  
Abscess 15-30%  
Airspace nodules common  
Centrilobular nodules, tree-in-bud
Staphylococcus aureus

3% of CAP
15% of nosocomial
IVDU, ICU patients

Imaging:
Patchy unilateral 60%
Bilateral 40%
Abscess 15-30%
Airspace nodules common
Centrilobular nodules, tree-in-
Staphylococcus aureus

3% of CAP
15% of nosocomial
IVDU, ICU patients

**Imaging:**
- Patchy unilateral 60%
- Bilateral 40%
- Abscess 15-30%
- Airspace nodules common
- Centrilobular nodules, tree-in-
Case 1

A college freshman after a recent drinking binge
“Passed-out” flat…on his back (supine)
Lung Abscess with air-fluid level
Radiography

Air-fluid level - equal length on orthogonal views
Lung Abscess with air-fluid level

Radiography

Air-fluid level - equal length on orthogonal views
Lung Abscess

Radiography

Spherical
Air-fluid level
  Equal length on orthogonal views
Does not compress lung
Intralobar sequestration

ILS

Three faces:
Homogeneous / heterogeneous irregular consolidation / mass
Air-filled, air-fluid levels, cysts
Lower lobe, posterior basal segment
Systemic supply: Angiography, CT, MRI
Pulmonary drainage
Pulmonary Sequestration

No normal communication to tracheobronchial tree
Systemic blood supply

**Intralobar** Sequestration (ILS)
  - Inside normal visceral pleura

**Extralobar** Sequestration (ELS)
  - Outside normal visceral pleura

ILS:ELS 4:1
Pulmonary Sequestrations

- Intralobar
- Extraloblar
Intralobar Sequestration

Clinical Features

Males = Females
> 50% of patients over 20 years
  Rare in infants
  Infrequent associated anomalies

Cough, sputum, recurrent pneumonia
Asymptomatic
Intralobar Sequestration

ILS

Left sided 55-60%
Lower lobe 98%

Systemic supply
T-Aorta 73%

Pulmonary Drainage 95%
Case 4

**Diagnosis:**
Intralobar sequestration
Case 5

Solitary lung cyst

Asymptomatic 42-year old man with abnormal CXR
Case 5

Solitary lung cyst

Asymptomatic 42-year old man with abnormal CXR

Imaging findings:

Solitary thin-walled cystic lesion in lingula
Case 5

Solitary lung cyst

Asymptomatic 42-year old man with abnormal CXR

Differential Diagnosis:

- Pneumatocele
- Coccidioidomycosis (chronic)
- Bulla
- Cystic neoplasm
Pneumatocele

Post-smoke inhalation
Pneumatocele
Post-traumatic
Pneumatocele

Post-traumatic

Fell two stories
Emphysema

Bullae
Coccidioidomycosis

*Coccidioides immitis*
Endemic: Southwestern USA, northern Mexico
Coccidioidomycosis

*Coccidioides immitis*

Endemic: Southwestern USA, northern Mexico

**Imaging:**

**Primary:** single/multiple consolidations

**Chronic:** SPN 1-3 cm

10-15% cavitate: thick or thin-walled ("grape skin")

Lymphadenopathy (20%)

Miliary disease (immunocompromised)
Coccidioidomycosis

Primary: consolidations / Chronic: SPN

1 month later

6 months later
Coccidioidomycosis

Chronic: SPN 1-3 cm

10-15% cavitate: thick or thin-walled ("grape skin")
Case 5

**Diagnosis:**

Coccidioidomycosis (chronic)
Case 6

Diffuse multifocal cysts

38-year old woman with cough
Case 6
Case 6
Case 6

Diffuse multifocal cysts

38-year old woman with cough

Imaging Findings:
Multiple thin-walled cysts
Randomly and diffusely distributed bilaterally
Case 6

Diffuse multifocal cysts

38-year old woman with cough

Differential Diagnosis:

Pulmonary Langerhans cell histiocytosis
Lymphangioleiomyomatosis (LAM)
Pneumocystis jiroveci pneumonia (severe)
Emphysema
Emphysema

HRCT

Focal areas of decreased opacity
With or without visible walls

Centrilobular - invisible walls. Upper lobes
Panlobular - uniform destruction of lobules

Paraseptal - subpleural, single layer
Emphysema
Centrilobular
Emphysema
Panlobular
Lymphangioleiomyomatosis
LAM

- Thin-walled cysts
- Diffuse distribution
- Mild septal thickening
- Small nodules (uncommon)
- Pleural effusion
Lymphangioleiomyomatosis
LAM
Lymphangioleiomyomatosis
LAM
Lymphangioleiomyomatosis
LAM
Honeycombing  LAM  Emphysema

LCH (EG)
Cystic variant
Case 6

**Diagnosis:**
Lymphangioleiomyomatosis (LAM)
ESSENTIALS OF RADIOLOGY
CHEST: Cystic Lung Disease

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